

# Will H<sub>2</sub> trucks power the supply chains of the future?



Namibia Green Hydrogen Conference  
Towards a Green Hydrogen Hub in Africa

*Roy Campe, CTO CMB.TECH  
17th of August 2022, Windhoek*

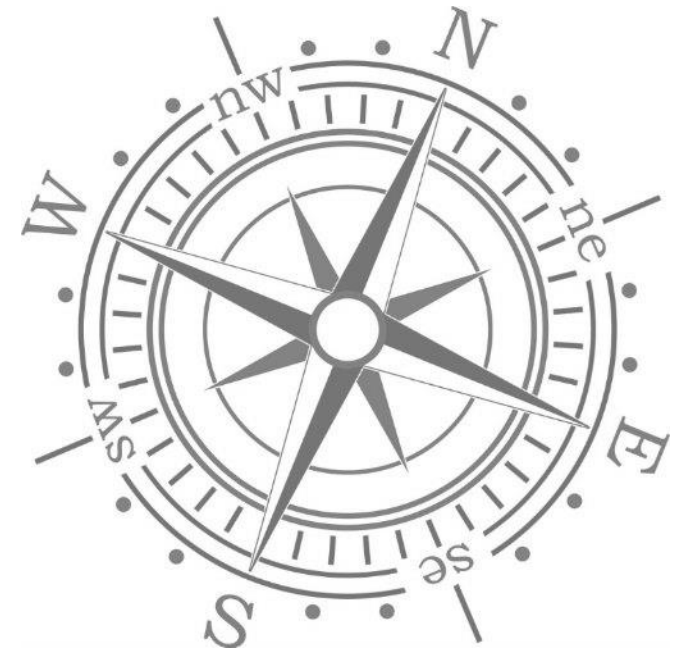


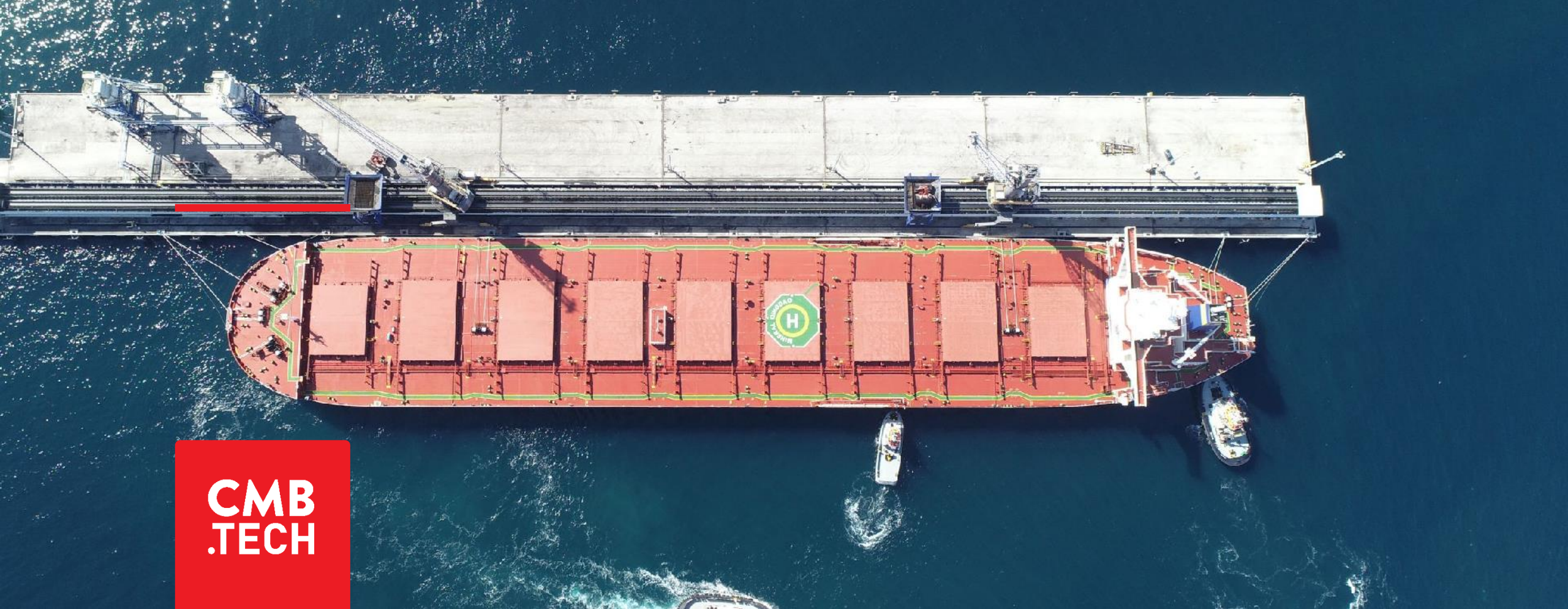
*A Joint Venture of:*



# Presentation Topics

1. Introduction CMB and its cleantech business unit
2. Cleanergy Solutions Namibia
3. H<sub>2</sub> trucks
4. Dual fuel technology as enabler
5. Other applications in the supply chain
6. Key take-aways
7. Q&A





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# Introduction

WE BRING HYDROGEN TO THE INDUSTRY



- CMB was founded in 1895
- Headquartered in Antwerp, Belgium
- 100% privately owned by Saverys family
- 320 shore-based staff and
- about 3200 seafarers

**CMB is a leading  
global shipping group operating 150  
ships**

**The group consists of 5 divisions:**

**Bocimar** : Dry cargo

**Delphis** : Container vessels

**Bochem** : Chemical tankers

**CMB.TECH** : Cleantech

**MCA** : Maritime Campus Antwerp



# CMB.TECH: the cleantech division of CMB

## MARINE

Design, building and operation of a future proof fleet powered by hydrogen and ammonia

## ENGINEERING

A fast growing highly skilled engineering team with >15y of experience with hydrogen systems

## INDUSTRY

Design and retrofit of industrial applications to run on the clean fuel of hydrogen

