Don Quichote

Demonstration of new qualitative innovative concept of hydrogen out of wind turbine electricity

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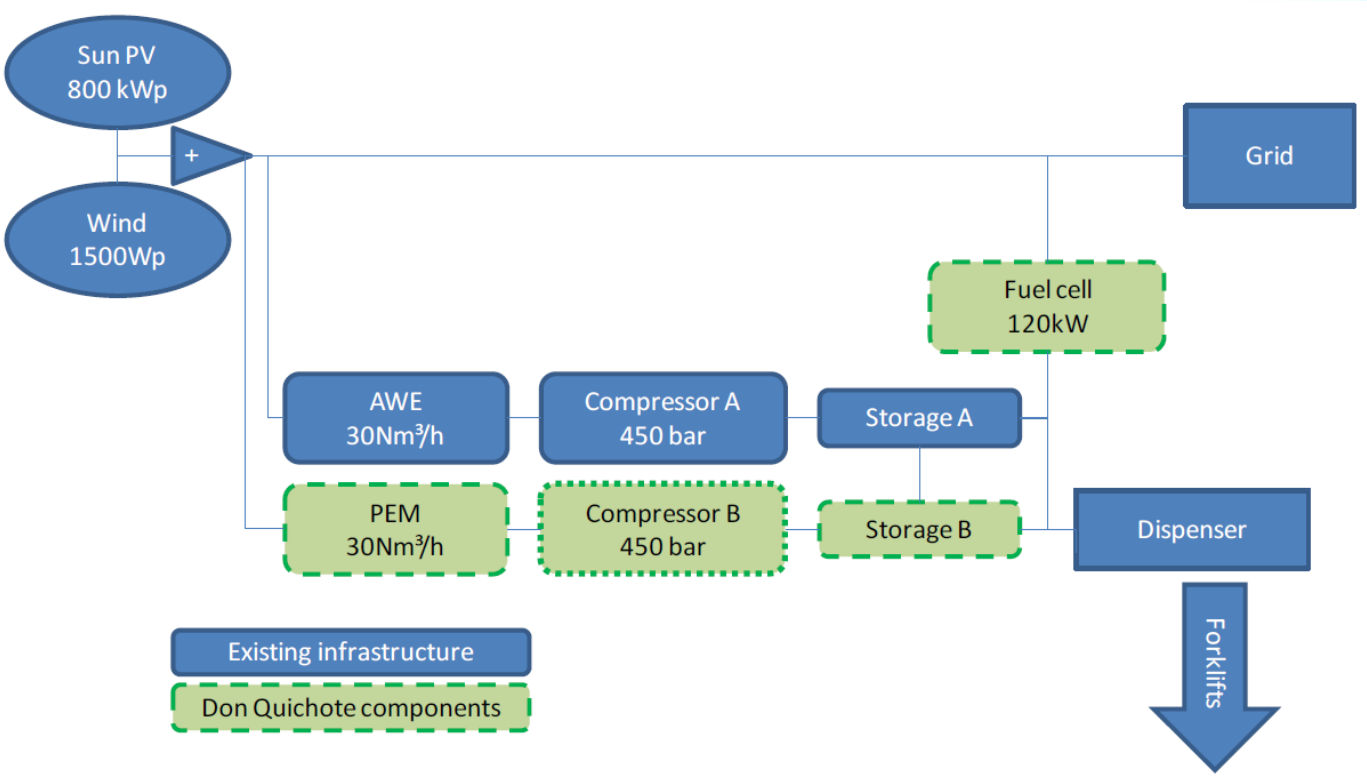
PROJECT OVERVIEW

