H2Ports

Implementing Fuel Cells and Hydrogen Technologies in Ports

Fundación Valenciaport

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 826339. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.

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Figures

209 PROJECTS

87 PLANNING AND MANAGEMENT SOFTWARE SOLUTIONS

15 INDUSTRIAL PROTOTYPES

9 HARDWARE SOLUTIONS

8 DATABASES AND SIMULATORS

199 MILLION € of POTENTIAL SAVINGS derived from the implementation of the PROJECTS TOP TEN

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Main project topics and completed courses

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ValenciaPort in figures

76,4 M Ton. Total Traffic in 2018

5,2 M TEU Containers Traffic in 2018

19.800 direct or indirect jobs in 2016

Indirect or related role in the generation of over **1.74 billion euros** in production in 2016

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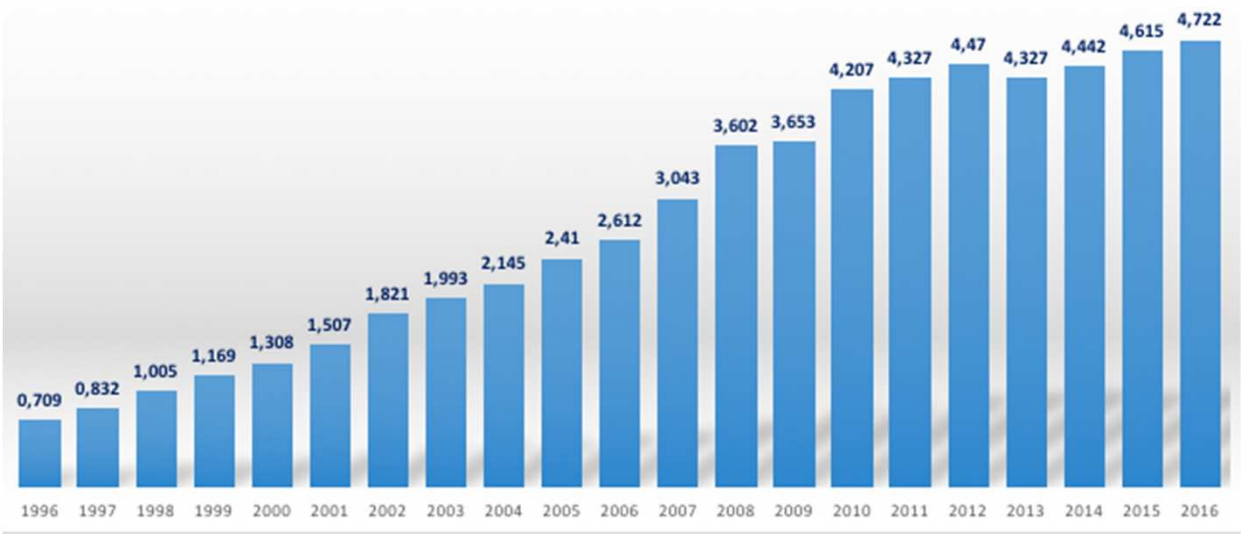

Container traffic Evolution

1996-2016 (Mio. TEUs)

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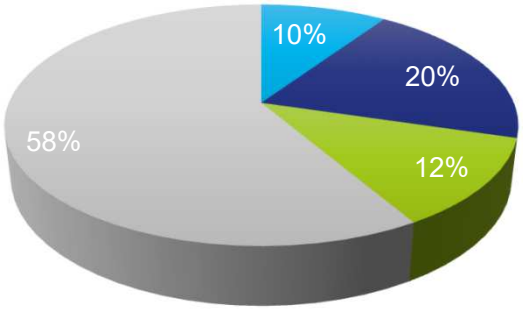
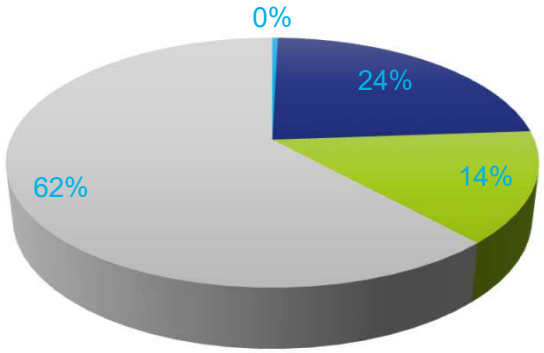
Total Emissions in 2014

