FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

MEGASTACK

REFHYNE
CLEAN REFINERY HYDROGEN FOR EUROPE

Programme Review Days 2018
Brussels, 14-15 November 2018

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PROJECT OVERVIEW

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- Call year: 2013
- Call topic: SP1-JTI-FCH.2013.2.3 - Large capacity PEM electrolyser stack design
- Project dates: 01/10/2014 - 30/09/2017
- % stage of implementation 01/11/2018: 100%
- Total project budget: € 3 451 654
- FCH JU max. contribution: € 2 168 543
- Other financial contribution: € 363 375 (Norwegian Research Council)
- Partners: SINTEF, Fraunhofer ISE, CEA Liten, ITM Power

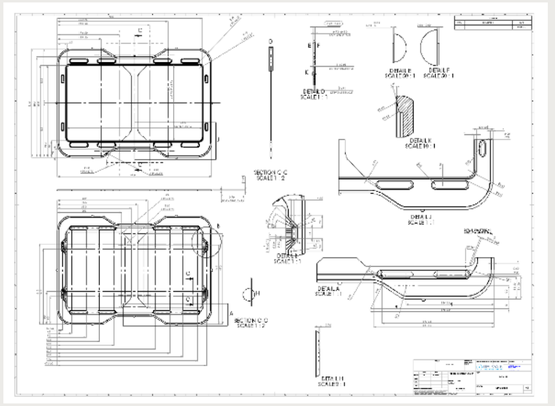
PROJECT SUMMARY - OBJECTIVES

Megastack main objectives:
Develop a cost efficient stack design for MW-sized PEM electrolysers.

Construct and demonstrate
a prototype stack
75% Efficiency (LHV) @ 1.2 Acm^{-2} ;
stack cost < €2,500 / Nm^3h^{-1}
target lifetime of 40,000 h (< 15 μVh^{-1})

PROJECT SUMMARY - APPROACH

- Increase active area and current density,
- 50 % Reduction in part count and improve manufacturability/assembly, reduce waste
- Develop new and more cost efficient, large volume supply chains



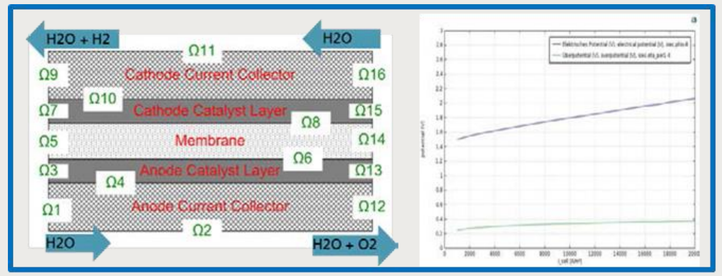
0.5MW

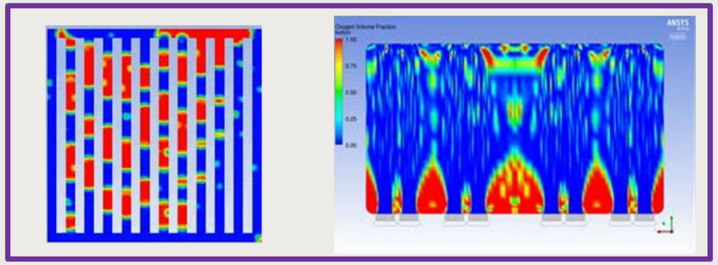
1MW

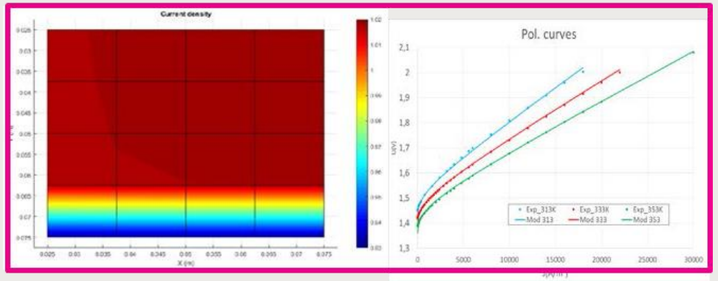
PROJECT SUMMARY - APPROACH

MEGASTACK

- Improved understanding of fundamental transport processes in PEM electrolyser components
- Two phase flow model for optimisation of cell designs
- Multiphysics stack model for stack design and control