## H<sub>2</sub> INFRA

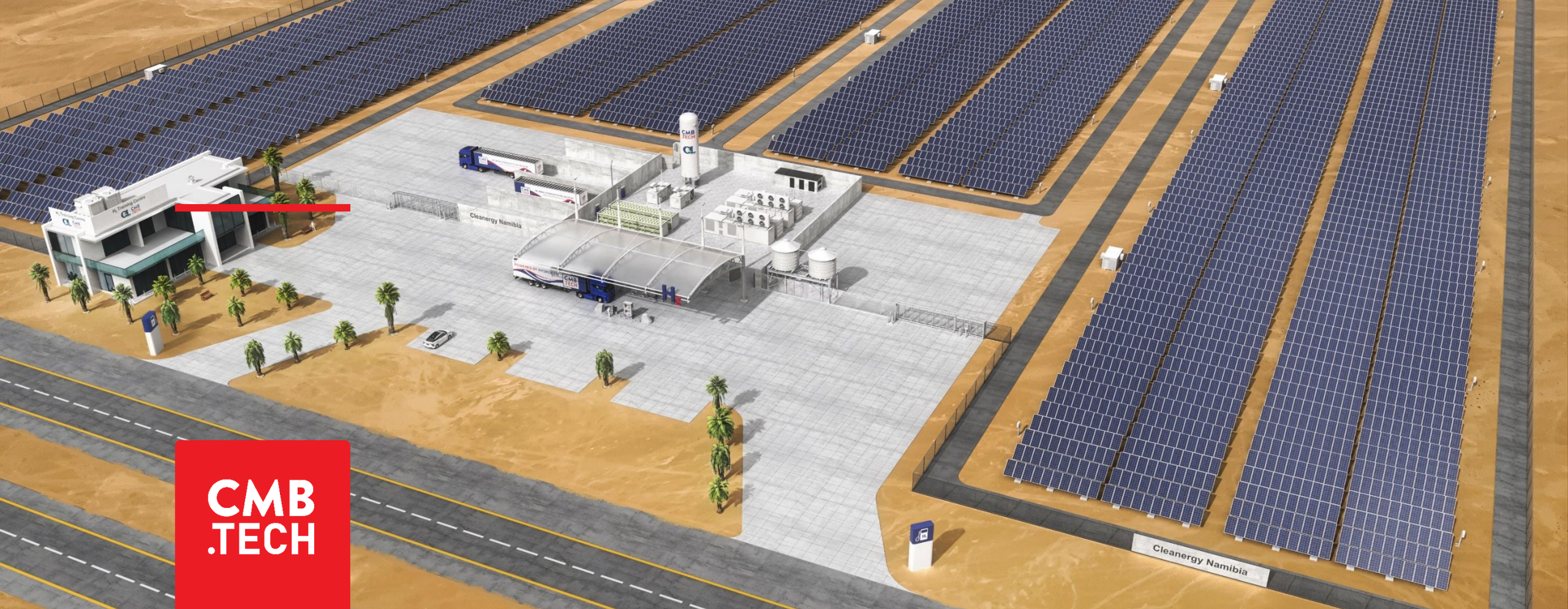
Technology and infrastructure to produce and distribute the clean fuels of the future

CMB.TECH's business model is to own/lease out or sell assets to customers looking for low and zero carbon solutions. CMB.TECH solves the chicken and egg discussion by offering H<sub>2</sub> and NH<sub>3</sub> molecules, either through own production or by sourcing it from third party producers.



>15y of experience





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# CLEANERGY

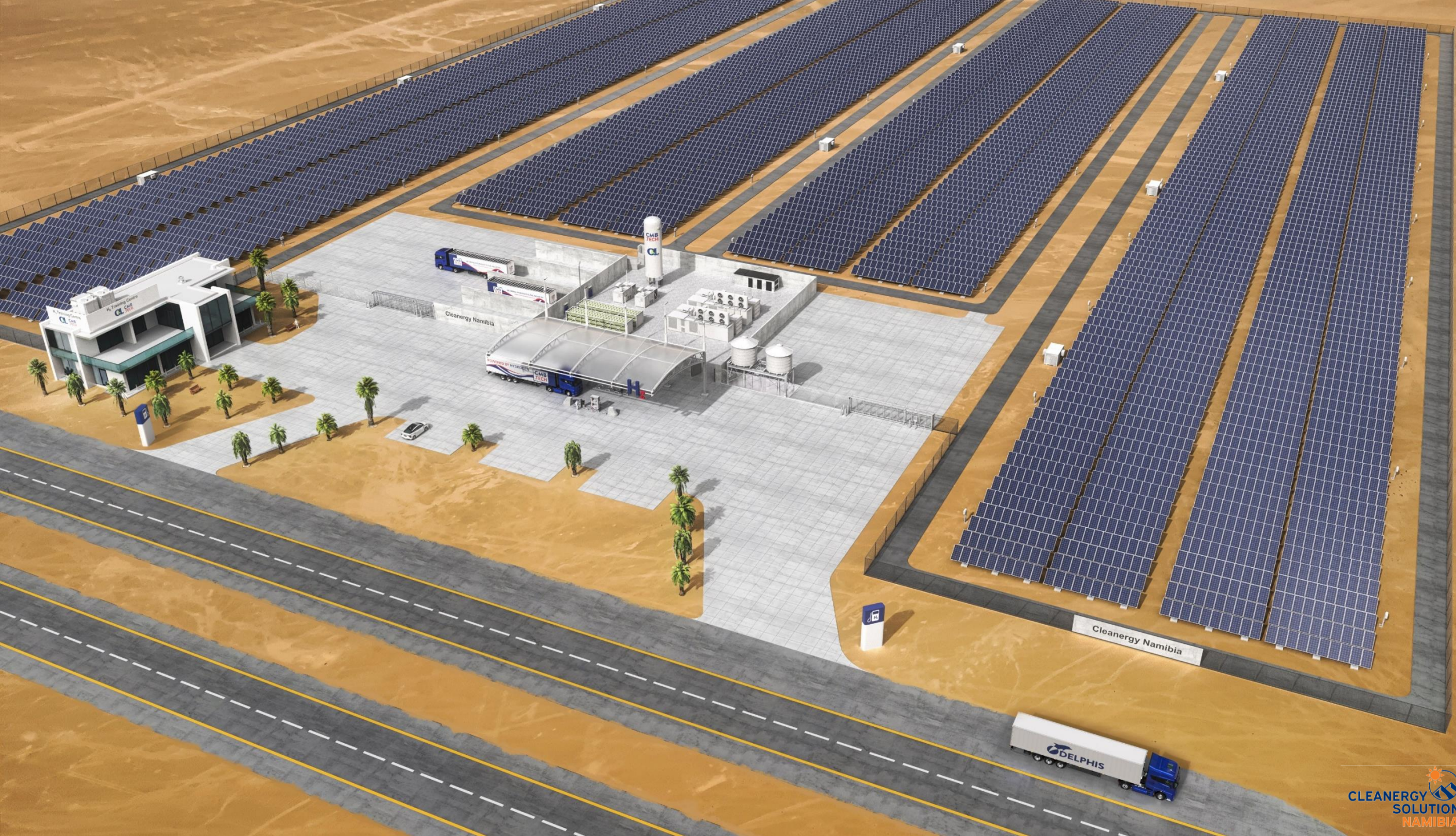
A JOINT VENTURE OF O&L AND CMB.TECH



# Cleanergy is Joint Venture of Ohlthaver & List and CMB.TECH

- Both partners have a strong commitment and will in synergy realise an H<sub>2</sub> demonstration hub by end of next year near Walvis Bay.
- The demonstration hub will be the first of its kind in Africa where hydrogen directly from a PV farm will produce green hydrogen which is dispensed at a public refuelling station.
- O&L has, with its Nexentury company, the relevant experience with the production of renewable energy in Namibia.
- CMB.TECH will bring in its hydrogen knowledge, experience and applications to Namibia.
- Cleanergy is backed by 2 renowned companies with more that 100y of experience.



