



Analysis of the Challenges for the Electrification of Heavy-Duty Vehicles from a Manufacturer and User Perspective

Results of the ELV-LIVE Research Project

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Current activities in the field of heavy-duty vehicles:

- Research project [ELV-LIVE](#) and the preceding projects [StratES](#) and [StratON](#)
- [Study on depot charging](#) for heavy-duty vehicles comparing Spain, France, the UK and Germany
- Evaluation of the German funding program on climate-friendly HDVs ([KsNI](#))
- Multiple consulting projects for the German government and the EU Commission on relevant regulations (including EU CO₂ standards)

Outline

- ELV-LIVE Research Project
- Background and Objectives
- Data and Methodology
- Results
- Conclusions



ELV-LIVE Research Project

The ELV-LIVE project in a nutshell

Title:

ELV-LIVE – Accompanying research on the use of battery-electric heavy-duty vehicles in regular logistics operations

Partners:

Oeko-Institut (research), Daimler Truck (associated partner), six case study partners

Duration:

1.1.2023 – 31.12.2025

Funding:

“Erneuerbar mobil”, German Federal Ministry of Economics and Climate Protection (BMWK)

More Information:

Project website: [Link](#)

Aims of the Project and Key Research Questions



What is the main topic ?

- Providing scientific support to accompany the market launch of battery electric trucks for the **first users** between 2023 and 2025
- Acquire important insights into the **obstacles** and **potential** of battery electric trucks for the case study partners and other transport companies



Key research questions

- How are the first battery electric trucks being used in **everyday fleet operations** and what are the current difficulties?
- What potential is there for battery electric trucks for **various applications** and what adaptations need to be made?
- What conclusions can be drawn from the first applications of electric-trucks regarding the **market ramp-up of battery electric trucks**?



Background and Objectives



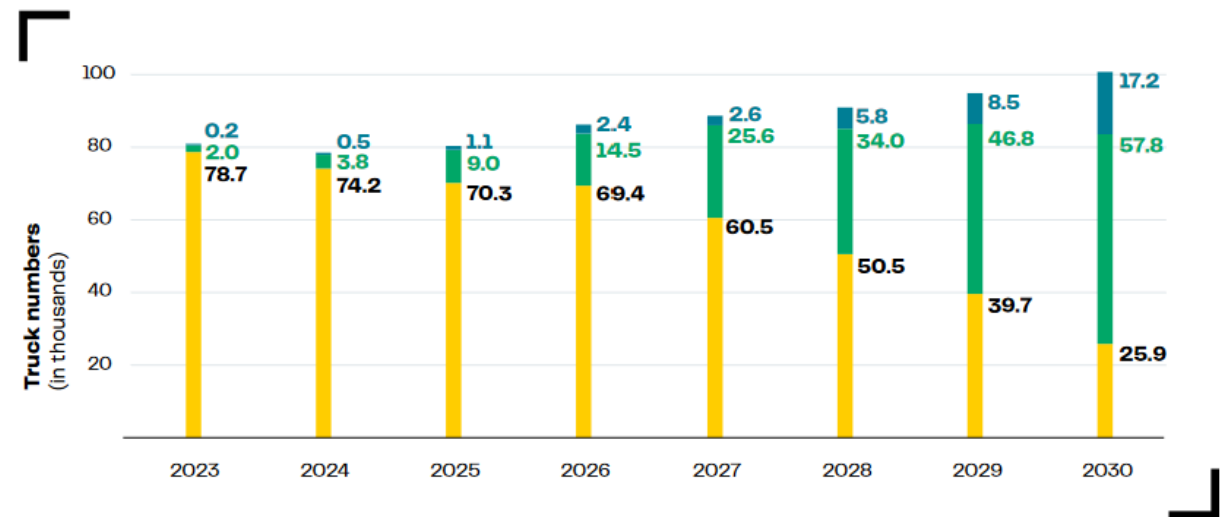
Background

- Road freight transport: **2nd most important source of CO₂ emissions** in the transport sector worldwide
- In 2024:
 - Diesel trucks still dominate by far, accounting for over 95% of new registrations in Europe
 - **Share of e-trucks: 2.3 %**
- Mandatory CO₂ emission standards in the European Union (EU), which were revised and tightened in 2024, are putting pressure on manufacturers to bring zero-emission vehicles onto the market
- Change of drive technology represents an **unprecedented transformation in road freight transport**
- **Key players** in the transformation:
 - **Vehicle manufacturers** on the supply side
 - **Transport companies** as vehicle users on the demand side

