H2Ports

Implementing Fuel Cells and Hydrogen Technologies in Ports

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WHO WE ARE

Fundación Valenciaport is a centre for **Applied Research, Innovation** and **Training**, serving the port-logistics cluster.

It is an initiative of the Port Authority of Valencia, bringing together key companies, universities and institutions in the port community.

Since its creation, it has developed projects in more than sixty countries, mainly in the Mediterranean, the rest of Europe, Asia and Latin America.

Port of Valencia

Valencia City : 789,744 hab ; Metropolitan area: 1,581,057 hab

The port in figures

77.5 M tonnes. Total Traffic[1]

5.6 M TEU Container Traffic[1]

412 k ITU RoRo Traffic[1]

31,563[2] direct or indirect jobs

1.82[2] **billion euros** in economic impact (GVA)

[1] Values from 2021
[2] Values from 2016 (update in progress)

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Clean Hydrogen Partnership

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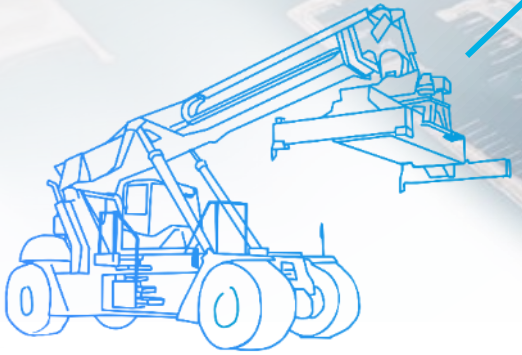
Port of Valencia

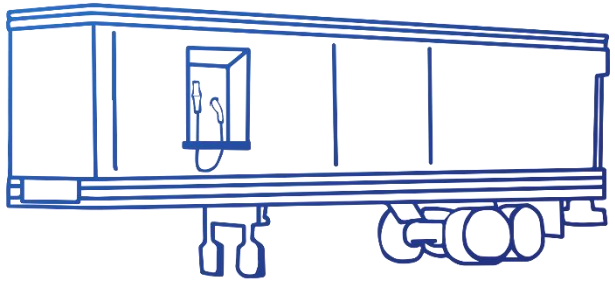


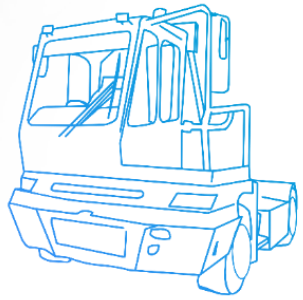
Reach Stacker in MSC Terminal

- 2 years / 5000 h of operation

Mobile HRS

- Hydrogen supply logistics at ports
- Port regulatory framework
- Safety procedures





Yard Tractor in Valencia Terminal Europa

- 2 years / 5000 h of operation

General features

- Total Budget: 4,117,197.5 EUR
- Duration: 2019-2023

First application in Europe of hydrogen technologies for port handling equipment in real operative conditions

