EMPOWER

Eco-operated, Modular, highly efficient, and flexible multi-POWERtrain for long-haul heavy-duty vehicles

Presenter:
Michele DE GENNARO (AIT Austrian Institute of Technology GmbH)

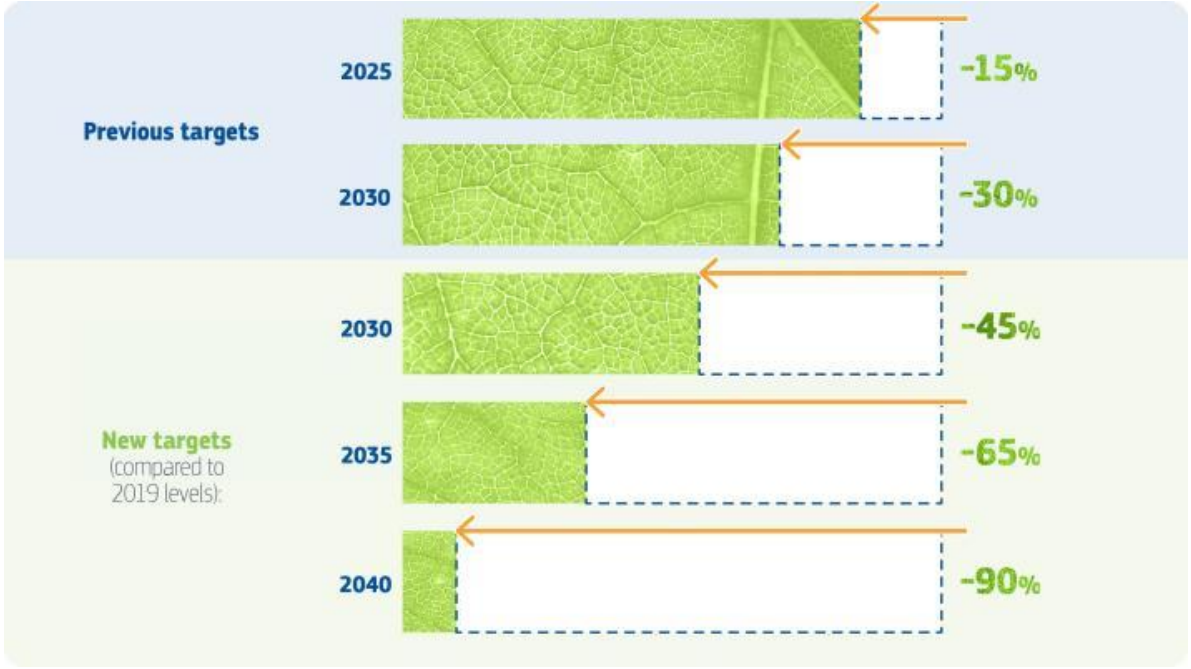
This project has received funding from the European Union's HORIZON EUROPE research and innovation programme under grant agreement No. 101096028. The content of this publication is the sole responsibility of the Consortium partners listed herein and does not necessarily represent the view of the European Commission or its services.

Context relevant to EMPOWER and to the HORIZON-CL5-2022-D5-01-08

Lorries, buses and coaches are responsible for **more than 25%** of GHG emissions from road transport in the EU, and for **over 6%** of total EU GHG emissions. Despite some improvements in fuel consumption efficiency in recent years, these emissions are still rising, mainly due to increasing road freight traffic.

COM (2023) – 88 final (14.02.2023)
Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EU) 2019/1242 as regards strengthening the CO_2 emission performance standards for new heavy-duty vehicles and integrating reporting obligations, and repealing Regulation (EU) 2018/956

The Regulation includes an incentive mechanism for Zero-emission vehicles (ZEV) and Low-emission vehicles (LEV), **promoting the uptake of ZLEV** and reward early action, a **super-credits system** applied from 2019 until 2024, that can be used to comply with the target in 2025, while, from 2025 onwards, the super-credits system is replaced by a **benchmark-based crediting system** until 2030.



