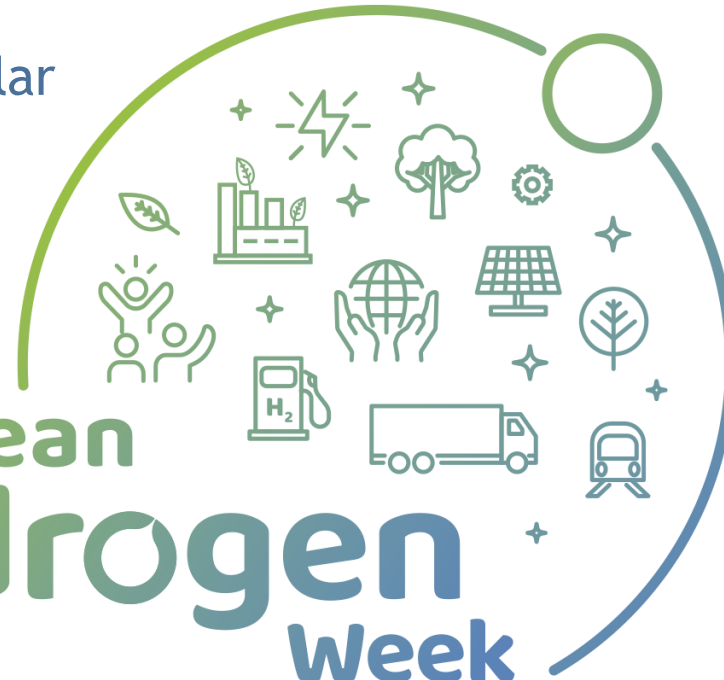


PECSYS

Technology demonstration of large-scale
photo-electrochemical system for solar
hydrogen production



European
Hydrogen
Week



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#PRD2021
#CleanHydrogen



Project Overview

Call year: 2016

Call topic:

H2020-JTI-FCH-
2016-1 -

Development of
processes for
direct production
of hydrogen from
sunlight

Project dates:
[01/01/2017- 31/12/2020]

Total project budget:
[2,499,993 €]

PECSYS

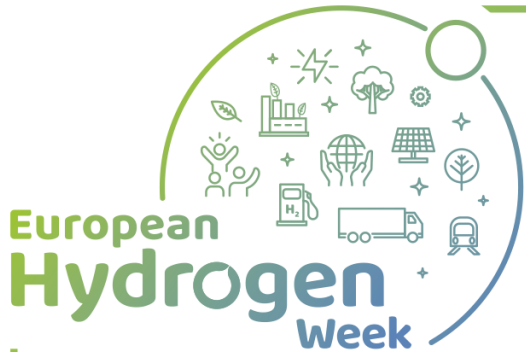
% stage of implementation
01/11/2021: [100 %]

FCH JU max. contribution:
[2,499,993 €]
Other financial contribution:
[0 €]



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Partners

Helmholtz Zentrum Berlin



Forschungszentrum Jülich



Enel Green Power



Consiglio Nazionale delle Ricerche



Uppsala Universitet



UPPSALA
UNIVERSITET

Solibro Research AB



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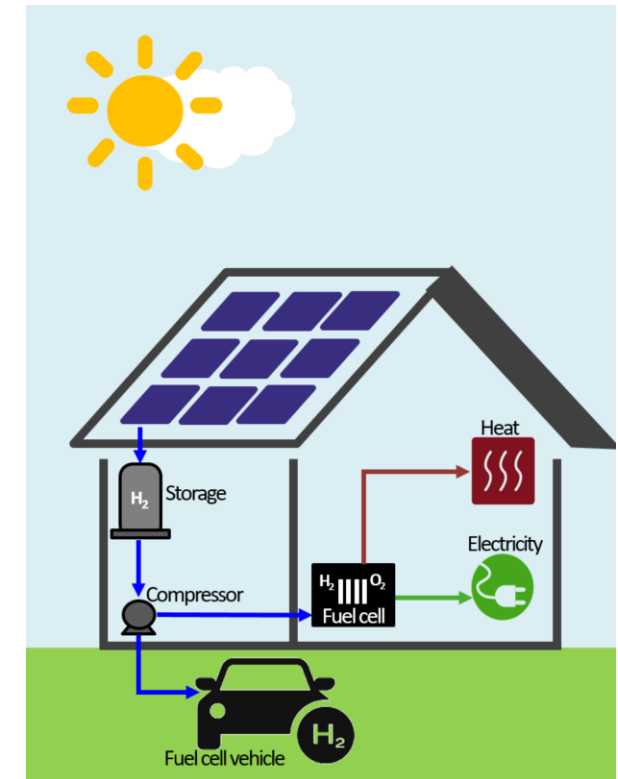
Project Summary