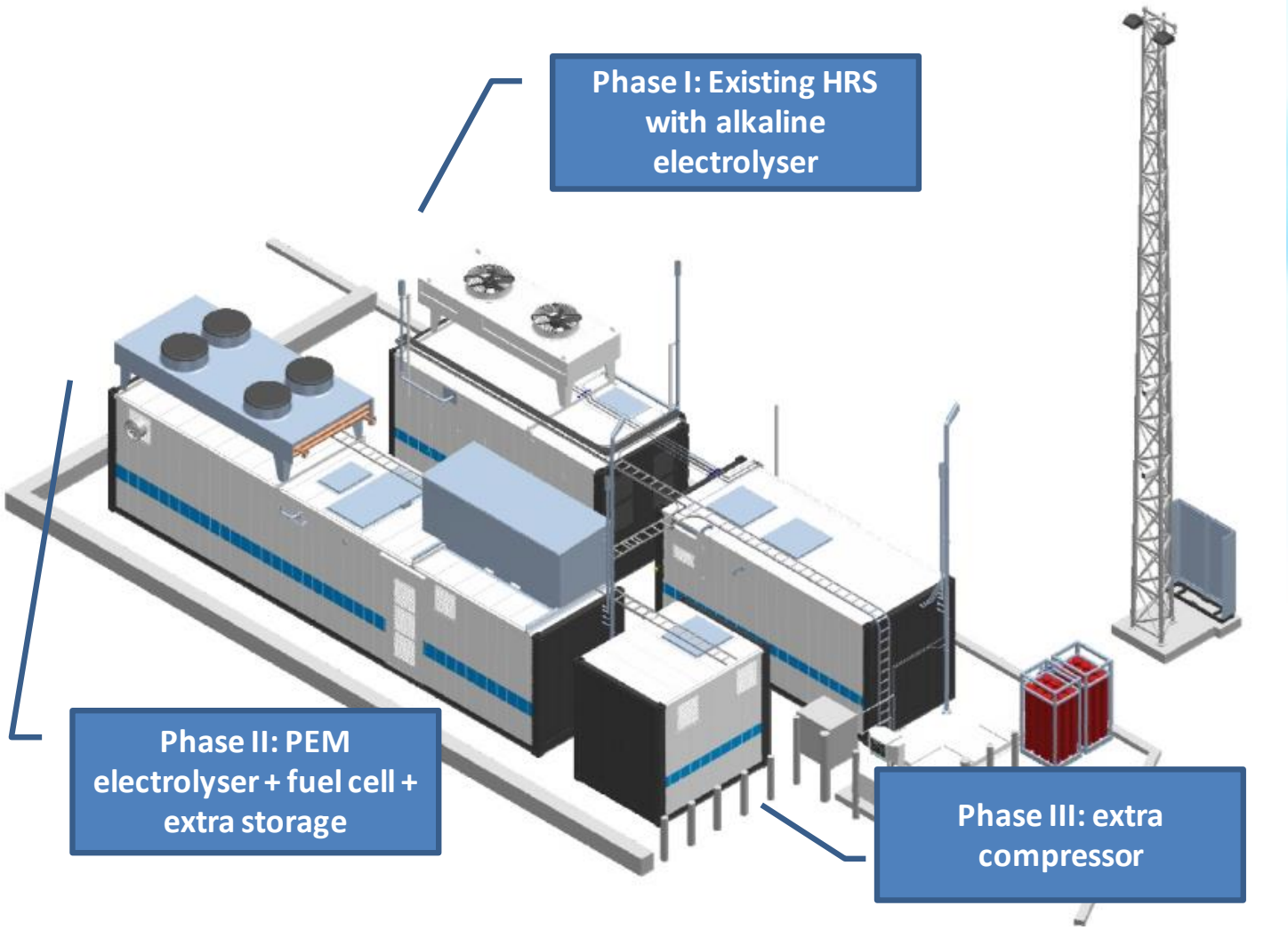
- Call year: 2011
- Call topic: SP1-JTI-FCH.2011.2.1 - Demonstration of MW capacity hydrogen production and storage for balancing the grid and supply to a hydrogen refuelling station
- Project dates: 1/10/2012– 31/03/2018
- % stage of implementation 01/11/2017: 90 %
- Total project budget: 4 940 593 €
- FCH JU max. contribution: 2 954 846 €
- Other financial contribution: balanced by consortium
- Partners: Waterstofnet vzw, Etn F.Colruyt nv, Eoly, Hydrogenics Europe nv, TUV Rheinland gmbh, Federazione delle Associazioni Scientifiche e Tecniche, Icelandic New Energy ltd, JRC -petten, Thinkstep ag