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EMPOWER Objectives and Ambition

- The objective of EMPOWER is to deliver **two modular and flexible Zero-Emission Heavy-Duty Vehicles** (ZE HDVs) of **Vehicle Energy Consumption Calculation Tool (VECTO) group 9**
- **Fuel Cell Electric Vehicle** (FCEV) suitable for **long-haul operation** conditions with a maximum unrefuelled driving range of **750 km**
- **Battery Electric Vehicle** (BEV) designed for **regional delivery mission** profiles with a maximum unrecharged driving range of **400 km**
- Gross Vehicle Weight (GVW) of at least **40 tons**, both at **Technology Readiness Level (TRL) 8**
- Develop, implement and demonstrate **FCEV** and **BEV**, guaranteeing a **maximum load capacity of not less than 90 %** compared to conventional trucks of this class and making them **ready to enter the market in 2029** with equal total cost of operation with 2020 engine-based solutions assuming a production volume of more than 10,000 pieces/year.

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Main objectives of EMPOWER organized in AREAs

AREA I (Obj. #2) tank-to-wheel **energy efficiency** of **44 %** for **FCEV** and **82 %** for **BEV** trucks

AREA I (Obj. #3) **highly efficient e-axle** (incl. modular power electronics and e-motor)

AREA I (Obj. #4) **energy consumption reduction** of HVAC by **40 %** for heating and **30 %** cooling

AREA I-II (Obj. #5) delivery **load capacity** not less than **90 %** compared to available trucks

kg

m³

IVECO vehicle platform (VECTO vehicle group 9)

(Obj. #1) **FCEV** **BEV**

EOL

AREA I-II (Obj. #6) **FC** availability of **90 %** and **30,000 h** operational life

AREA III (Obj. #7) **750 km** (FCEV), **400 km** (BEV) unrefueled/unrecharged **driving range**

AREA III (Obj. #8) **500 km** (FCEV), **300 km** (BEV) average daily operation

€

TCO

AREA III (Obj. #9) **reducing total cost of operation** assuming production volume ≥ 10,000 p.a.

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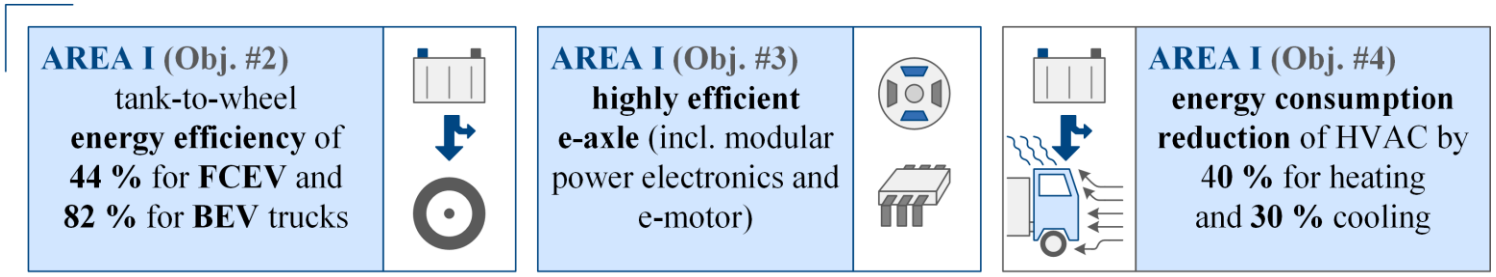
EMPOWER Technology Bricks



1) modular vehicle system architecture
2) modular low voltage E/E architecture
3) FC system with high reliability and extended operational lifetime with a modular energy storage
4) highly efficient e-axle
5) optimised thermal- and energy management
6) optimised HVAC system featuring CO_2 as refrigerant and infrared heating panels
7) electrified distributed braking system
8) digital twin models of the demonstrator vehicles

