

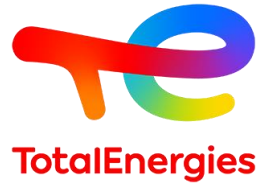
Fueling the Future Hydrogen Mobility Solutions

MS/NMM/H2MS

9 November 2023

Luxembourg

The Energy Journey onwards Net Zero by 2050, together with Society



TotalEnergies is a **global multi-energy company** committed to providing energy that is ever more **affordable, clean, reliable and accessible** to as many people as possible.

To preserve the planet in the face of the climate challenge, we are moving together towards new energies.
This energy journey is ours.



OIL



NATURAL
GAS



ELECTRICITY



HYDROGEN



BIOMASS



WIND



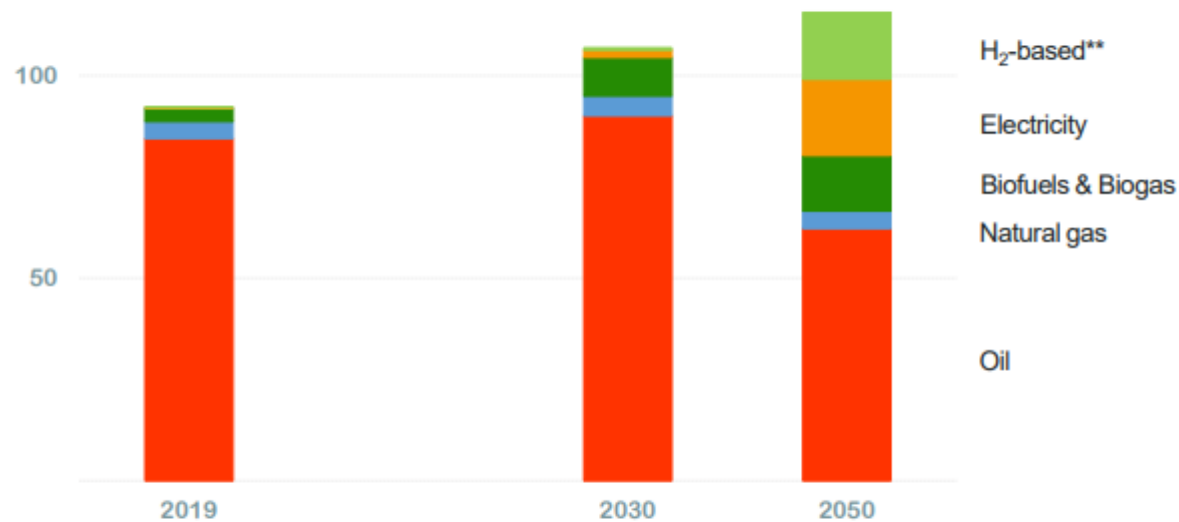
SOLAR

Mix diversification in Heavy Duty Vehicles

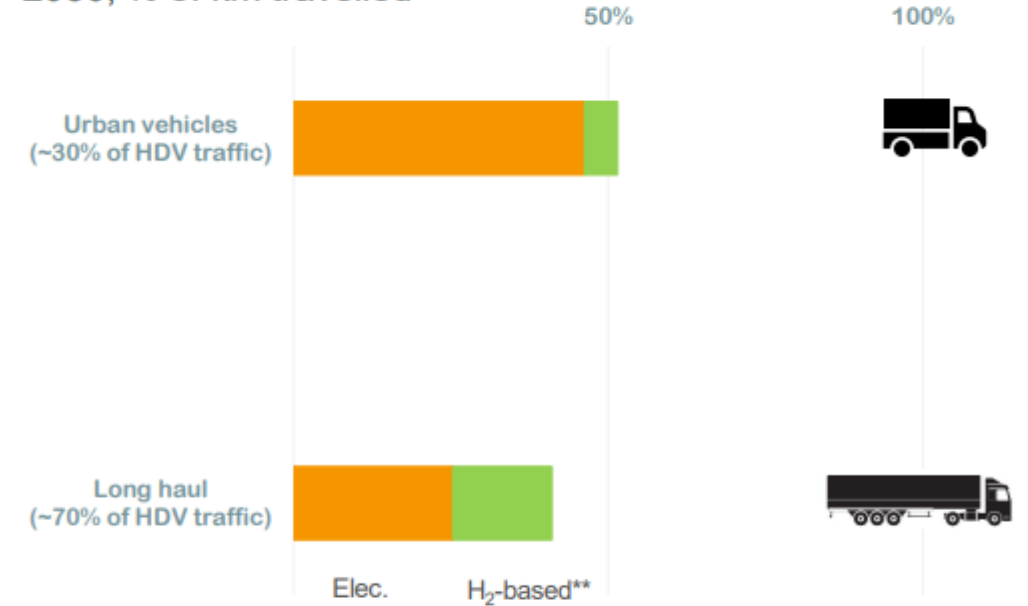
A full set of clean energies will contribute to trucking decarbonization



Heavy Duty Vehicles * final consumption (Momentum)
PJ/d



Zero Emissions Vehicles share of HDV traffic (Momentum)
2050, % of km travelled



- HDV: 28% of 2019 transport final energy demand and CO₂ emissions