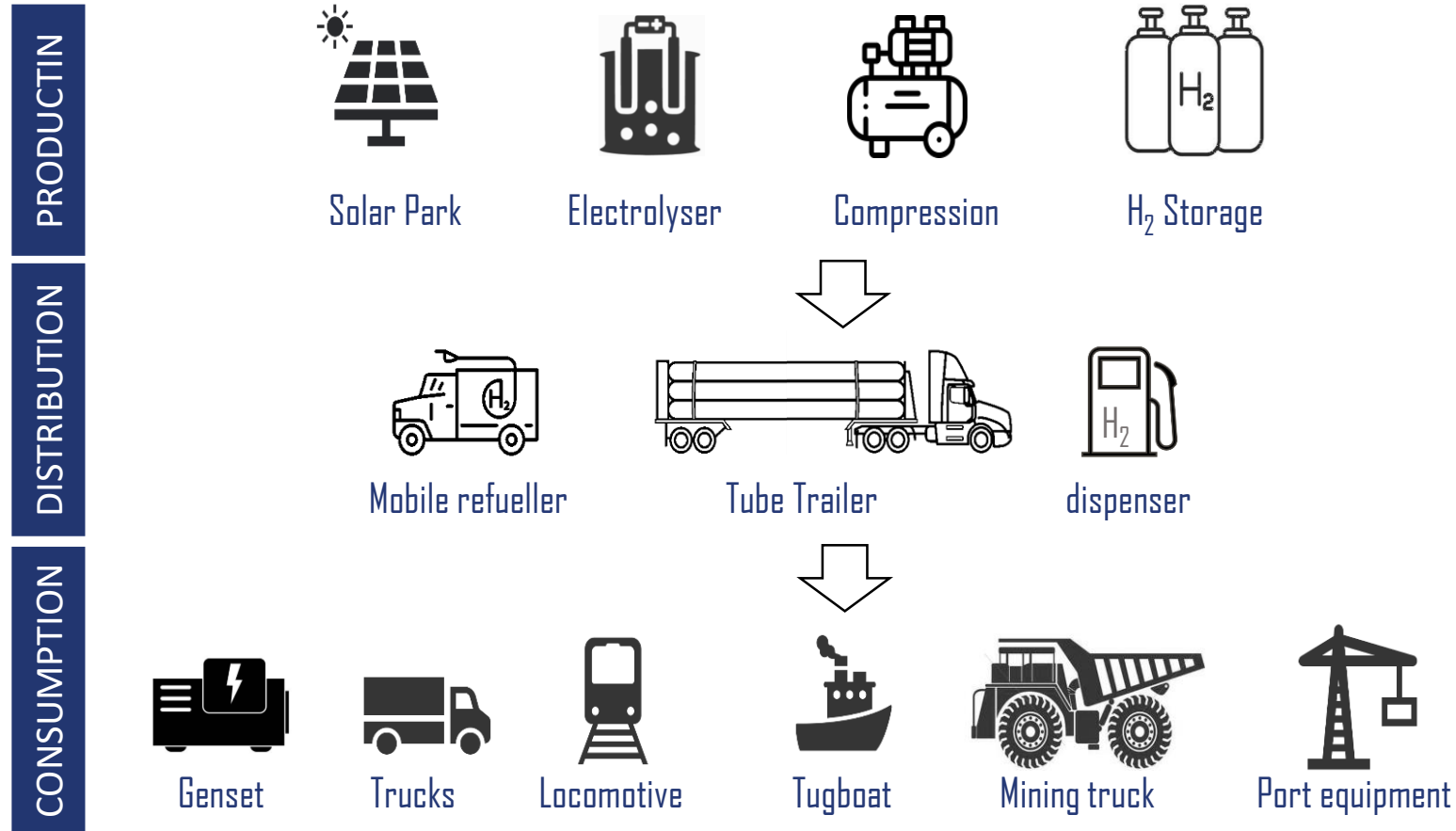


Hydrogen Centre  
Cleanergy Namibia

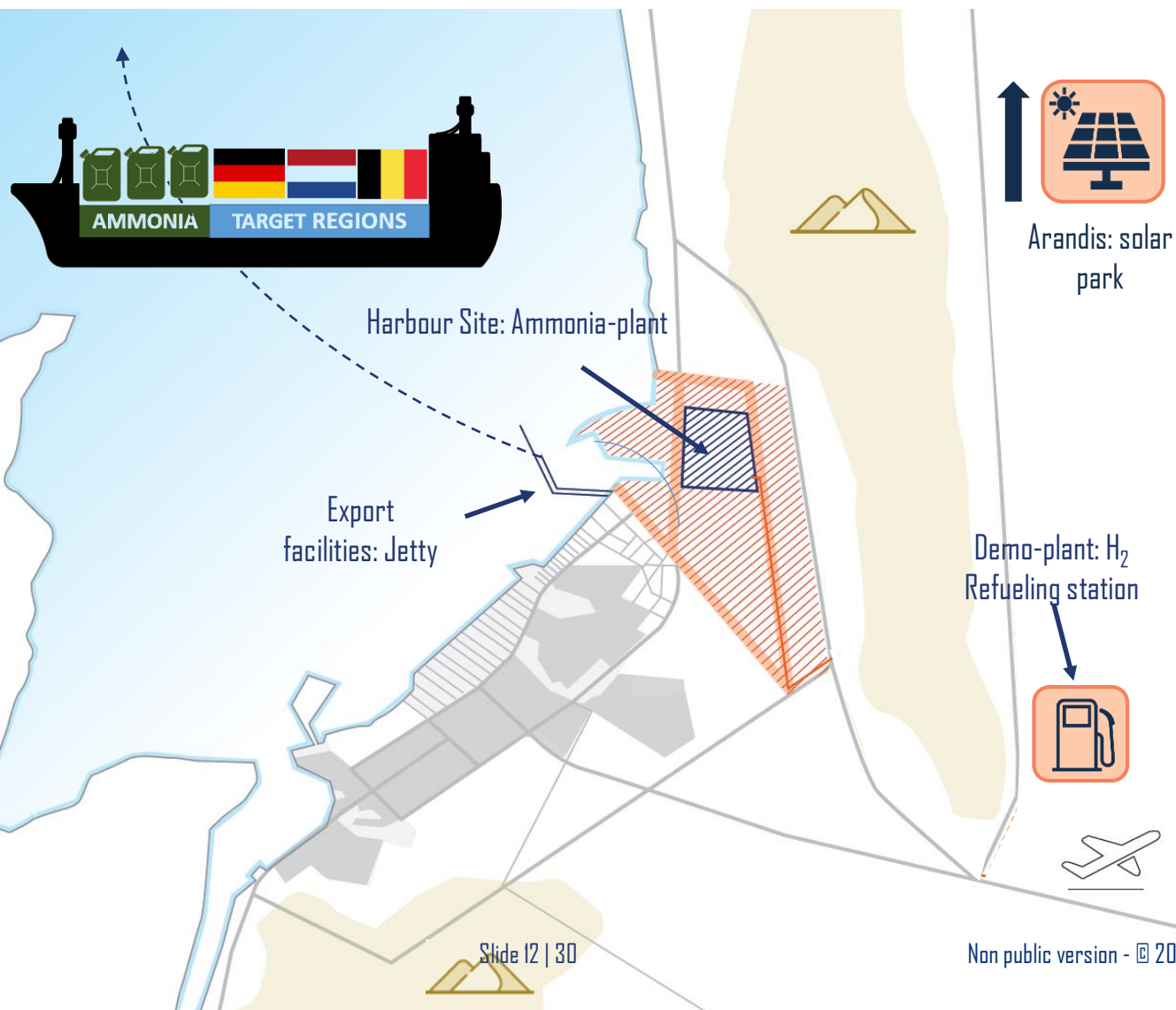
Cleanergy Namibia

Cleanergy Namibia

# Demo-project will kickstart the development of the Hydrogen value chain in Namibia

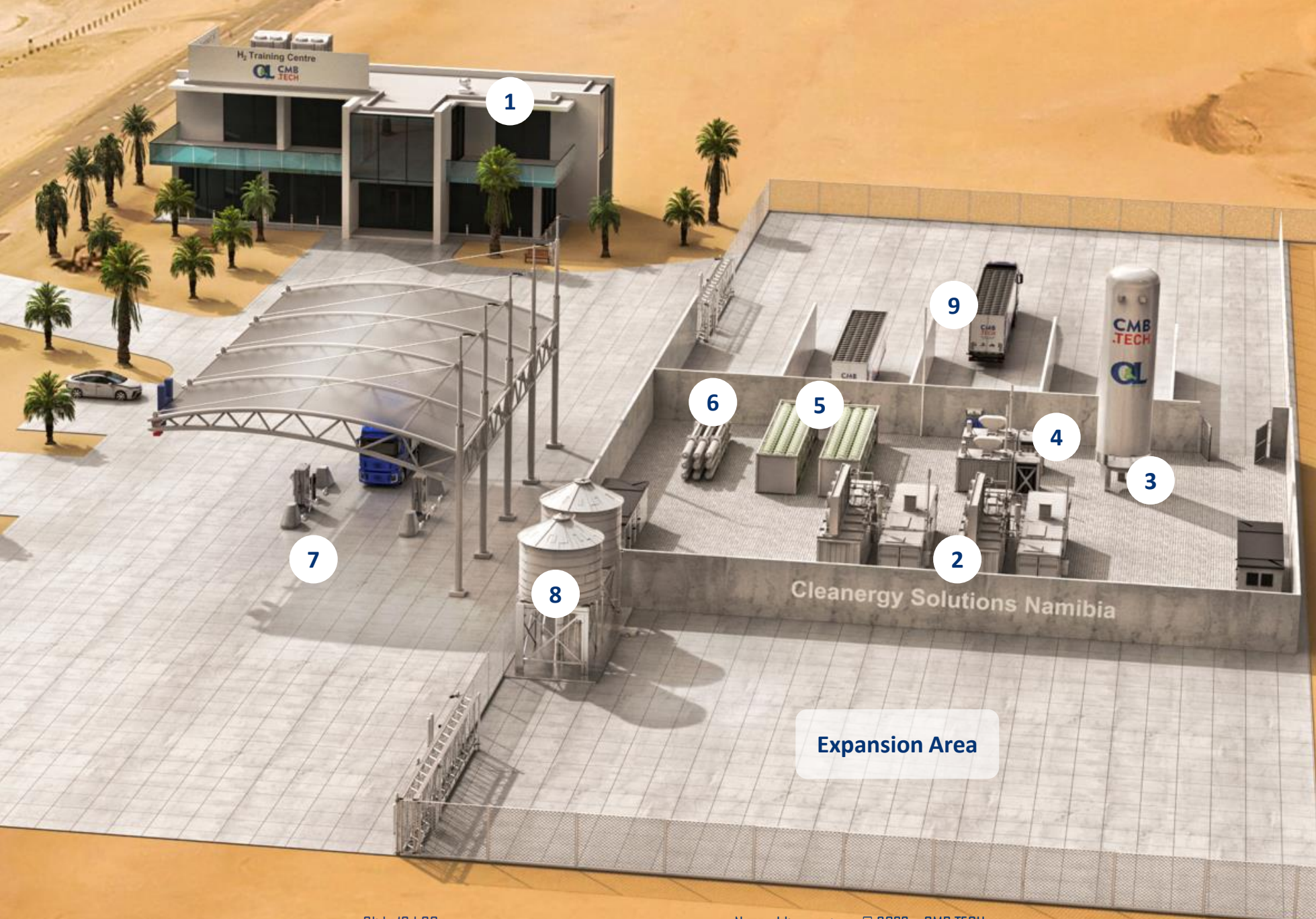


# Demo-plant will be located at a logistical hotspot near Walvis Bay



Walvis Bay is a preferred location for a hydrogen demonstration plant:

- ✓ Logistical connection to the hinterland of Namibia by road (Windhoek, Swakopmund,..)
- ✓ Proximity to end-customers with heavy-equipment (port area)
- ✓ End-location of TransNamib
- ✓ Availability of service providers
- ✓ Attractive for high-level visitors (Airport, vibrant city, proximity port and Swakopmund)



- 1 H<sub>2</sub> training centre
- 2 H<sub>2</sub> process and power containers
- 3 Low pressure buffer
- 4 Compressor
- 5 300 bar buffer
- 6 500 bar storage tanks
- 7 350 bar dispensers
- 8 Water tanks
- 9 Tube trailers bus