Partners

Coordination: FUNDACIÓN VALENCIAPORT

Public authorities

valenciaport
Autoridad Portuaria de Valencia

Research institutions

Centro Nacional del Hidrógeno

ATENA
FUTURE TECHNOLOGY

End users

msc TERMINAL VALENCIA

GRIMALDI GROUP

Industry

CARBUROS METALICOS
Grupo Air Products

HYSTER-YALE GROUP

BALLARD®

enagas

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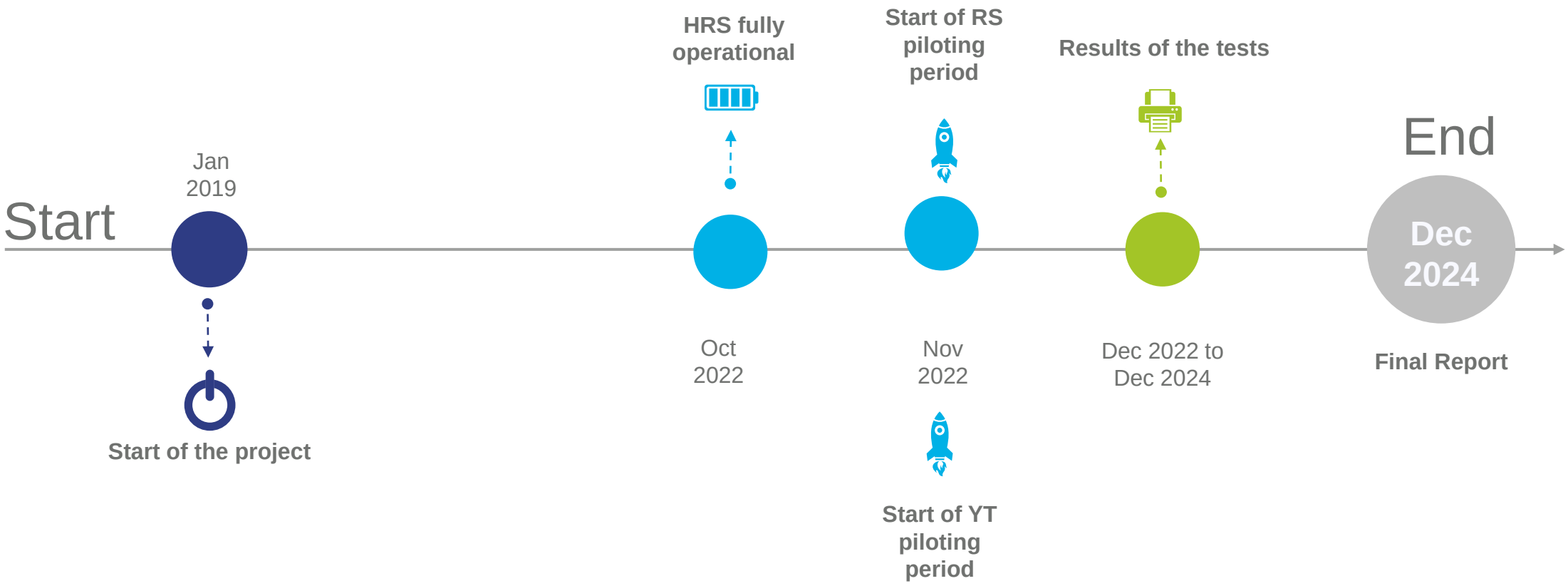
H2Ports current planning



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Hydrogen supply

Gas Supplier

Buffer Tank
50 m³; D:2450 L:11510
10-40 bar
180kg

Compressor
50m3/h
p_{in}:10-40 bar
p_{out}: 300-450 bar

Mobile Unit

High pressure storage

Panel dispenser
Up to 3.6 kg/min
Tmax 85 °C

300 bar
44 x 153 L
6732 L
151 kg

450bar
33 x 135 L
4450 L
138 kg

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FCHJU funding € 800,000 approx.

National Hydrogen Centre, Carburos Metálicos, Fundación Valenciaport, Valencia Port Authority, MSCTV, Hyster-Yale, Grimaldi, ATENA, Enagás

- Mobile hydrogen refuelling station
- Up to 60 kg of H_2 at 350 bar per day
- Hydrogen flow rate up to 3.6 kg/min
- Storage cascade at 300 and 450 bar use in order to save energy

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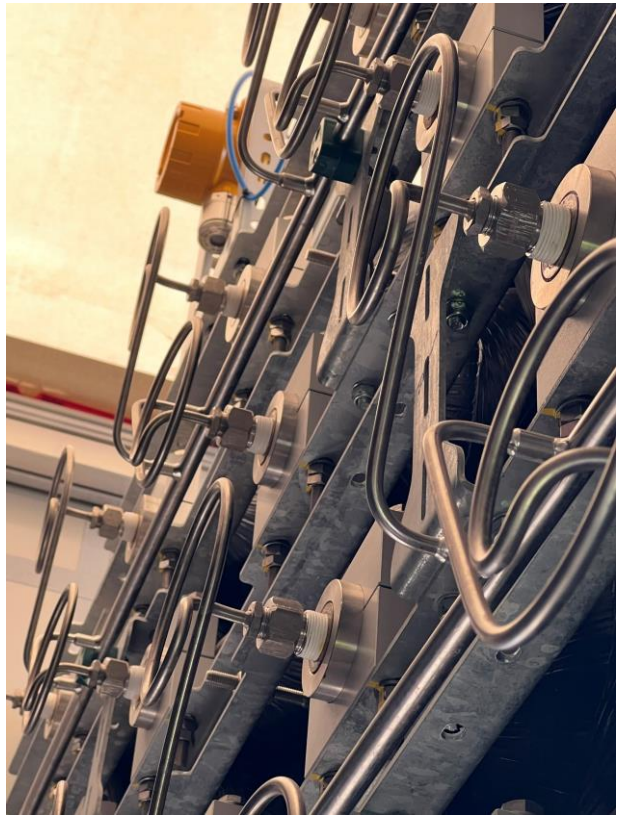
Hydrogen supply



