ABSTRACT
SYMPOSIUM POWER ELECTRONICS FOR ENERGY TRANSITION

30 Sept. & 1 Oct. 2025

Graz, Austria

Submission to the Call for Presentations and Posters

(please save as pdf and upload your document via the submission form by **12 May 2025**)

Corresponding topic (please tick)	☐ Power Electronics in Automotive & Charging Applications ☐ Power Electronics in Medium Voltage Applications ☐ DC Industry ☒ Sustainability & Circular Economy in Power Electronics
Proposed presentation title (you can indicate a preference for oral or poster presentation in the submission form)	Powering the Transition Sustainably: Life Cycle Assessment for Batteries and Power Electronics
Authors (please highlight corresponding author / speaker)	Christoph Brandner

Abstract (1,500 – 3,000 characters), you are encouraged to add graphs/images to highlight your research

The global energy transition relies not only on clean energy generation but also on the technologies that store and convert it efficiently—batteries and power electronics. While the focus often lies on performance and cost, the environmental impact of these enabling technologies must not be overlooked. Life Cycle Assessment (LCA) offers a powerful tool to quantify and compare the environmental burdens associated with different products and production pathways, ultimately guiding sustainable innovation.

In the context of electric mobility, LCA plays a vital role in comparing battery electric vehicles (BEVs) with conventional internal combustion engine vehicles, revealing significant differences in lifecycle emissions. Furthermore, detailed LCA studies on lithium-ion batteries with varying cathode chemistries have shown how material choices can greatly influence overall environmental performance. In my recent study I compare their production impacts in a state-of-the-art globalized supply chain versus a hypothetical European production scenario, highlighting the environmental benefits of regionalized manufacturing and material choices.

However, batteries are only one part of the picture. As we scale up renewable energy infrastructure, power electronics plays an equally critical role by enabling the transformation and control of electric power. Just like batteries, the production of power electronics involves complex supply chains and resource-intensive materials, making it essential to assess their environmental footprint through LCA.

Yet, a major barrier remains: a lack of transparent and high-quality environmental data on the materials and components that make up power electronic systems. Current databases often rely on outdated or overly generic data, leading to LCA results with high uncertainty and low applicability for ecodesign. This bottleneck hampers the development of truly sustainable power electronics.

This presentation calls for urgent action: we need a dedicated environmental database for power electronics, developed in collaboration with manufacturers, researchers, and policymakers. Without it, we risk designing the backbone of our future energy systems without a full understanding of their true environmental costs.

To truly combat climate change through technology, we must ensure the technologies themselves are as sustainable as the energy they support.

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Contact details of corresponding author / speaker	Title	DI
	First name	Christoph
	Last name	Brandner
	Organisation	Silicon Austria Labs
	Department	Power Electronics
	Position	Research Engineer
	Address	Sandgasse 34, 8010 Graz
	Email	christoph.brandner@silicon-austria.com
	Phone	06648396145
Short CV	I am 28 years old, live in Graz, Austria and hold a Bachelor's degree in Environmental Science and recently completed my Master's in Materials Science, during which I focused on sustainability within battery technologies. My thesis, "Assessing Greenhouse Gas Emissions in Conventional and European Lithium-Ion Battery Production for NMC111-, NCA- and LFP-Chemistries," sparked a deep interest in bridging material innovation with environmental responsibility. Building on this, I am currently working at Silicon Austria Labs in the field of sustainable power electronics, specifically performing a life cycle assessment in the “Tiny Power Box 2” project—an onboard charger that combines high power density with high efficiency. I am also involved in corporate sustainability reporting and environmental management, which provides me with insight into the systemic aspects of sustainable development. In parallel, I am authoring a paper in collaboration with Graz University of Technology on "The potential of reducing greenhouse gas emissions of lithium-ion battery production in different geographic scenarios."	

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