Expected Results

- High-quality evaporated perovskite absorbers and cells with a high radiative efficiency, enabling Voc > 1.3V and featuring high stability against light, heat, humidity, and electric fields.
- Enabling technologies for the mass production of PVSK/Si tandem devices while increasing PV module circularity.
- Demonstrator of a perovskite/Si tandem solar cell with a PCE ≥33% integrating a fully evaporated top cell and processes ready for industrial scale-up.
- Demonstrator of a PVSK/Si tandem PV module with best PCE >30% , including sustainable BoM.
- Proof of concept of Pb recycling (100%) for PVSK absorber and Si reuse (weight-based yield >95%).
- Guidelines for sustainable industrial practices, based on the results of the optimum fabrication analysis for PVSK/Si tandem modules.

Consortium

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Funded by the European Union

NEXUS

Next Generation of Sustainable Perovskite-Silicon Tandem Cells

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Grant Agreement n°101075330

About NEXUS

NEXUS's aim is to develop stable, 2-terminal perovskite (PVSK)/Si **tandem solar cells** with power conversion **efficiencies above 33%** (and modules > 30%) whilst following an innovative **eco-design approach**: employing solvent-free perovskite deposition, abundant and optimized use of materials, circularity, recyclability, improved and simple manufacturing processes, to create a **viable economic pathway** for the European commercialization of this sustainable technology.

Single junction solar cells are reaching their plateau efficiency whilst the need for solar to decarbonise energy consumption, and space to install solar, to meet climate protection and mitigation laws is growing. At the same time, new solar technologies need to demonstrate they can be made with abundant and sustainable raw materials within the circular economy to meet environmental and sustainability goals.

The core of NEXUS is meeting these challenges with a competitive European PV product, by bringing together **research** and **industry** to develop new perovskite-Si tandem cells and demonstrate the **scalability into industry** of these cells with **proof-of-concept equipment**.

Expected Impacts

Scientific Impacts

- Demonstrate tandem technologies for efficiencies beyond single-junction Shockley–Queisser limit (~29%).

Societal Impacts

- Minimize the impact of PV on landscape and environment by increasing its energy yield/m^2.
- Enhanced sustainability of renewable energy and renewable fuels value chains.
- Perform an LCA analysis to bring evidence of the lower environmental impact, and circularity potential.
- Contribute towards establishing a solid European innovation base and a competitive, continuous and coherent PV value chain.
- Accelerate the replacement of fossil-based energy and Improve the security of energy supply in Europe.

Economic Impacts

- Creating a viable economic pathway for the commercialisation of the technology.
- Reduce cost and improved efficiency.
- De-risking of renewable energy and fuel technologies with a view to its commercial exploitation and net-zero GHG emissions by 2050.
- Creating more and better jobs.

Objectives

1. Develop solvent-free high-bandgap perovskite absorbers and top cells stable to light, heat, humidity and electric stress.
2. Develop bottom cells adapted for the tandem technology with an eco-design approach: In-free, low Ag and low-CO2 Si wafers.
3. Develop technologies for the manufacturing of PVSK/Si tandem devices with a low environmental impact.
4. Deliver tandem modules with PCE >30% and establish the BOM for different applications.
5. Demonstrate the outdoor reliability of PVSK/Si tandem modules.
6. Realize outdoor durability of the tandem modules.
7. Quantify the economic, environmental, and social impact of the sustainable tandem technology, provide proof of the principle of circularity.