PROJECT SUMMARY

Don Quichote develops, installs and operates hydrogen generation equipment, hydrogen compression and storage, fuel cell re-electrification additional to an existing refueling station



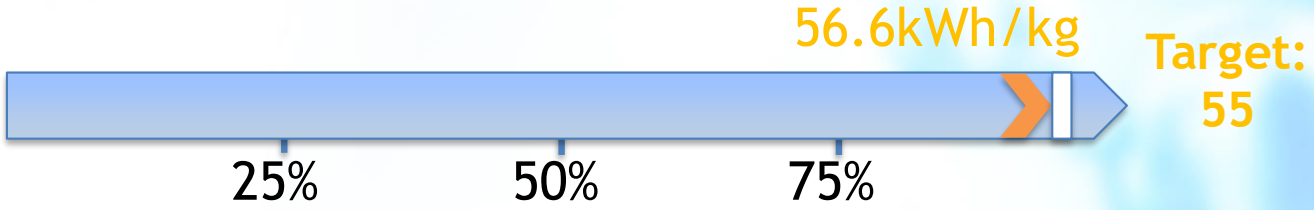
Project set-up



PROGRESS/ACTIONS - Efficiency

Achievement to-date

% stage of implement.



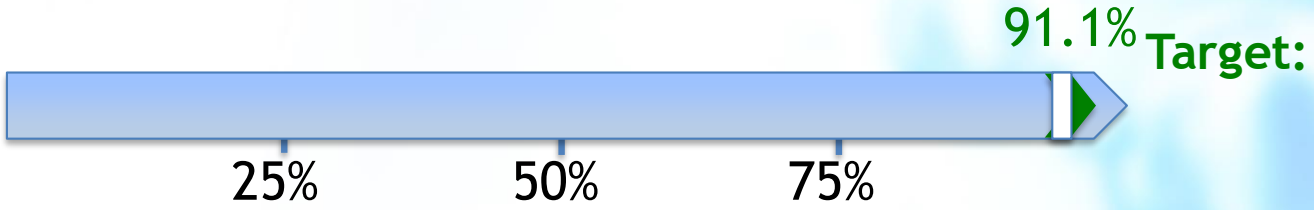
Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Efficiency	Stack	kWh/kg	49			
	Unit in Production	kWh/kg	56.6	60	55	52
	Unit in Application	kWh/kg	>>			

Stack : production of hydrogen (DC power)
Unit in Production: + AC/DC conversion + utility power @ production
Unit in Application: + H_2 losses + Standby losses (heating + ventilation)

PROGRESS/ACTIONS - Quality

Achievement to-date

% stage of implement.



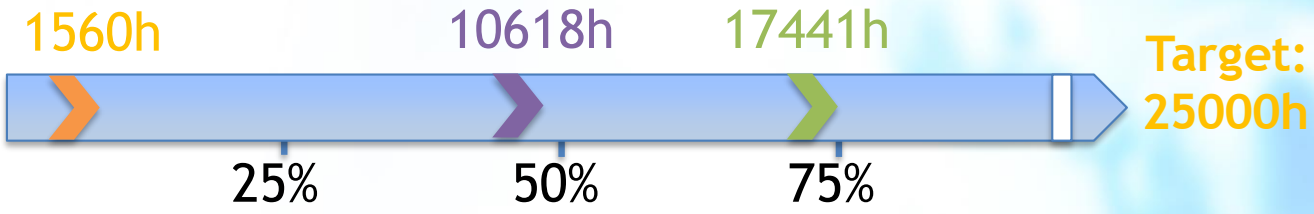
Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Quality	Time @ 5.0 / Total production time	%	94.1			

94.1% of all hydrogen produced by PEM is of 4.8 quality (99.998% purity)
This fraction will rise when the station is in production continuously

PROGRESS/ACTIONS - Time

Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call	2017	2020
Time	Operation	h	1560			
	Uptime	h	10618	20000 h	2-20 yr	8-20 yr
	Active	h	17441			

