



HYDROSOL-PLANT

Thermochemical HYDROgen production in a
SOLar monolithic reactor: construction and
operation of a 750 kW_{th} PLANT

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***Programme Review Days 2017
Brussels, 23-24 November***

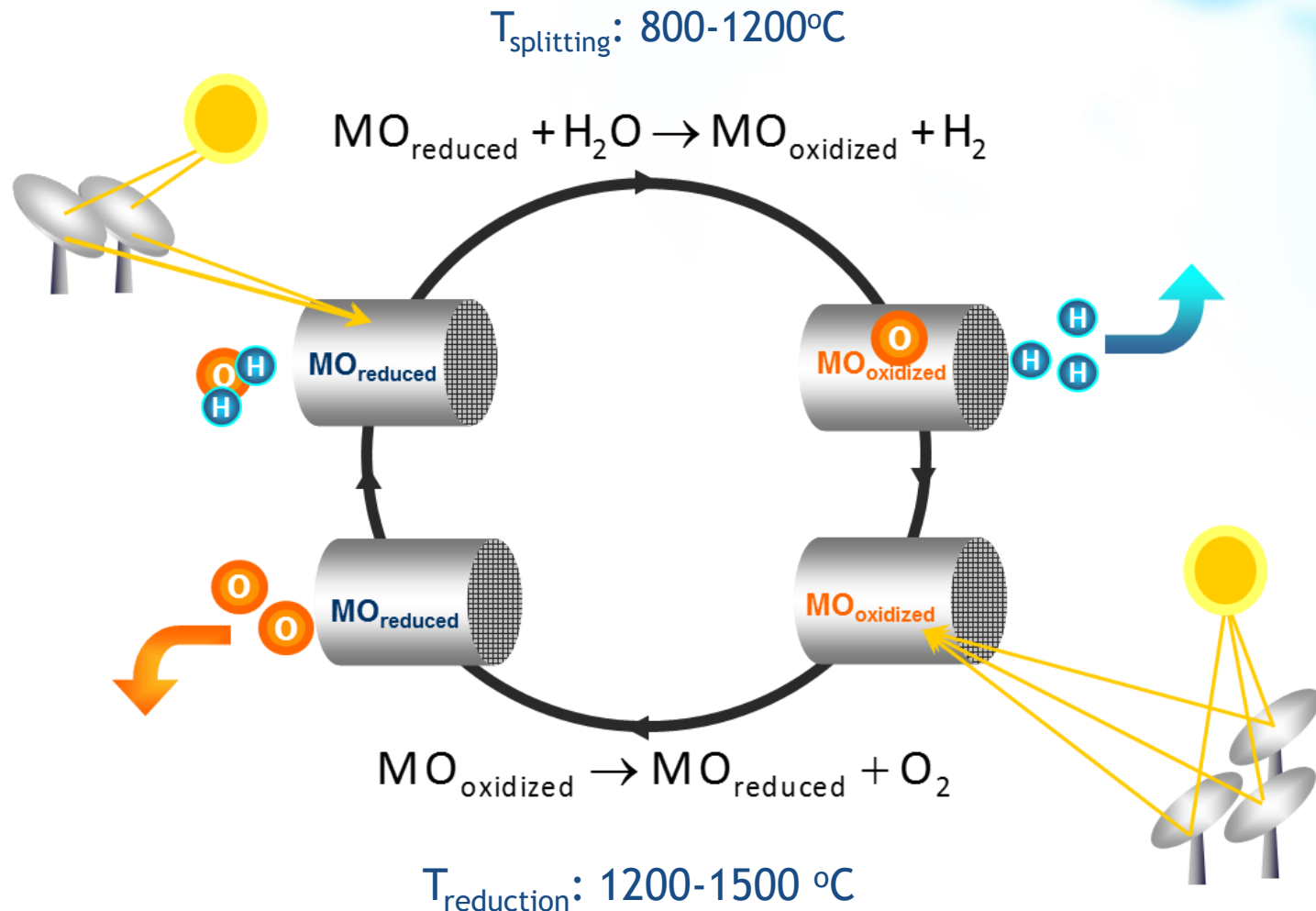


PROJECT OVERVIEW

- Call year: 2012
- Call topic: SP1-JTI-FCH.2012.2.5: Thermo-electrical-chemical processes with solar heat sources
- Project dates: 1/1/2014-31/12/2017
- % stage of implementation 01/11/2017: 80 %
- Total project budget: 3,480,806 €
