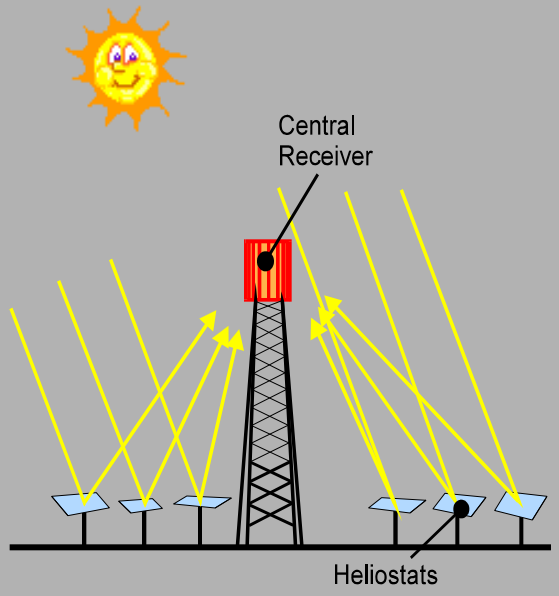
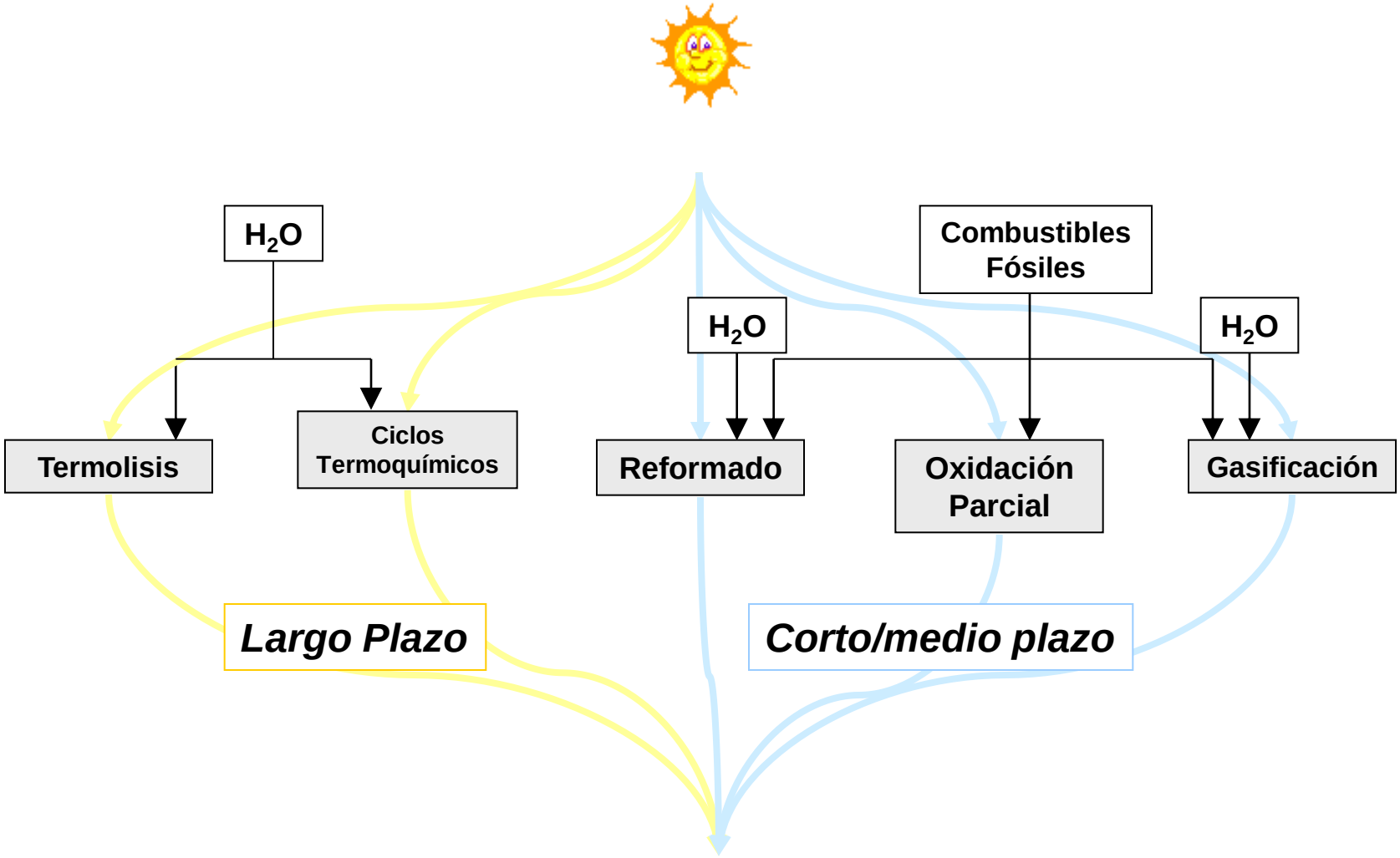
Plataforma Tecnológica de Hidrógeno y Pilas de Combustible

