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## A Project in the Framework "Nextgenerationeu": Sustainable Photoelectrochemical Hydrogen Evolution - SERGIO

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**Abstract :** The exploration of solar energy for the photoelectrochemical splitting of water into hydrogen and oxygen has been extensively researched as a means of generating sustainable H<sub>2</sub> fuel. However, despite these efforts, commercialization of this technology has not yet materialized. Presently, the primary impediments to commercialization include low solar-to-hydrogen efficiency (2-3% in PEC with an active area of up to 10-15 cm<sup>2</sup>), the utilization of costly and critical raw materials (e.g., BiVO<sub>4</sub>), and energy losses during the separation of H<sub>2</sub> from O<sub>2</sub> and H<sub>2</sub>O vapours in the output stream. The SERGIO partners have identified an advanced approach to fabricate photoelectrode materials, coupled with an appropriate scientific direction to achieve cost-effective solar-driven H<sub>2</sub> production in a tandem photoelectrochemical cell. This project is designed to reach Technology Readiness Level (TRL) 4 by validating the technology in the laboratory using a cell with an active area of up to 10 cm<sup>2</sup>, boasting a solar-to-hydrogen efficiency of 5%, and ensuring acceptable hydrogen purity (99.99%). Our objectives include breakthroughs in cost efficiency, conversion efficiency, and H<sub>2</sub> purity.

 $\textbf{Keywords:} \ photoelectrolysis, green \ hydrogen, \ photoelectrochemical \ cell, \ semiconductors$ 

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