

Power electronics, the hidden hero behind resilient grids

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Why this hidden technology now matters more than ever

Belgium is accelerating the electrification of industry, mobility and buildings. That shift raises the pressure on the electricity system. It must stay resilient, affordable and cybersecure. Agoria and Sirris therefore send a clear message: power electronics is no longer a supporting technology. It has become a decisive lever for energy efficiency, system resilience and industrial competitiveness.



Power electronics moves to the centre

Power electronics sits at the intersection of component innovation, grid architecture and system reliability. It forms the interface between the grid and many major energy applications. Think of renewable generation, industrial electrification, EV charging, battery storage, heat pumps and motor drives.

That role makes it critical. When power electronics performs well, it remains almost invisible. When it fails, the impact is immediate. As Bram De Wispelaere of EnergyVille put it, it is “invisible when it works, painfully visible when it doesn’t”.

This matters even more as the grid shifts toward large shares of inverter-based resources. Grid stability now depends increasingly on the quality, robustness and intelligence of this interface. Power electronics has therefore moved beyond a supporting role. It now helps define how resilient and efficient the future electricity system can become.



Three R&D frontiers shape the next decade

According to Wilmar Martinez of KU Leuven, three research and innovation domains will shape the coming decade.

1. Wide-bandgap semiconductors

Silicon carbide and gallium nitride enable converters that are smaller, cooler, faster and more efficient. These technologies open new possibilities for performance improvement.

At the same time, the value does not sit only at device level. Benoît Bidaine of CE+T stressed that the real opportunity lies in system-level optimisation. The challenge is not only to use better components, but to design better systems around them.

2. High-frequency magnetic design

High-frequency magnetic design enables ultra-compact, high-density conversion with better efficiency. This is especially relevant at low power levels.

That remains a known challenge in EV charging. Hans Wouters of EnergyVille and KU Leuven pointed out that losses at low power can rise to 40 percent. Better magnetic design can therefore make a direct difference in practical applications.

3. AI-powered engineering and control

Artificial intelligence is becoming a force multiplier in power electronics. It supports simulation,



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Industrialisation brings tough trade-offs

Innovation only creates impact when it reaches the market. That step is often difficult. CE+T highlighted several tensions that companies must manage during industrialisation:

- Electrical optimisation versus manufacturability
- Power density versus serviceability

- Advanced control sophistication versus field reliability

These are practical choices with strategic consequences. A technically impressive design still needs to be manufacturable, reliable in the field and maintainable over time.

Jurgen Caeyman of Automation added another perspective from data centres. He pointed to a shift ir cooling to liquid



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LVDC systems gain relevance

Several speakers highlighted the growing relevance of LVDC (low voltage DC) systems for industry, data centres and multi-energy sites. That shift depends on a number of practical enablers already taking shape.

Key examples discussed during the panel included:

- Interoperability through LVDC subcircuits
- Demonstrators such as the Open Thor Living Lab
- Progress in DC protection
- Well-documented demos, ecosystem building and training

Glenn Emmers of BASF stressed the value of interoperability through LVDC subcircuits. Patrice Fleurquin of Thor Park pointed to the Open Thor Living Lab as a real-life test bench for DC grids. Peter Van Den Heede of ABB highlighted progress in DC protection, which is opening the door to large-scale DC grids. Simon Ravyts of EnergyVille and KU Leuven underlined the importance of



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Collaboration must replace fragmentation

The panel discussion delivered a clear message: separate efforts are not enough. Reinventing the wheel in isolation serves little purpose. Collaboration is essential.

Speakers also called for ambition. They argued that the ecosystem should commit to a moonshot demonstrator, such as an innovative data centre project in Flanders. The knowledge is available. The infrastructure is available. What is needed now is investment and long-term commitment.

That same logic came back in the contribution of Annick Dexters of P4ELECS. She stressed the need to train young people, invest in start-ups and equip the workforce with the skills required to design and protect next-generation DC grids.

Piet Vanassche of Mtuition added that open-source hardware and software can help accelerate innovation. They can also reduce unnecessary duplication across the ecosystem.

A strong legacy can inspire the next step

Sam Jordens of POM Limburg reminded the audience that Limburg was built by pioneers. The miners shaped the region through courage, hard work and long-term vision.

That same spirit still matters today. The energy transition asks for innovators who are willing to build, test and collaborate. In that sense, the future of power electronics is not only about technology. It is also about industrial ambition.

Conclusion

Power electronics is moving from evolutionary improvement to step-change innovation. Companies and regions that master wide-bandgap devices, high-frequency magnetics, AI-powered design tools and robust industrialisation will help shape the resilient energy systems of the next 30 years. Belgium already has the knowledge, ecosystem and infrastructure. Now the focus must shift to bold action, broad collaboration and strong demonstrators.

Would you like to explore how power electronics, DC systems and AI can strengthen your energy strategy?

Join the Energy4AI event to discover practical applications, expert insights and future perspectives for energy-efficient data centres and smarter energy systems.

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