HYDROSOL

CATALYTIC MONOLITH REACTOR FOR HYDROGEN GENERATION FROM SOLAR WATER SPLITTING



Alfonso Vidal
CIEMAT-PSA


H_2O
Termolisis
Ciclos Termoquímicos
Combustibles Fósiles
H_2O
H_2O
Reformado
Oxidación Parcial
Gasificación
Largo Plazo
Corto/medio plazo
Hidrógeno Solar

1ª ETAPA : ACTIVACIÓN → Reducción

$$\mathbf{MFe_2O_4 \longrightarrow MFe_2O_{4-\delta} + \delta/2\ O_2} \qquad T < 1200\ ^oC$$

2ª ETAPA: HIDRÓLISIS → Oxidación

$$MFe_2O_{4-\delta} + \delta\ H_2O \longrightarrow MFe_2O_4 + \delta\ H_2 \qquad T < 800\ ^oC$$

REACCIÓN GLOBAL :

$$\delta\ H_2O \longrightarrow \delta/2\ O_2 + \delta\ H_2$$

European Commission:

- **HYDROSOL I (ENK6-CT-2002-00629)**
- **HYDROSOL-II (FP6-2005-Energy-1, 020030).**

APTL/CERTH/CPERI - Aerosol & Particle Technology Laboratory (Coordinator) (RES) - advanced material synthesis, reactor design

DLR - Deutsches Zentrum für Luft- und Raumfahrt (RES) – solar reactor engineering, solar field/plant design and operation

CIEMAT - Centro de Investigaciones Energéti-cas, MedioAmbientales Y Tecnológicas (RES) – owner/operator of PSA solar platform

JOHNSON MATTHEY (IND) - catalyst supplier and manufacturer-Fuel cells developer/producer

STC (SME) - Producer of advanced ceramics

DURATION: 01/11/05-31/10/09; Total cost: 4.297.400 € ; EU funding: 2.182.700 €

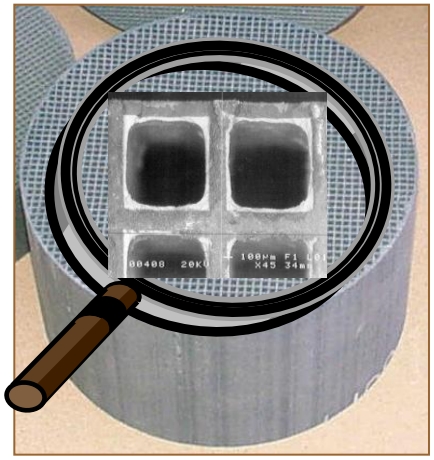
HYDROSOL II

"Catalytic monolith reactor for hydrogen generation from solar water splitting"

SOLAIR collector technology

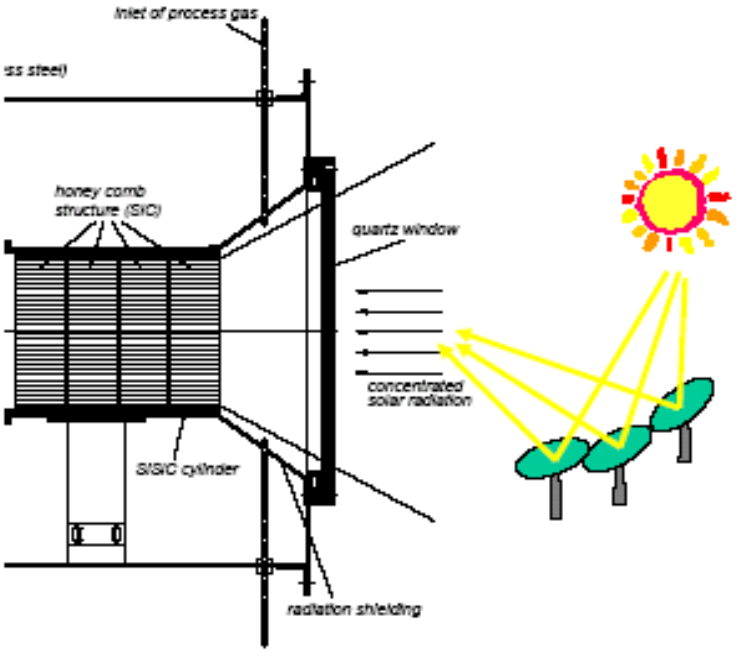
- Bajo estrés térmico y mecánico
- Bajo mantenimiento
- Fácil escalado