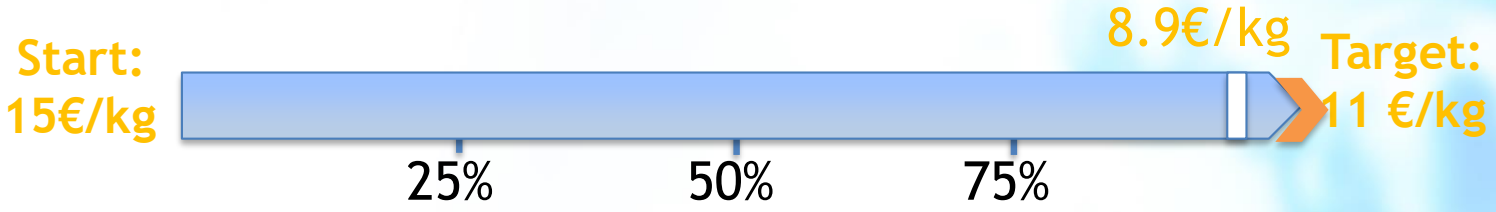
description	Hours
Mission Time	1,561
Standby	9,057
Delay	62
Sched. Maint.	1,217
Corr. Maint.	5,544
Inactive	2,194

Operation: Mission Time (H2 production)
Uptime: Mission Time + Standby
Active: key switch ON

PROGRESS/ACTIONS - Cost of H_2

Achievement to-date

% stage of implement.



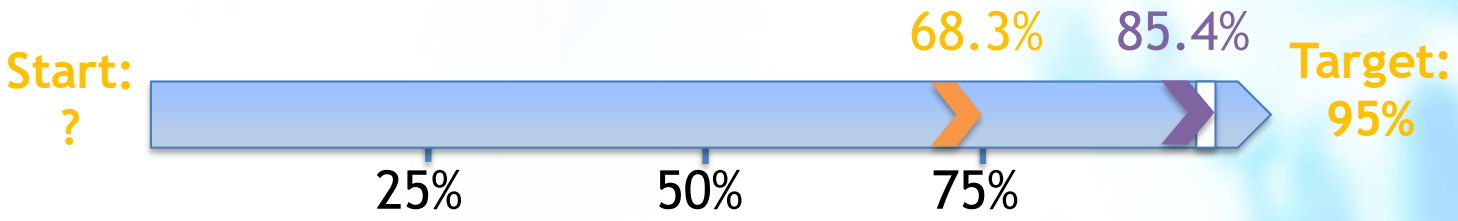
Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
	Cost of hydrogen delivered	€/kg	8.9	15	11	10

Electrolysis	*56.6 kWh/kg*
Compression + Cooling	*9.1 kWh/kg*
Maintenance PEM + compressor	*6.9%CAPEX + 6%CAPEX per year*
Estimated electricity cost	*100€/MWh*

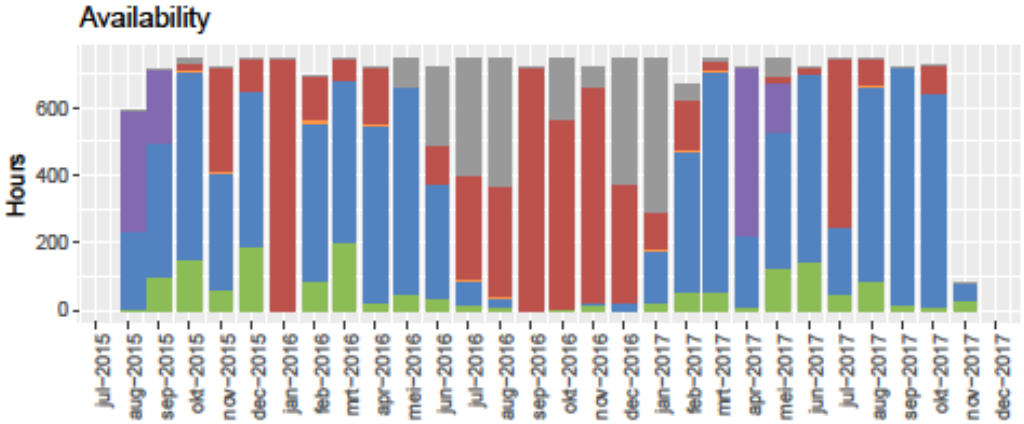
PROGRESS/ACTIONS - Availability

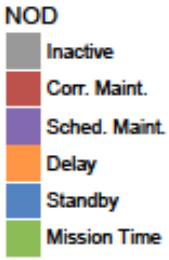
Achievement to-date

% stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
Availability	Overall	%	68.3	95%	95%	
	2017	%	85.4			