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REACH STACKER

FCHJU funding € 1,300,000 approx.

Hyster-Yale Nederland B.V., MSCTV, Port Authority of Valencia, Fundación Valenciaport, National Hydrogen Centre

Expected achievements

- Average CO_2 reduction of 128,000 kg per year per vehicle (3000 h & 16 L/h)
- Lower TCO
- Improved productivity

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REACH STACKER

Specifications

	Parameter	Specifications	
Nuvera ® Fuel Cell Engine		**E-45-HD**	**E-60-HD**
Performance (Beginning of Life)	Gross output power*	54 kW	67 kW
	Net output power*	45 kW	59 kW **
	Operating voltage	170–290 VDC	180–270 VDC
	Maximum operating current	312.5 A	375 A
Physical	Dimensions (L x W x H)	1000 x 600 x 500 mm	
	Mass	187 kg	190 kg
Operation	Ambient operating temperature	-30oC to 45oC	
	Coolant	De-ionized water or glycol mix	
	Oxidant	Air	
	Fuel quality	SAE J2719 ISO 14687-2	
	Air supply pressure	0.70–1.05 bara	
	Fuel supply pressure	12.5–15.0 bara	
	Input power for balance-of-plant	1.2 kW at 27 VDC 6.0 kW at 375 VDC	1.2 kW at 27 VDC 7.5 kW at 375 VDC
Emissions	Exhaust	Zero emissions (no PM, NOx, SOx, CO, or CO_2)	

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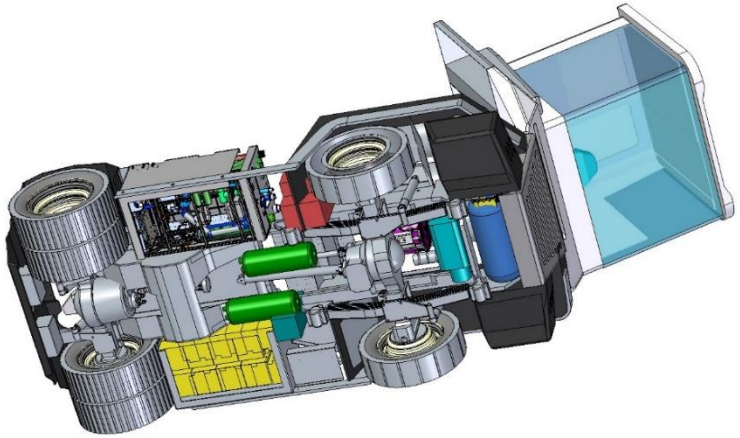
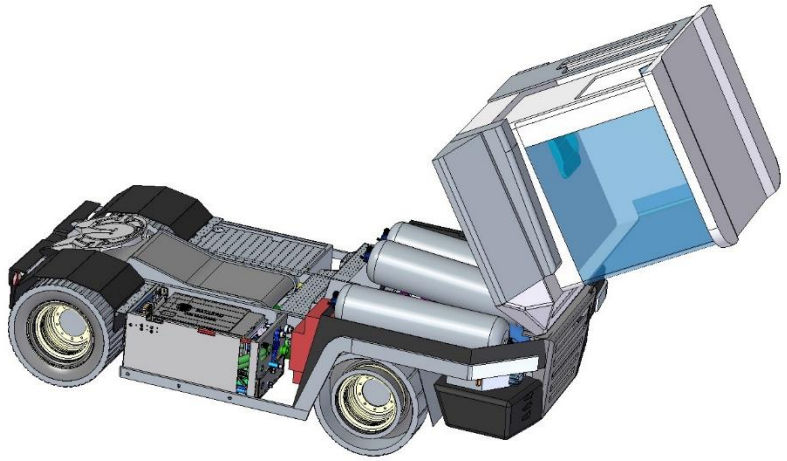
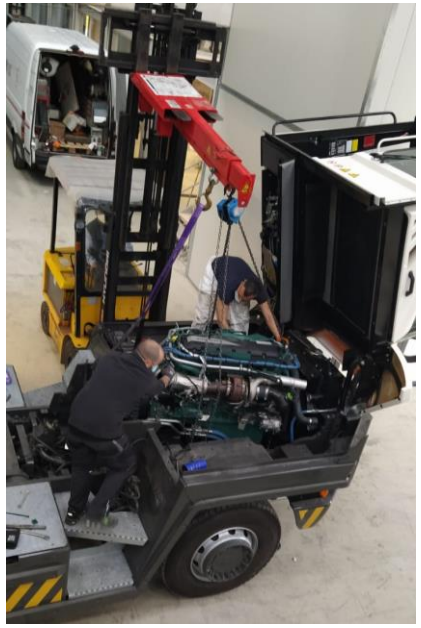
4x4 Terminal Tractor