Status Quo – Manufacturer Perspective

- Prior to CO₂ standards for HDV: **no clear technology strategy** for reducing CO₂ emissions
- A **wide range of drive and fuel options** were cited by manufacturers as possible technology alternatives
- **Since the CO₂ standards came into force**: concentration of technical development on a few options – **focus on BET**
- BUT: cross-manufacturer analyses of product strategies are still rare

Forecast sales figures for heavy-duty vehicles (N3/> 12 t)
In Germany according to manufacturer data



Notes on uncertainty due to incomplete market coverage:

- Data is not available for all drivetrain types, manufacturers and years.
- For the second half of the decade, the response rate in terms of current market shares is 95%.
- For fossil fuel-based drivetrains, the response rate was between 70% and 90% by 2025.

For better readability, the low sales figures for PHEVs, H₂ combustion engines and natural gas (CNG/LNG) are not listed.

■ H₂ fuel cell
■ Battery
■ Diesel

Status Quo – Vehicle Users (Transport Companies)

- **Most transport companies** have **little previous experience** with electric trucks
- Majority of transport companies **unclear about prospects for different drive technologies**
- Although battery electric trucks are increasingly seen as the future of road-bound logistics by early adopters, **many obstacles remain**
- **Addressing obstacles will be crucial** to ensure electric trucks reach users across entire transport industry

Objective

Aim of our analyses:

- I. **Highlight and compare the challenges** from the perspective of manufacturers and users
- II. **Discuss needs for action** for a successful market ramp-up
- III. **Identify recommendations** for further developing the framework conditions

Our approach:

- Identify **similarities and differences** in the **manufacturers' strategies**
- **Compare the perspectives of transport companies with and without previous experience of e-trucks:**
 - Opportunity to identify the **practical challenges** in the current market phase
 - **Necessary measures** for attracting more transport companies to the electrification of their fleets

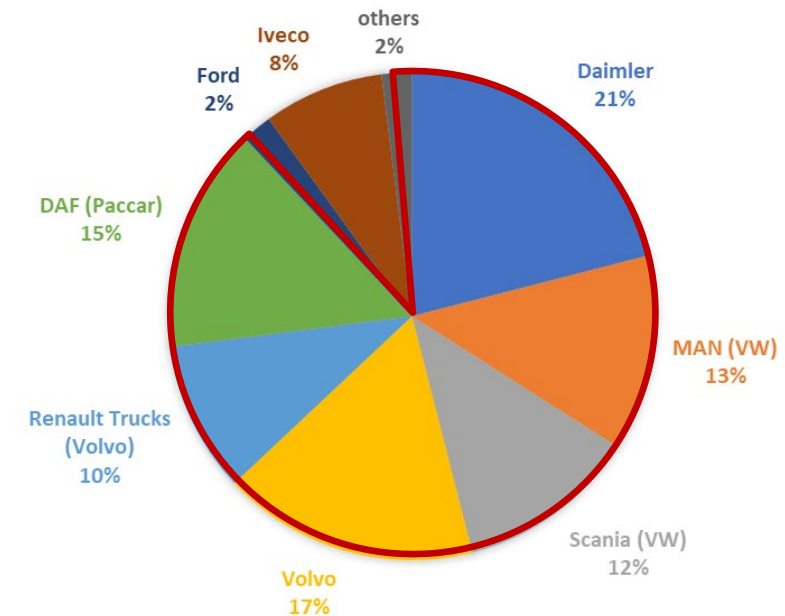
→ Allows differentiated view on challenges and forms basis for **targeted recommendations for action**

Data and Methodology

Data and Methodology – Manufacturer Perspektive

- Literature-based market analysis
- **Guided question-based individual interviews:** 60- to 90-minute interviews with representatives of OEMs (end 2023 to mid 2024)
- **Joint workshop** (06/2024) with interviewees: synthesis of the individual interviews was validated and the challenges and needs for action were substantiated
- Involvement of manufacturers, **representing about 90% of the European heavy-duty vehicle market**

Market shares of heavy-duty trucks from different manufacturers in the EU



Data and Methodology – Vehicle User Perspective

- **Literature-based analysis** of the transport market
- In-depth analysis of 6 case studies: **interviews, on-site visits and joint workshops**
 - Spectrum of companies involved **ranges from small companies** with just a few vehicles to **medium-sized companies** and the **largest European logistics and transport companies**.
- **Standardized survey** of a larger number of **German transport companies using BET (2024/2025)**
- Separate **survey of over 200 transport companies** from 2021 as a basis **for comparison**.

