Outcomes of the workshop:

"Decarbonisation of Heavy Duty Vehicle Transport: Zero Emission Heavy Goods Vehicles"

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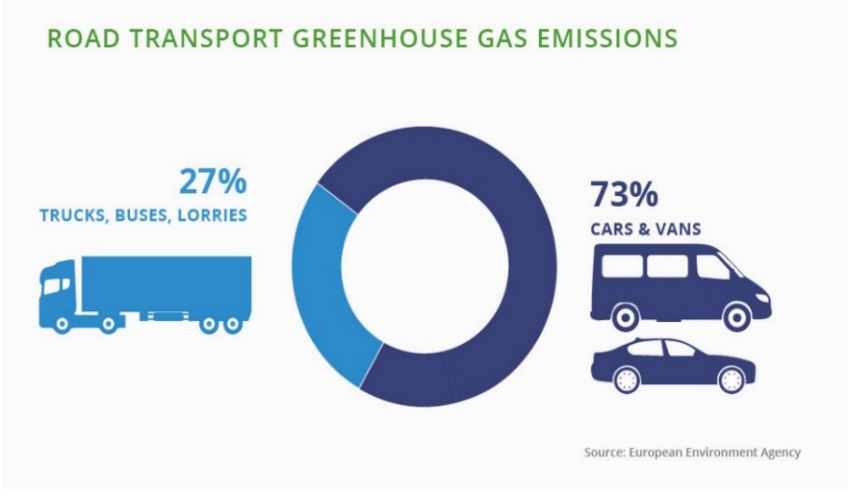
UNECE Meeting, 2.6.2021

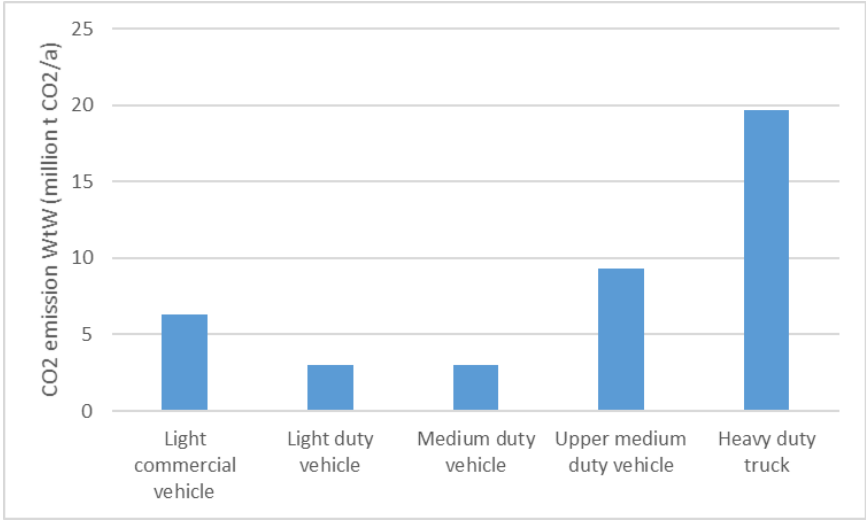
JRC Workshop: Background and Scope

- EU's commitment to net zero GHG emissions by 2050 means bringing emissions from inland freight transport down close to zero
- It is assumed there will be a continuing need for long distance lorry transport, although modal shift will play a part
- It is not clear yet how much energy demand can be met by biofuels or e-fuels. They may need to be prioritised for aviation/maritime.
- Renewable electricity, powering lorries either directly or via the production of renewable hydrogen, is key for the decarbonisation of freight transport
- Workshop scope considered technologies ***zero emission at point of use***: Fuel Cell Electric Trucks, Battery Electric Trucks, Electric Road Systems

Why JRC organised the event

- Road freight currently makes up 65% of all inland freight transport
- Heavy Duty Trucks are responsible for a significant share of GHG emissions (in particular, long-haul)
- For urban fleets and short range delivery hydrogen fuel cell and battery buses, trucks have already been deployed





Source: based on figures from https://www.isi.fraunhofer.de/content/dam/isi/dokumente/cce/2017/4-346-17_Gnann.pdf

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Structure of the Workshop

- Session 1: Introduction and Policy Context
- Session 2: Technical Readiness
  - Fuel Cell Electric Trucks
  - Battery Electric Trucks
  - Electric Road Systems
- Session 3: LCA/WTW Studies; Techno-economic Assessment
- Session 4: Panel Discussion

