The role of hydrogen as propulsion for heavy trucks in Europe

How to prepare the vehicle for hydrogen

H2 Convention | Piacenza, Italy – 12th September 2024 | Hans Breevoort – Head of Advanced Engineering Medium & Heavy Trucks

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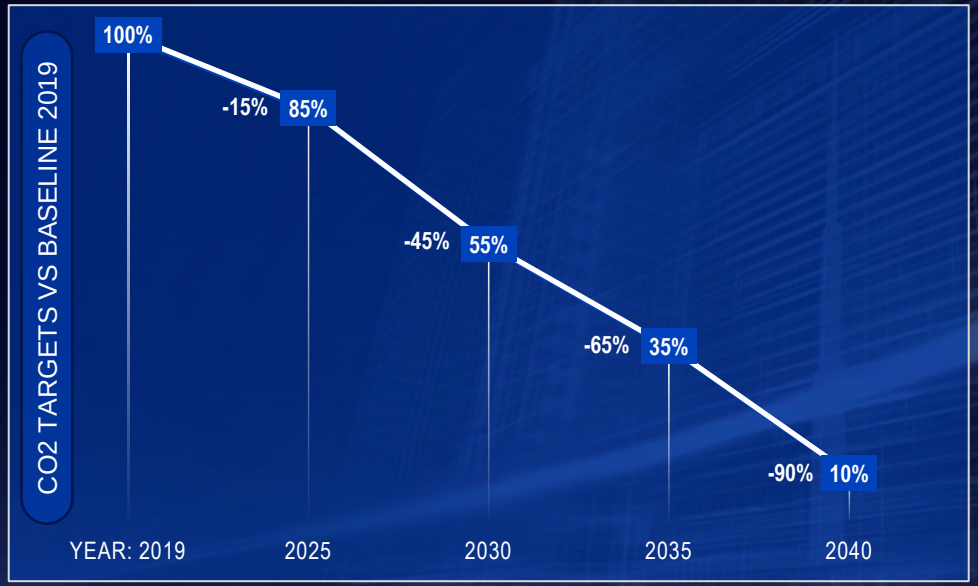
How to prepare the vehicle for hydrogen

Agenda

- CO2 regulation
- Propulsion technology overview
- Vehicle adaption to hydrogen propulsion
- Main challenges for the vehicle manufacturer

CO2 regulation targets

CO2 regulation fleet targets for heavy trucks in Europe



Source: REGULATION (EU) 2024/1610 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 May 2024

KEY TAKE AWAYS

Strict CO2 targets require zero emission vehicles to fulfil legislation in larger volumes from 2030

Introduction of zero emission technology is a complete chain exercise to make it successful: from legislation, **vehicle OEM**, refilling network and customer adoption.

Remark: CO2 regulation is not equal to real customer fuel and energy consumption as CO2 regulation is based on a standardised average mission and methodology for tailpipe emissions simulation

Propulsion techologies

Overview of main propulsion technologies for heavy trucks in Europe

	DIESEL	CNG / LNG	BEV	H2-ICE	H2 FUEL CELL
	No VECTO Zero Emission (also not with HVO)	No VECTO Zero Emission (also not with bio gas)	VECTO Zero Emission	VECTO Zero Emission (<3gr CO2/tkm)	VECTO Zero Emission
	All applications and missions	CNG: urban and regional LNG: long haulage	Urban & regional	Regional & long haulage	Long haulage
	Low product cost and TCO	Medium product cost, low TCO	High product cost, medium TCO	Medium product cost & TCO	High product cost, medium TCO
	Fast refill	Fast refill	Slow refill / costly fast refill (MC)	Fast refill	Fast refill
	Wide available refill network	Sufficient refill network	Limited refill network	No refill network	No refill network
	Highest customer acceptance	Customer acceptance	Limited customer acceptance	Customer acceptance expected	Customer acceptance unknown
	CONVENTIONAL TECHNOLOGY		ZERO EMISSION TECHNOLOGY		

