CAMBRIDGE ZERO

Light Harvesting
Special Interest Group

Where do emerging PV technologies best fit into achieving decarbonisation goals?

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Panel

Sam Stranks, Asst. Professor in Energy & Royal Society University Research Fellow, UoC. *Expertise: Lead halide perovskite characterization and application in optoelectronic devices*

Louise Hirst, University Lecturer, Physics and Materials Science and Metallurgy, UoC. *Expertise: Ultrathin III-V photovoltaics for space applications*

Neil Greenham, Professor in Physics, UoC. *Expertise: Organic photovoltaics and singlet fission (down conversion)*

Chris Case, CTO, Oxford Photovoltaics. *Expertise: Commercialization of perovskite/silicon tandem solar cells*

Nigel Mason, Director, PV Consulting Limited. *Expertise: Photovoltaics value chain*

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Discussion Points

- Deployment of photovoltaics (PV) consistently beats projections by the International Energy Agency. The price of PV has dropped 100x since 1980 and 10x since 2010, due to economies of scale and higher power conversion efficiencies (PCE). This has all been achieved by silicon based technologies, which make up more than 95% of the market. The discussion addresses whether or not other technologies can also play a role.
- Other technologies would need to offer significant improvements or be able to do something that silicon cannot. i.e. PCE >27% and lower cost, or for niche applications such as lightweight and flexible electronics or in space. Alternatively, use the emerging technology to enhance silicon. Prime examples are singlet fission, which could boost PCE by 10-20% (relatively) or perovskite-silicon tandem solar cells.
- An often overlooked aspect of the rapid growth and cost reduction of silicon PV is that quality has suffered. There are hidden costs for assets that do not last the specified lifetime.
- Considering the large carbon footprint of transport and the desire for energy security, it would be advantageous to produce PVs locally. Module assembly in particular can be easily done locally.
- There are no real obstacles to bring lead-based materials (perovskite) to the market. PV is excluded from lead regulations, and lead-free perovskites cannot currently compete with lead-based perovskites. Research is being done on sequestering lead in case it leaches out of the solar panel.
- Replacing glass with polymeric materials may be useful for niche applications (lightweight) and depends on lifetime needed. Glass is one of the most robust materials in the solar cell module. Polymeric alternatives are currently more expensive. A better effort could be to make glass thinner and stronger.
- Subsidy is not needed; the product should be viable in its own right. The government could help by removing red tape and providing a mandate for renewable building.

Challenges

- Sustainability: the 30-40 year lifetime of modules means efficient recycling is be needed to preserve valuable materials.
- Shortage in power electronics: due to a lack of production capacity. This is a long term challenge and can have a profound impact on development.
- Funding next-generation technologies is hindered by the lack of an established industry, making it hard to take them beyond research.

Opportunities

- Lead sequestering agents for securing lead in halide perovskite cells in case of failure
- Develop thinner and stronger glass to reduce cost of all PVs, provide wider applications.
- Improve power electronics management to reduce impact of shading losses
- Integration of III-V and other thin film PV technologies into electric vehicles – maintain aesthetics and form factors
- Develop local manufacturing methods for new thin film technologies

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