Main Objectives

Performance measure	Target	Relevance
Hydrogen production rate	≥ 16 g/hr	Yield at maximum irradiance
Solar to hydrogen (StH) efficiency	$> 6\%$	Efficiency
Device stability, Δ StH	$< 10\%$ after $\frac{1}{2}$ year	Service life, reliability
Cost target, LCOH	$< \text{€ } 5/\text{kg}^*$	Economic feasibility

* LCOH: Levelised cost of hydrogen production

Application and market area



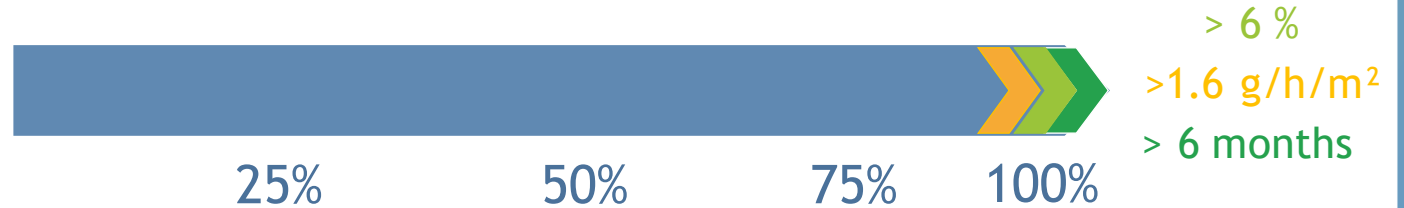
Decentralised green hydrogen supply and storage for residential to small size commercial and industrial use

Project Achievement - 10 m² Demonstrator

Solar hydrogen generation using photovoltaic modules directly coupled to electrolyser with balance of plant innovations

Solar to hydrogen (STH) efficiency, Hydrogen production rate, Stable operation

n/a
n/a
n/a



- Water supply only via cathode PEM electrolyser¹
- No active heating of electrolyser
- Better performance than state of the art^{2,3}



¹ Müller, et al., *Energies*, 2019, 12(21): 4150.

² Muhammad-Bashir, *Solar Energy*, 2020, 205:461.

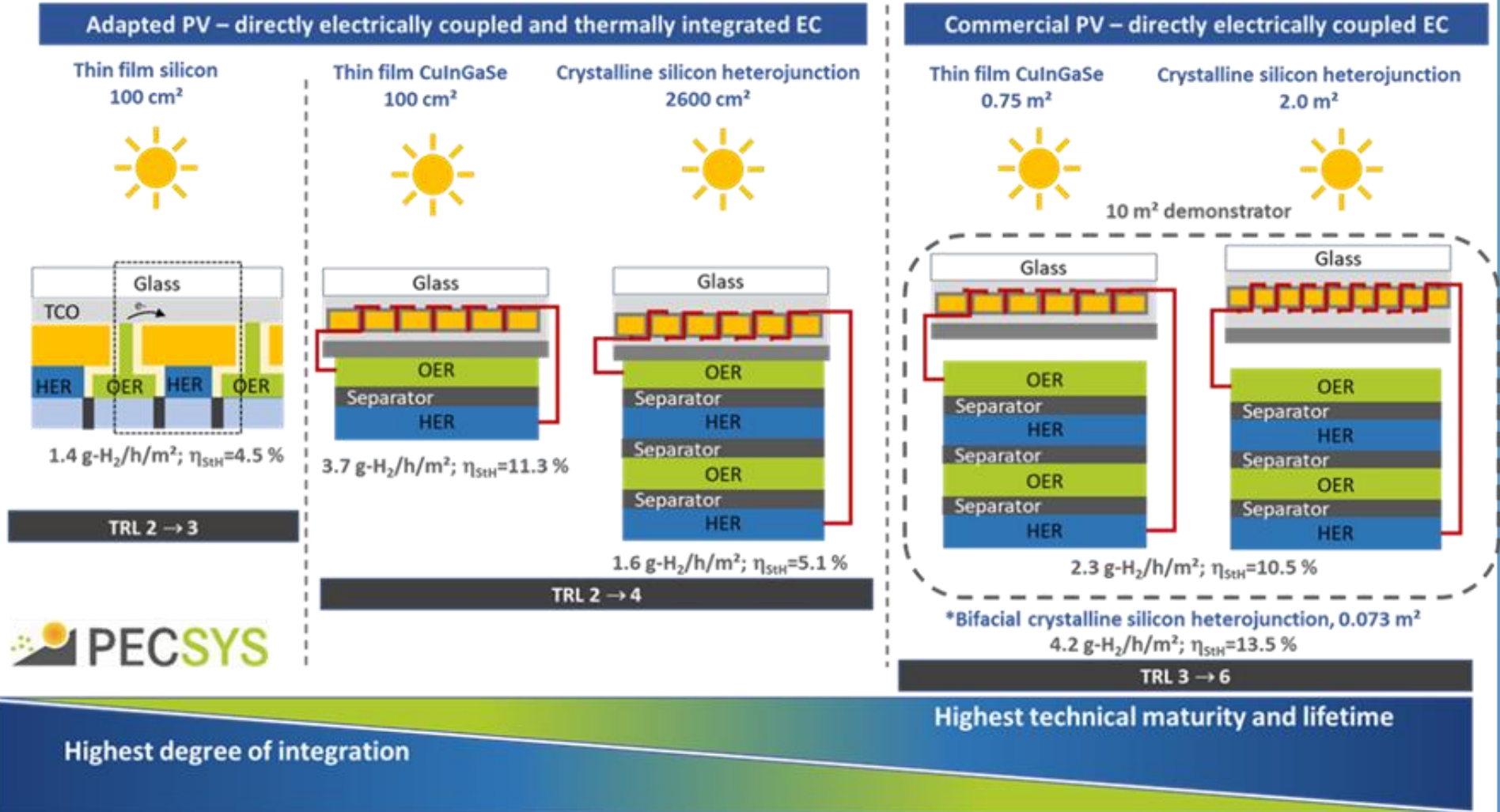
³ Maeda, et al. *J. Intl Council on Electrical Engineering*, 2016, 6(1): 78.

