Electrification of Heavy-Duty Vehicles

IEA HEV-TCP Task41 "Electric Freight Vehicles"
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German Aerospace Center (DLR), Institute of Vehicle Concepts

IEA AMF ANNEX57 WEB SEMINAR
"Heavy Duty Vehicles — Recent and Future Options
with Regard to Energy Consumption and Pollutant Emissions"
October 21st 2021, Online

Background

First steps are taken in electrification of freight vehicles:

- ✓ first products on the market
- ✓ first series of demonstration projects done
- ✓ problems are identified: costs, range, infrastructure etc.

Environmental targets tightened

- Paris 1.5 °C-target & air quality in EU
- EU targets for average CO2 emissions from new lorries

Zero-Emission Freight Vehicles needed!

How to proceed?

- How is the system of OEM, logistic companies, leasing companies, city policies evolving?
- Which powertrain technologies are suitable for which application/transport task?
- Which policy framework is needed?
- What could/should be the contribution of EFV to CO_2-reduction?

Task41 „Electric Freight Vehicles“

Programme of Work:

Monitor of technological progress and analyse the potential contribution of electric freight vehicles to emission reduction targets

Working Method:

- Hosting stakeholder workshops for the exchange of information to a wider audience
- Desk research to provide information for dedicated discussion topics and summarize it in fact sheets/policy briefs
- Networking/cooperation with further (international) initiatives on (Electric) Freight Vehicles

Members:

German Aerospace Center (DLR), Coventry University, Sabancı Üniversitesi, CNL, eFORCE, 울산대학교 University of Ulsan, E/NRIDE

Running time:

01/04/2019 -01/04/2022

More Information: http://www.ieahev.org/tasks/task-41-electric-freight-vehicles/

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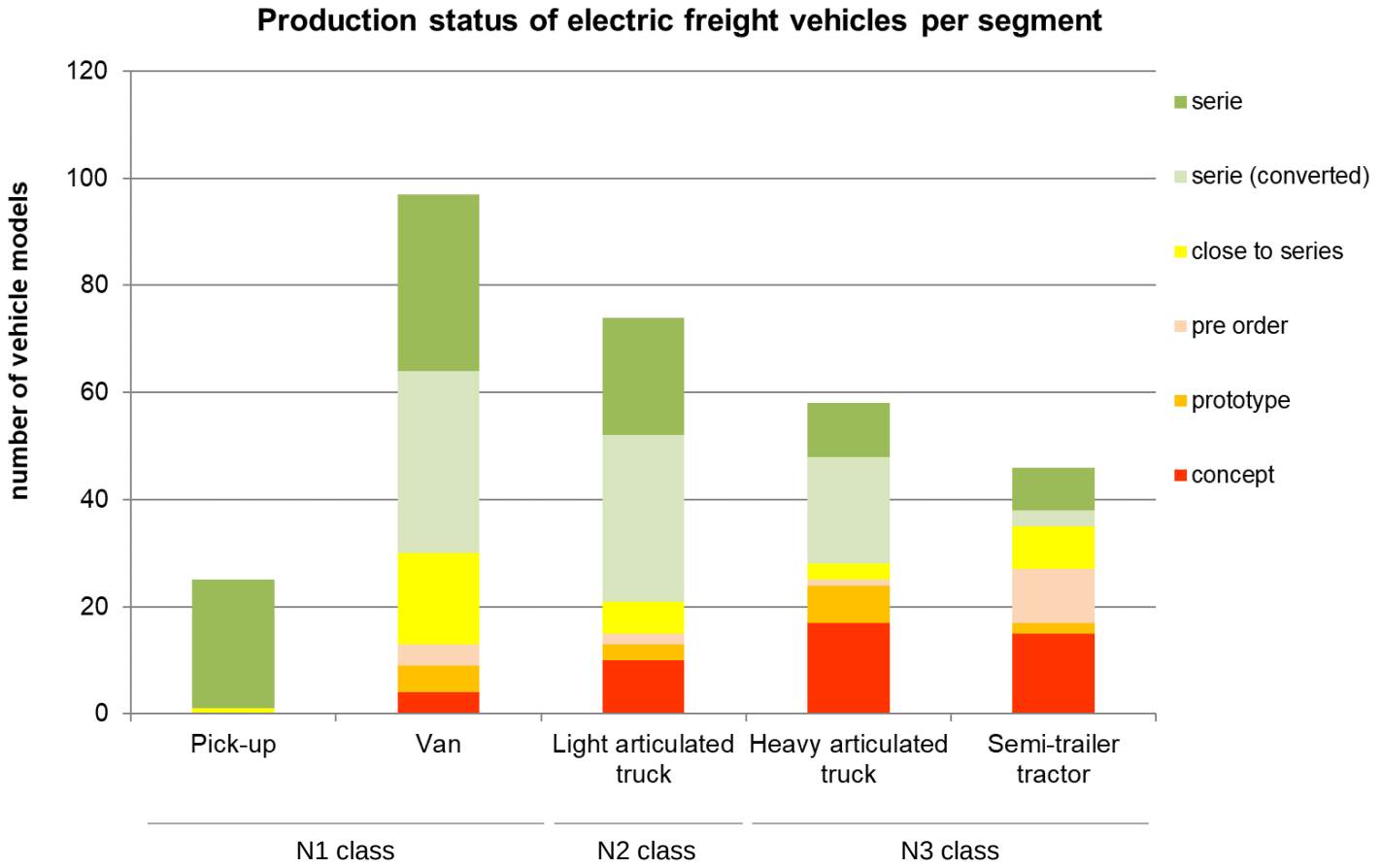
Technology Development

