



Hydrogen technology developments at AVL

V4 - ZalaZONE, 9th June 2022

Szigeti Ádám

Facts and Figures



Global Footprint

Represented in 26 countries

45 Affiliates divided over 93 locations

45 Global Tech and Engineering Centers (including Resident Offices)

1948

Founded

11,500

Employees Worldwide

10%

Of Turnover Invested in Inhouse R&D

70+

Years of Experience

65%

Engineers and Scientists

1,500

Granted Patents in Force

96%

Export Quota

Solutions for all Customer Segments



Passenger Cars



2-Wheelers



Racing



Construction



Agriculture



Commercial Vehicle



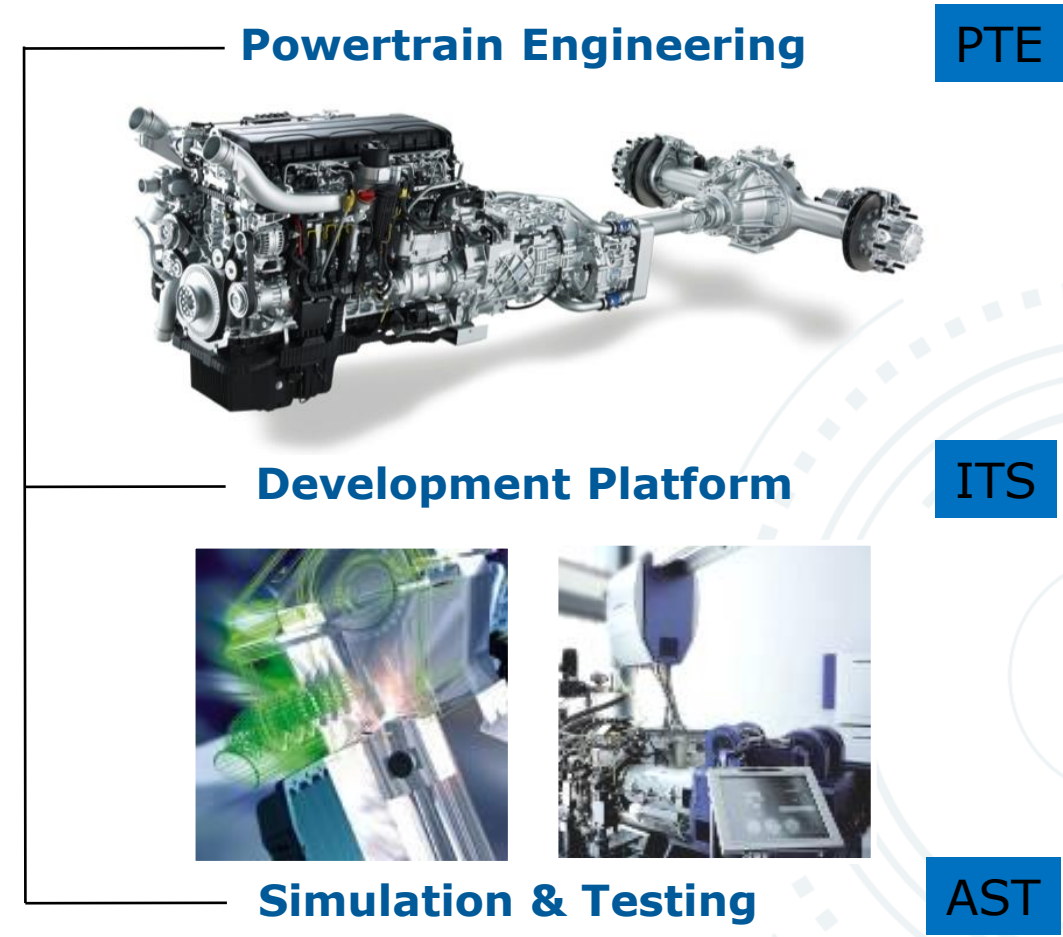
Locomotive



Marine



Power Plants



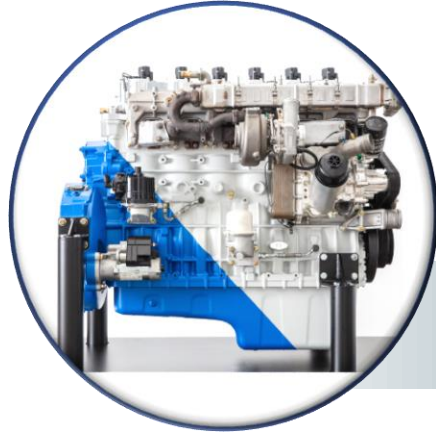


- Power train, Simulation tool and testing environment development
- Involved in both technologies (ICE, FC)