Results and Discussion

Perspective of Vehicle Manufacturers: Views on Market Development



- **Main application BET: shift from regional to long-distance transportation**
- **European CO₂ fleet targets: main driver** and key point of orientation for product strategy
- **CO₂ pricing** (including a CO₂-differentiated truck toll) **more important than vehicle purchase subsidies**
- **Manufacturers expect battery-electric trucks to dominate road freight transport** in the future, but development of hydrogen-powered drives in parallel
- Majority of manufacturers do not believe that **hydrogen-powered trucks** will be economically competitive in the longer term – **only applications in niche markets**
- Fail-safe **charging infrastructure as key** for market ramp-up of e-trucks

Perspective of Vehicle Manufacturers: Challenges and Need for Action

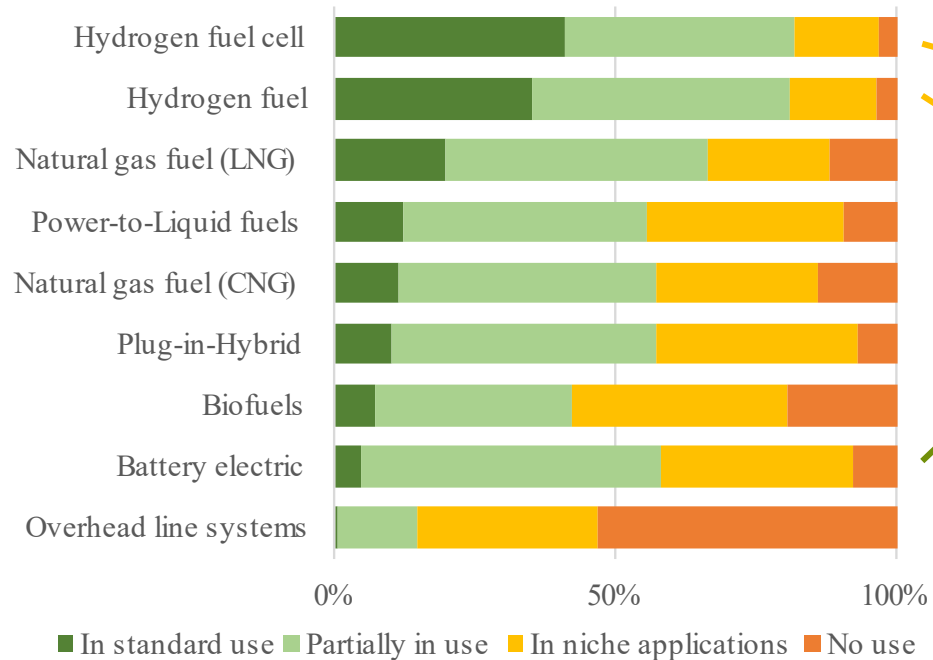


- **Grid connection** of charging infrastructure: **costs and lead times**
- Development of **private charging infrastructure**: high **grid connection capacity** required, high **costs**
- **Reliable framework conditions** in the long term: **CO₂ fleet target**, **CO₂-price**, CO₂-based truck toll; ZEV quota for supply side
- Development of **public charging infrastructure**: **AFIR**, **mandatory character**
- **Sites for (public) charging infrastructure**: availability of sites and grid connection
- **Change management for vehicle users**: sound advice and case-specific solutions