The State of the Art of Electric Freight Vehicles

- Task41 Electric Freight vehicles database consist currently of 330 entries (FHEV, PHEV, BEV, FCEV)
- A benchmark analyse of EFV was carried out using technical specification on the vehicle models and concept listed in the Task41 EFV database

Task41 Fact sheet on technical parameter of EFV [1]



Source: Task41 fact sheet „The state of the art of electric freight vehicles –Technical Performance“ [1]

Technology Development

How is the electric freight vehicle market developing?

Pick-up Trucks
(N1 category)

BEV

Alke ATX 330E [2]

Clean Motion Re:volt [3]

Vans
(N1 category)

HEV

Ford Transit (PHEV) [4]

FCEV

Renault Master Z.E. Hydrogen [5]

BEV

Mercedes-Benz eSprinter [6]

Light Articulated Trucks
(N2 category)

HEV

Mercedes-Benz Atego FHEV (7)

FCEV

Quantron Q-Light FCEV 120 [8]

BEV

Fuso eCanter [9]

Heavy Articulated Trucks
(N3 category)

BEV

MAN eTGM [10]

Daimler eActros [11]

Semi-trailer Trucks
(N3 category)

HEV

Scania R450 Hybrid [12]

FCEV

Hyundai Xient Fuel Cell [13]

BEV

Volvo FE Electric [14]

Availability checked for Germany in mid October 2021!

Technology Development

How is the light electric freight vehicle market evolving?

Pick-up trucks
(N1 category)

BEV

Alke ATX 330E [2]

Clean Motion Re:volt [3]

Vans
(N1 category)

HEV

Ford Transit (PHEV) [4]

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Light Articulated Trucks
(N2 category)

HEV

FCEV

BEV

Fuso eCanter [9]

Electric Light Duty Vehicles for urban Applications

- In the pick-up segment, only BEVs are available (in small series)
- PHEV and BEV are already in series production in the vans segment; SOP of the first FCEV models announced for 2022
- Light articulated trucks: First hybrid vehicles were sold in 2009 (e.g. by Mercedes Benz), but only a few BEVs are available in series production today; converted FCEVs are also on the market

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Best practice & Suitability

Experiences with Light Electric Freight Vehicles in urban applications

1st Task41 workshop on “battery-electric freight vehicles in city logistics” on October 15th 2019 in Stuttgart, Germany) with 20 attendances

Challenges of EFV in city logistic

- Operationalization: range vs. payload; “secured payload for greater planning reliability”
- Invest risk: investment vs. operating costs; “too high investment costs result in return of investment above total cost of ownership”
- Perspective more loading zones necessary

Potentials of EFV in city logistic

- Attractiveness of the professional driver
- “Green” company image
- new financing concepts – leasing and rental in combination with BEV

MAN eActros tests with DACHSER [15]

Availability checked for Germany in mid October 2021!

