



# Hydrogen Europe: European Hydrogen & Fuel cell Project Database

## Project ARTIPHYCTION

Fully artificial photo-electrochemical device for low temperature hydrogen production

Leaves can split water into O<sub>2</sub> and H<sub>2</sub> at ambient conditions exploiting sun light. James Barber, one of the key players of ArtipHyction, elucidated Photosystem II (PSII), the enzyme that governs this process. In photosynthesis, H<sub>2</sub> is used to reduce CO<sub>2</sub> and give rise to the various organic compounds needed by the organisms or even oily compounds which can be used as fuels. However, a specific enzyme, hydrogenase, may lead to non-negligible H<sub>2</sub> formation even within natural systems. Building on the pioneering work performed in a FET project based on natural enzymes ([www.solhydromics.org](http://www.solhydromics.org)) and the convergence of the work of the physics, materials scientists, chemical engineers and chemists involved in the project, an artificial device will be developed to convert sun energy into H<sub>2</sub> with close to 10% efficiency by water splitting at ambient temperature, including: -) an electrode exposed to sunlight carrying a PSII-like chemical mimic deposited upon a suitable transparent electron-conductive porous electrode material (e.g. ITO, FTO) -) a membrane enabling transport of protons via a pulsed thin water gap -) an external wire for electron conduction between electrodes -) a cathode carrying an hydrogenase-enzyme mimic over a porous electron-conducting support in order to recombine protons and electrons into pure molecular hydrogen at the opposite side of the membrane. A tandem system of sensitizers will be developed at opposite sides of the membrane in order to capture light at different wavelengths so as to boost the electrons potential at the anode for water splitting purposes and to inject electrons at a sufficiently high potential for effective H<sub>2</sub> evolution at the cathode. Along with this, the achievement of the highest transparence level of the membrane and the electrodes will be a clear focus of the R&D work. A proof of concept prototype of about 100 W (3 g/h H<sub>2</sub> equivalent) will be assembled and tested by the end of the project for a projected lifetime of >10,000 h.

## Project Information

**Type of project :** Research

**Timing :** 01/05/2012 > 31/10/2015

**Project website:** <http://www.artiphyction.org/>

**Project Budget :** 3.594.581 €

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## Funding

European Union through FCH JU: Grant agreement 303435 - [CORDIS link](#)

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## Project partners

**Coordinator :**

[Polito - Politecnico di Torino](#)

**Partners :**

[HYSYTECH S.r.l.](#)

[CEA - Commissariat à l'énergie atomique et aux énergies alternatives](#)

[CERTH \(National Centre for Research and Technology Hellas\) with CPERI](#)

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[TECNOLOGIA NAVARRA DE NANOPRODUCTOS SL](#)

[PYROGENESIS SA](#)

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**Sub project(s)**

**Sub project 1**

**Country:** Italy

**Address:**

CORSO DUCA DEGLI ABRUZZI 24 10129 TORINO

**Sub project categories**

Research

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