Perspective of Vehicle Users; Views on Market Development

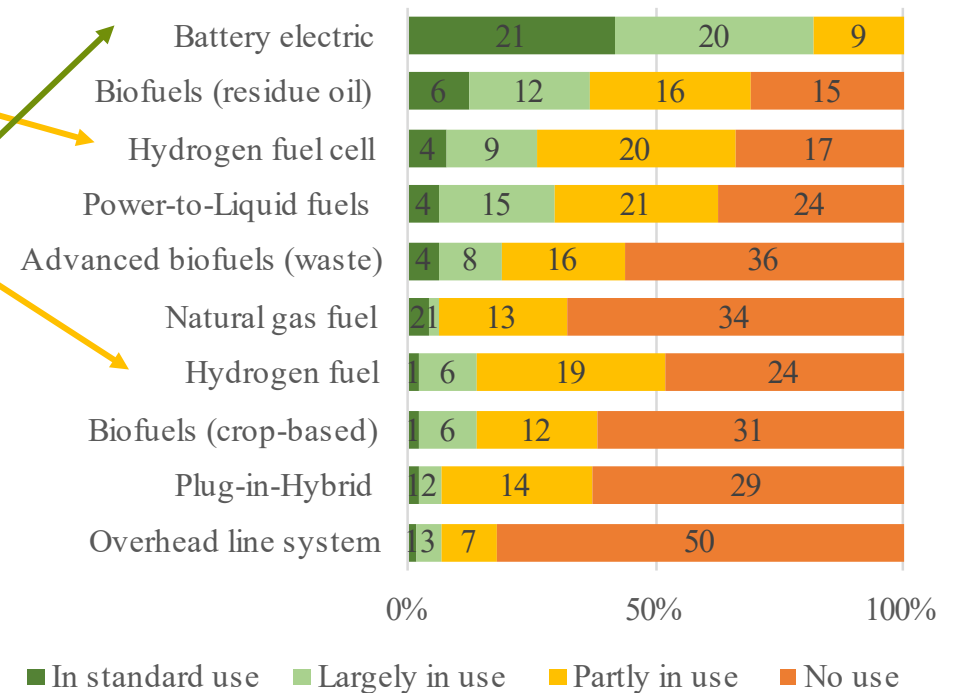
German transport companies (2021)

What role will powertrains and fuels play in road freight transport by 2030? (n=219)

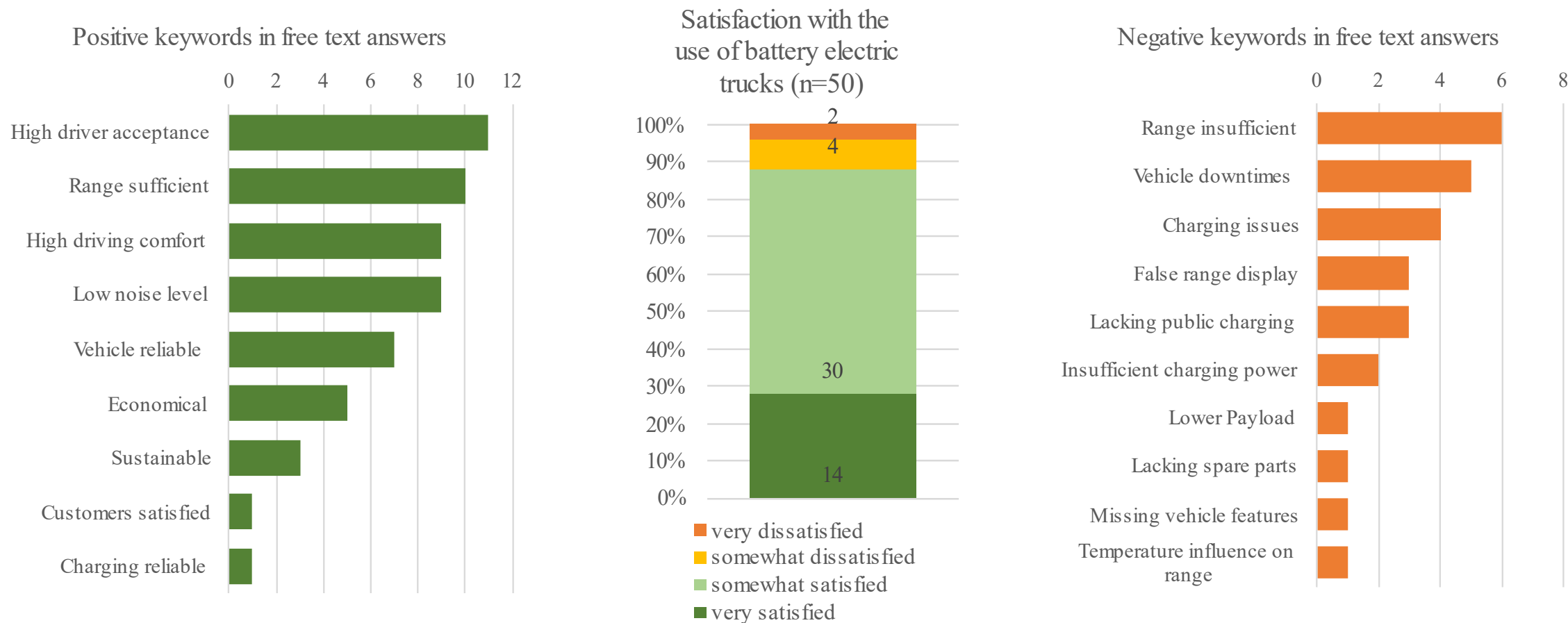


German transport companies with BET in fleet (2024/25)