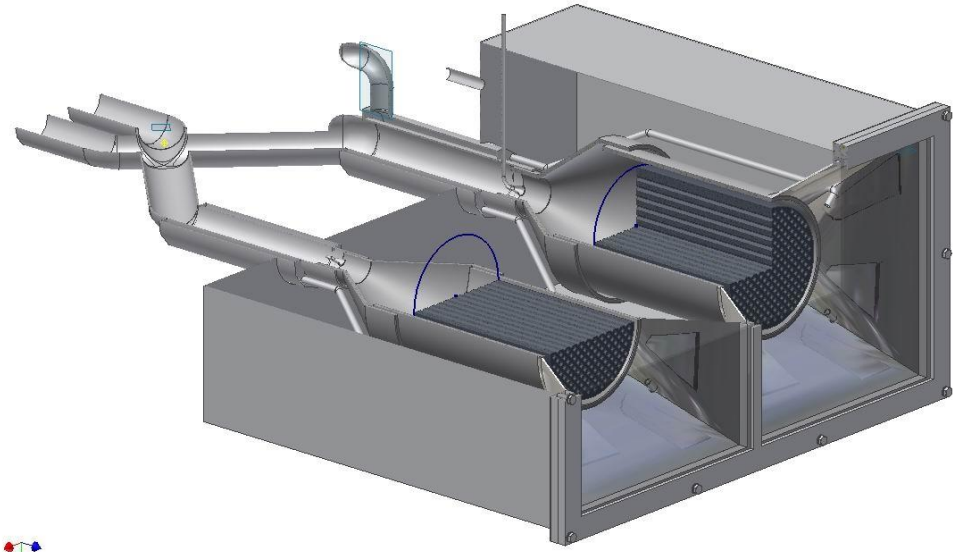
CERAMIC HONEYCOMB MONOLITH



Monolithic reactors (catalytic converters and Diesel soot filters)

