

#H2OffThePress

Port decarbonisation

**How to develop a use case with
hydrogen?**



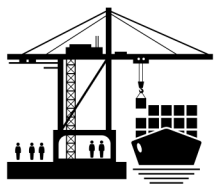
Why do we need to decarbonise ports?



The **global maritime** industry:

- carries **90%** of traded goods
- is set to **triple** by 2050
- is committed to reaching **net zero by 2050**
- is today responsible for **3%** of the global GHG emissions

Maritime emissions



**3% of
global
GHG**

Shipping

Port Operations

Logistics
(*Drayage*)

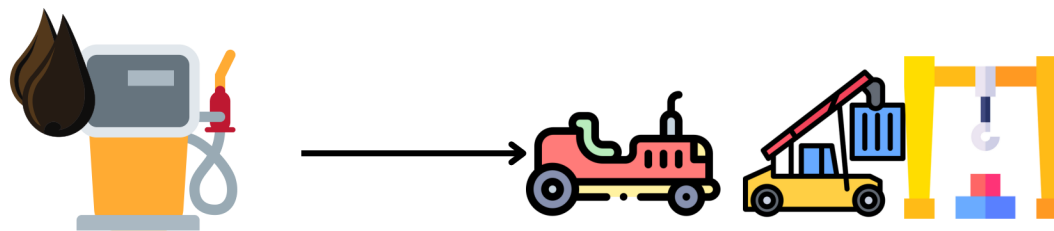
Decarbonisation efforts start to be seen all across, including for the reduction of the “**in-port**” **emissions**, i.e. the emissions related to **port operations** (handling equipment, trucks, etc).

But how to decarbonise port equipment?

Two options: Electrification or Hydrogen



Conventional cargo handling supply chain includes



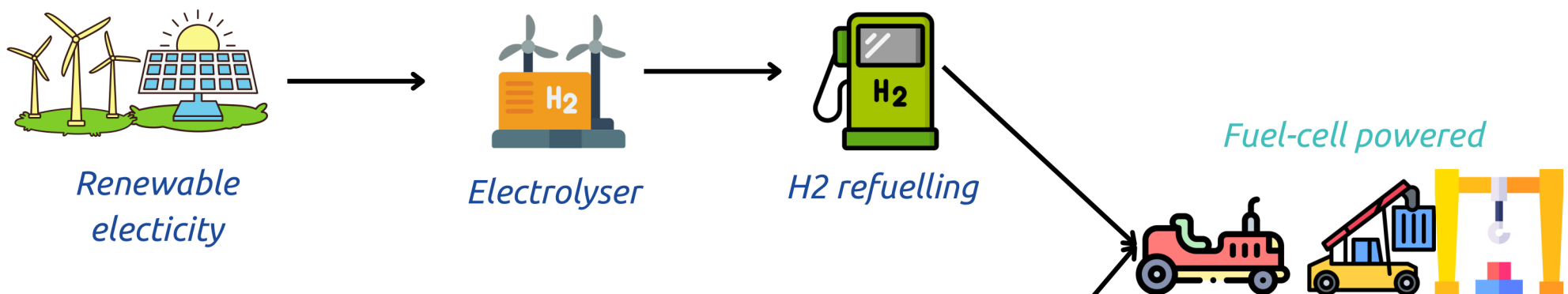
Diesel refuelling

Diesel-powered cargo handling equipment

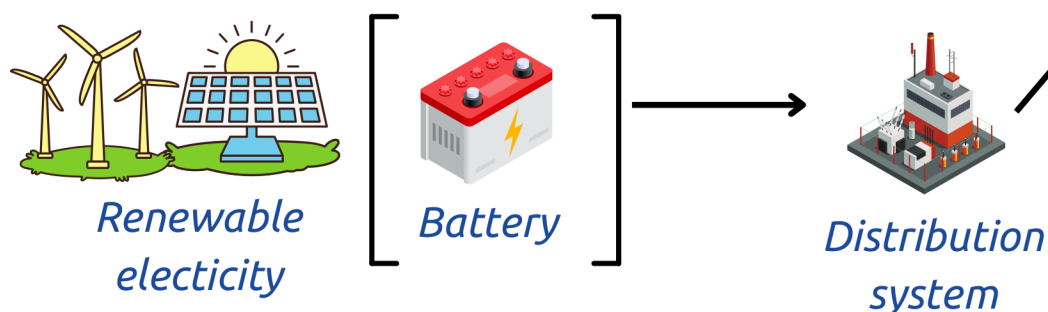


“Green” cargo handling supply chain

Option 1: Fuel-cell powered equipment



Option 2: Green electricity powered equipment



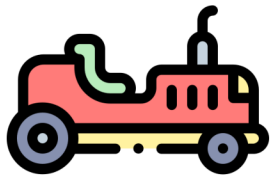
Case Study



Let's consider a port with

65

Yard Tractors



Semi-tractor
intended to move
semi-trailers within a
cargo yard

5

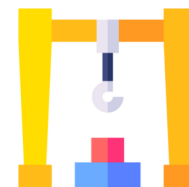
*Reach
Stackers*



Handling
intermodal cargo
containers

35

*Rubber Tyred
Gantry Cranes
(RTG)*



Used for vertical
stacking

Let's focus on the hydrogen case:

- How much **hydrogen consumption (ton/yr)** does this represent?
- What is the size of the **electrolyser (MW)** needed to supply this port?