CO_2e emissions in kg



- Total emissions associated to electrical consumptions
- Total emissions associated to fuel consumptions
- Total emissions associated to transport
- Total emissions associated to vessel stops

NO_2 emissions in kg



- Total emissions associated to electrical consumptions
- Total emissions associated to fuel consumptions
- Total emissions associated to transport
- Total emissions associated to vessel stops

Source: Own elaboration based on Valenciaport Carbon Footprint

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APM TERMINALS VALENCIA

MSC: SPECIALISED TERMINAL

NOATUM-COSCO: PUBLIC TERMINAL

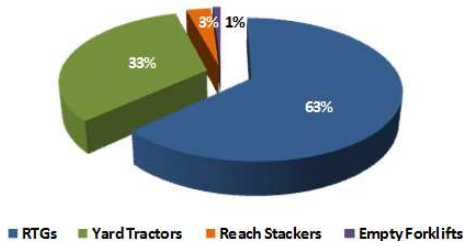
VALENCIA TERMINAL EUROPA: RO-RO TERMINAL

Port Container Terminals. Energy Profile

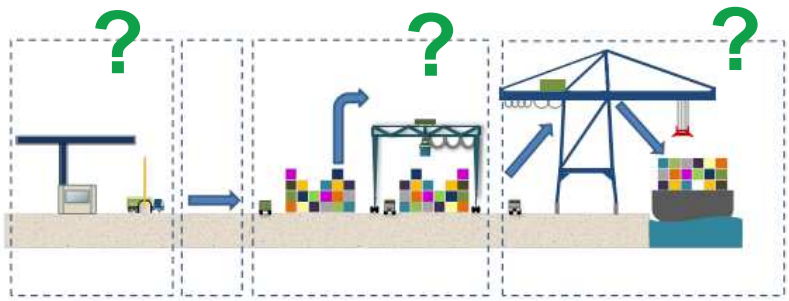
Port Container Terminals have been studied with the aim of obtaining their energy profiles and the global carbon footprint produced, taking into account the activities carried out by the whole group of machinery and equipment involved.

The aim is to characterise PCTs energy profiles by means of the evaluation of the energy performance of their activities and processes, thus quantifying their impact in terms of GHG emissions.

How much energy is consumed?



Where is the energy consumed?



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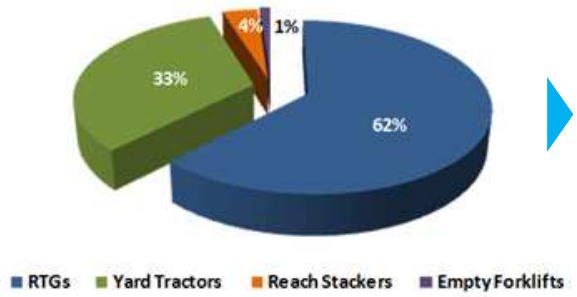
How Much Energy? Fuel Consumption

NCTV Yard Machinery
Total Fuel Consumption 2012



90%


4,049,138 L **(58%)**

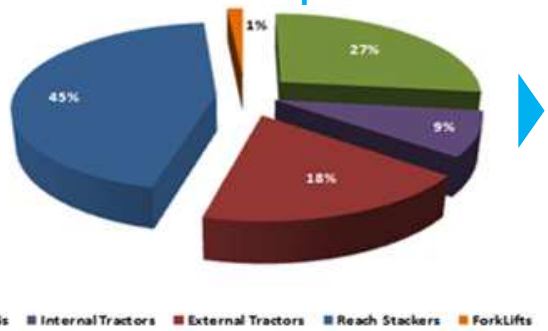

2,245,147 L **(32%)**


611,460 L **(9%)**


80,819 L **(1%)**

6,986,564 L

Livorno TDT Yard Machinery
Total Fuel Consumption 2012



Carbon Footprint (Fuel)

7.57 kg CO_2eq / TEU

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Decarbonization in Port Container Operation

1. **Decarbonisation Experiences in Port Container Operations**
   - **Liquefied Natural Gas**
   - **Electrification**
2. **Next Step: Hydrogen**

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LNG Terminal Tractor Prototype

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LNG Terminal Tractor. Design Requirements

