E-Mobility for the Truck Market
Solutions from Continental

Alex Rupprecht,
Director of Business Segment Driveline and Electrification

E-Mobility for the Truck Market

Overview – Market Demands

Market Demands

In this complex field, manufacturers need an experienced partner to help them deliver the right solutions.

Increasing demand
for alternative powertrain concepts in the CV market.

Worldwide emission regulations
OEMs need to move fast to bring their solutions to market.

Technological uncertainties
with regards to energy carriers, low volumes and high investment costs make profitable investments harder.

Charging infrastructure
will need to be developed to guarantee reach and availability also for commercial vehicles.

Sustainability
Prove CO_2 neutral production + global CO_2 emissions also valid for trucks.

E-Mobility for the Truck Market
Products


Thermal Input/ Output ECU


Electric Vehicle Charging Controller (EVCC) incl. PLC[1]


Sound Module (AVAS)

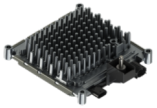

High Voltage Cables


Low Voltage ECU


Twin Motor Control


Sensors


Automated Conductive Charging Robot


DCDC Converter


Body Controller


Body High Performance Computer


Level & Roll Control


Battery Management Systems


Pantograph


Inverter


Vehicle Control Unit


Access Systems


Gateways

1 PLC: Power-Line Communication

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Daily routine of a battery electric truck

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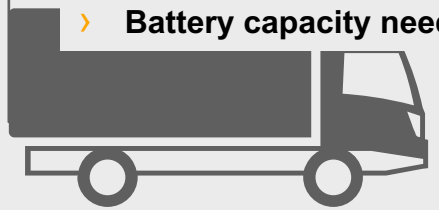
07:00 | 09:00 | 11:00 | 13:00 | 15:00 | 17:00 | 19:00

Driving Period 1:
max 4.5 hours

- Vehicle starts with a fully charged battery
- Vehicle needs to drive up to 4.5 hours under every condition without recharging

Key challenges:

- **Battery capacity needs to support this!**



Uninterrupted Break
min. 45 minutes

- Battery needs to get charged with enough energy to support the next 4.5 hours driving.

Key challenges:

- **High Charging Power:** (Battery, Charging Point, Infrastructure)
- **Availability of Charging Point**

Driving Period 2:
max 4.5 hours

- Vehicle needs to drive up to another 4.5 hours

Rest Period

- After the end of the rest period SoC needs to be at 100%.
- Charging with lower power

Key challenges:

- **Availability of Charging Point**
- **Availability of energy**

Demand of Energy

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	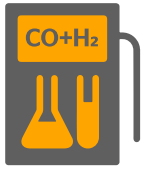 **Bio-Fuel**	 **Green Hydrogen**	 **EV**
Energy reaches the wheel	13%	25%	75%
Amount of Energy	72 TWh	37 TWh	12 TWh
Wind turbines (on-shore, approx.)	17,000	9,000	3,000
Land area	5.6 times EV	3 times EV	-

Assumptions: 100,000 Long-Halls, 93 tkm/a, 100 kWh/100km

Sources: Traton, FutureManagementGoup AG, PIARC Online Discussion

Electric Road System (ERS)

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What is ERS?

Trucks are connected to an overhead contact line and receiving energy used for:

- Electric Propulsion System
- Charging the battery

That means for the key challenges:

Charging during rest period no longer required

- No search for charging station
- High power charging not necessary (battery, infrastructure)
- Rest period can be planned independent of charging
- Battery capacity can be reduced by 50 to 75%

Summary
High Power and Dynamic Charging

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Battery electric trucks can reach their full economic and ecological potential when using a combination of dynamic and stationary charging

High Power Charger Weaknesses

- Increases battery use and energy losses
- Loss of time, unless used during planned stops
- Very high local grid load
- Additional space demand

High Power Charger Strengths

- Simple stand-alone solutions
- Gradual build-up with large spacing and few points per location possible

Dynamic Charging Strengths

- Many vehicles can be charged at the same time
- Hardly any additional land required
- Established technology with manageable adaptions for road
- Easier load on the grid

Dynamic Charging Weaknesses

- Higher threshold of min. number of users
- Dependent on road operators cooperation
- Higher technical complexity

A combination of dynamic and high power charging for Battery Electric Trucks is the way to reduce road freight emission efficiently.

The analysis of the German road network leads to the following key facts

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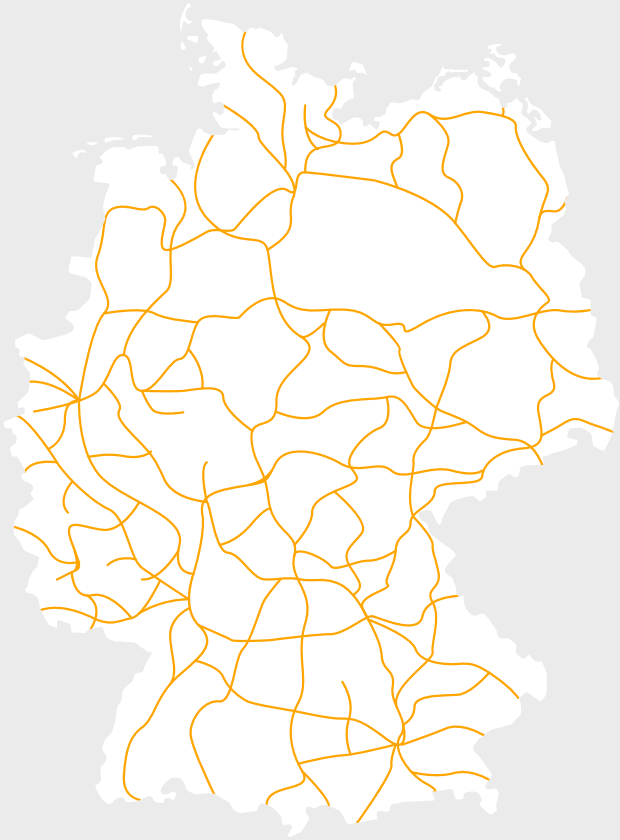
1. **60%** of the Heavy-Duty Vehicle emissions occur on 2% of the road network (German Autobahn (BAB) ~12,500km)
2. The most intensely used **~4,000 km** handle **60%** of all ton-km on the BAB
3. **89%** of trucks trips after leaving the highway are **≤50 km**



Source: Verkehr in Zahlen 2012; Fraunhofer 2017; BMVI website. Study available here

Vision

Level 5 autonomous trucks could operate nonstop up to 24/7

- No charging points at motorway services needed.
- No space for parking during breaks or rest periods needed.
- The utilization of the truck as a processing machine can be increased significantly.


Thank you!