

Battery and catenary trucks – the best combo for economy and climate



INSTITUT FÜR ENERGIE-
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Truck technologies 2030: Potential for cost-efficient use and CO₂ reductions compared to diesel

Share of German domestic truck kilometers for which the new technology will be cheaper than diesel trucks in 2030

Remaining CO₂-equivalent emissions (incl. electricity generation and vehicle production) from truck transport in Germany



98 %



-52 %

Battery trucks will be cheaper to operate than diesel trucks on 98 % of all routes in 2030. If battery trucks were used on all these routes, CO₂ emissions from truck transport could be reduced by 52 %.



42 %



-27 %

... 3000 kilometers
of overhead line in Germany



24 %



-15 %

... 1500 kilometers
of overhead line in Germany



Catenary trucks: If 3000 km (1500 km) of German highways are already equipped with overhead lines in 2030, then catenary trucks would be cheaper to operate than diesel trucks on 42 % (24 %) of all routes. If catenary trucks were used in all these cases, CO₂ emissions in truck transport could be reduced by 27 % (15 %).



0 %



-0 %

H₂ from Germany



31 %



-27 %

cheap H₂ import



Fuel cell trucks running on domestic hydrogen in Germany have no economic application potential in the medium term. Only if it were possible to import green hydrogen to Germany in sufficient quantities and at very favorable prices, fuel cell trucks would be cheaper to operate than diesel trucks for about one third of all routes. Their operation could then reduce CO₂ emissions by 27 %.



68 %

32 %



-55 %



Cost-optimal solution: The combined use of battery trucks (68 %) and catenary trucks (32 %) offers cost advantages over diesel trucks for all applications in 2030, with the lowest total costs of all conceivable options. With widespread use of this technology combination, CO₂ emissions in truck transport could be reduced by 55 %.

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Main findings (reference year 2030):

- In the future, energy costs will be the most decisive factor for the profitability of trucks.
- Battery electric trucks show cost advantages compared to diesel trucks for almost all application profiles.
- Fuel cell trucks will only find application niches in the case of very low H₂ costs.
- In the catchment area of an overhead line base network, catenary trucks show stable cost advantages for medium and long distances.
- A mix of battery electric trucks and overhead line catenary trucks is expected to be most cost-efficient for truck operators.
- Truck operators could save several billion euros a year by switching completely to direct electricity use.
- By implementing the most cost-effective technology mix, a good half of the GHG emissions could theoretically be saved compared to diesel trucks.
- The results show the limits of possible GHG reductions through an exclusive change of drives. Avoidance of unnecessary transports and modal shift are expected to be elementary for achieving the climate targets.

Conclusions:

- Battery electric trucks must play a central role in the future.
- The price of high-power intermediate charging is of great importance for battery electric trucks in long-distance transport.
- The usefulness of overhead lines for trucks depends not only on economic aspects, but also on a number of operational and energy-system aspects.
- Connecting the highway network to the power grids with high capacity and the large-scale piloting of battery electric and catenary trucks are no-regret options for government action.
- Fuel cell trucks will probably require continuous government intervention for competitive operation in most parts of the domestic German transport market.

Assumptions:

- Cost perspective of truck operators
- Consideration of domestic German truck traffic > 3.5 t GVW
- No technology-specific subsidies (e.g. toll exemption, purchase premiums)
- CO₂ price = 100 €/t on emissions of diesel trucks
- CO₂-equivalent emissions incl. operation, energy supply and vehicle production



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