PROJECT PROGRESS/ACTIONS – Cost

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Achievement to-date

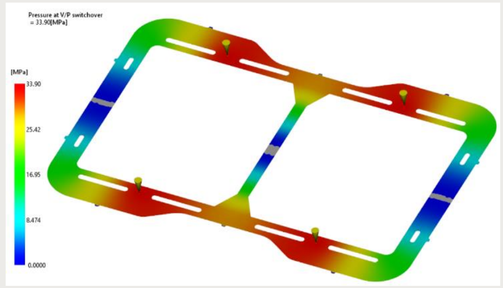
~5 €/kg < 3000 €/Nm³h⁻¹

8700€/Nm³h⁻¹
6 €/kg

2000€/Nm³h⁻¹
5 €/kg

25% 50% 75%

Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Cost	CAPEX	Nm^3h^{-1}	8700	2500	4000	2200
	H_2 Cost	€/kg	5-13	-	5-11	5-9



PROJECT PROGRESS/ACTIONS – Efficiency

MEGASTACK

Achievement to-date

82 %

70% HHV → 88% (HHV)

25% 50% 75%

Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Efficiency	Efficiency	%	68	88	71	75
	Energy use	kWh/kg	57	42	55	52

PROJECT PROGRESS/ACTIONS – Durability

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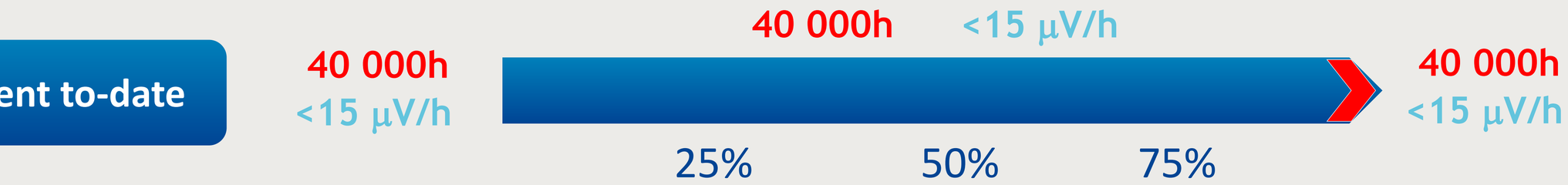
Achievement to-date



Aspect addressed	Parameter (KPI)	Unit	SoA 2016	FCH JU Targets		
				Call topic	2017	2020
Durability	Lifetime	h		40000 h	N/A	N/A
	Degradation rate	µV/h		< 15	< 4	< 3

Communications Activities

Public deliverables

- D1.1: Cost benefit analysis and cost and performance target for large scale PEM electrolyser stack
- D2.1: Cost benefit analysis and cost and performance target for large scale PEM electrolyser stack

Conferences/Workshops

- 1 organised by the project
- 3 in which the project has participated
- Stand at Hannover trade fair

Publications: 10 oral presentations, 3 poster presentations, 4 journal publications, 1 book chapter

Kolja Bromberger, Jagdishkumar Ghinaiya, Thomas Lickert, Arne Fallisch, Tom Smolinka Hydraulic ex situ through-plane characterization of porous transport layers in PEM water electrolysis cells. Int. J. Hydrogen Energy 2531-3076 (2018)
Magnus Thomassen, Svein Sunde, Electrocatalysis for the Oxygen Evolution Reaction (OER) in PEM Electrolysis for Hydrogen Production: Principles and Applications, CRC Press, Boca Raton (2015)