- FCH JU max. contribution: 2,265,385 €
- Other financial contribution: -€
- Partners: APTL, DLR, CIEMAT, HYGear, HELPE

PROJECT OVERVIEW

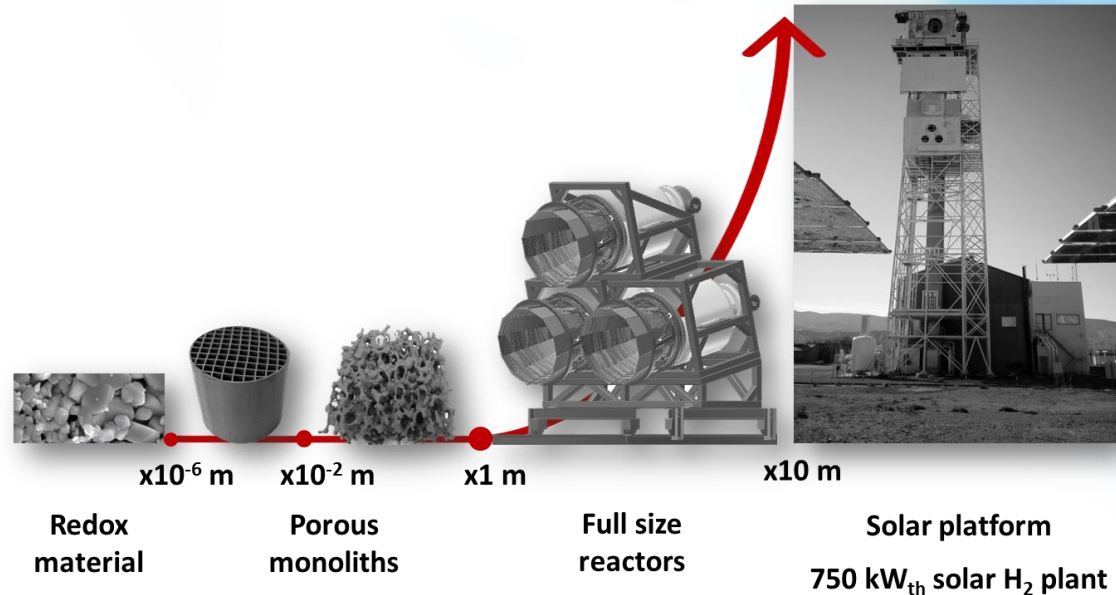
Monolithic honeycomb capable to absorb concentrated solar irradiation coated with redox water splitting materials



PROJECT SUMMARY

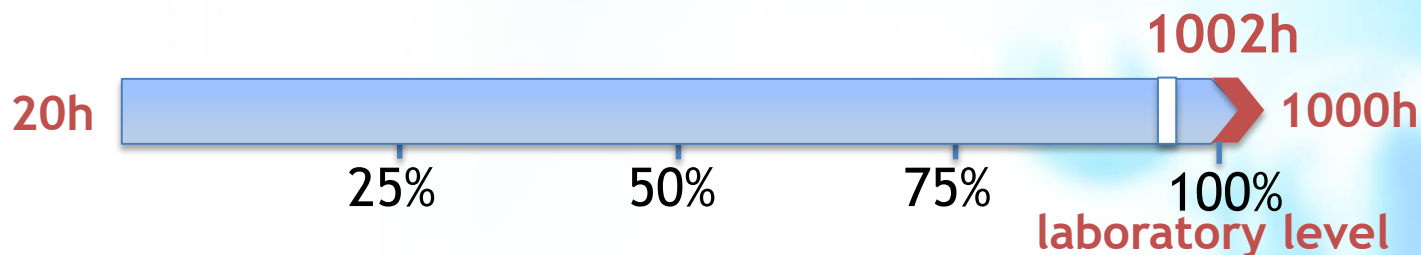
Aim of the HYDROSOL-PLANT is the development and operation of a plant for the solar thermo-chemical hydrogen production from water. The main objectives are :