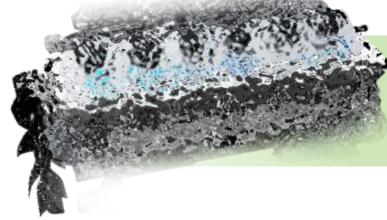
The AVL Hydrogen Engine

HD H₂-ICE Roadmap until 2030+ (13l engine class)

The AVL Hydrogen Engine



AVL R&D 2021/22



High pressure H₂ DI
50 % BTE

H₂ storage:
700 bar / LH₂

Low pressure H₂ DI
43-44 % BTE

350-700 bar

H₂-MPI
42-43% BTE

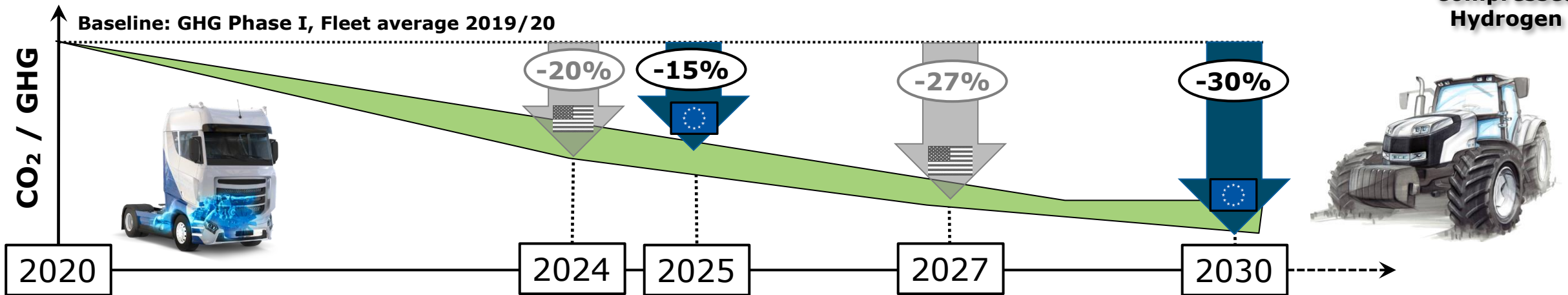
350-700 bar

Status: 02/2022

Cryogenic Hydrogen



Compressed Hydrogen



Summary and Outlook



Motivation

- Carry over of
 - engine base components
 - powertrain
 - vehicle architecture (coolant system)
- Time to Market
- Durability, Robustness (Heavy Duty)
- TCO

The AVL Hydrogen Engine

AVL Hydrogen Engine: Fact Sheet

The AVL Hydrogen Engine – Status and Achievements



12.8l NG base engine LP-DI (MPI)