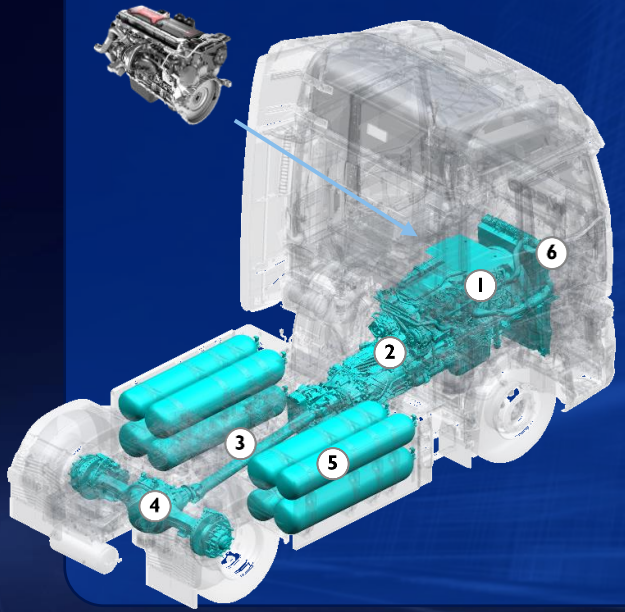
Remark: refill network and customer acceptance as per 2024 knowledge base

Vehicle adaption to hydrogen propulsion

From conventional CNG vehicle to zero emission H2-ICE vehicle

FPT xC13 multifuel engine

Iveco S-WAY MY24 4x2 tractor



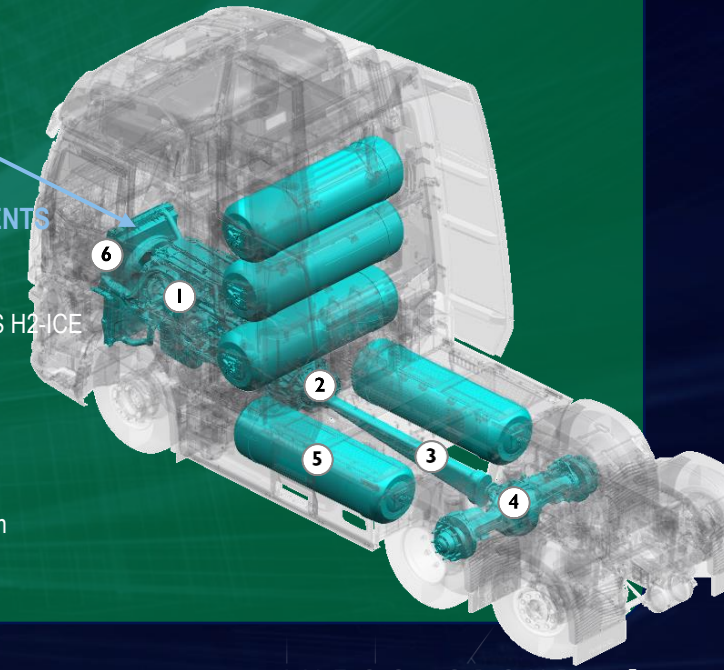
MAIN COMPONENTS

DIESEL

1. xC13 Engine & ATS CNG
2. Gearbox
3. Propshaft
4. Rear axle
5. Fuel tank & system
6. Cooling system

FPT xC13 multifuel engine

Iveco S-WAY H2-ICE 6x2 tractor



MAIN COMPONENTS

H2-ICE

1. xC13 Engine & ATS H2-ICE
2. Gearbox
3. Propshaft
4. Rear axle
5. Fuel storage system
6. Cooling system

