HORIZON-CL5-2023-D3-02-12
Large area perovskite solar cells and modules

LUMINOSITY

Large area uniform industry compatible perovskite solar cell technology

Starting date of the project: 01/06/2024
Duration: 48 months

= Deliverable D7.1 =

Eco-design strategies: intermediate

Abstract

Deliverable D7.1 presents preliminary eco-design strategies for scalable flexible perovskite modules based on intermediate life cycle assessment (LCA) and techno-economic assessment (TEA) results. Five flexible single-junction perovskite module configurations were assessed environmentally, while the baseline configuration was evaluated economically to identify key environmental hotspots and manufacturing cost drivers.

The intermediate LCA results show a global warming potential of approximately 29 kg CO_2 eq/m^2 across the assessed scenarios, meeting the project target of ≤30 kg CO_2 eq/m^2. The baseline TEA estimates a manufacturing cost of EUR 46/m^2, which falls within the EUR 41–126/m^2 range reported in the literature but exceeds the project target of EUR 20/m^2. Materials account for 72% of the estimated manufacturing cost, with nitrogen used in the buffer layer deposition and PCBM in the electron transport layer identified as the main material cost drivers.

The assessment identifies buffer layer deposition as a major environmental and economic hotspot due to high nitrogen consumption, while polymer and aluminium substrates contribute substantially to the embodied energy of the module. Sputtering is the most energy-intensive deposition method among the processing steps. Based on these findings, preliminary eco-design strategies are recommended, including nitrogen recovery, different buffer-layer deposition methods, lower-impact substrates, and alternatives to high-cost materials such as PCBM.

These intermediate findings provide the basis for further refinement of the environmental and economic assessment in the succeeding iteration. Next steps include extending the system boundary, integrating more primary data, and considering module efficiency and uncertainty/sensitivity analysis.

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