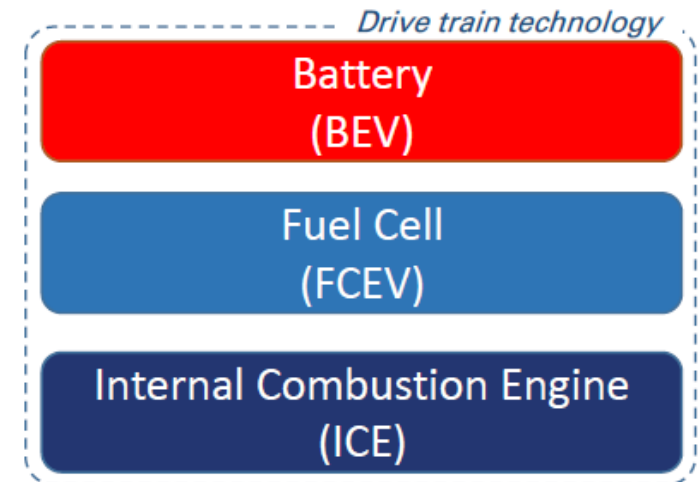
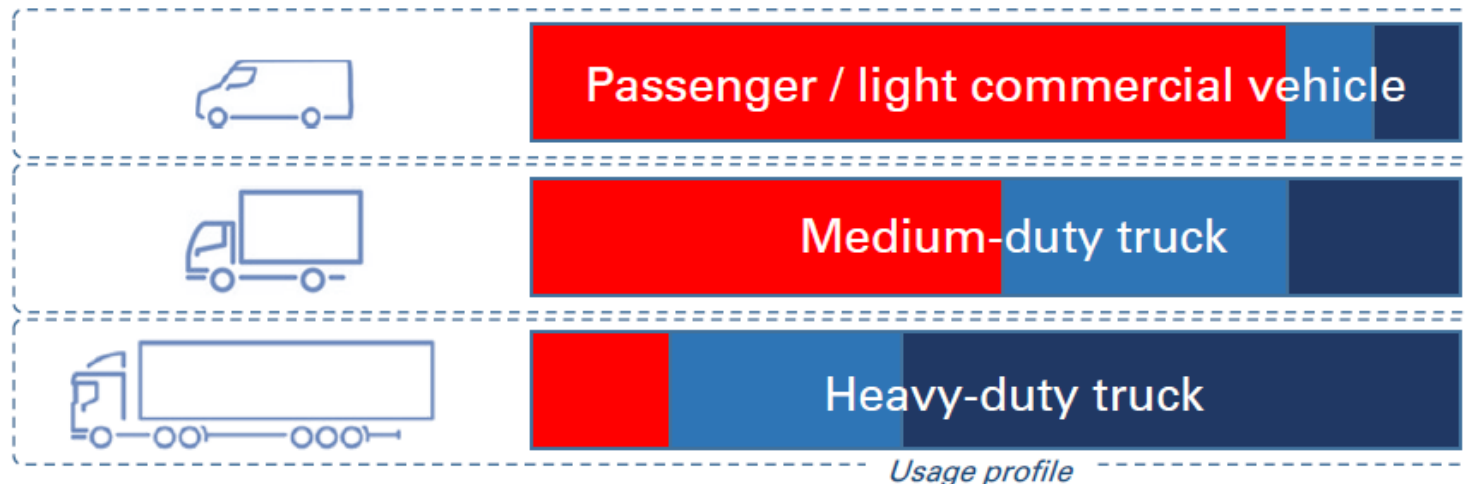
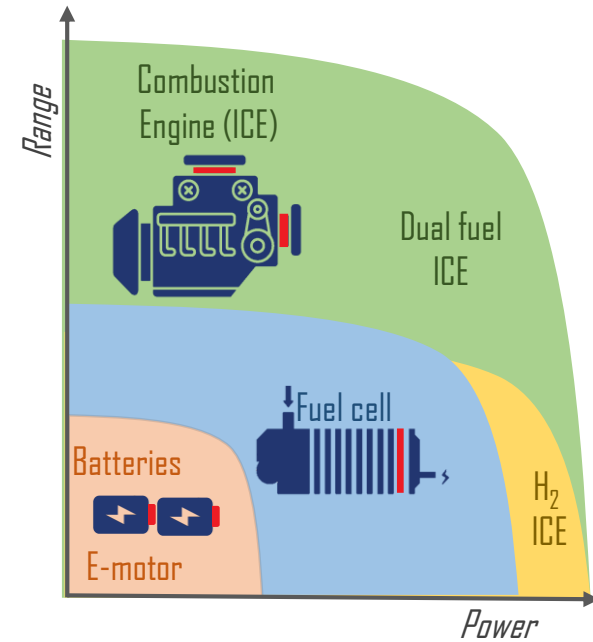
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# Hydrogen Trucks

POWERFUL & CLEAN LOGISTICS

# Each segment of the logistics and supply chain will have its preferred solution

- The more powerful vehicle, the bigger the difference between batteries, FCs and combustion technology.
- The typical driving distance and the duty cycle mainly determines the preferred drive train selection.
- ICE is clean, reliable and affordable and will be the preferred technology for heavy-duty transport.

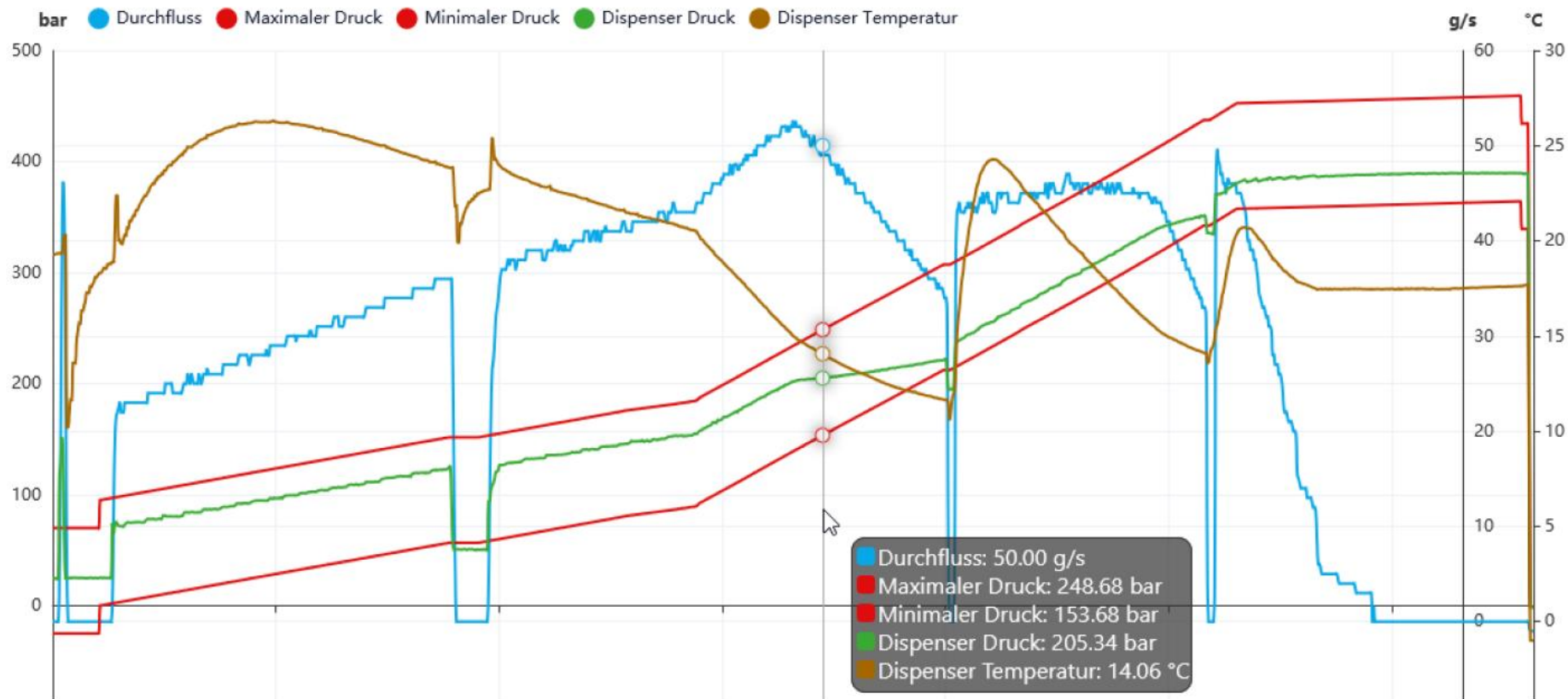




- Every major truck builder is looking into hydrogen solutions
- Both FC and ICE solutions exist already and are commercially offered
- Mostly, 350bar of compressed hydrogen is used for the storage of the gaseous fuel