What role will powertrains and fuels play in road freight transport by 2030? (n=50)

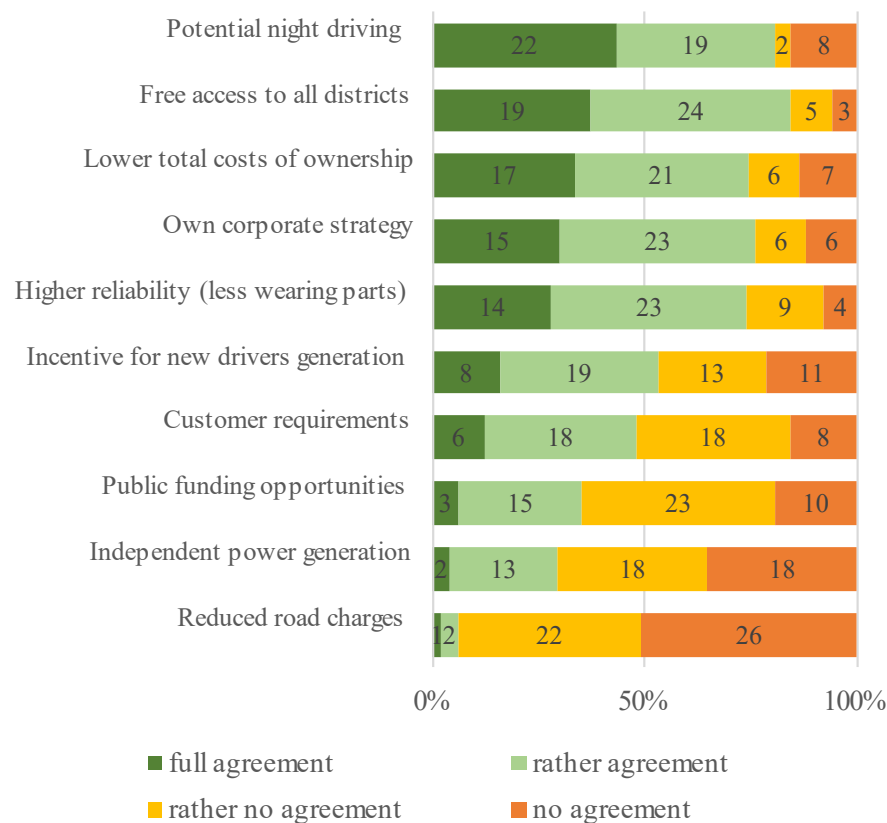


Perspective of Vehicle Users: Practical Experience of Early Adopters in Regional Transport