- A mix of clean energies (electricity, hydrogen and bioenergies) required to decarbonize trucking; electric powertrains leading the way.
- Even though HDV slower to decarbonize than Light Vehicles, oil share decreased to about half of the energy demand by 2050

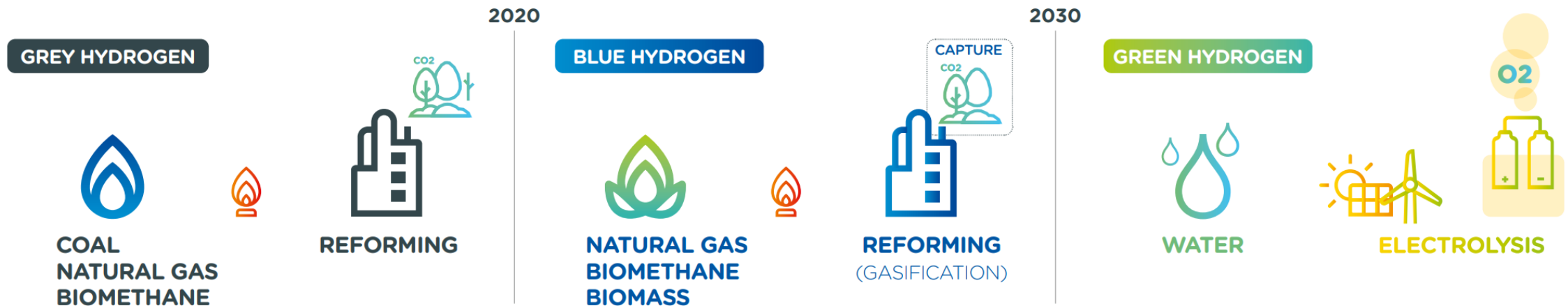
- Urban and some regional/long haul application see a rapid battery-based EV trucks development
- Fuel-cells penetration rate more progressive, nonetheless taking an important share especially for long haul trips

* Trucks + Buses + Coaches
** Includes Fuel cells and H₂, e-fuels (H₂ + CO₂)

TotalEnergies & Hydrogen

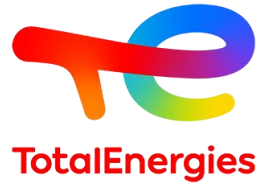


- TotalEnergies is **working with its suppliers and partners to decarbonize all the hydrogen used** in its European refineries by 2030.
- This represents a **reduction in CO2 emissions** of 3 Mt per year.
- Further out, the Company's ambition is to **pioneer mass production of clean and low carbon hydrogen** to serve demand for hydrogen fuel as soon as the market takes off.