Technology Development

How is the heavy electric freight vehicle market evolving?

<u>Electric Heavy duty vehicle for regional distribution and long-haul transport</u>

- First electric heavy articulated trucks for regional distribution in series production
- No series production ready alternatives but successful prototypes via pilot projects known for long-haul transport; from overhead catenary trucks in Germany, FC trucks in Switzerland to battery-electric trucks from Volvo

see also *Task41 Fact sheet about OEM Strategies and announcement on alternative powertrains see [1]*

Heavy Articulated Trucks
(N3 category)

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MAN eTGM [10]

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Semi-trailer Trucks
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Hyundai Xient Fuel Cell [13]

BEV

Volvo FE Electric [14]

Best practice & Suitability

Different powertrain options for long-distance transport depending on individual transport tasks

2nd Task41 online workshop on “Electrification of Heavy-Duty Vehicles in Long Haul Transport”, September 29th, 2020 with 40 attendances

MAN eTGM tests in Austria since 2018

- Nine 26-ton E-trucks operated in distribution transport
- Range of 200km is sufficient for the transport tasks
- Need for standardization of the charging process and communication

eHighways from Siemens on German Highways

- Development of the eHighways today in the 3rd generation = field trials (1st generation: Proof-of-concept, 2nd Swedish and US demonstration projects)
- three field trials in Germany with each around five km track length and five trucks in operation

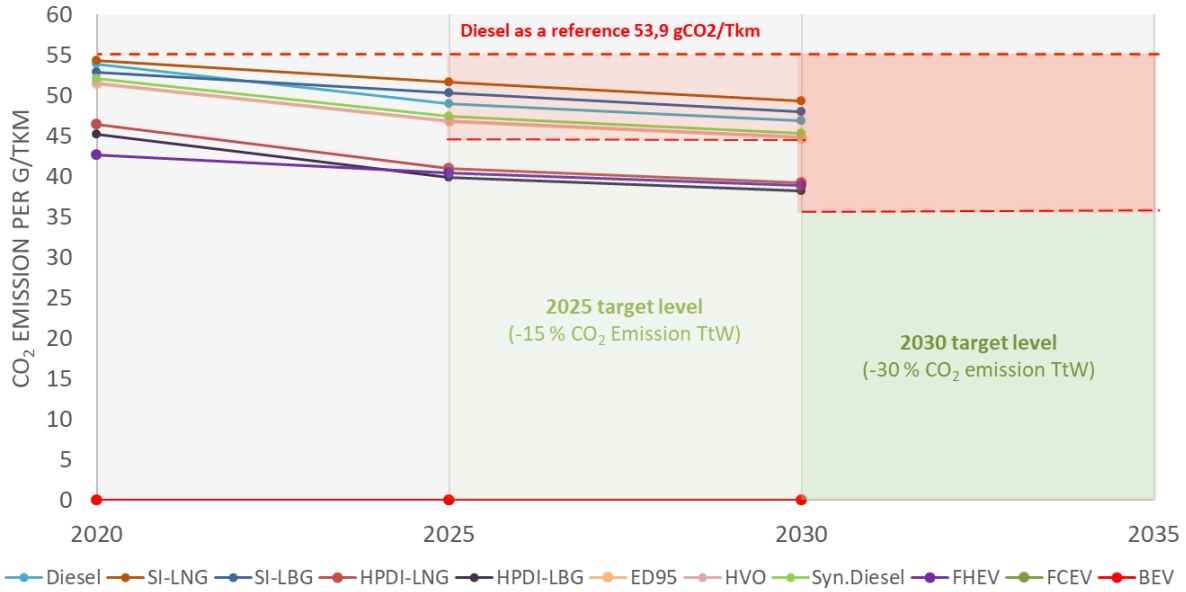
MAN eTGM tests in Austia [16]

