Alternative delivery fleets: the economic viability of last-mile delivery battery-electric trucks in Europe

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Decarbonizing last-mile delivery fleets is crucial

- Among the largest heavy-duty vehicles segments by sales volume in Europe
  - Vehicles between 3.5 and 7.5 tonnes represented 11% of the registrations in 2020

- Continuous growth in the e-commerce industry which is expected to be sustained
  - 15% growth between 2019 and 2021

- Promising application for electrification given their low daily mileages
  - Smaller batteries required with minimal impact on weight and volume capacity
Use case of urban parcel delivery trucks

- **Geographic scope**: Berlin, Paris, London, Warsaw, Amsterdam, and Rome

- **Representative vehicle**: StreetScooter WORK XL electric truck (2,600 units registered between 2016 and 2020)

- **Fleet**: 23 vehicles that operate for 12 hours a day and charge at the depot (window 6:00 p.m. to 6:00 a.m. at max. 22 KW)

- **Daily mileage**: 40 to 60 km with ~ 15,000 km annual mileage
Methodology framework
TCO Calculation

Total cost of ownership

Fixed expenses
- Retail price
- Salvage value
- Infrastructure
- Finance
- Taxes

Operational expenses
- Charging costs
- Diesel fuel
- Maintenance
Fixed expenses: Truck retail price

- **2022 prices**: official market prices (German Federal Office of Economics and Export Control)
- **2023-2030**: bottom-up approach to estimate retail price
- **Battery cost**: continuous reduction until the end of the decade
  - $100/kWh by 2025, ~$60/kWh by 2030 according to BNEF.
- **Retail price gap**: €19,000 in 2022 to less than €6,000 by 2030

Battery-electric and diesel trucks retail price evolution between 2022 and 2030
Operational expenses: Charging Costs

Cost for January – June 2021
Charging costs – Network Prices (example)

City
- grid area
- price sheet

Depot
- consumer category
- applicable tariffs

Demand
- Load curve
- Final cost calculation

Hourly Network fees in London in p/kWh

Volumetric time-of-use charges in London.
Source: UK Open Power Networks, 2022
Electric trucks to reach cost parity by the second half of the decade

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<th>City</th>
<th>Parity year (no premiums)</th>
<th>Parity year (with premiums)</th>
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Diesel and electricity prices for January – June 2021

Without purchase subsidies

With purchase subsidies

5-year TCO (first ownership analysis)
Recent energy crisis further justifies the business case of electric trucks.
A Bonus-malus tax scheme can stimulate the early market uptake of electric trucks.

- **Fiscally sustainable** approach to finance electric truck purchase premiums during the early market uptake phase

- **Properly designed** to cover the TCO gap between an electric truck and its diesel equivalent

- **Designed based on the “polluter-pays” principle** as vehicles with higher CO₂ emissions will be taxed more

- **One-time registration tax for diesel vehicles**: annually updated based on required premiums and electric trucks – diesel trucks market share per country
Emission charges in low- and zero-emission zones can be a game changer for diesel fleets!

- **More than 250** low- and zero-emission zones in Europe
- **Low- and zero-emission zones** either ban specific vehicle from entering the zone or impose a daily access charge
- **An Emission charge on all diesel-powered vehicles between €2/day to €4/day** can bring TCO parity to mid-decade

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TCO parity year between battery-electric and diesel trucks under several emission charge scenarios
Smart charging coupled with time-varying pricing accelerates truck electrification
Main takeaways

- Battery-electric trucks for last-mile delivery applications are already economically viable today

- Battery-electric trucks for last-mile delivery applications will reach cost parity by the second half of the decade without purchase premiums

- Policy measures, from both the energy and transport sector, are needed during the early-market uptake of last-mile delivery battery-electric trucks in Europe
Related publications

- Electrifying last-mile delivery: Battery-electric delivery trucks soon cheaper to use than diesel trucks in Europe (fact sheet)
- Electrifying last-mile delivery: A total cost of ownership comparison of battery-electric and diesel trucks in Europe (report)
- Electrifying city logistics in the EU: optimising charging saves cost
- Total cost of ownership of tractor-trailers in the EU: battery-electric vs diesel (white paper).
Questions

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