European Commission

IPHE

Hydrogen - A Competitive Energy Storage Medium To Enable the Large Scale Integration of Renewable Energies

Seville, 15-16 November 2012

SolH2. Solar hydrogen production by using solar thermal power.

Overall Objectives and Budget

The objective of the project is to analyse different ways to produce hydrogen by using solar thermal power, in order to store the energy produced that cannot be consumed. Within the project, two major lines are analysed:

- Thermochemical mixed-ferrite cycle. Process based on thermochemical water splitting cycles are a promising alternative to produce hydrogen in an CO_2 emission-free way. A two-step water splitting cycle using metal-oxide redox pair is the simplest process among the multistep thermochemical water splitting processes

Thermal integration of hydrogen production processes with concentrated solar energy systems.

- Biofuels reforming: steam reforming is a well-defined chemical process that has been implemented in the last few years. To increase the efficiency, a further sustainable optimization of this type of process is the integration with concentrated solar energy
  Budget: 4 M€

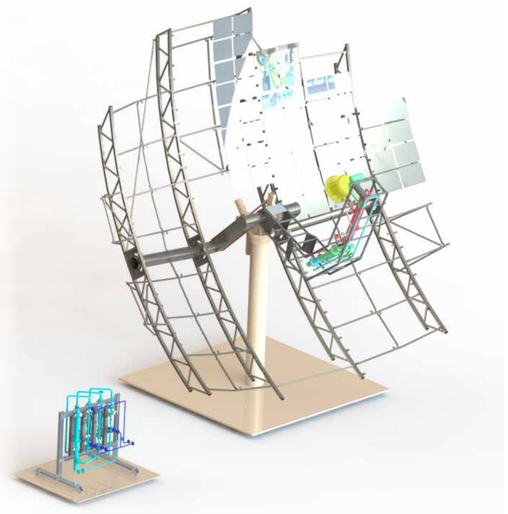
Technical Barriers and Targets

- Develop solar thermochemical technologies for hydrogen production
- Demonstrate the technical feasibility of both technologies by designing, constructing and testing both systems
- Demonstrate hydrogen can be used as a way of storing excess of energy

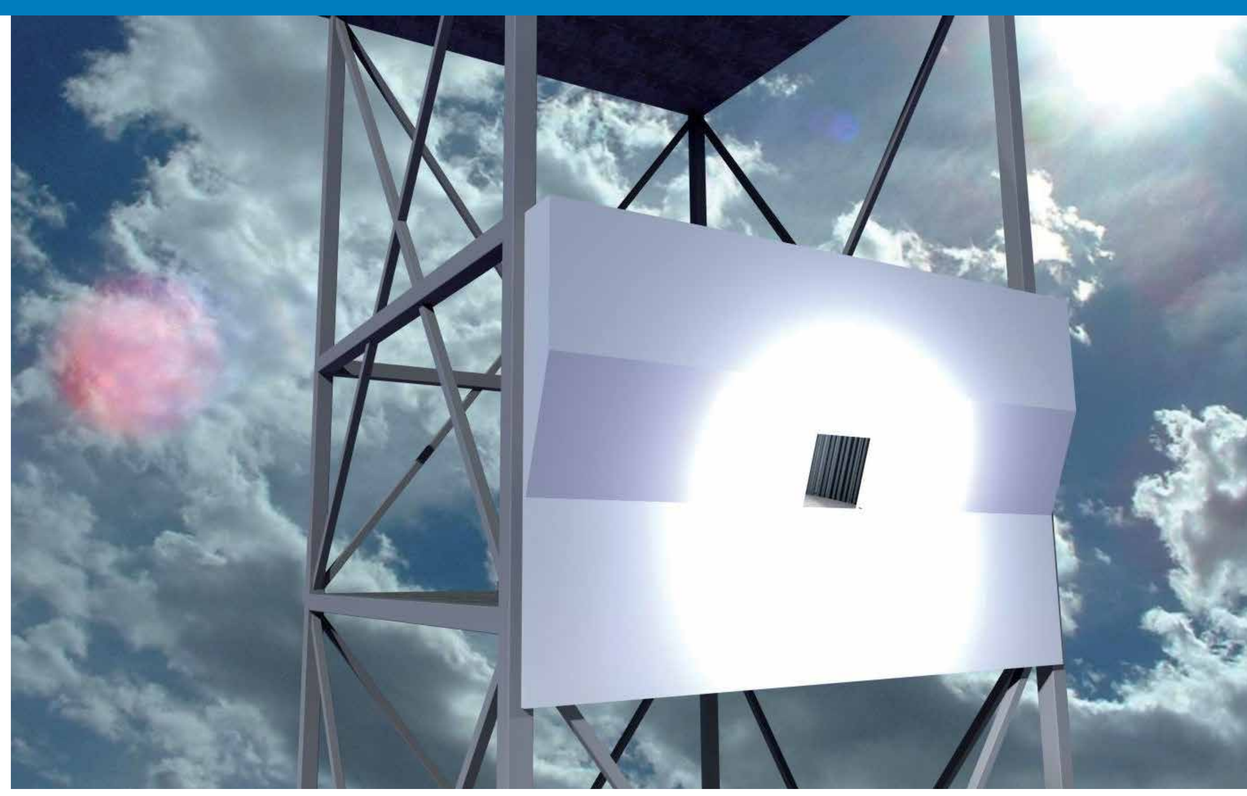
Technical accomplishments / progress / results

Conceptual and detailed engineering design of both technologies.
Design and implementation of control system.
Two prototypes are being built:

- Small reactor for bioethanol reforming in a parabolic dish
- Large reactor aimed to produce hydrogen by using a cycle using ferrites in a tower



Schematics of the biofuels processing system integrated in the parabolic solar dish.



3D model of the tower.

Future Work

- Test both prototypes: bioethanol process in the solar dish and two-step thermochemical cycle for water splitting based on mixed ferrites at a solar tower
- Test results analysis and evaluation
- Future optimizations to design, like improving efficiency or reducing costs
- Comparative study of both technologies in terms of daily hydrogen production, reagents consumption, thermal power input, performance, market orientation, among other considerations of interest

Conclusions and major findings

- Temperature levels required for this type of thermochemical process are considerably lower than the ones required for direct water splitting
- Steam reforming processes are candidate processes for converting solar high-temperature heat to chemical fuels
- Excess of thermal energy can be stored as hydrogen

Project Overview

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  Financial support from the Spanish Ministry of Economy and Competitiveness and the European Regional Development Fund (ERDF) given to the SolH2 project (IPT- 2011-1323-920000).
- From 01/10 to 12/13

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