Siemens eHighways in Germany [17]

Evaluation & policy framework

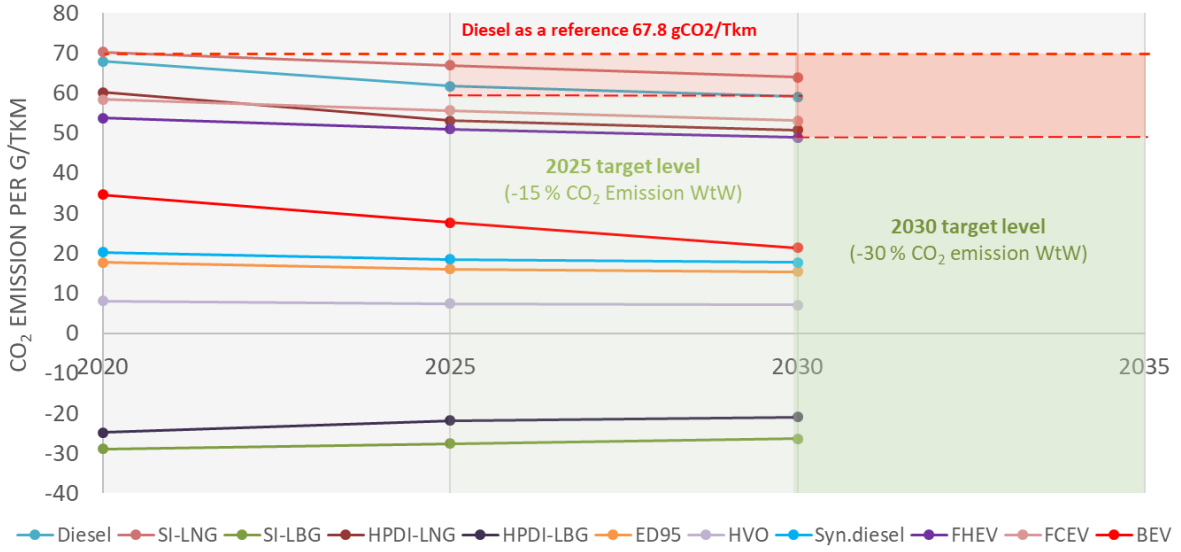
Evaluation of powertrain and fuel options for heavy-duty vehicles to meet the EU CO2 emission fleet targets

Tailpipe CO_2 emissions in g per ton-kilometer for different powertrain and fuel options



* 40 tons GVMR as reference for FHEV, FCEV and BEV
42 tons GVMR as reference for all ICEs (rest)

Total CO_2 emissions in g per ton-kilometer for different powertrain and fuel options



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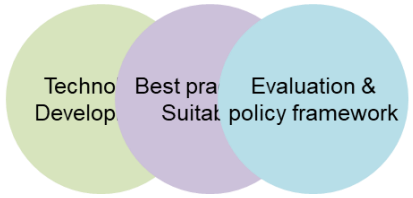
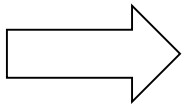
*Source: Task41 fact sheet „*Evaluation of powertrain and fuel options for heavy-duty vehicles to meet the EU CO2 emission fleet targets” *[18]*



First findings and outlook

- Conventional powertrain with fossil fuels are not compatible with EU CO2 fleet target in 2030
- Market-ready solutions with traction batteries for urban and distribution transport exist
- Combination of powertrain options is needed for long-haul transportation
- TCO parity, infrastructure availability and suitable regulatory framework are essential for scaling the EFV market
- Electrification of the freight vehicle market requires a holistic approach (incl. infrastructure roll-out plan, regulatory etc.)



3rd Joint Task41/Task45 online workshop on “Electrifying Road Freight – Overcoming the Diesel Vehicle Mindset” December 7th-9th 2021

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