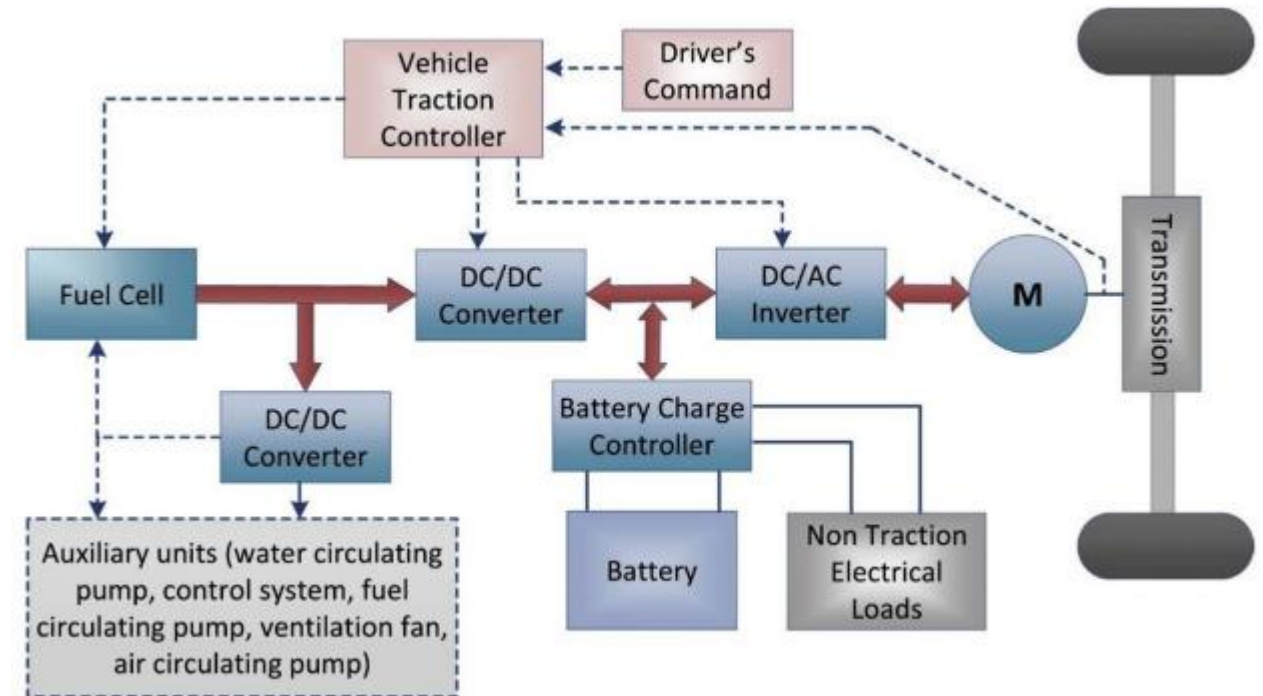
# A full truck refuelling takes about 10-14 minutes to refuel



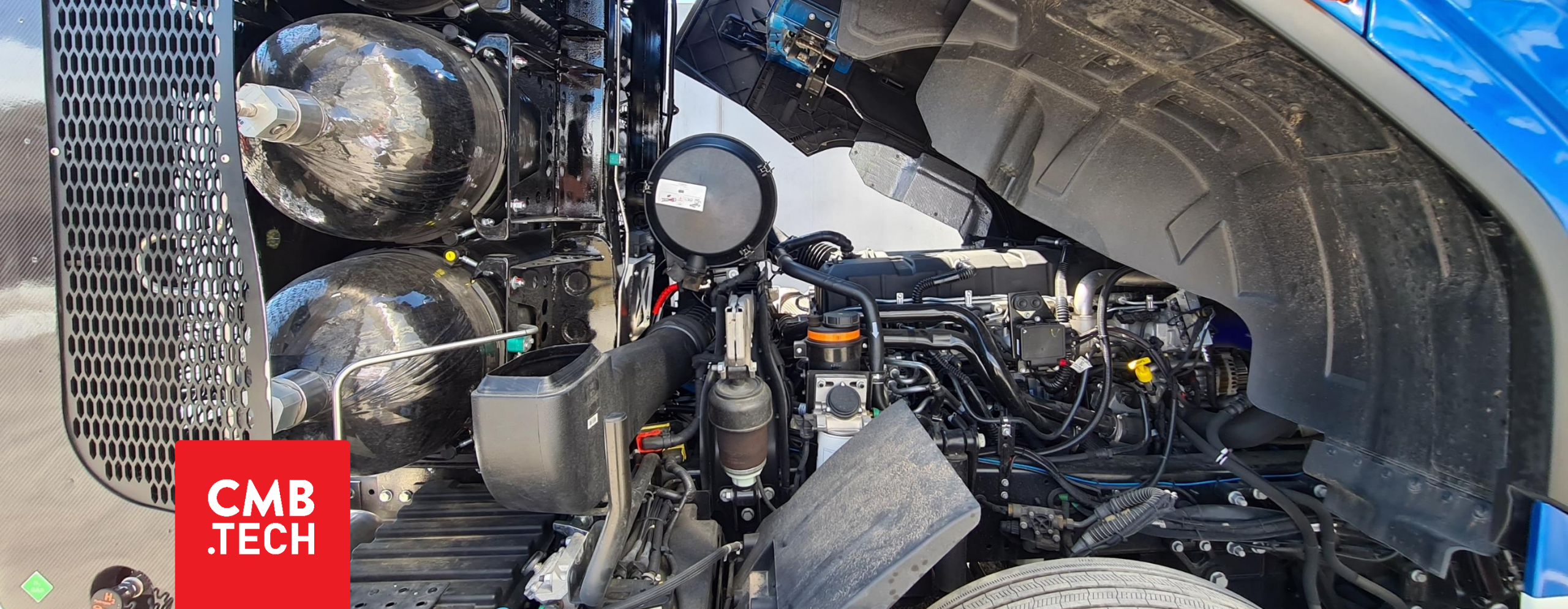
Prime Minister Alexander De Croo performed the first refuelling

# Simplified architecture of Fuel Cell Electric Vehicle (FCEV) show challenges for easy implementation into Namibia

- 800V DC batteries require special licences and training to perform the maintenance.
- Expensive high torque electric motors & power electronics which do not allow easy maintenance.
- Fuel cells are sensitive to H<sub>2</sub> impurities and suffer from a harsh working environment.
- No proven technology yet, and it will take years to achieve the same reliability as a diesel truck.
- Chicken & egg problem associated with a new technology.