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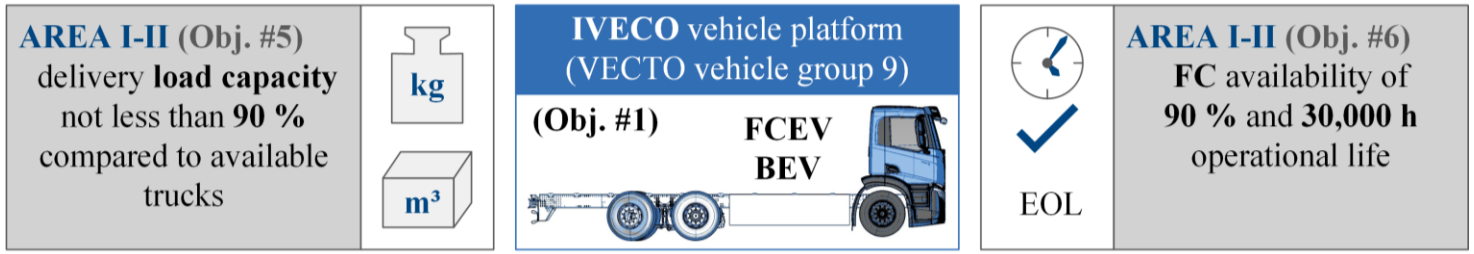
EMPOWER Technology Bricks

9) innovative Human Vehicle Interface for optimised control of the vehicle systems, featuring Vehicle-to-Grid communication and eco-routing
10) fleet management system for the integration of ZE HDV into the fleet



11) overall LCA and TCO assessment
12) operation of a green hydrogen infrastructure for ZE HDV needed for the long-haul European cross-border demonstration

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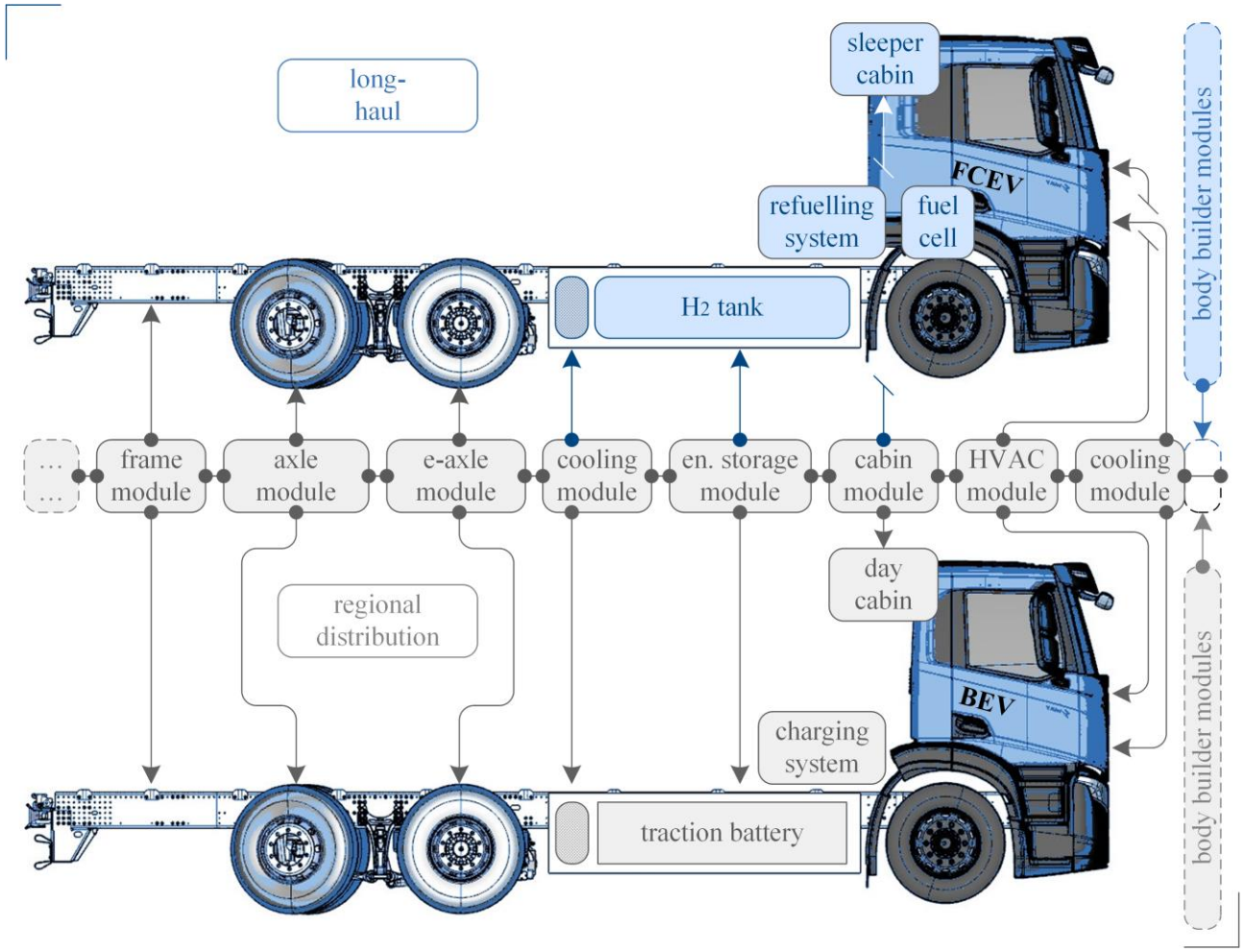
EMPOWER Modular structure of the FCEV and BEV demonstrators