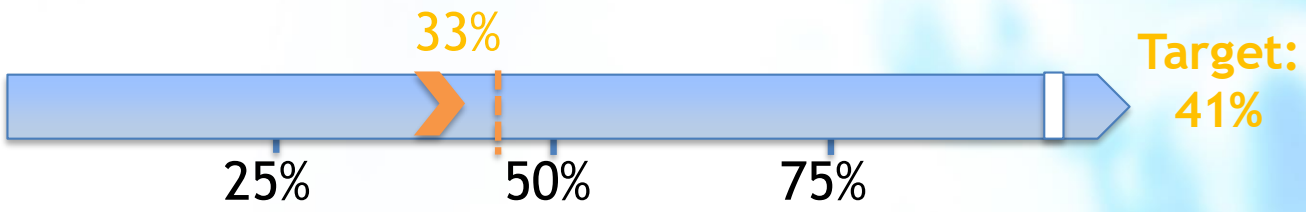


- *Jan 2016: ROS*
- *Jul 2016 – Jan 2017: Valve issue*
- *Jul 2017: Power Supply*

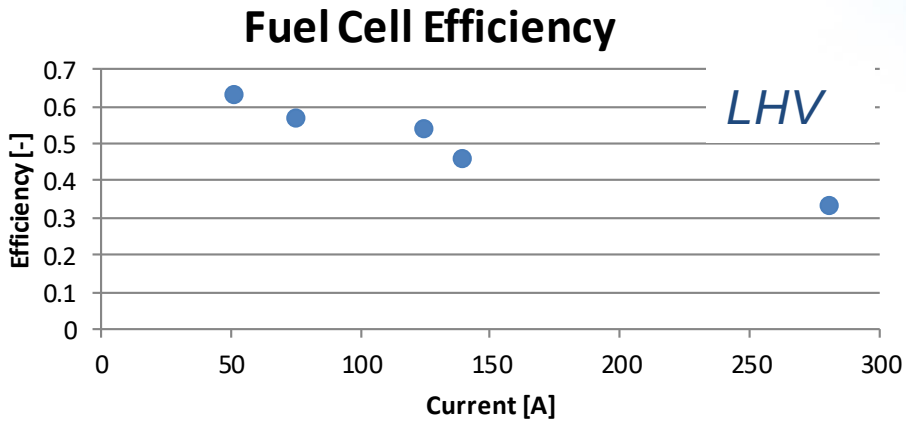
PROGRESS/ACTIONS - FC efficiency

Example and explanation in the next slide

- Achievement to-date
- % stage of implement.



Aspect addressed	Parameter (KPI)	Unit	SoA 2017	FCH JU Targets		
				Call topic	2017	2020
FC Efficiency	efficiency	%	33		41-50	42-55



Key findings

- Other aspects
  - ISO/DIS compliant, end-use distribution
    - >5000 refuelings
  - Portfolio of sustainable H2 production
    - AWE and PEM operational, LCA,TCO analysis ongoing
    - Materal Handling positive: activity ramping up (fleet, Interreg Flanders/The Netherlands project 'Hydrogen Region 2.0' > 75 MHV's end 2017. 200 MHV's projected in 2018.
    - Spin off activities: 2 extra indoor dispensers for MHV's + 1 HRS 700 bar coupled to production facility outside the fence of Colruyt facility)
  - innovative H_2 production, storage and supply