Source: *Developments of electric cars and fuel cell hydrogen electric cars - ScienceDirect*

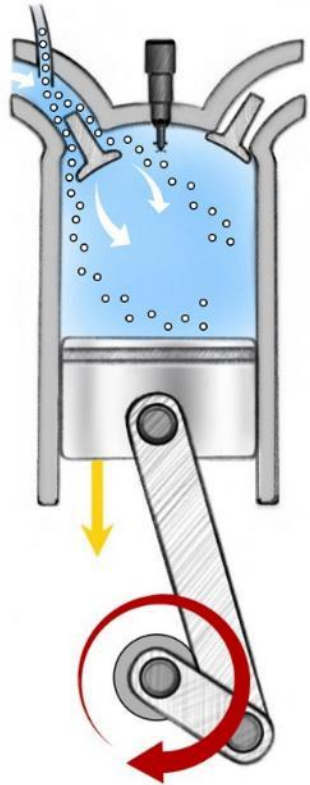


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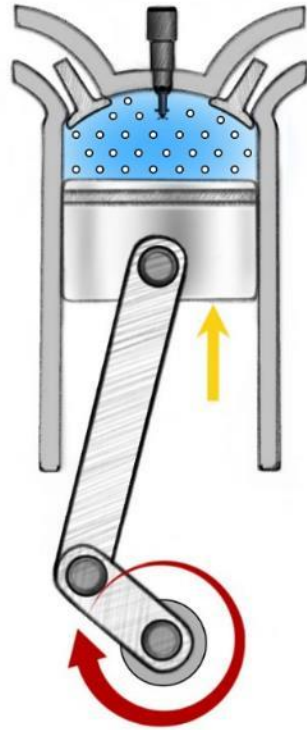
# Dual fuel as enabler

COMBUSTION FOR A COST EFFECTIVE AND ROBUST APPROACH

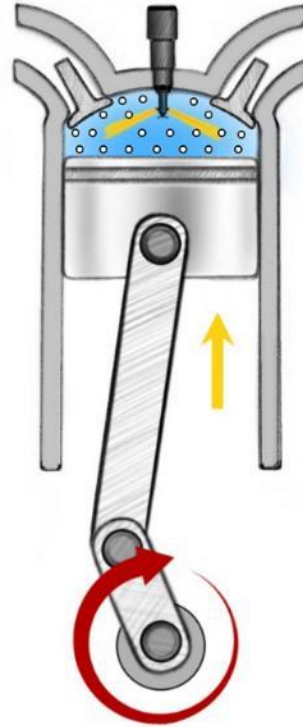
# H<sub>2</sub>-Diesel co-combustion: ability to combine fuel flexibility & efficiency with environmental performance



Hydrogen is injected at the port and aspirated in the cylinder during intake stroke



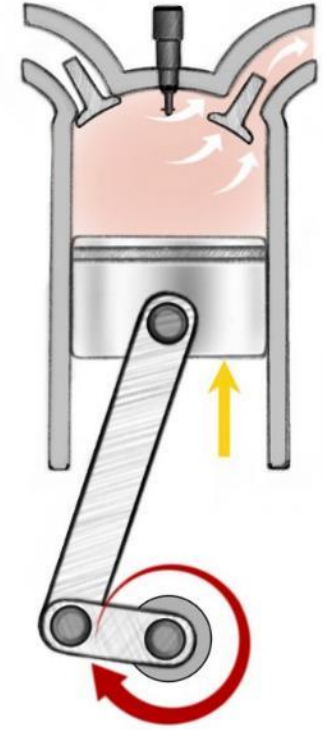
Hydrogen mixes further into a uniform and homogeneous mixture during the compression stroke



A small amount of pilot fuel (diesel) is injected into the chamber just before top dead centre



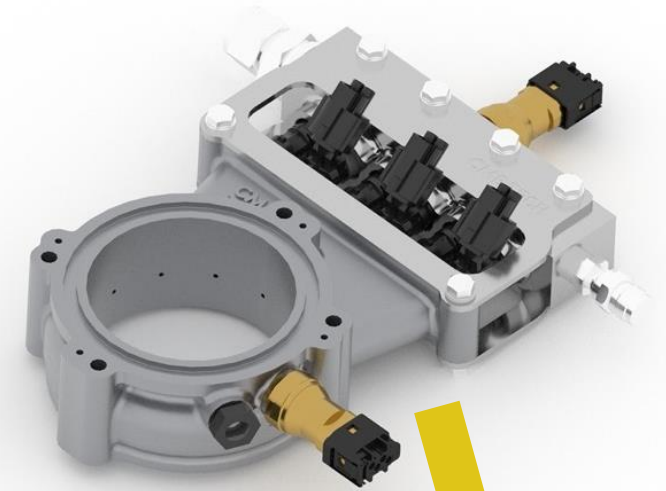
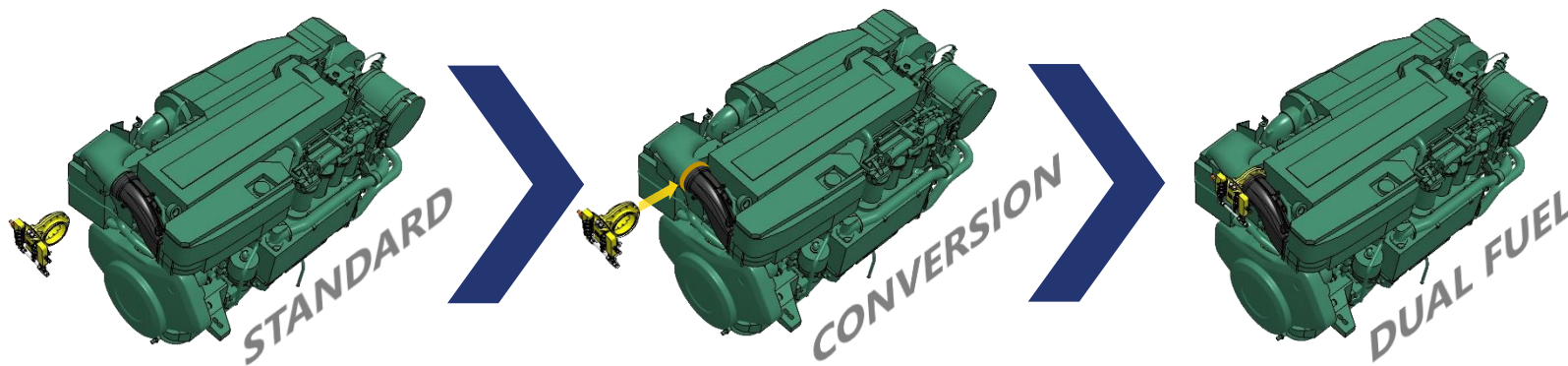
Diesel auto-ignites (due to high temperature and pressure) and co-combusts with all the H<sub>2</sub>, forcing the piston down during the power stroke