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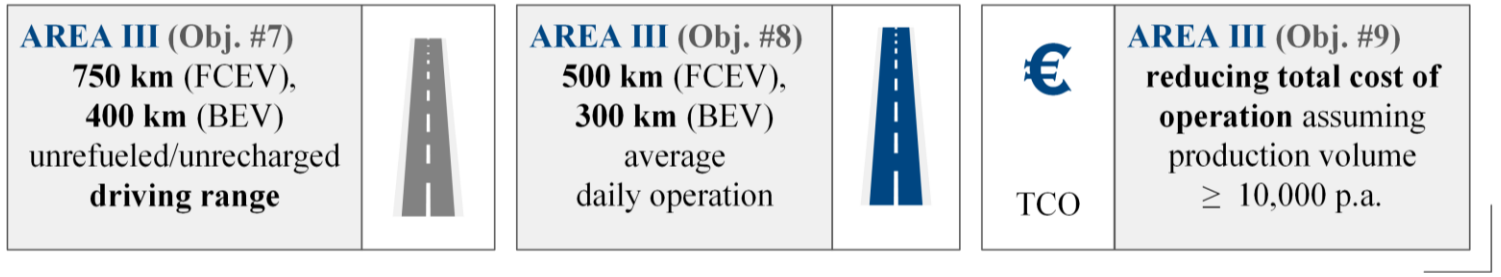
EMPOWER Demonstration

- **Stage 1** demonstrates the maximum unrefuelled/unrecharged driving ranges of
  - 750 km for the FCEV
  - 400 km for the BEV

  both on the Balocco Proving Ground (IT)

- **Stage 2** is the concluding six-month demonstration in different real-world use cases (UCs)