Source: Sustainability & Climate 2022 Progress Report

TotalEnergies and Air Liquide Joint Venture: a Boost for the Hydrogen Industry for Heavy Duty Vehicles



- Two major and complementary players join forces for an intensive deployment of hydrogen infrastructure for trucks.
- A network of 100 hydrogen refueling stations for trucks, well positioned on major European roads, under the TotalEnergies brand.
- The joint venture will invest in, build and operate these stations, as well as supply hydrogen to the market and sell it to transport customers.
- To give visibility to all the players in the sector today.




H2 Mobility Solutions: Developing H2 through cooperation

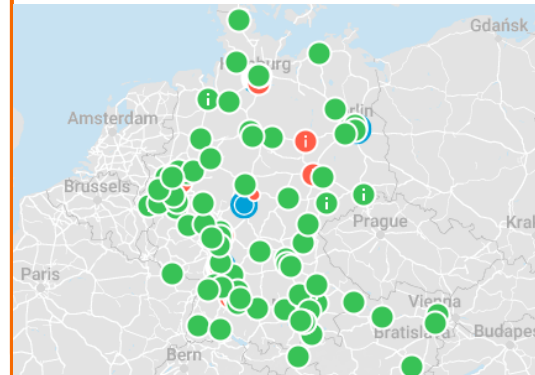
European H2 Truck Network (projected JV*)

- Europe
- Heavy Duty Mobility 
- TotalEnergies Brand
- 100 sites projected




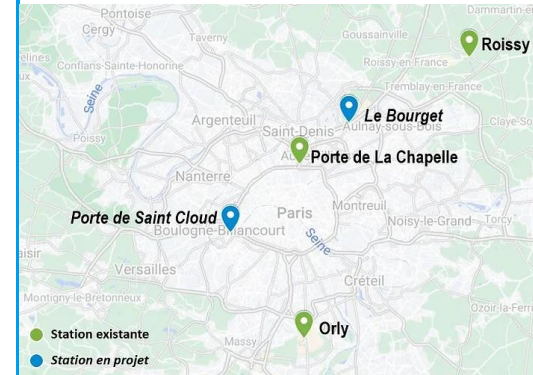
H2 MOBILITY (JVpartner)

- Germany, Austria & Switzerland
- Intensive Mobility 
- H2M Brand





Hysetco (JVpartner)