This side free to install the 323 liters LNG tank

\ 3.500 mm wheelbase
Instead 3.300 mm standard

Hydraulic tank, battery and air compressor moved to the same side

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Full Electrical Tractor

Batteries

Traction battery capacity 206[kWh]
Traction battery type Lithium Iron Phosphate
Nominal voltage 299 [V] (260-380 Volt)
Current 700Ah

Driveline

Power/torque 160/180 hp @ 1800-2800 RPM 633/712 Nm @0-1800 RPM

Autonomy

6 hours (1 operational shift)

Recharging Time

Between 3-5 hours (depending on plug type)

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LNG vs Electrification

LNG Terminal Truck

Refuelling time similar to Diesel
Equipment cost similar to Diesel
LNG availability
Less Autonomy than Diesel
Not Zero-Emission solution

Full Electric Terminal Truck

Zero-Emission solution
Electricity price lower than Diesel
Charging time higher than Diesel refuelling
Low autonomy (less than 6 hours)
Equipment cost much higher than Diesel

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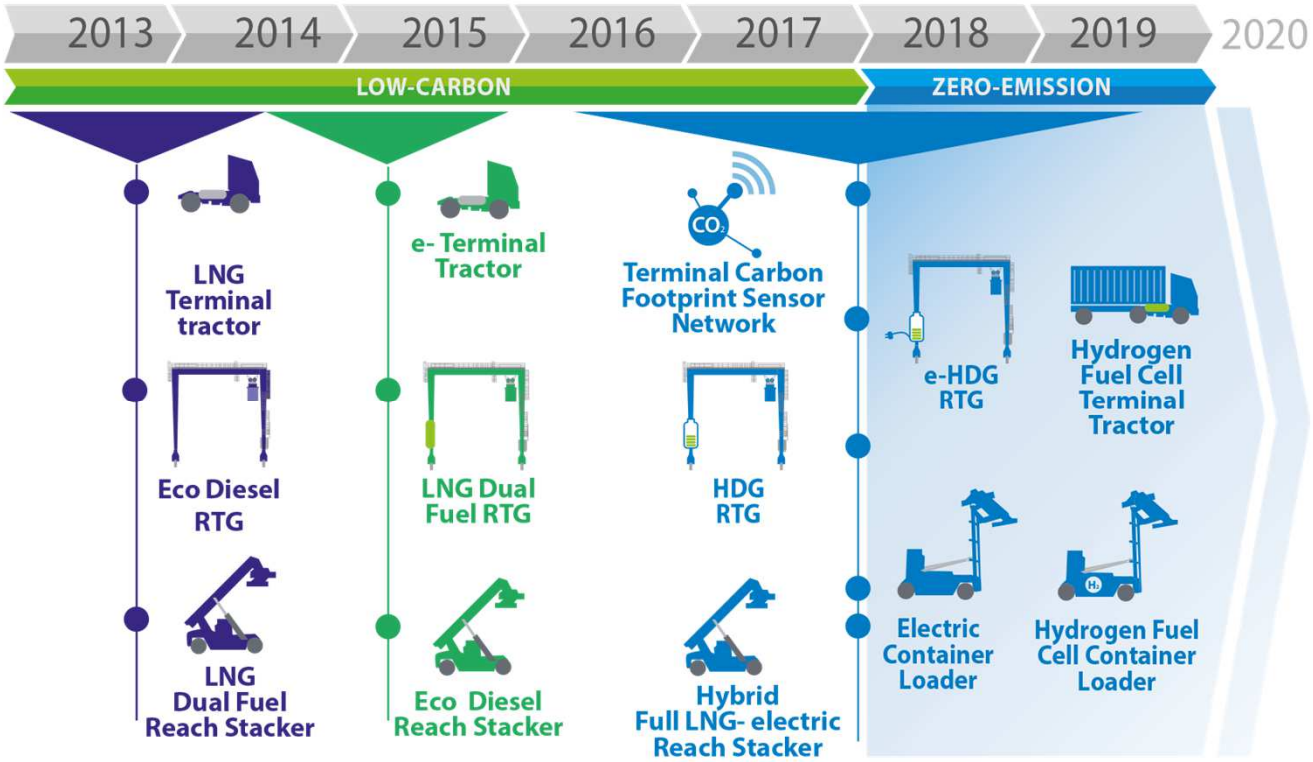
Towards Zero-Emissions Operations in Ports