FCHJU funding € 1,100,000 approx.

ATENA, Grimaldi Group, Ballard, National Hydrogen Centre, Fundacion Valenciaport

Development and deployment a 4x4 Yard Tractor equipped with a Fuel Cells and test it in Valencia Terminal Europa (Grimaldi Group). It involves three tasks:

- Design of the new FCEV YT
- Assembling of new components in the YT
- Testing and Piloting of the FCEV YT in Valencia, Spain

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4x4 Terminal Tractor

Fuel Cell

Ballard FCmove-HD 70	
Company producing	Ballard Power Systems Inc
Fuel cell module	Ballard FCmove-HD 70
Net system power	70 kW
Operating system current	20-250 A
Operating system voltage	250-500 VA
Idle power	8 kW
Dimensions (l x w x h) including air filter	1783 x 815 x 415 mm
Weight	250 kg

+

Battery Pack:

The battery pack is Lithion Battery P40-24 higher power performance, it is composed by 24 modules connected in series configuration, each module having nominal capacity and voltage of 40 Ah and 25.6V, and the battery pack allows for a nominal energy capacity of 24.6 kWh.

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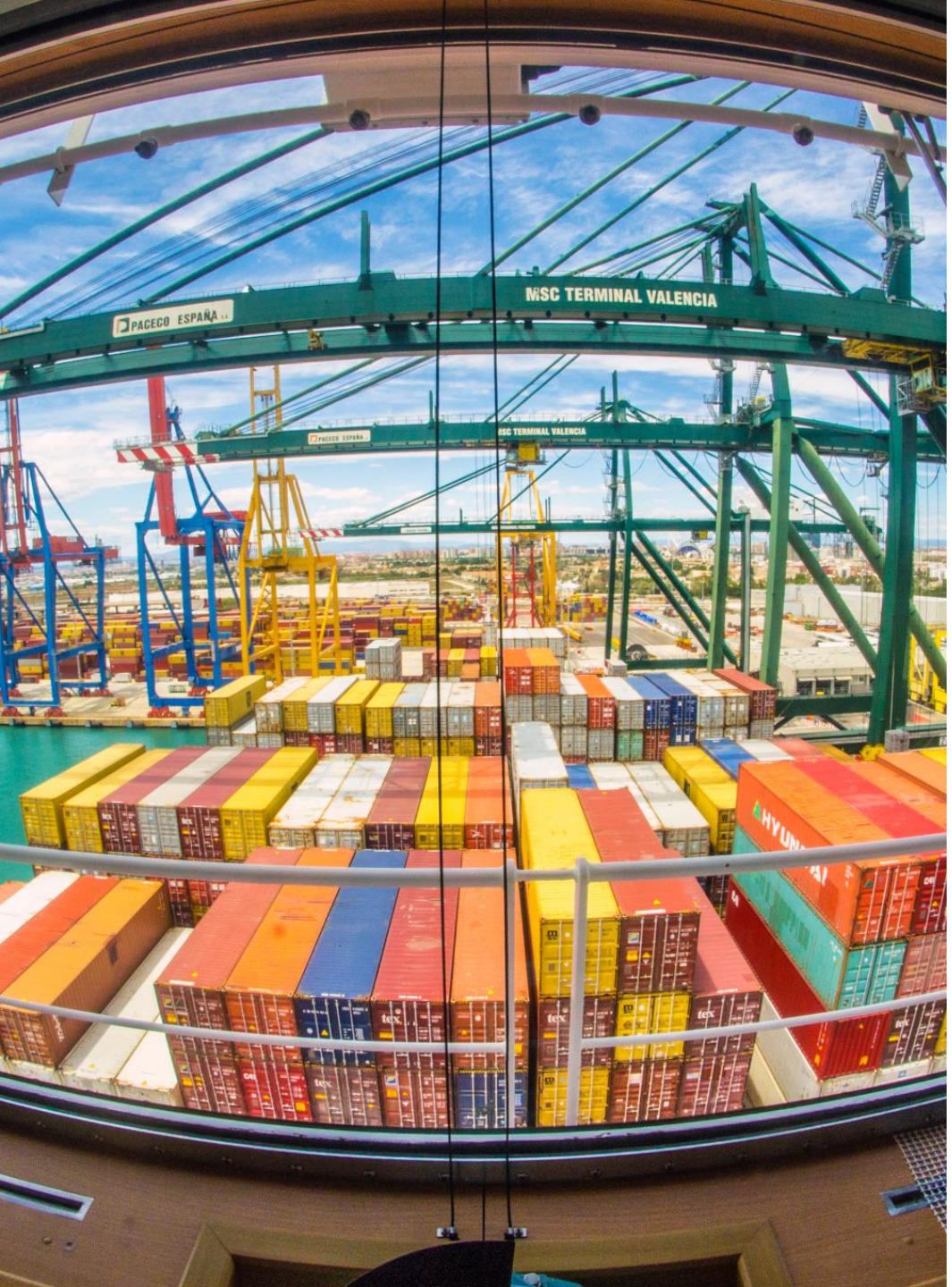

Market uptake strategy and risk management

Objectives

Analysis of the technical and financial feasibility of the use Hydrogen Fuel Cells in ports machinery.

Logistics

Define the most adequate logistic chain for supplying hydrogen. Estimate potential agregated demand

Regulatory

Analyse all aspects related to safety. Study the permiting process

Market uptake

Assess the financial feasibility. Propose a path for the introduction of FC in the port maritime sector. Define the most probable implementing scenarios.

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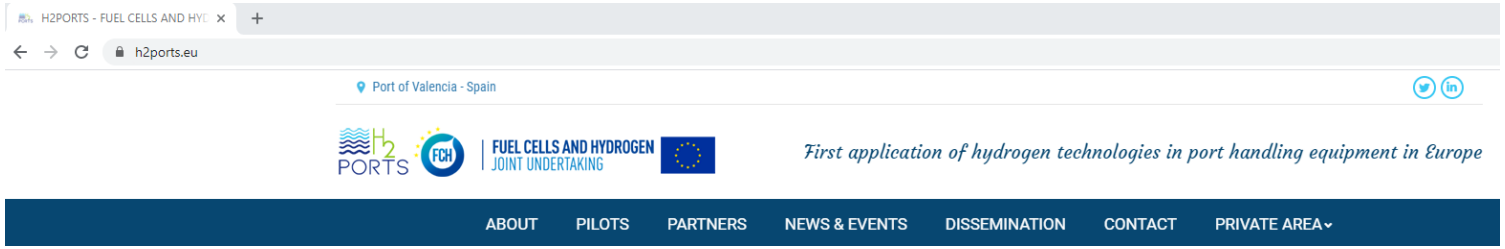

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Thank you!

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