- Paris
- Taxis & LCV 
- Urban intensive Mobility
- Hysetco Brand



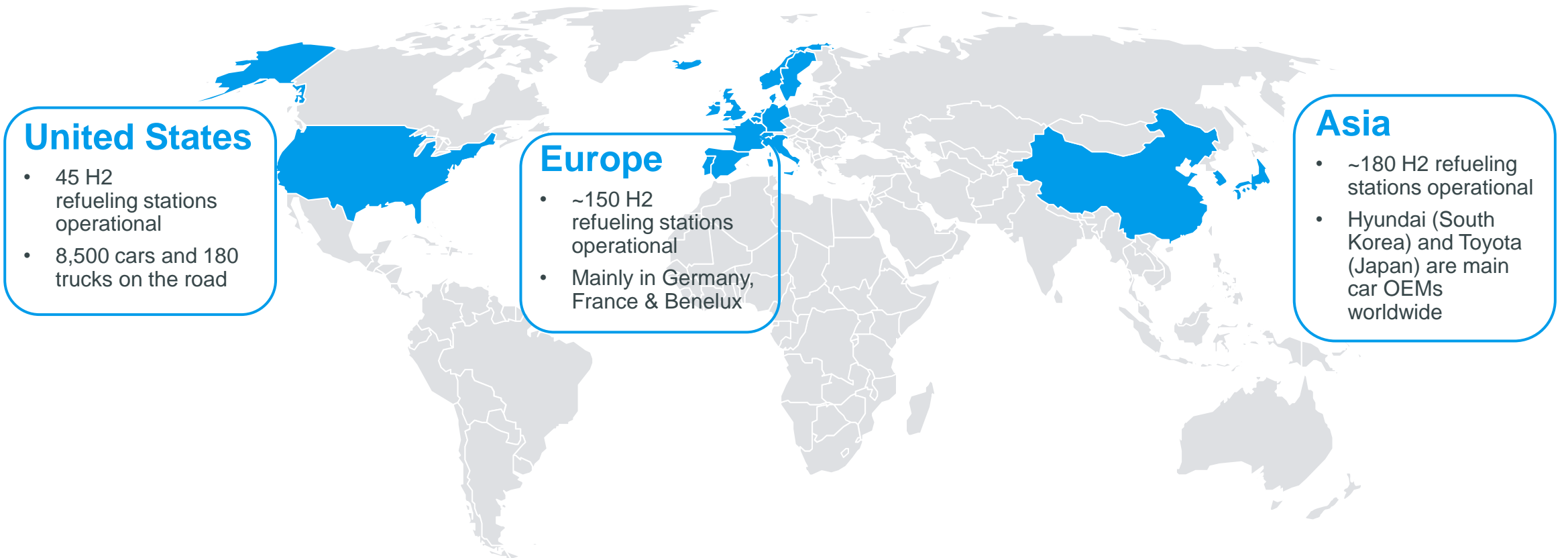
Off-Road

- Exploring opportunities on Rail and Offroad - Mining 



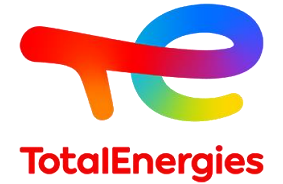
Focused on Heavy Duty, involved in intensive mobilities, initiating Off-road.

Global Hydrogen Mobility Adoption: 3 Regions in the Lead



These are TotalEnergies' focus regions for H2 in mobility activities, driven by strong public support with the aim of combating climate change, reducing local air pollution and driving economic development.

Market Drivers towards Hydrogen Mobility



Clients

- Shippers increasingly driven by net zero or similar
- Transporters principally driven by cost, or by shippers



Supply

- Green H2 still expensive with low availability but expected to increase
- Biomethane production continues to increase, seen as potential source for H2 production



Technology

- Several OEMs actively present with smaller car fleets in selected markets
- H2 trucks prototypes on the road, series production expected towards 2030



Regulation

- Significant decarbonization in the heavy-duty sector mandatory in future
- Low/Zero emissions zones to come
- What future for ICE?

Principal short-term driver likely to be shippers looking to green their operations

TotalEnergies & H2 for Mobility



Berlin Usedomer Straße (DE) 2002



Munich Detmoldstraße (DE) 2007



Port of Antwerp Scheldehaven (BE) 2014



Helmond Automotive Campus (NL) 2016



Arnhem (NL) 2019



Breda (NL) 2022

First dedicated H2 bus refueling station *Berlin*

First public LH2 car station with innovative underground storage system *Munich*

First dedicated H2 bus station in Belgium *Port of Antwerp*

First public H2 station in Netherlands realized for WaterstofNet *Helmond*

Second public H2 refueling station in Netherlands operational *Arnhem*

HRS in Netherlands: Helmond relocated to *Veldhoven & Breda* operational



First European public station offering 350/700bar/LH2 for cars and 350bar/LH2 for buses *Berlin*

