



European  
Commission

# INNOVATION FUND

Driving clean innovative technologies towards the market

## SUN2HY: First Small-Scale Deployment of a Pre-Commercial Plant Based on Photoelectrocatalytic Technology for Hydrogen Production

The Innovation Fund is 100% funded by the EU Emissions Trading System

Plant at Repsol Tech Lab in Madrid (Spain)

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### Project summary

The aim of the SUN2HY project is to design, implement and validate a pre-commercial stage production plant to generate green hydrogen via photoelectrocatalysis (PEC), an innovative technology which directly converts solar energy to chemical energy by splitting water into hydrogen and oxygen with no external energy input. The produced hydrogen will supply refuelling stations serving the transport sector (i.e. freight buses, trucks and light duty vehicles (LDVs)). The project has the potential to reduce greenhouse gas (GHG) emissions by 94% compared to conventional electricity production.

#### COORDINATOR

SUN2HY

#### LOCATION

Puertollano, Spain

#### SECTOR

Hydrogen

#### AMOUNT OF INNOVATION FUND GRANT

EUR 4 484 293

#### RELEVANT COSTS

EUR 7 473 822

#### STARTING DATE

01 January 2022

#### PLANNED DATE OF ENTRY INTO OPERATION

31 March 2025

2012



**Project TRANSFORMACO2**

Repsol begins the study of the potential of photoelectrocatalytic technology.

2014-2018

**Project LUXHOR**

Laboratory scale proof of concept with results ahead of the state of the art (28 cm<sup>2</sup> cell, TRL4).

2018



**Joint venture agreement**

Enagas joins the development to continue scaling up to a pilot plant through the SUN2HY project.

2018-2021

**Project SUN2HY**

Design, construction and validation of a new photoelectrochemical cell (TRL5) and demonstration of the technology in a pilot plant (m<sup>2</sup> scale, TRL6).

2021



Sunrgyze company incorporations.

## A disruptive technology on its path to commercial scale

The project will develop a disruptive photoelectrocatalysis (PEC) technology, with a solar-to-hydrogen (STH) efficiency above 13% (current competitive technologies are around STH efficiency of 8%). Commercial uptake of PEC technology, since its initial discovery more than 30 years ago, has been hindered by module stability, limited efficiency and cost challenges. With its scale (>1m<sup>2</sup> per module), adequate stability (between 70 000 - 80 000 hours) and high operational current density, the project represents a breakthrough innovation that should provide a real step forward for the technology on its path to full commercial scale.

## A sustainable alternative route for renewable hydrogen

The aim of the project is to demonstrate the first pre-commercial PEC plant in the world, with a hydrogen production capacity of 200 tons per year. By using solar energy, the technology provides a sustainable alternative route for renewable hydrogen production and will ensure supply of low carbon fuel for hydrogen refuelling states (freight buses, trucks and LDVs) in the surroundings of Puertollano Industrial Complex. The use of hydrogen instead of conventional fuel will help avoid more than 25 000 tCO<sub>2e</sub> net absolute GHG emissions during the project's first ten years of operation. In addition, PEC technology also has a potential to bring the costs of green hydrogen production down as it requires lower CAPEX than

alkaline and Polymer electrolyte membrane (PEM) electrolysis integrated with renewables. Moreover, considering that PEC devices can be operated with sole sunlight (and independency from natural gas and electricity), it also has a potential to bring OPEX down.

## Very concrete scale up potential in the region and beyond

The modular design of the proposed technology means that it can be scaled up very easily by adding further PEC modules, which allows for further expansion on the same site in a second phase. The project also has great potential for being replicated at other similar locations with direct access to large source of solar energy. For example, REPSOL has large potential in terms of expansion of the proposed project based on its plan to instal 30 Hydrogen Refuelling Station (HRS) in its existing service stations globally until 2030. Moreover, the recent Spanish Hydrogen Plan sets as an objective 100-150 HRS by 2030. Additionally, Puertollano is one of the larger industrial areas of Spain, where several potential clients are located.

The regional hydrogen refuelling station roadmap – coupled with expected market uptake of hydrogen-fuelled vehicles – demonstrate potential for further scale up and replication for this technology elsewhere in the sector. The technology can also be applied across the economy to contribute to the shift towards a low carbon future in many industries.