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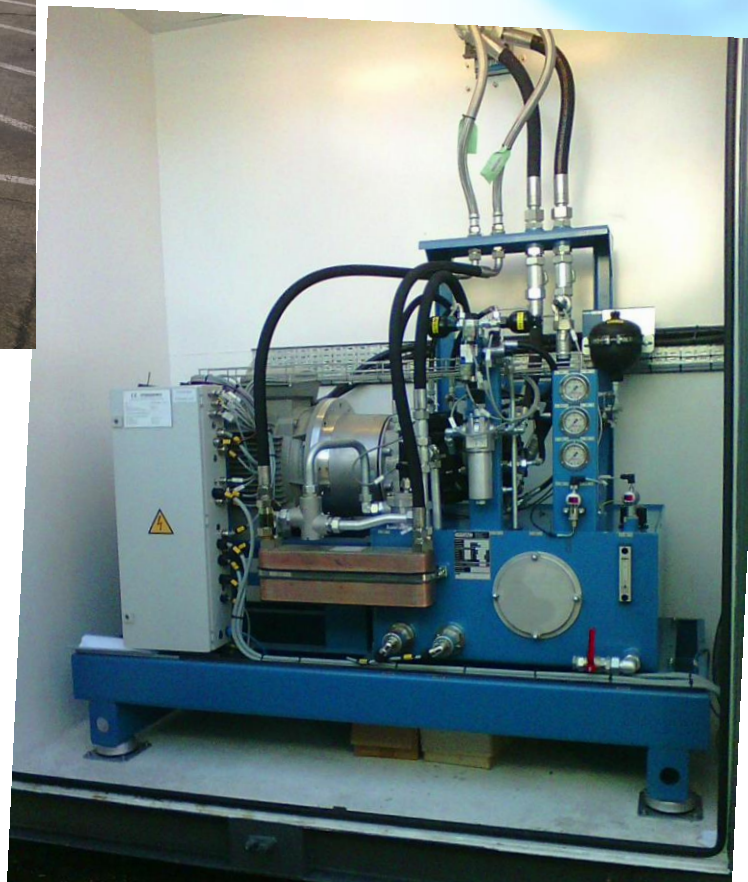
hydrogen out of wind turbine energy



RISKS AND MITIGATION

Compressor upscaling

- Semi-commercial set-up on fully operational site
- Hyet – scalability/cost of electrochemical compression (cfr. Phaedrus)
- Installation of conventional compressor

Fuel cell operation

- Poor business case/ round trip efficiency
- Shortening test campagne

10 kg/day commercial hydrogen compressor

SYNERGIES WITH OTHER PROJECTS AND PROGRAMMES

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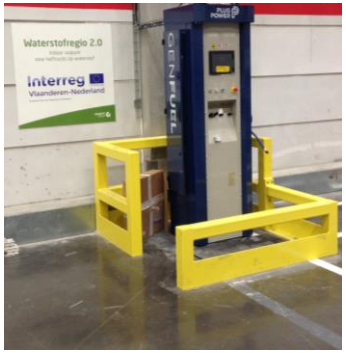
- Interactions with EU projects
  - Reselyser, Ingrid FP7)
  - Hybalance (2016)

  - Interreg Flanders/The Netherlands:
    - Upgrading capacity alkaline electrolyser
    - Hydrogen pipeline for different dispensers
    - 2 indoor dispenser for Material Handling Vehicles
    - Public 700 bar refueling station outside the fence

Interreg
EUROPESE UNIE
Vlaanderen-Nederland
Europees Fonds voor Regionale Ontwikkeling



DISSEMINATION ACTIVITIES

Public deliverables

- D6.4 Report on barriers to deployment and recommendations
- D7.1 Don Quichote Project Dissemination Plan
- D7.2 Exploitation Plan of renewable hydrogen storage systems

Conferences/Workshops

- 2 organised by the project
- 32 participations

Social media

Construction of Don Quichote installation

Hydrogen tank station in smart grid environment

Publications:

- « A Step Towards the Hydrogen Economy – Life Cycle Cost Analysis of a Hydrogen Refueling Station », L. Viktorsson, J. T. Heinonen, J. B. Skulason, R. Unnthorssson
- Il Pianeta Terra magazine, Issue May 2017 www.ilpianetaterra.it/2017/06/rivista-maggio-3017
- "Feasibility study of large scale hydrogen power-to-gas applications and cost of the systems evolving with scaling up in Germany, Belgium and Iceland" (in preparation)

Thank You!

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