First 350/700bar & LH2 station with on-site Electrolyser *Berlin*

Official start of operation for the H2 Mobility Joint Venture *Germany*

First dedicated & clean H2 bus station in the Netherlands *Delfzijl*

Mission H24 mobile station starts operation on a racetrack *Le Mans*

Inauguration of Luxembourg's first hydrogen refueling station, in *Bettembourg*



Berlin Heerstraße (DE) 2006



Berlin Holzmarktstraße (DE) 2010



Berlin Holzmarktstraße (DE) 2010



Delfzijl Chemiepark (NL) 2018



Mission H24 (FR) 2020



Bettembourg (LX) 2023



Ambitions

Hydrogen for Road Transport



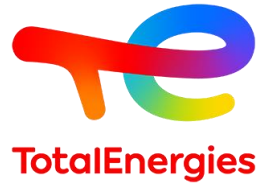
27 hydrogen refueling stations (HRS) in Europe today, including:

- Operated: 3 public and 2 private (for bus fleets) stations in the Benelux and 1 public station in Germany.
- Hosted: 21 public stations in Germany within the H2 Mobility joint venture network (consisting of 90+ stations today).

Develop H2 truck stations in Europe:

- Deploy more than 100 hydrogen stations on major European roads – mostly in France, Belgium, Netherlands, Luxembourg and Germany – in the next ten years. These stations, under the TotalEnergies brand, will be located on major strategic corridors.

Hydrogen Refueling Stations in Europe (E5)



Stations we own & operate:



Legend

- Fully operational
- Building phase



Heavy duty road trucks:

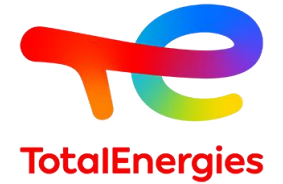
Segment with high potential due to strong regulatory push for zero emission.

Stations we host:

Germany: 21 in total



H2 Project Development requires Partnerships across the Value Chain



Truck OEMs we work with



Associations we are a member of

H2Accelerate



Hyzon Zero Carbon Alliance



Hydrogen Europe



Waterstof Industrie Cluster



National H2 organisations



HRS projects we are engaged in

H2Mobility Germany



HyTrucks



HEAVENN



Pegasus



HyCET and H2Haul



H2Benelux

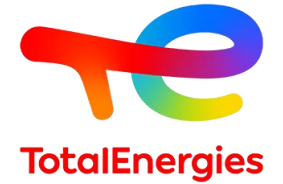


Waterstofregio 2.0

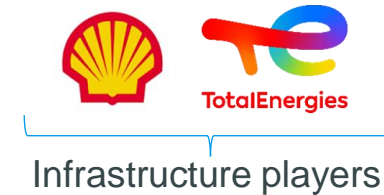


H2 Accelerate

H2Accelerate



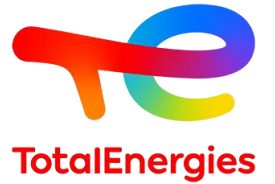
- **Aim:** develop a pan-European H2 refuelling network.
- **Commitment from the Project Partners:**
 - Infrastructure players – invest in production equipment & refueling infrastructure at scale
 - Truck manufacturers – invest in scaling up production to reach series manufacturing in the 2020s.
- **Phased approach:**
 - Phase 1: R&D and deployment
 - Phase 2: Industrial scale up
 - Phase 3: Sustainable growth



The “H2Accelerate TRUCKS” bid to the Clean Hydrogen Partnership was successful, the consortium has been selected to obtain funding for 150 H2 trucks!



HYSETCO

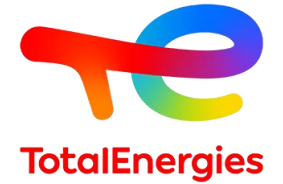


- **Policies and decarbonization:** in Paris area, 67% of current passenger car fleet and 91% of current LCV fleet need to be replaced by 2024.
- **Addressable market is significant:**
 - 50k taxis in Paris
 - 550k light commercial vehicles
- **Retail:** 4 stations in operation incl 1 in production + 8 in development.
- **~330 taxi licences** to propose a turnkey solution for professional end users.



