

H2PORTS

First application of hydrogen technologies in port handling equipment in Europe

Aurelio Lázaro, PhD

Fundación Valenciaport

Project Website

alazaro@fundacion.valenciaport.com

//EU HYDROGEN

RESEARCH DAYS

15-16 NOVEMBER



Co-funded by
the European Union

//EU HYDROGEN

RESEARCH DAYS

15-16 NOVEMBER

Project Overview

Call year:
2018

Call topic:

FCH-03-1-2018 -
Developing Fuel
Cell applications
for port/harbour
ecosystems

Project dates:
[01/01/2019 - 31/12/2024]

Total project budget:
[4.117.197,50 €]

H2PORTS

Stage of implementation
01/11/2023: [80 %]

**Clean Hydrogen Partnership max.
contribution: [3.999.947,50 €]**



The Port of Valencia



In figures



77.5 M tonnes. Total Traffic¹



5.6 M TEU Container Traffic¹



412 k ITU RoRo Traffic¹



31,563² direct or indirect jobs



1.82² billion euros in economic impact (GVA)

¹ Values from 2021

² Values from 2016

//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Project Objectives



Implementing Fuel Cells and Hydrogen Technologies in Ports



Port of Valencia

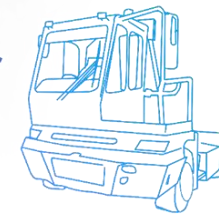


Reach Stacker in MSC Terminal

- 2 years / 5000 h of operation

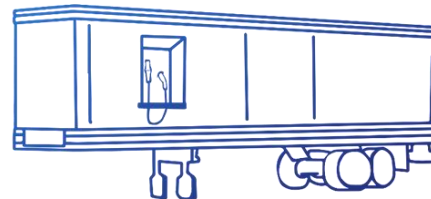
Mobile HRS

- 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



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Partners

Coordination:



Public authorities



Research institutions



End users

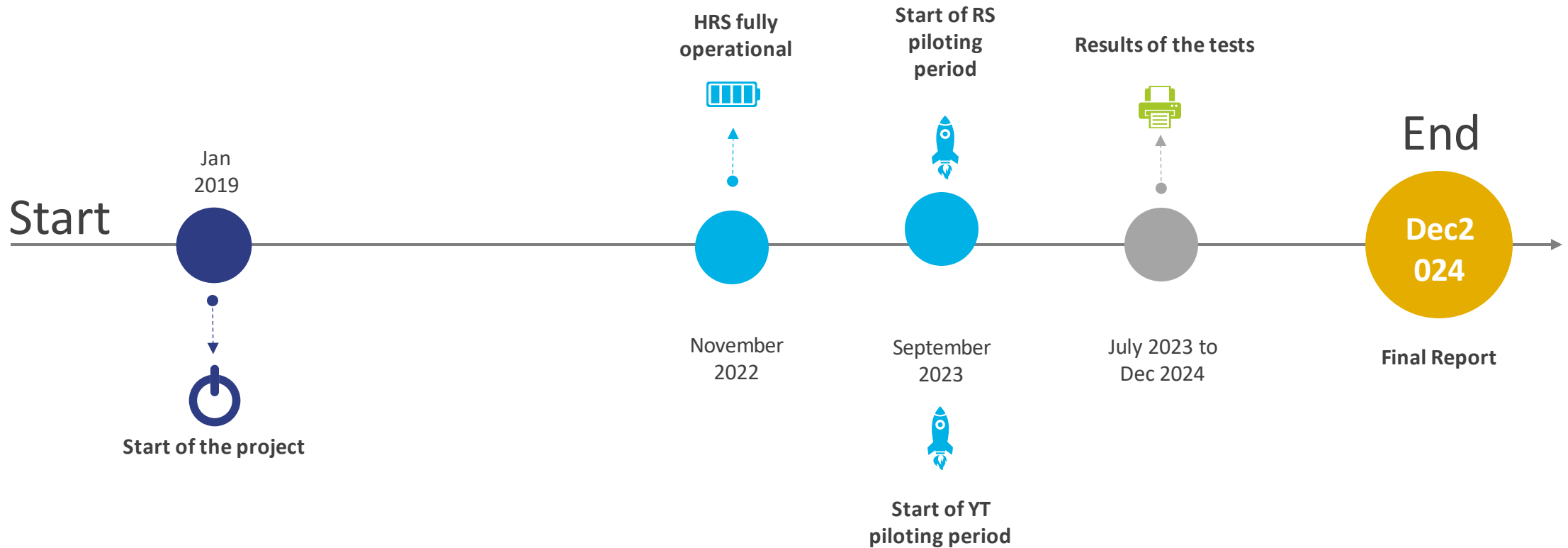


Industry



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

H2Ports current planning



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



Panel dispenser
Up to 3.6 kg/min
 T_{max} 85 °C

Mobile Unit

High pressure storage



300 bar
44 x 153 L
6732 L
151 kg

450bar
33 x 135 L
4450 L
138 kg



FCHJU funding € 800,000 approx.



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



- Mobile hydrogen refuelling station
- Up to 60 kg of H₂ 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

//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Hydrogen Supply



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Hydrogen Supply



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Reach Stacker - MSC Terminal



FCHJU funding € 1,300,000 approx.



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



Expected achievements

- Average CO₂ reduction of 128,000 kg per year per vehicle (3000 h & 16 L/h)
- Lower TCO
- Improved productivity

Reach Stacker - MSC Terminal



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)	

//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Reach Stacker - MSC Terminal

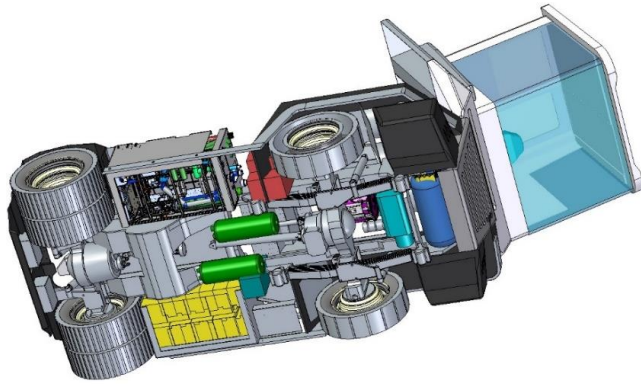


Co-funded by
the European Union



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

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

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



Terminal Tractor

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.



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Terminal Tractor



Co-funded by
the European Union



Risk management and Market strategy



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 aggregated demand



Regulatory

Analyse all aspects related to safety. Study the permitting 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.



//EU HYDROGEN

RESEARCH DAYS

15-16 NOVEMBER

Dissemination Activities

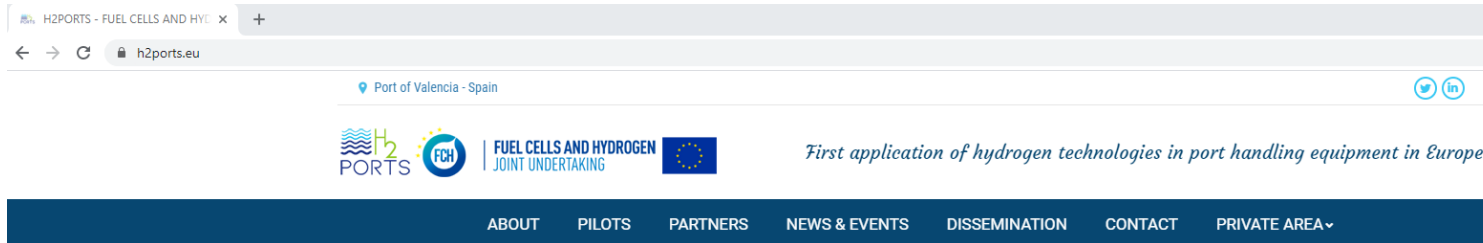
- The H2PORTS's Stakeholder Group has been set up, with 79 members.
- During this period 3 Newsletters have been launched with a total of 1.480 downloads from our website.
- 18 PRESS RELEASES have been written and sent to the national and international media.
- Awarded as best innovation project at GREENGAS conference.
- H2PORTS project has already been presented in nearly 50 Conferences, Webinars and Technical Meetings .



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Follow us

<https://h2ports.eu/>



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER

Communications Activities



RADIO PROGRAMMES



TV NEWS



Co-funded by
the European Union



//EU HYDROGEN
RESEARCH DAYS
15-16 NOVEMBER



Co-funded by
the European Union