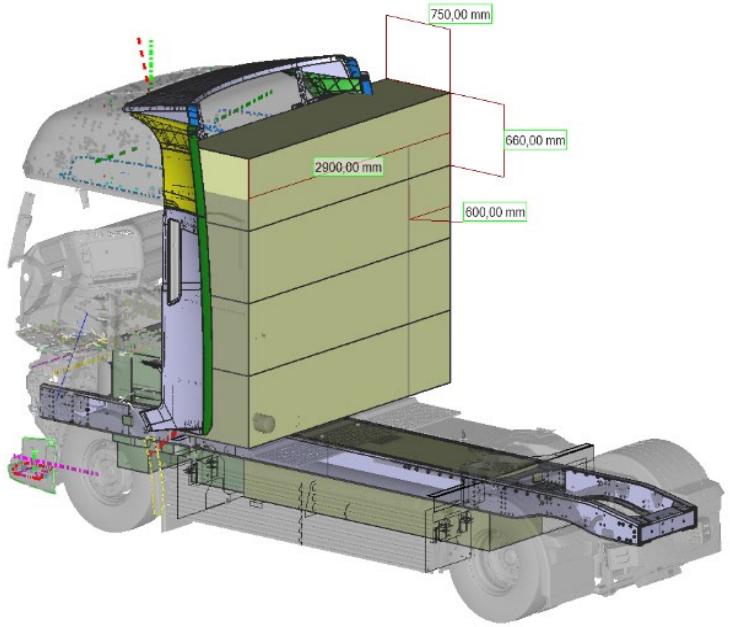
Hydrogen FC Electric Trucks

Advantages:

- Potential for dealing with long range
- Versatility (remote locations)

Challenges:

- Hydrogen storage volume (range vs. payload)
- Fuel cell stacks (increase durability, reduce cost)
- Hydrogen infrastructure
- Costs of hydrogen compression



Source: Presentation by CNH Industrial, JRC Workshop

Battery Electric Trucks

Advantages:

- High efficiency, low LCA emissions (direct electricity use)
- Deployed in smaller trucks (HDV current range 500 km)

Challenges:

- Size/weight of batteries (range vs. payload)
- Long charging times
- Charging infrastructure costs
- Effect on local electricity grids (capacity bottlenecks)

Source: Presentation by Scania, JRC Workshop

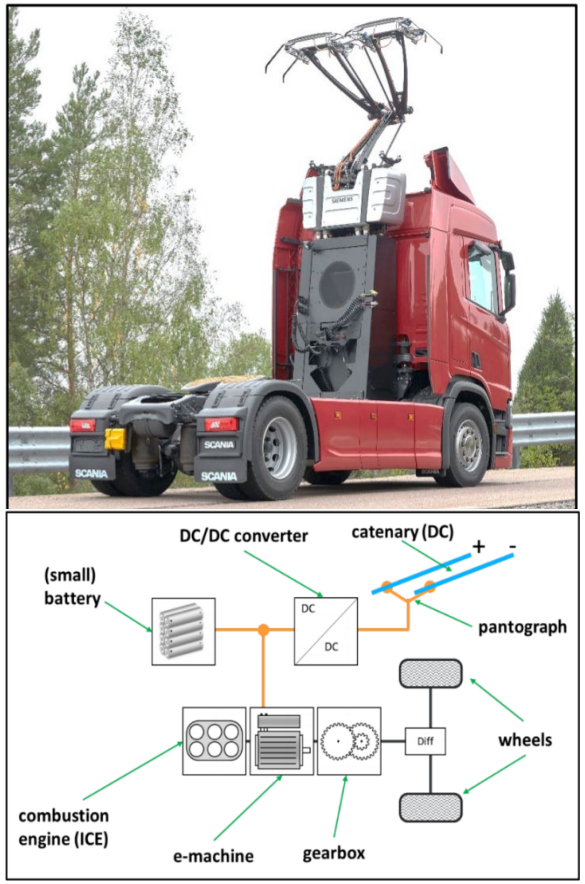
Catenary/Pantograph Electric Trucks

Advantages:

- Fewer implications for truck architecture
- Efficiency (direct electricity use)

Challenges:

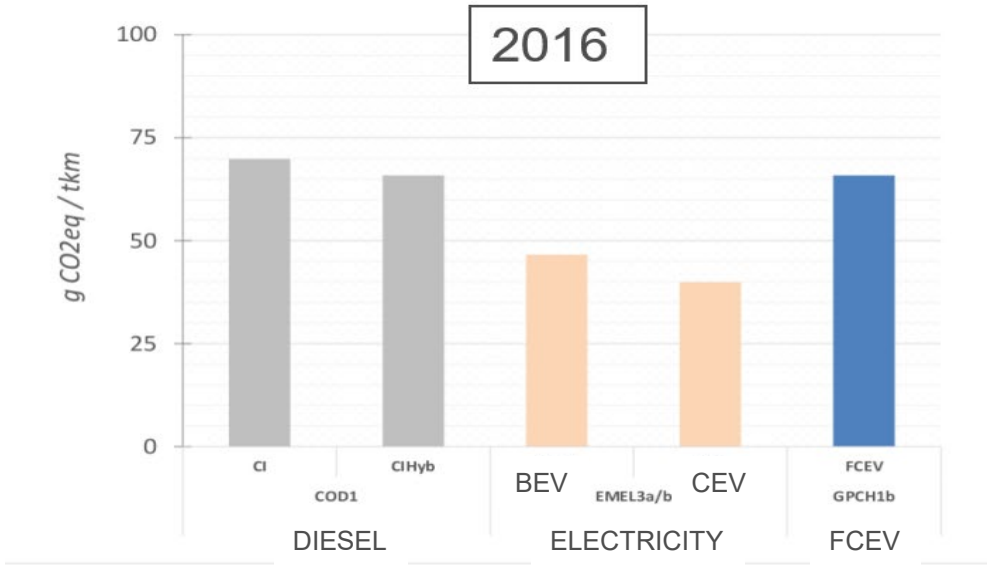
- Cost and implementation of infrastructure
- Lack of versatility
- Impact on the grid

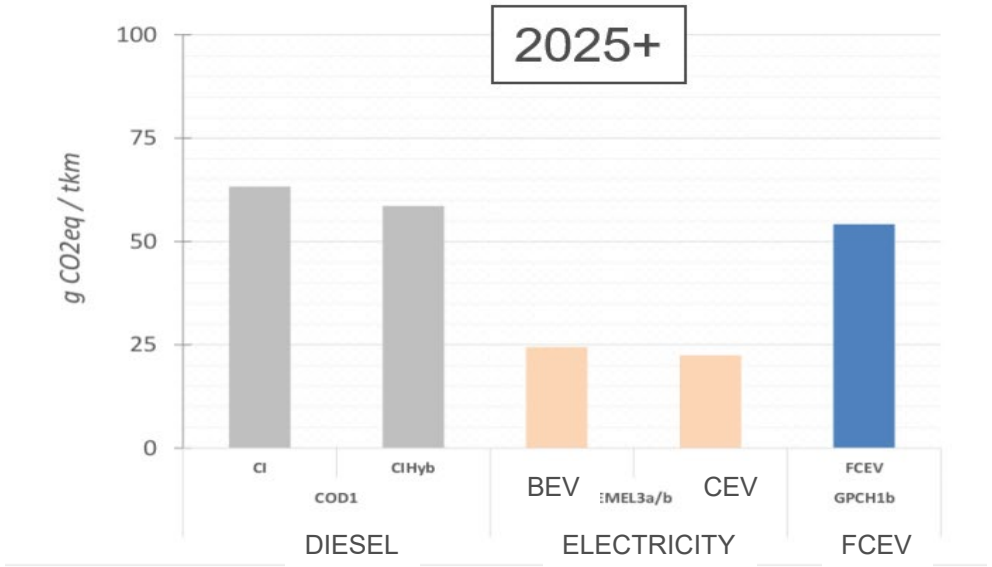


Source: Presentation by Volkswagen, JRC Workshop

LCA/WTW Outcomes

- All stated types of electric truck provide lifetime GHG emissions savings versus diesel trucks
- Benefits increase with decarbonisation of electricity supply
- Direct electric use is favourable (efficiency and GHG)
- LH_2 more GHG intensive than CGH_2
- Certain parameters (human toxicity potential and mineral/metal consumption) are worse than the incumbent technology in the short term
- Less than 5% of vehicle LCAs include HDVs; LCA Studies rarely include infrastructure





Source: Presentation by JRC, JRC Workshop

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Techno-economic Outcomes

- FCET and BET similar infrastructure costs for full EU coverage. CET considerably more expensive.
- Contradictory statements over which ZE technology is cheapest for Total Cost of Ownership (TCO). Varies considerably depending on assumptions.
- Typical development cycle for a vehicle is 5-7 years. The adoption time of a new technology can be even longer. Decisions needed now to affect 2030 goals.