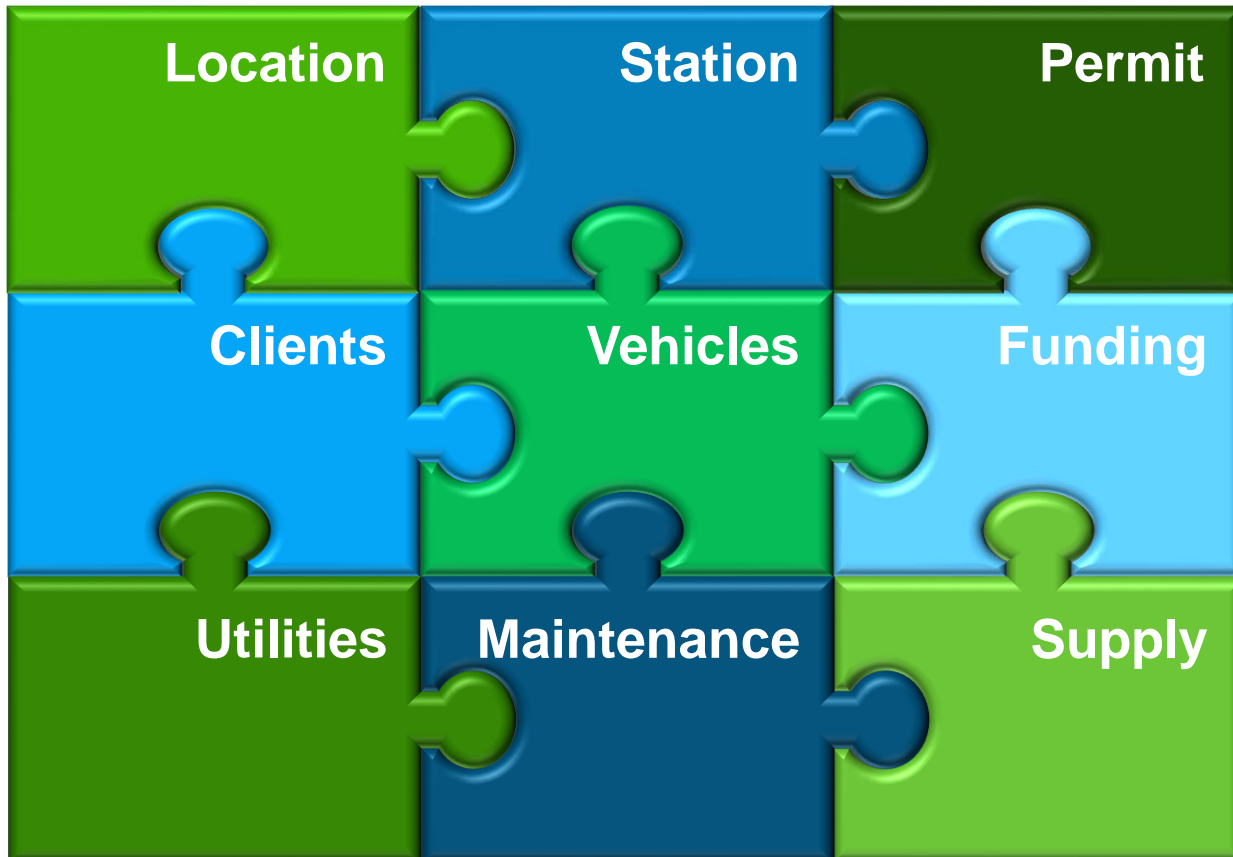
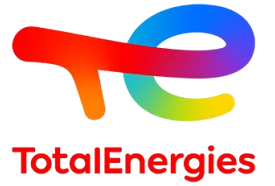