How to size the hydrogen case?



→ Step 1: Calculate the current diesel consumption

	unit	Tractor	Stacker	RTG
Diesel consumption (hourly)	L/hr	10	15	20
Working hours	hr	3,900	2,300	5,800
Diesel consumption (yearly)	L	39,000	34,500	116,000
Number of units	#	65	5	35

→ Step 2: Calculate the equivalent hydrogen consumption



→ Step 3: Calculate the necessary electrolyser capacity

$$6,767,500 \text{ L of Diesel} = 1,200 \text{ tons H2} \approx 7 \text{ MW electrolyser capacity}$$

assuming a 100% load factor (grid), 50kWh/kg efficiency, and 98% availability

Hydrogen-powered ports are starting to be a reality



→ Pilot decarbonisation projects are underway across the globe with the help of green hydrogen and fuel cells



Port of Valencia, Spain



30th busiest port in the world (2021)

- ✓ Fuel cell Yard tractor, stackers and H2 refuelling station used in terminals - **operational since 2023**
- ✓ **First port in Europe** to adopt H2 for handling operations



Port of Los Angeles, USA



17th busiest port in the world (2021)

- ✓ 5 Fuel cell trucks and 2 H2 refuelling stations - **operational since 2021**
- ✓ Plans to introduce Fuel cell Yard tractor and Rubber Tyre Gantry

TCO, the right metric to compare electrification and H2

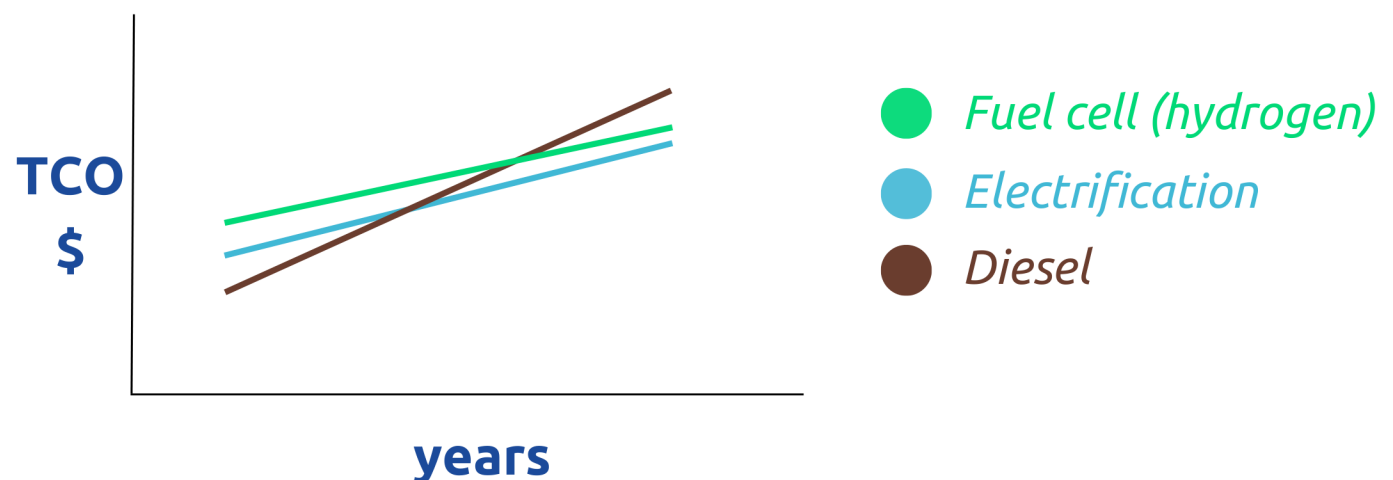


→ **Total cost of ownership (TCO)** refers to the overall cost of a product or service throughout its life cycle

$$\text{TCO}_{\text{year N}} = \frac{\text{Acquisition price}}{\text{Lifetime of asset}} + \text{Maintenance cost} + \text{Fuel cost (incl tax)}$$

→ Once TCO is found for all considered options, it can be plotted throughout the years to see which options is the **most competitive**, and **by when**.

Illustrative
TCO analysis



Besides TCO, projects have to overcome key risks and barriers



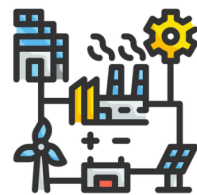
Remaining lifetime of the equipment

Difficult to make the case for decarbonisation in case of brand new diesel equipment



Unavailability of renewable electricity

High carbon content of the grid, unavailability of land to develop greenfield RE plants



Main Project Barriers



Available budget of the port operator

Investment in hydrogen/electricity powered equipment requires high capex

→ This is why before any heavy decarbonisation investment, port are incentivized to undertake **energy efficiency** initiatives