General Conclusions

- Acceleration in vehicle and infrastructure commercialisation is needed - this will require major efforts regarding public fuelling and electricity infrastructure
- Trucks are produced in low volumes and profit margins are low. Therefore, the number of options needs to be reduced for a given mission profile.
- Advantages of diversification between the ZEV options for different mission profiles:
  - BETs are potentially disadvantaged for longer, higher payload missions due to their weight. Best-suited to short- to medium-range missions.
  - CET is most applicable to dedicated high-frequency routes.
  - FCET are potentially best-suited for longer-range missions and the heaviest goods, enabling connectivity to more remote areas.

Panel Feedback and Implications

- A cohesive pan-European strategy and policy framework is needed to provide clarity for investors. Remaining technology neutral may not solve imminent concerns regarding the coherent and timely roll-out of infrastructure

- A successful policy framework, that either (i) allows a coherent mix of technologies to develop at a European level simultaneously or (ii) uses policy measures that favour certain technologies over others is needed, in order to provide investment certainty.

    - For (i) additional modelling of the options is required, including to determine how best to optimise the competing technologies geographically in the case of deploying multiple infrastructures. The implications of ZEV hybrids need to also be considered. The potential improvements in the technologies need to be taken into account.

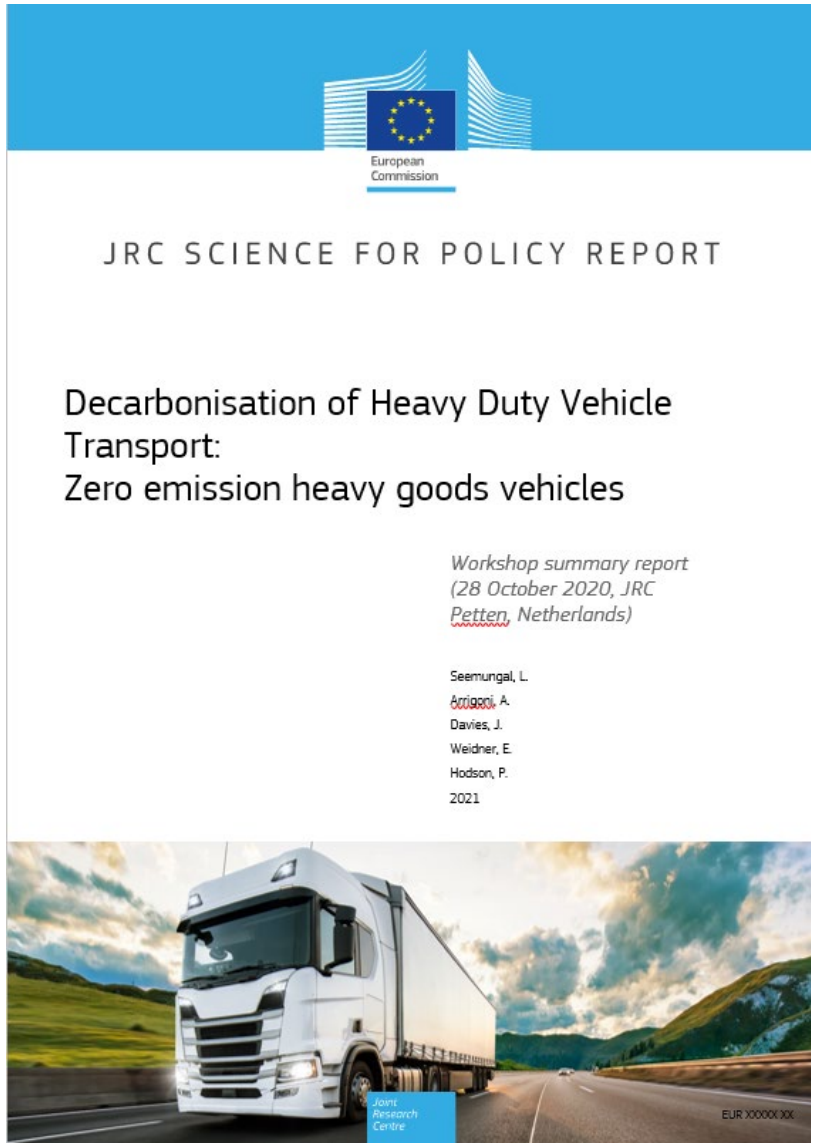
    - For (ii) all stakeholders need to identify and prioritise the most important factors in deciding upon the favoured technology: e.g. private TCO cost, public cost, environmental impact, electricity consumption, energy efficiency.

Webpage and Report

- Presentations available at:

https://ec.europa.eu/jrc/en/event/workshop/heavy-goods-vehicles-workshop

- Report currently undergoing review process
- Expected June/July 2021



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Thank you

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