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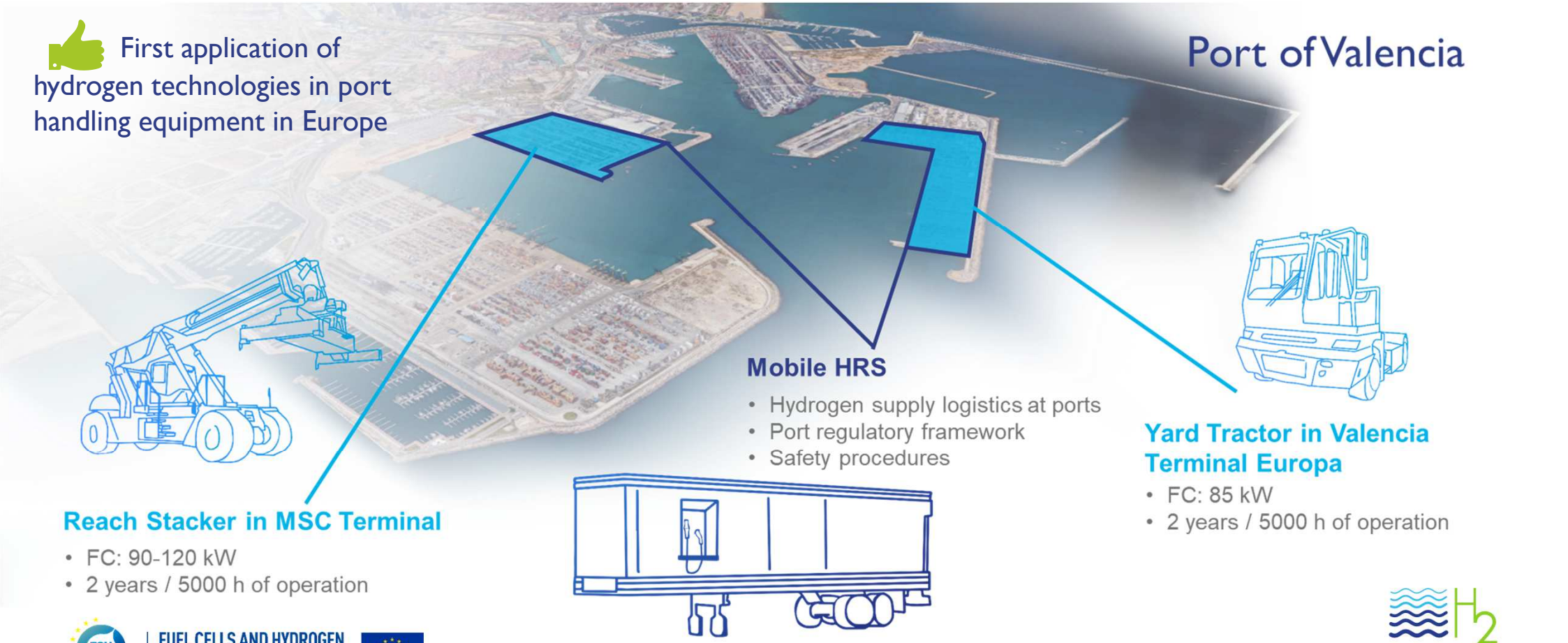
General Overview

First application of hydrogen technologies in port handling equipment in Europe



Reach Stacker in MSC Terminal

- FC: 90-120 kW
- 2 years / 5000 h of operation

Mobile HRS

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

Yard Tractor in Valencia Terminal Europa

- FC: 85 kW
- 2 years / 5000 h of operation

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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

HYSTER-YALE GROUP

BALLARD

enagas

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Challenges for the Implementation of H2 in Ports

- Certification of the equipment
- Hydrogen distribution model according our particularities
- Suitable location inside/outside the terminal?
- Protection against fire
- Training staff
- Emergency protocols
- Permitting
- City Perception

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Conclusions

- Port container operations can (and must) be decarbonised: electrification and low carbon / zero-emission fuels;
- This task is challenging: not all port operators are prepared for making the transition towards zero-emission solutions;
- There are knowledge and awareness gaps in the port industry about zero-emission alternatives. Need to bridge the gaps with successful stories;
- Need for cooperative innovation among technology providers and end users;
- Financial feasibility and short pay-backs are critical factors for real implementation of disruptive technologies (like Hydrogen).

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Thank you!

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