Location	Year	Photovoltaic array			Time in operation (h)	Average StH eff. (% _{LHV})	ṁ _{H2} (g/h-m ²)
		Type	Area (m ²)	Power (kW _{el})			
Juelich, (DE), PECSYS	2020	Silicon HJT & CuInGaSe	10.5	1.73	>2680	~10	2.3
Thuwal, (SA) ² SOA	2020	Polycrystalline silicon	1.5	0.27	~10	9.4	1.2
Tsukuba, (JP) ³ SOA	2013	Polycrystalline silicon	21.5	2.6	~20	~5	-/-

* Irradiance and device temperature vary

Project Results - TRL and Efficiency

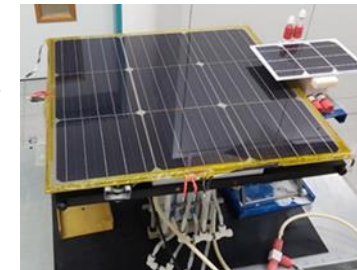
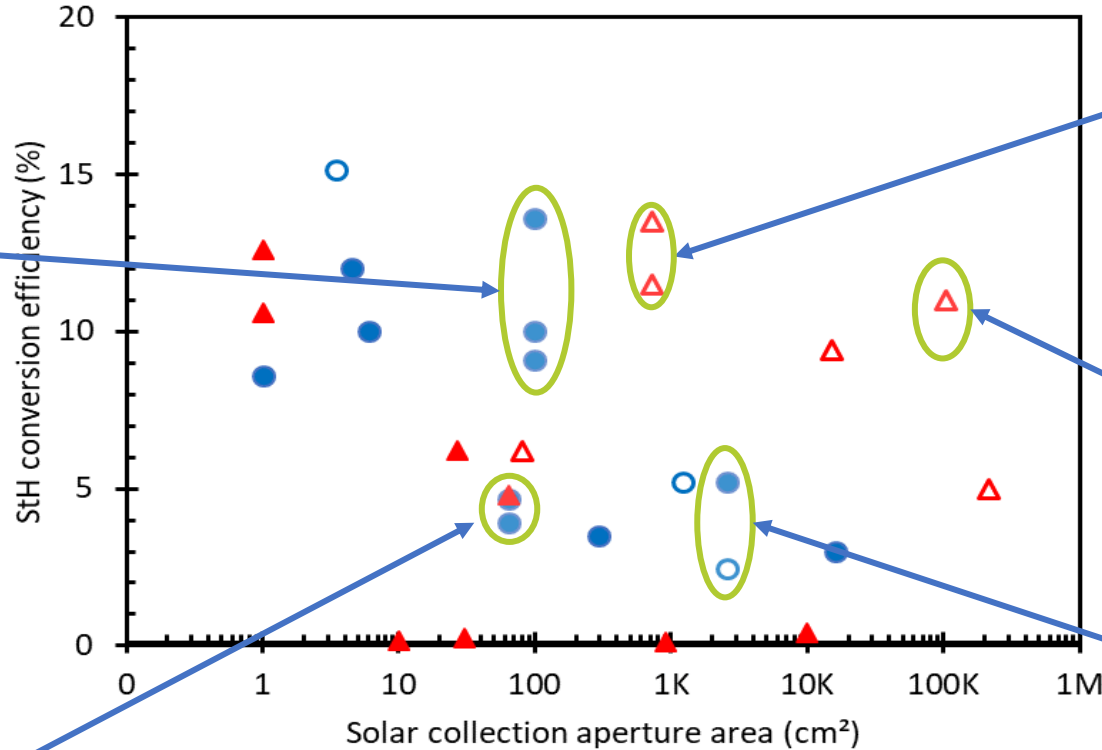
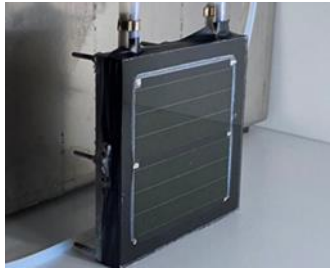
Broad variety of technologies investigated



