Solar Polygeneration Collector for Combined Heat, Power, Hydrogen Fuel and Wastewater Treatment



Scientific and Technical Report – M18

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Public Executive Summary

This report aims to summarize the technical and scientific progress of the project by March 2025 and to identify the main deviations regarding the work plan. During the third semester of the project, steady progress was achieved across technical, dissemination, and management activities, with tangible outputs delivered and key coordination mechanisms strengthened.

SPECTRUM activities started with an identification of industrial sectors producing industrial wastewater (IWW) with promising characteristics for photocatalytic pollutant degradation with cogeneration of hydrogen. Samples from promising IWW sources have been collected and their composition was analysed. Photocatalysts tuned for the selected IWW have been developed, characterised and tested under laboratorial conditions, with artificial light sources. These photocatalysts contain non-precious metals and are designed to improve recovery, regeneration and reuse capabilities.

Design and computational simulation activities have been carried out to develop the novel polygenerating collector concepts (one for lower temperature applications, up to 100 ºC, and another for medium temperature applications, up to 200 ºC), focusing on the development of the optical, thermal, electrical and photocatalytic sub-systems of the prototypes, targeting their synergistic integration in a single device.

The most relevant and innovative results obtained so far are the following:

- Development of low cost, sustainable photocatalysts for hydrogen production using industrial wastewater as sacrificial agents. These photocatalysts are dual-functional as they are used for hydrogen generation and to improve the biodegradability of the industrial wastewater;

- Conceptual design of a multi-product solar collector for power, low temperature heat (up to 100 ºC) and hydrogen production with remediation of industrial wastewater;

- Conceptual design of a multi-product solar collector for power, medium temperature heat (up to 200ºC) and hydrogen production with remediation of industrial wastewater.

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