- to achieve a material life-time of more than 1000 operational hours
- to construct a solar hydrogen production demo-plant in the 750 kW_{th} range
- demonstrate hydrogen production and storage on site at levels > 3kg/week
- largest H₂ production facility via solar thermochemical water splitting



PROJECT PROGRESS/ACTIONS - Durability

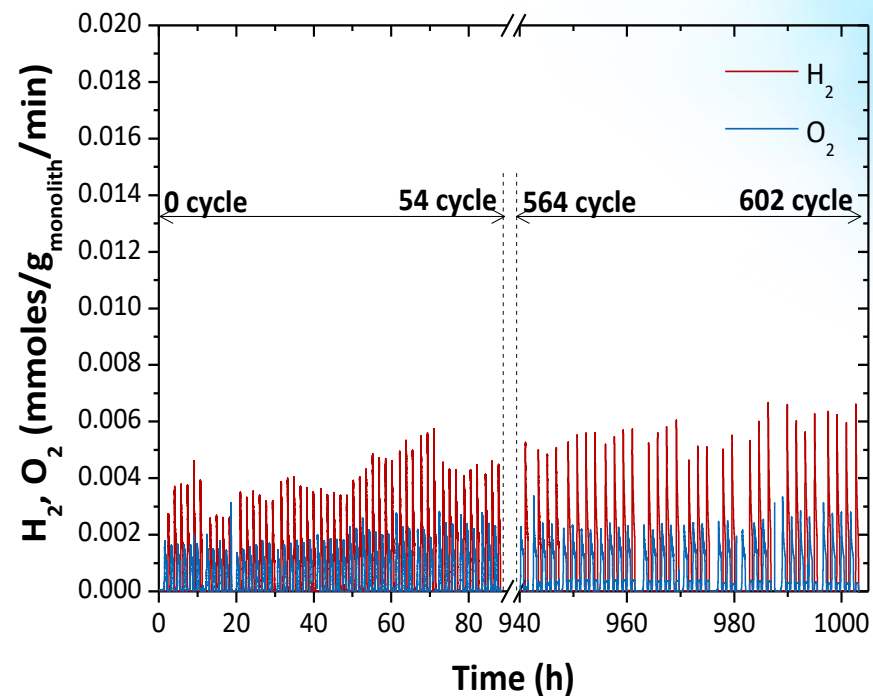
➤ Achievement to-date
 █ % stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Durability	Material life time	h	283	1000		

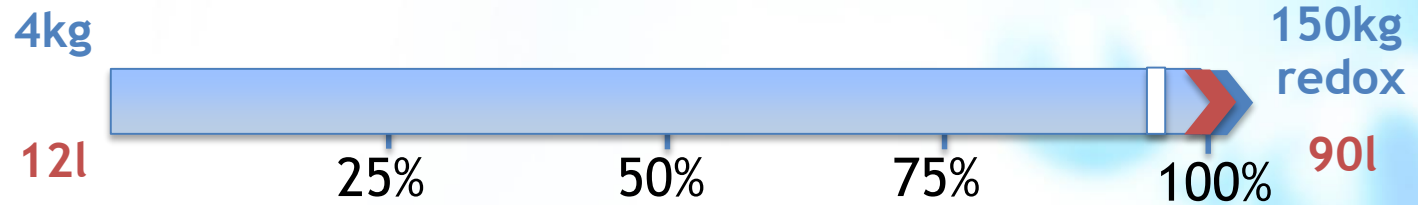
Future steps:

- evaluation of other structures
- evaluation at the solar platform level



PROJECT PROGRESS/ACTIONS - Reactor

 Achievement to-date
 % stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Reactor	redox mass	Kg	150	-	-	-
	volume/reactor	l	90	-	-	-

Future steps:

- revisit structured reactor design
- implement heat recovery concepts
- minimize inert gas utilization

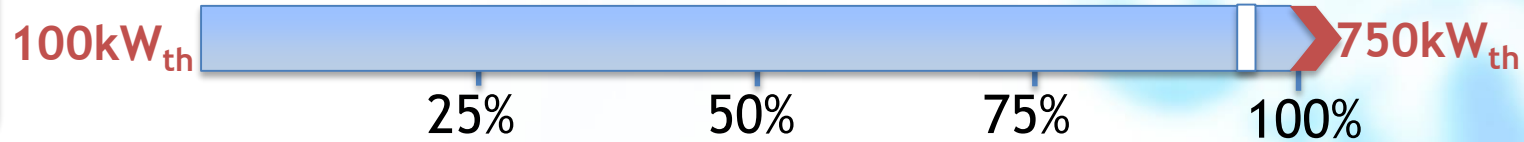


PROJECT PROGRESS/ACTIONS - Construction of a solar H₂ production demo-plant



Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
solar H ₂ plant	Solar demo-plant construction	kW _{th}	100	500-2000	-	-

- largest solar thermochemical H₂ production facility to date

Future steps:

- initiation of thermal tests
- H₂O splitting thermochemical experiments
- post-project exploitation of existing platform to improve the technology



PROJECT PROGRESS/ACTIONS - Solar H₂ production



➤ Achievement to-date
▮ % stage of implement.



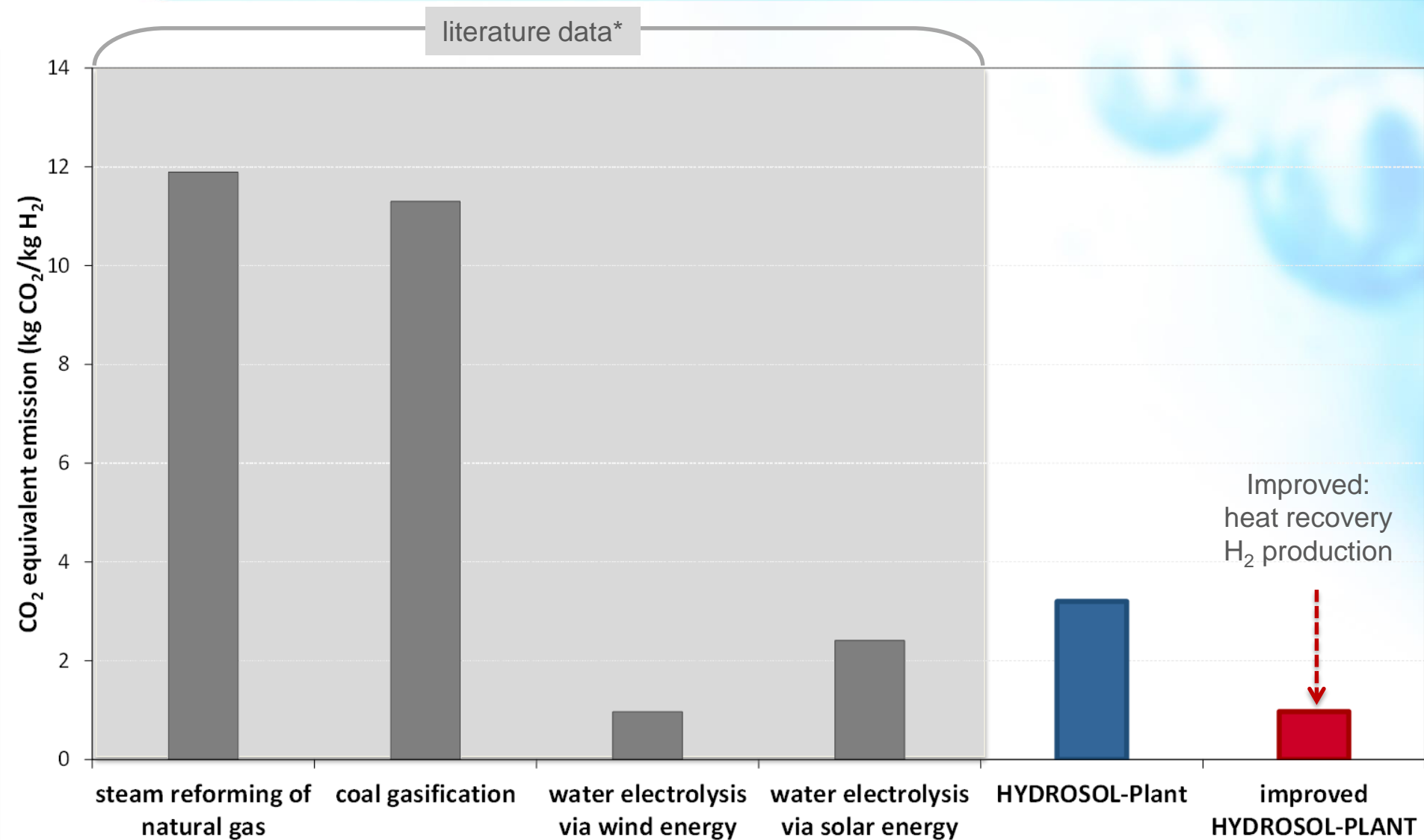
Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Solar H ₂ production	Structure 1: Extruded monolith	kg/week	1.6	3	-	-
	Structure 2: Cast monolith				-	-
	Structure 3: Foam				-	-