*Calnan, et al., *Solar Rapid Research Letters*, 2021.
<https://doi.org/10.1002/solr.202100479>

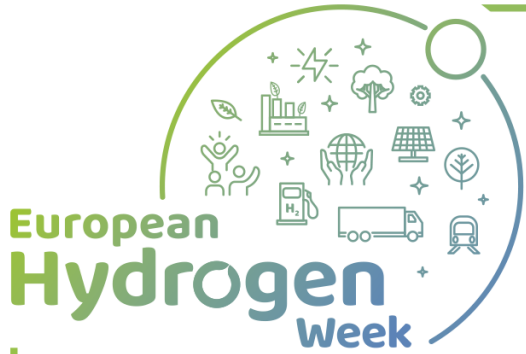
Project Results - Comparison SoA

Advancement in scale and efficiency of directly coupled PV electrolysis



- non-PGM, with thermal int.
- non-PGM, no thermal int.
- ▲ PGM, with thermal int.
- △ PGM, no thermal int.

*Calnan, et al., *Solar Rapid Research Letters*, 2021.
<https://doi.org/10.1002/solr.202100479>



Dissemination & Communication Activities

Project website: www.pecsys-horizon2020.eu

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Conferences
& workshops
attended

1

Project
Workshop
5th Nov 2020

22

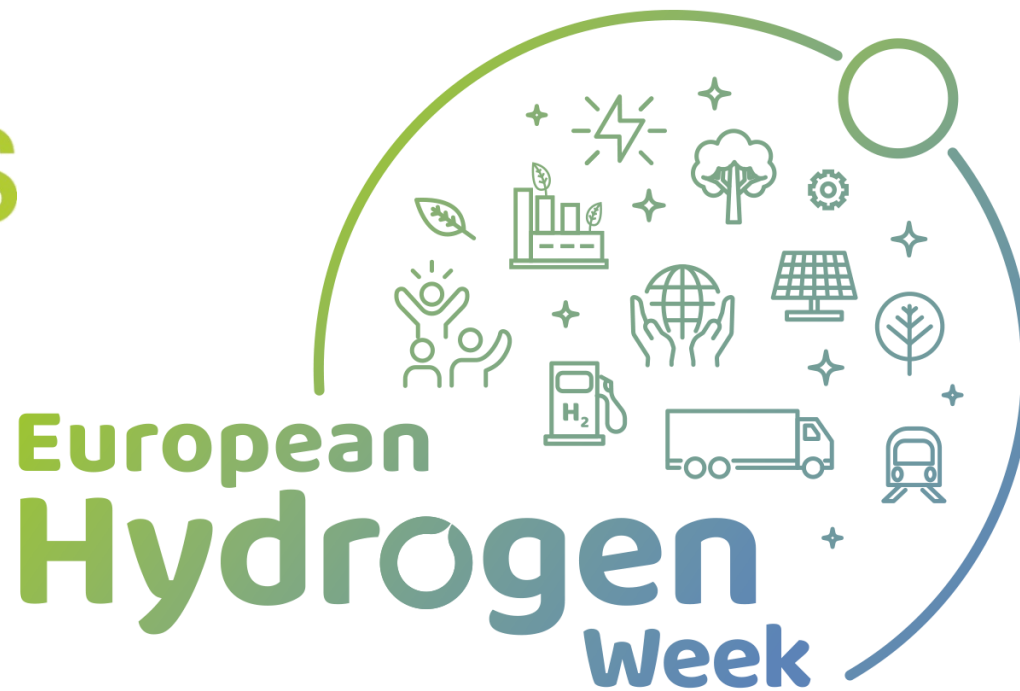
Peer
reviewed
publications
*

4

Project
videos

- Peer reviewed publication with summary of project results: *Calnan, et al., Solar Rapid Research Letters, <https://doi.org/10.1002/solr.202100479>
- Public deliverables and videos of the project available at: https://www.helmholtz-berlin.de/projects/pecsys/public-documents_en.html

Thank you



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