Vehicle adaption to hydrogen propulsion

From conventional Diesel vehicle to zero emission H2 Fuel Cell Electric Vehicle

FPT xC13 multifuel engine

Iveco S-WAY MY24 4x2 tractor

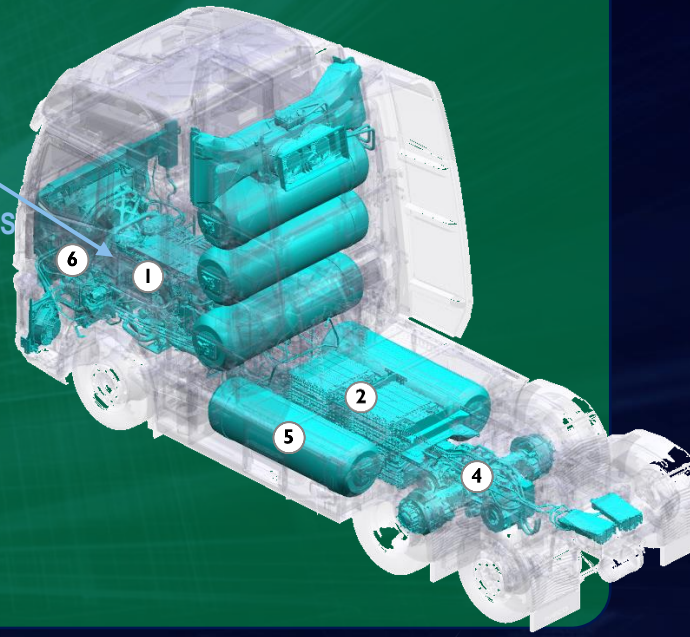
MAIN COMPONENTS

DIESEL

1. xC13 Engine & ATS Diesel
2. Gearbox
3. Propshaft
4. Rear axle
5. Fuel tank & system
6. Cooling system

Fuel Cell system

Iveco S-WAY FCEV 6x2 tractor



MAIN COMPONENTS

H2-FUEL CELL

1. Fuel Cell
2. Battery and inverter
4. eAxle
5. Fuel storage system
6. Thermal system

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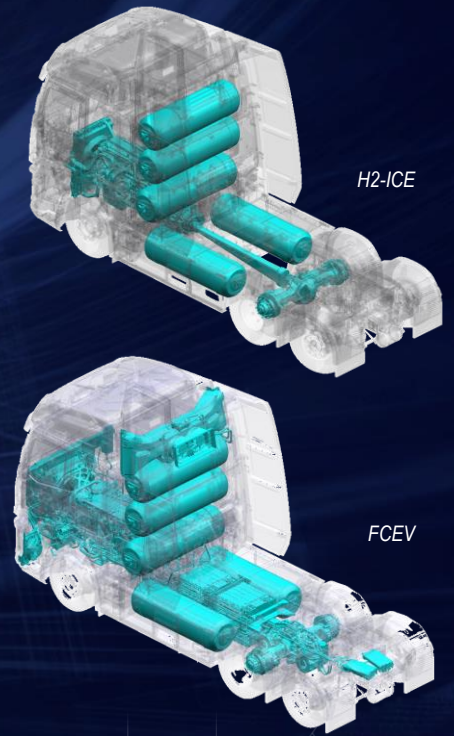
Main challenges for the vehicle manufacturer

Technical and timing challenges:

- Technology readiness and maturity that enables a competitive TCO:
  - H2-ICE: engine efficiency is key
  - Fuel cell: product cost and reliability for all applications
- Infrastructure readiness: no proper infrastructure exists yet. To enable vehicles to run in the near future we need to start rolling out the preparation of the refilling infrastructure and assuring availability of green H2 when mass production will start
- Customer acceptance: customers needs to feel comfortable using new technologies that suits their needs
- Timing constraint: at the end of this decade mass production vehicles will be ready to support the next CO2 reduction step compliance



Closing statement: *collaboration within the complete chain (from legislators, base supplier through commponent and technology providers up to the final customer is key to make this enormous hydrogen challenge reality.*