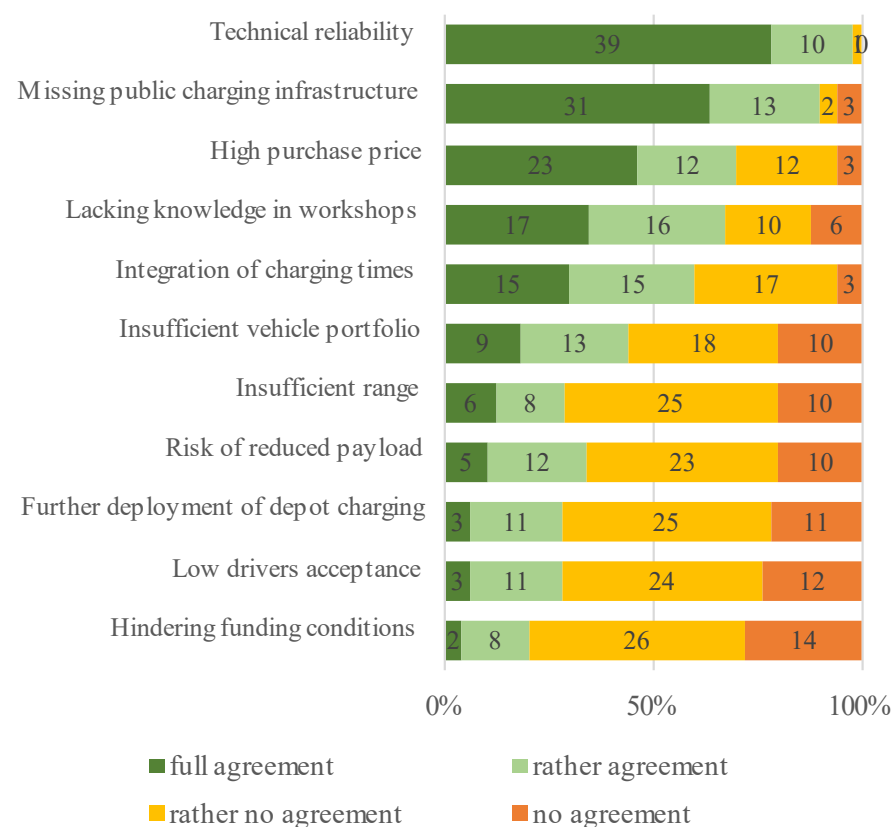


Perspective of Vehicle Users; Drivers and Challenges for the Electrification of HDVs

Why has your company purchased a battery electric truck? (n = 50)



What challenges your company for a further purchase of battery electric trucks? (n = 50)



Perspective of Vehicle Users: Challenges and Need for Action



- **Still no clear picture regarding the dominant drive technologies** of the future
 - Views differ greatly depending on BET experience
- **Technical issues:** technical **reliability** is the top ranked challenge
- **Total cost of ownership:** cost advantages are a central economic prerequisite; high investment costs; **government funding programs are still considered useful**
- **Change management:** **corporate strategy** is a key motivation; willingness to pay of customers still low
- **Grid connection:** available grid connection **at depots (lead times and costs)**
- **Public charging infrastructure:** essential **for long-distance transport; maximum price of around 30 cents/kWh** at public charging points
- **Long term framework conditions:** far-reaching investments; predictable framework conditions in order to **minimize investment risks**



Conclusions



Conclusions

- **Manufacturers:**
 - EU CO₂ standards have led to a **clear product strategy** – BET as the main technology
- **Vehicle users (transport companies):**
 - Picture is much more ambivalent and the **reservations about switching to BET are greater**
 - **Lack of clear regulatory framework conditions**, scepticism towards regulation (e.g. ZEV targets)
 - **Financial restrictions** on transport companies make it difficult to invest in BET
 - **Public support programmes** or **partnerships with contractors** as possible solutions.
- **Both groups:**
 - Demand for **long-term** and **predictable framework conditions** to avoid investment risks.
- **Perspective:**
 - Pay **greater attention to the majority of companies** that have not any experience with BET

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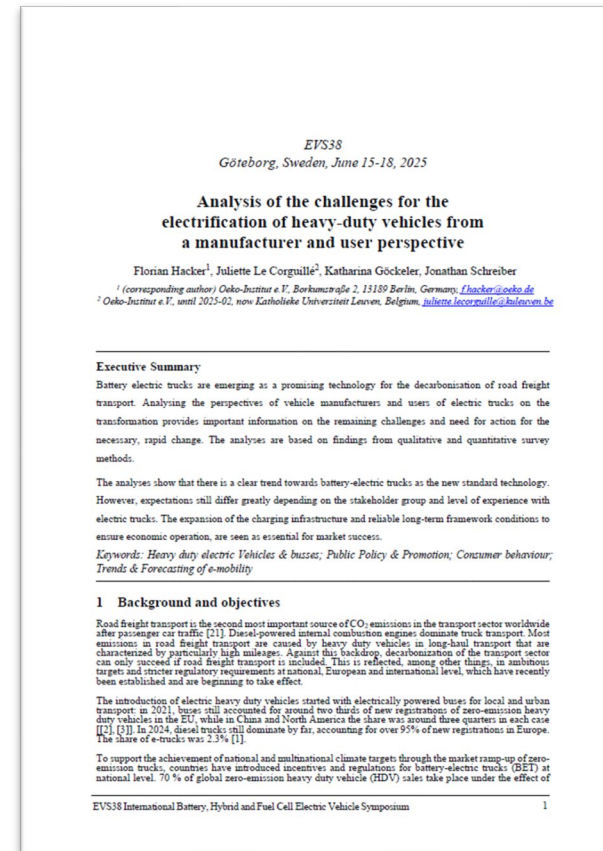
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*Florian Hacker, Juliette Le Corguillé, Katharina Göckeler, Jonathan Schreiber (2025): **Analysis of the challenges for the electrification of heavy-duty vehicles from a manufacturer and user perspective.***