H2 Mobility Germany Joint Venture

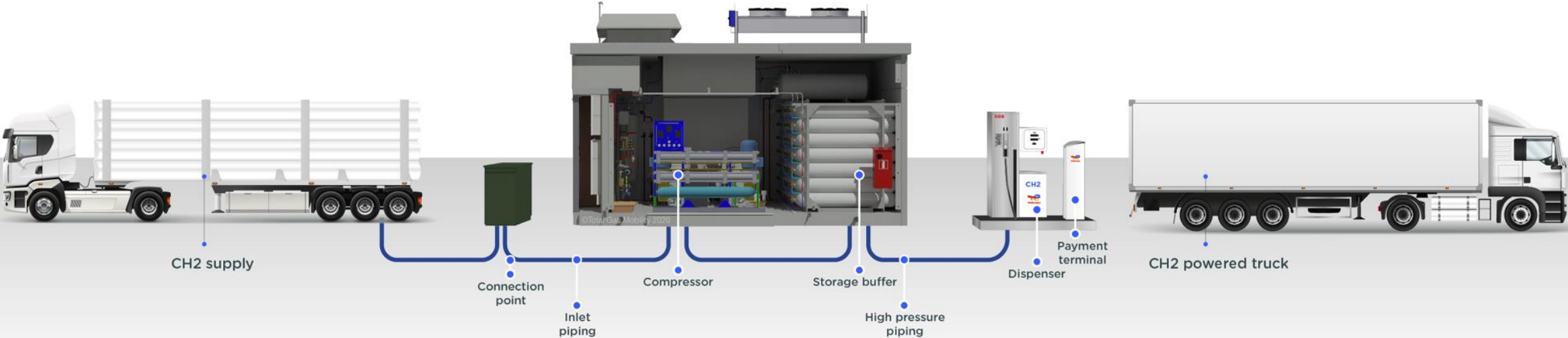


- **90+ H2 stations operated in Germany**, including 21 at TotalEnergies branded stations.
- **Currently 8 shareholders:**
 - Hy24, Air Liquide, Shell, EG Group, Daimler Truck, TotalEnergies, Hyundai, Linde.
- **110 M€ raised for new phase in 03/2022:**
 - Upgrade existing network and build new stations to meet rising demand for commercial and intensive use vehicles.
 - Up to 300 H2 stations in 2030.

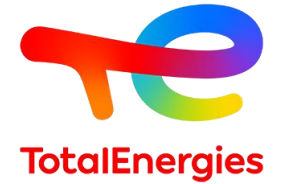
Developing an H2 Station Project can be Challenging – with many different Components



CH2 Refueling Station



H2 Refueling Station: Breda, Netherlands

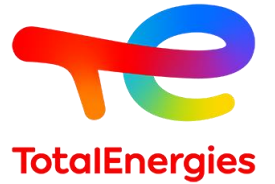


- **The Company's 5th H2 station** (fixed, operated), located in the Dutch city of Breda.
- **Designed, built and maintained by GMOB.**
- **Supply of H2 for light- and heavy-duty vehicles**, at 700 and 350 bar, respectively.
- **The municipality of Breda, with two hydrogen-powered garbage trucks**, as the launching B2B customer.



H2 Station in Breda, The Netherlands

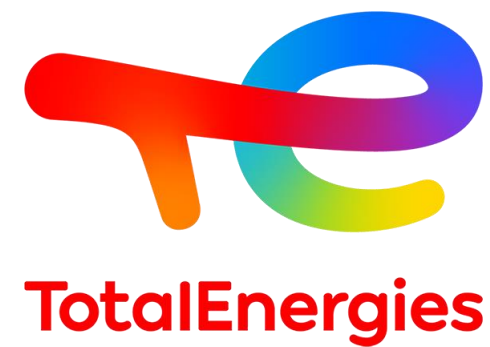
H2 Refueling Station: Bettembourg, Luxembourg



- The first hydrogen (H₂) refueling station in Luxembourg, located in Bettembourg.
- Part of the European 'H2Benelux' project.
- **Supply of H₂ for light- and heavy-duty vehicles,** at 700 and 350 bar, respectively.



H2 refueling station Bettembourg, Luxembourg



Questions?

Contact details

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