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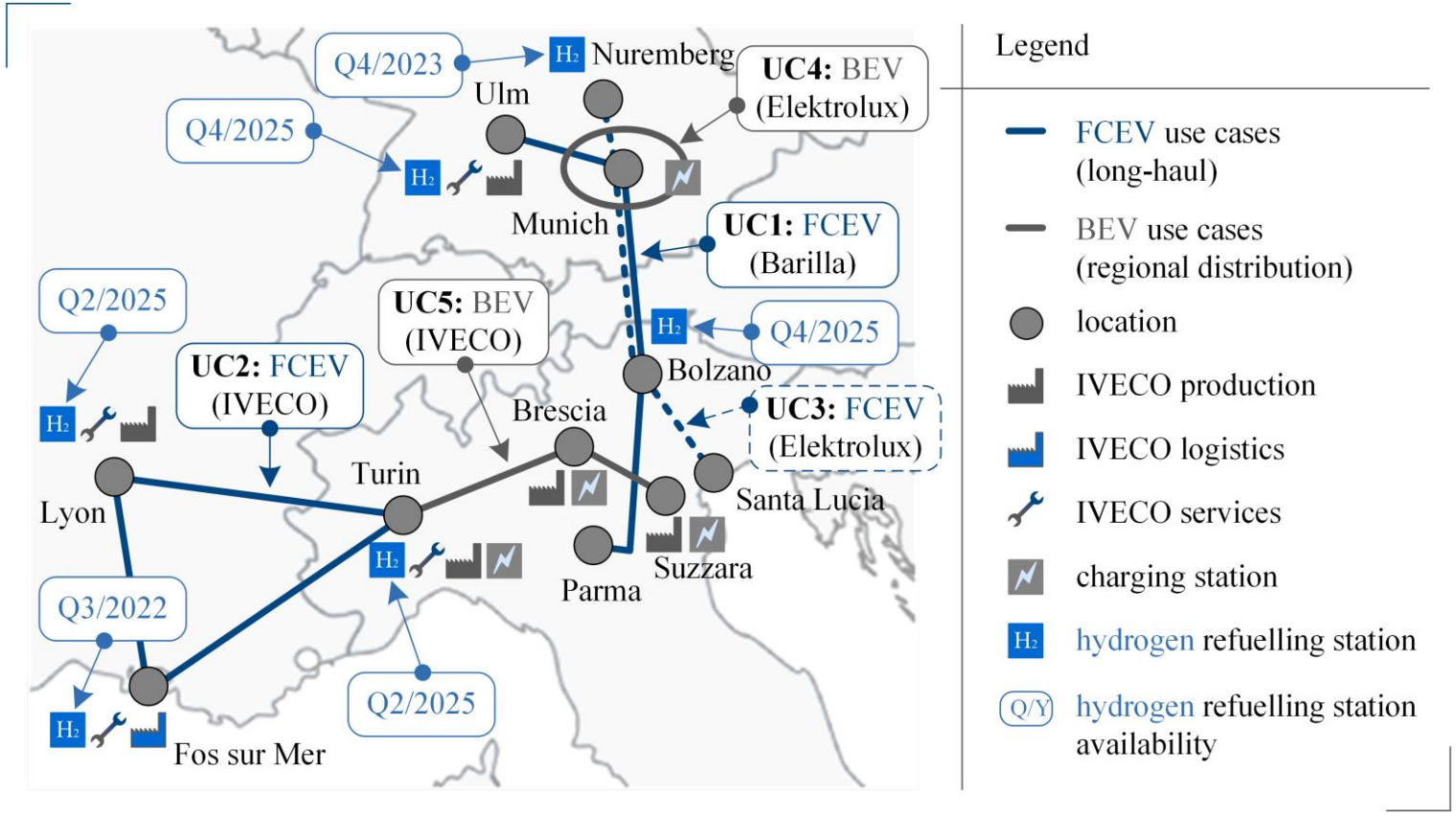
EMPOWER demonstration routes



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EMPOWER General info and Consortium (14 partners from 4 Member States plus CH)

- Topic:
  Modular multi-powertrain zero-emission systems for HDV (BEV and FCEV) for efficient and economic operation (2ZERO)
- Topic identifier:
  HORIZON-CL5-2022-D5-01-08
- Type of action:
  Innovation Action (IA)
- Coordinator:
  AIT Austrian Institute of Technology GmbH
- Grant agreement number:
  101096028 - EMPOWER
- Maximum grant amount:
  18,052,313.00 EUR

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Thank you!

I'm looking forward getting in contact with you!

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