- achievement at laboratory scale

Future steps:

- solar thermochemical H₂O splitting and H₂ production at the actual plant scale on the solar platform

PROJECT PROGRESS/ACTIONS - Life cycle assessment



*Cetinkaya et al. 2012

SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES



- Interactions with projects funded under EU programmes
 - HYDROSOL (FP5), HYDROSOL-II (FP6) and HYDROSOL-3D (FP7, FCH-JU): The HYDROSOL-Plant project is the natural evolutionary step of the previous HYDROSOL projects
 - ARMOS (ERC Grant): extension of the HYDROSOL concept to solar fuels
 - RESTRUCTURE (FP7): common process principles
 - Sun-to-Liquid (Horizon): common process principles
 - SOL2HY2 (FCH-JU): reactor and process design
- Interactions with national and international-level projects and initiatives
 - HYDROSOL-Plus: extension of the HYDROSOL concept to solar fuels
 - Nanoredsol: common process principles
 - Task II “Solar Chemistry Research” of the SolarPaces CSP Research Tasks: Participation and interaction in expert group meetings and presentations



DISSEMINATION ACTIVITIES

Public deliverables

- D1.1 Project's website, protected acronym, electronic communications network
- D5.1 Complete solar tower platform including the reactor, all necessary peripherals and components integration
- D8.2 Publications in Scientific Technical Journals and conference presentations
- D8.3 Workshop on Project's final achievements

Conferences/Workshops

- 1 project workshop on 28th November 2017, at Plataforma Solar de Almeria, Spain
- 10 conferences and workshops

Social media



Publications: 5 articles in peer reviewed journals

- J.-P. Säck, S. Breuer, P. Cotelli, A. Houaijia, M. Lange, M. Wullenkord, C. Spenke, M. Roeb, Chr. Sattler Solar Energy, Volume 135, 2016, Pages 232-241, 2016
- Lorentzou S., Pagkoura C., Zygianni A., Karagiannakis G., Konstandopoulos A.G. International Journal of Hydrogen Energy, 42 (31), pp. 19664-19682, 2017

Patents: 1

- Gas/solid phase reaction, Patent number: 9492807

Thank You!

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