Patents: 0

The next step

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NOVEL

NEXPEL

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

PROJECT OVERVIEW

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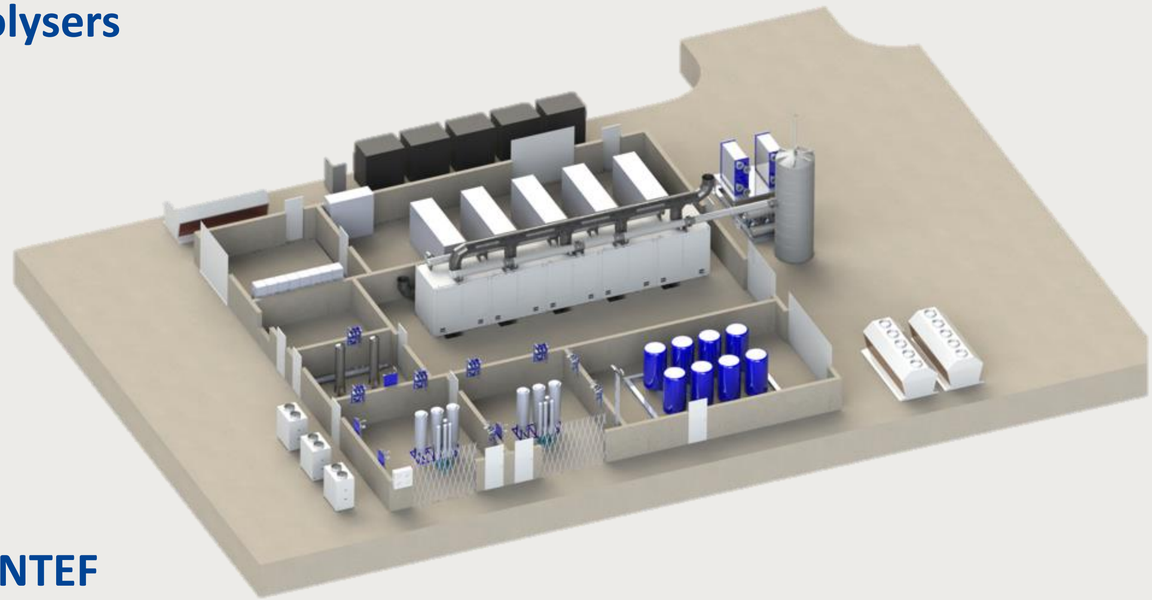
CLEAN REFINERY HYDROGEN FOR EUROPE

- Call year: 2017
- Call topic: FCH-02-5-2017: Demonstration of large electrolysers for bulk renewable hydrogen production
- Project dates: 01/01/2018 - 31/12/2022
- % stage of implementation 01/11/2018: 18%
- Total project budget: ~ € 20 000 000
- FCH JU max. contribution: ~ € 10 000 000
- Partners: Shell, ITM Power, Element Energy, thinkstep, SINTEF



PROJECT SUMMARY - OBJECTIVES

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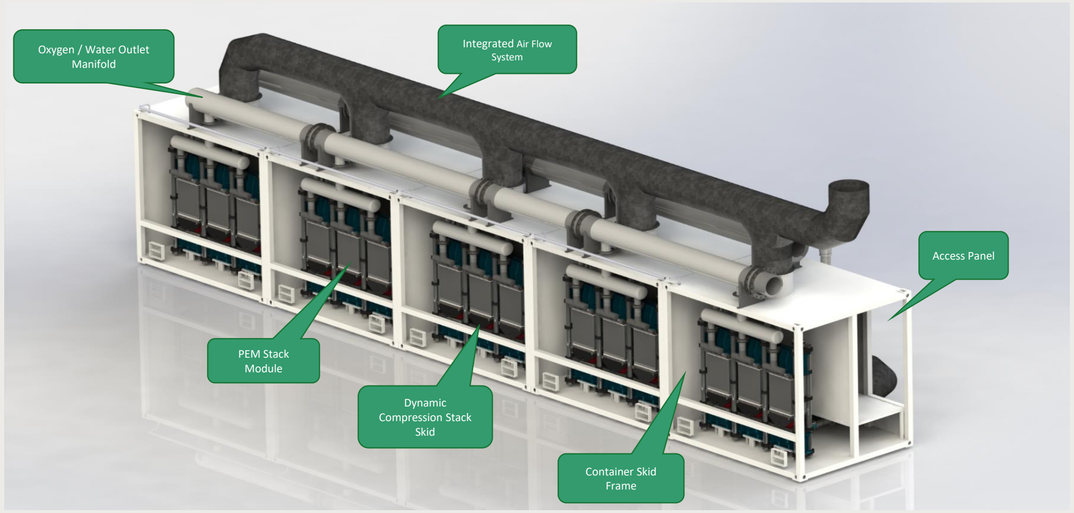
REFHYNE main objective:
To deploy and operate a 10MW electrolyser in a Power to Refinery setting:

- Up to 4 tonnes H_2 per day to refinery gas grid
- Load balancing for refinery
- Grid balancing



PROJECT PROGRESS – timeline

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CLEAN REFINERY HYDROGEN FOR EUROPE

2018

2019

2020

2021

2022

Design and permitting

Design and Permitting

Construction and Commissioning

Construction and Commissioning

Operational

Operational


FCH
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