

Light Harvesting Special Interest Group

Power electronics and grid connections

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Panel

Teng Long, Associate Professor, Applied Power Electronics Laboratory, University of Cambridge

Michael Pollitt, Professor of Business Economics, electricity markets, University of Cambridge

Ioannis Lestas, Associate Professor, power system control, University of Cambridge

Yogev Barak, Chief Marketing Officer, domestic solar power connection, SolarEdge

James Yu, Head of Innovation, Scottish Power and Industrial Professor, Newcastle University

Roland Huemphner, Huawei, string inverter for solar farms

Rapporteur: Ameer Janabi

For more information, contact
decarbnetwork@admin.cam.ac.uk

Discussion Points

- UK solar subsidies were initially introduced for the commercial sector; the scheme was extended to domestic use in 2010. It is scheduled to end on 31 March 2022.
- Limited export solar systems are becoming increasingly common. This mostly happens during the day when the solar generation is at its peak.
- Electricity storage is a technology that is deemed to be an enabler to wider renewables deployment. Currently, energy storage is more costly than solar energy generation.
- Unlike conventional grids, solar power grids have decentralized control policies for voltage/frequency. The solar inverter is required to have a grid-forming role. It is estimated that 20% renewable penetration is a critical threshold for forming the whole grid.
- Working on technologies beyond silicon to develop a low-cost inverter is necessary to drive the overall solar system cost down. It is important to note that there is a temporary rise in semiconductor costs due to chip shortage.
- There is a significant business case to justify the high cost of semiconductor devices. That is, the return on investment can happen faster if the power electronics can provide grid services. For instance, one of these services includes coming back from the black-start. Especially now, black-start scenarios are becoming more usual events.
- Another way to justify the high system cost is by increasing the lifetime of operation and reducing the mean time before maintenance. This is already a trend that can be seen with most systems being designed for a lifetime of 25 years.
- Comprehensive carbon pricing across the whole economy is necessary. The production sector for producing capital assets would then be included. This will capture some of the lifecycle issues related to the production of solar-systems.

Challenges

- Grid-forming role is more of an open program and yet to have an established protocol.
- Power converters are the most expensive component in the solar system. The cost of the solar inverter did not change that much in 10 years. It is essential to develop lower-cost solar power electronics.
- There is a current challenge in adapting wide bandgap devices in solar systems, including meeting the lifetime requirements.

Opportunities

- Academic-industry collaborations to develop advanced control methods for solar inverters with grid-forming capabilities.
- UoC can research energy storage solutions, including lithium-ion batteries, that accommodate large-scale storage, a significant enabler in this industry.
- Life cycle assessments are needed for full systems including considerations for end of life
- Interdisciplinary research to link energy storage and semiconductors is expected for power electronics.
- Solar inverter industry increasingly needs engineers as the market is good. Training and research in power electronics from the universities should be promoted to provide more graduate engineers and also non-degree level training.