The cylinder is cleaned during the exhaust stroke, having lower NO<sub>x</sub> and CO<sub>2</sub> emission in the exhaust gas

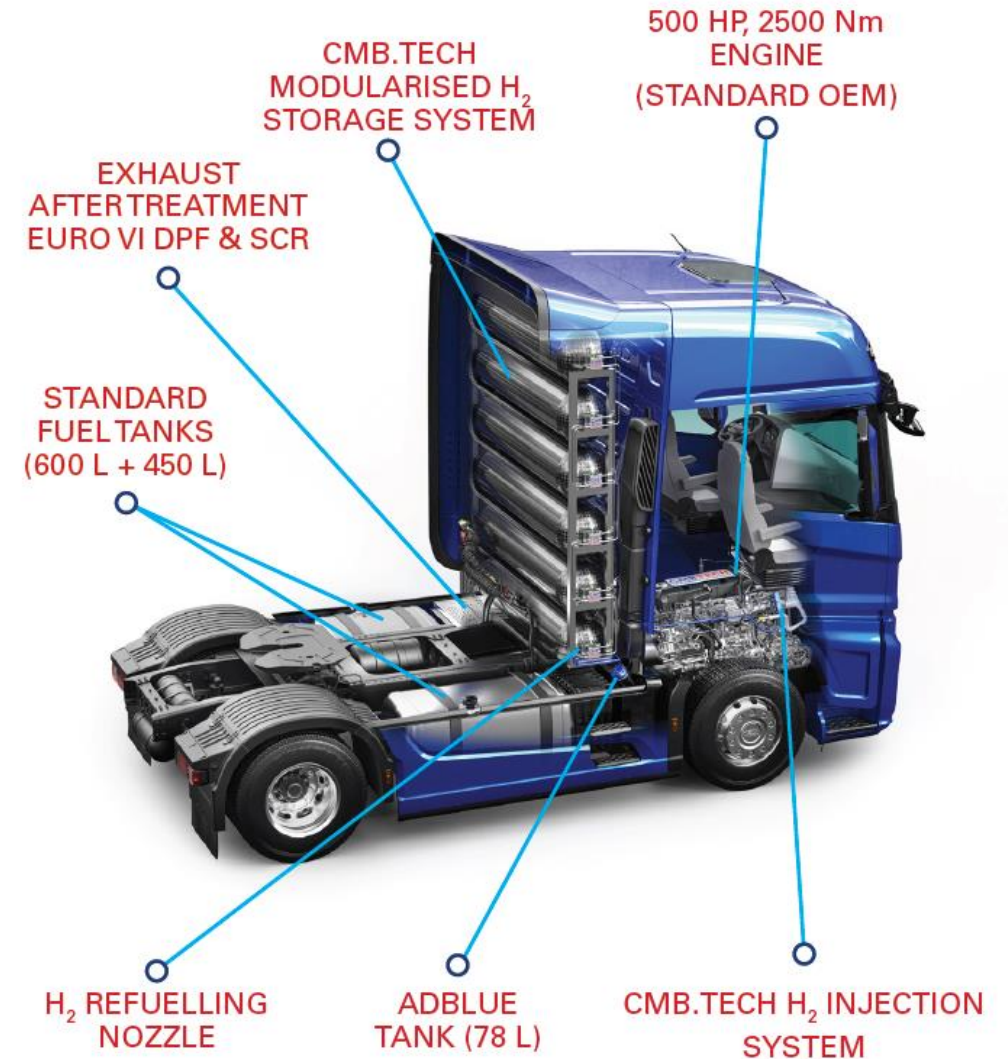
# Retrofitting existing engines / trucks with a H<sub>2</sub> injection technology is a low CAPEX route

- By injecting hydrogen into the air inlet, less diesel will be required for the same power output, resulting in less CO<sub>2</sub>.
- Engine can run on 2 modes with a turn of a switch:
  1. Diesel only
  2. Dual fuel diesel-hydrogen
- Besides the direct CO<sub>2</sub> savings, also NO<sub>x</sub> production is significantly reduced (resulting in less AdBlue)



# The H<sub>2</sub> technology is installed as an add-on kit to a vehicle which is already built and used in large volumes

- Full weight of the module is 950kg.
- 6x Type III tanks store a total of ca 30kg of H<sub>2</sub> at 350bar.
- Offering a dual fuel range of:
  - 980km with 30% emission savings
  - 490km with 60% emission savings
- Operation can continue on diesel if H<sub>2</sub> runs out and no H<sub>2</sub> refuelling station is available.
- On diesel, the vehicle complies with the latest Euro 6 emission standards.





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# Other applications

H<sub>2</sub> CAN POWER HEAVY DUTY EQUIPMENT IN NAMIBIA

- TransNamib needs 75 locos of which 50 for mainline and 25 for shunting.
- Majority of the locos are 60y old. 85% of its fleet is 50y in service.
- Railway is very suitable user of hydrogen as fuel.
- An extra carriage can be used for the fuel storage.





- Mining equipment use same type of engines as smaller ships.
- A mining site is hotspot of heavy duty equipment (excavators, gensets, drilling rigs, dump trucks, wheel loader, etc) which is hard to electrify.
- Instead of importing the fuel, the clean fuel can be produced locally at a cheap cost.



- Most port equipment can use hydrogen as a fuel.
- The full supply chain from the assisting the ship to berth, towards the container handling and transport, can be realised with a clean and affordable fuel, produced locally in Namibia.





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# Key take-aways

H<sub>2</sub> WILL IMPACT THE FUTURE SUPPLY CHAIN

# The future supply chain will rely on the usage of green H<sub>2</sub>

- Transport and Logistics is the back bone of the country. Its trucks and locomotives play a crucial role for trade, industrialisation and for socio-economic development. Most equipment involved in the supply chain can use hydrogen as a fuel.
- For heavy-duty & long-haul applications, the dual fuel technology is the most preferred approach.
- Namcor's facility in Walvis Bay is importing 15million litres of diesel on a monthly basis, which equals to 147 ton of H<sub>2</sub> per day. With pure sun and a 1GW electrolyser, you can produce this.
- 15million litres comes at a cost of 320million N\$ and 40,500ton of CO<sub>2</sub> emissions.
- Hydrogen will play a key role in making the logistics cleaner and cheaper and it will create new opportunities for Namibia due to the abundant sun conditions.



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