World's first HD H₂ MCE MPI & LP-DI engine

BMEP 22,5 bar demonstrated

BTE 42,1 % demonstrated

post Euro VI emissions

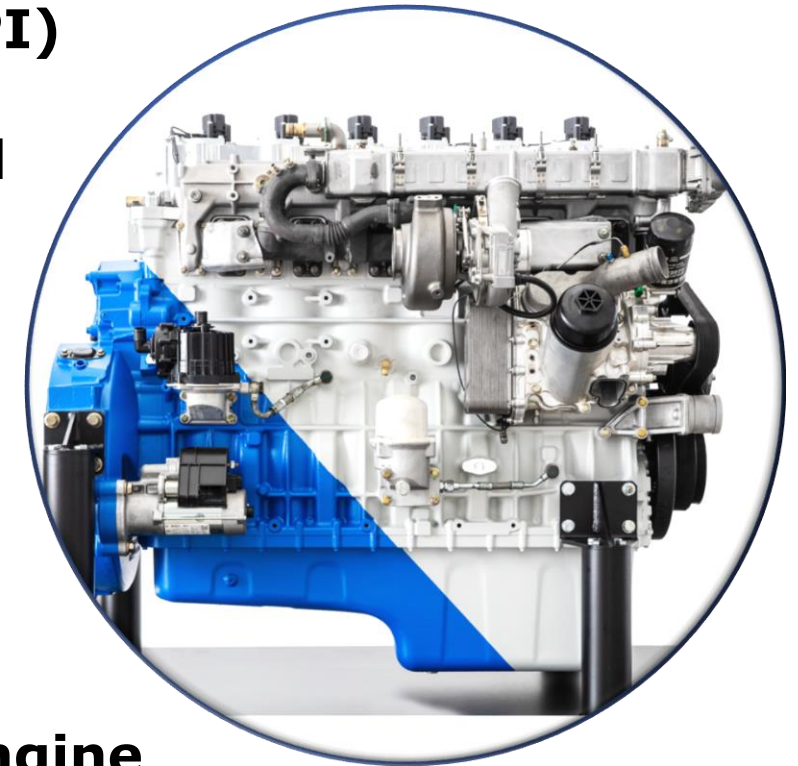
ongoing

**Transient performance
for conventional PT-vehicle**

ongoing

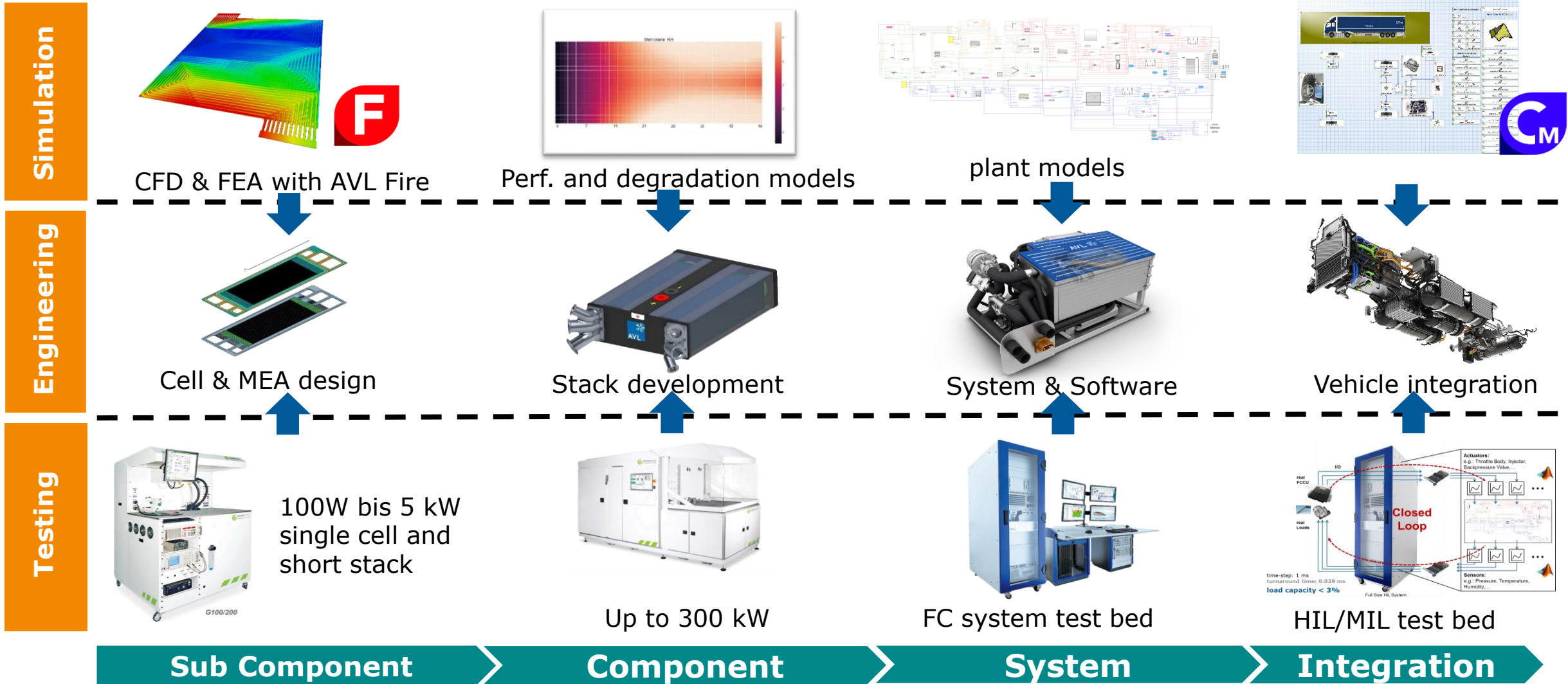
Maximum similarities to base engine

ensured



Status: 02/2022

AVL product and service portfolio Fuel Cell



AVL's Fuel Cell World | Demonstrator Vehicles



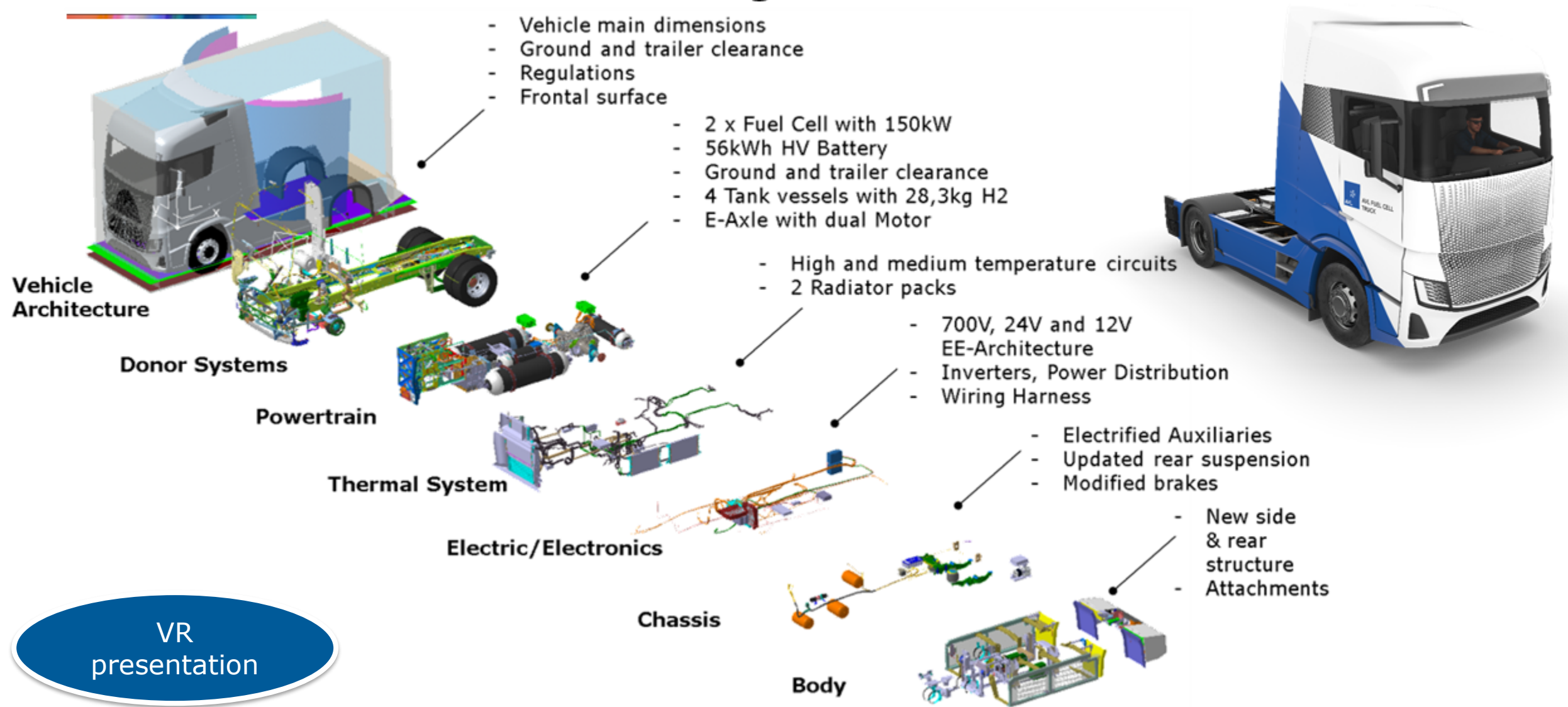
Fuel Cell Demo Truck	Donor vehicle	KEYTECH4EV
DAF XF	VW Passat GTE	
9800 kg	Vehicle curb weight	1746 kg
52 kWh	Battery size	9.9 kWh
~310 kW	Fuel cell system power	~55 kW
540 kW	e-drive power	100 kW
28.3 kg	Hydrogen tank capacity	3.8 kg
4	Number of tanks	3
approx. 13 min	Hydrogen refilling time	approx. 3 min
7.9 kg / 100 km	Hydrogen consumption	0.8 kg / 100 km
>350 km	Driving range	>500 km



In the parking lot

AVL develops and integrates Fuel Cell Powertrains from passenger vehicles up to various commercial applications

Demonstrator Vehicle to show Technical Competence and Performance of Technologies of AVL and Partners



VR presentation

AVL Kecskemét Fuel Cell R&D development Centre

- Existing employee no.: 45 (Design and development engineering)
- New building under construction (Planned finish: 2023)
- Test and validation opportunities (SOFC, PEM)



Thank you



www.avl.com