REDOX COATING





2 Step redox thermochemical cycle using mixed iron oxides:

1. Endothermal Step (1000-1200°C)

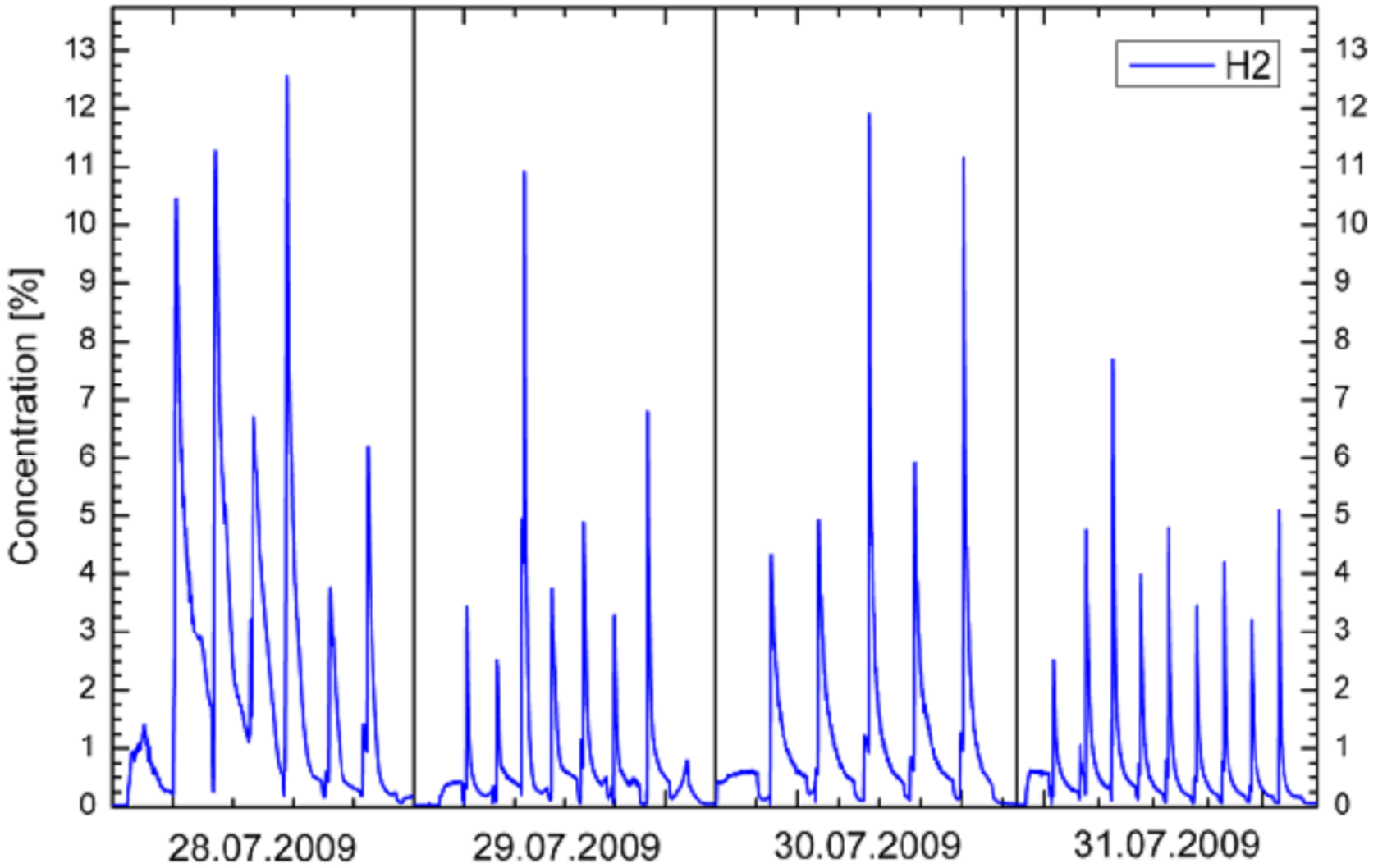
$MO_{ox} \leftrightarrow MO_{red} + ½\ O_2$

2. Splitting (700 - 1000°C)

$MO_{red} + H_2O \leftrightarrow MO_{ox} + H_2$

System: e.g. MO = $(Zn,Y)Fe_2O_4$
Y = Ni oder Mn

costs: 10-20 ct/kWh [DLR]


H2
Concentration [%]
0
1
2
3
4
5
6
7
8
9
10
11
12
13
28.07.2009
29.07.2009
30.07.2009
31.07.2009

HYDROSOL-3D

Scale Up of Thermochemical **HYDRO**gen Production in a **SOL**ar Monolithic Reactor: a **3**rd Generation **D**esign Study.
Duration: 2010 - 2013

- Call identifier: FCH-JU–2008-1
  - Topic: SP1-JTI-FCH.2.3: Water Decomposition with solar heat sources
  - Date of publication: 8th October 2008
  - Deadline: 15th January 2009 at 17:00:00 (Brussels local time)
  - Indicative budget: EUR 28.1 million from the FCH JU 2008 budget.
  - Funding scheme: Collaborative Project
- March 2009. Evaluation summary report
  Threshold : 13/15 (among the 18 proposals out of the 32)
- June – July 2009.
  Starting Negotiation
- Consortium Agreement . September 2009 – January 2010
- Starting date of the project. 1st January 2010.

HYDROSOL-3D

Scale Up of Thermochemical **HYDRO**gen Production in a **SOL**ar Monolithic Reactor: a **3**rd Generation **D**esign Study. Funding: FCH-JU–2008-1. Duration: 2010 - 2013

Participant Organization	Country
Aerosol and Particle Technology Laboratory (APTL)	Greece
Deutsches Zentrum fuer Luftund Raumfahrt e.V. (DLR)	Germany
Centro de Investigaciones Energéticas Medioambientales y Tecnológicas (CIEMAT)	Spain
Total SA (TOTAL)	France
HyGear B.V. (HYG) NL	The Netherlands

Project objective:
The principal objective of HYDROSOL-3D is the in-detail preparation of a plant for solar thermo-chemical hydrogen production from water in a 1 MW scale on a solar tower.