

The KITE tool

Key Infrastructure for Truck Electrification

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Truck Decarbonisation Challenges

■■■■ Battery electric forms part of the decarbonisation solution for trucking

■■■■ Each solution has its challenges

BEV Challenges:

■■■■ Higher mileage requires bigger (more expensive) batteries

■■■■ Bigger batteries require more powerful chargers for which the grid is not ready

■■■■ Strict requirements on the battery weight and volume

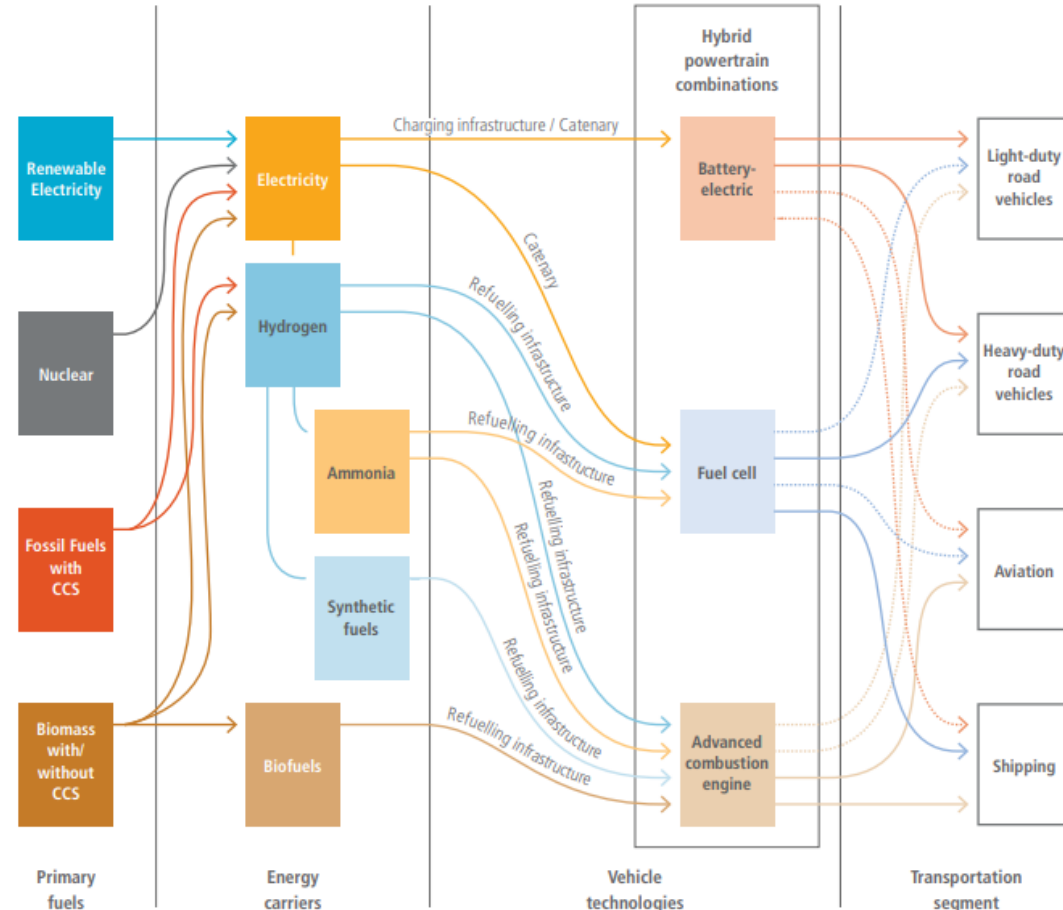


Figure 10.2 | Energy pathways for low-carbon transport technologies. Primary energy sources are shown in the far left, while the segments of the transport system are in the far right. Energy carriers and vehicle technologies are represented in the middle. Primary pathways are shown with solid lines, while dotted lines represent secondary pathways.

Source: Intergovernmental Panel on Climate Change (IPCC), ed. Transport. In: *Climate Change 2022 - Mitigation of Climate Change: Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press; 2023:1049-1160.



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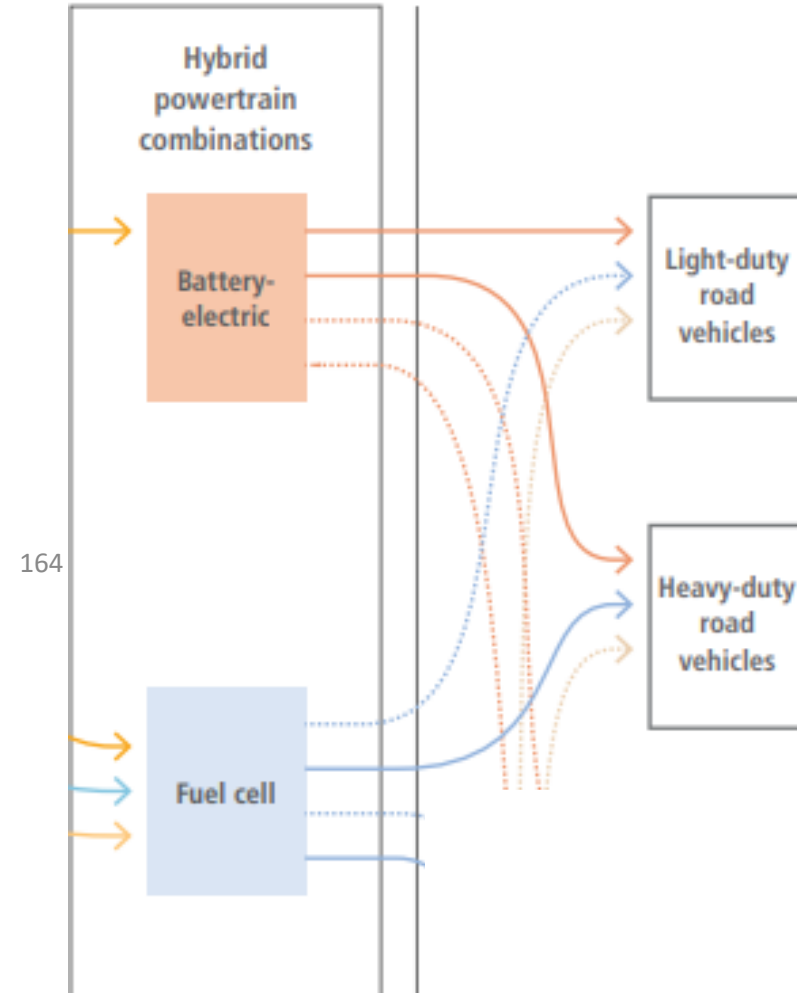
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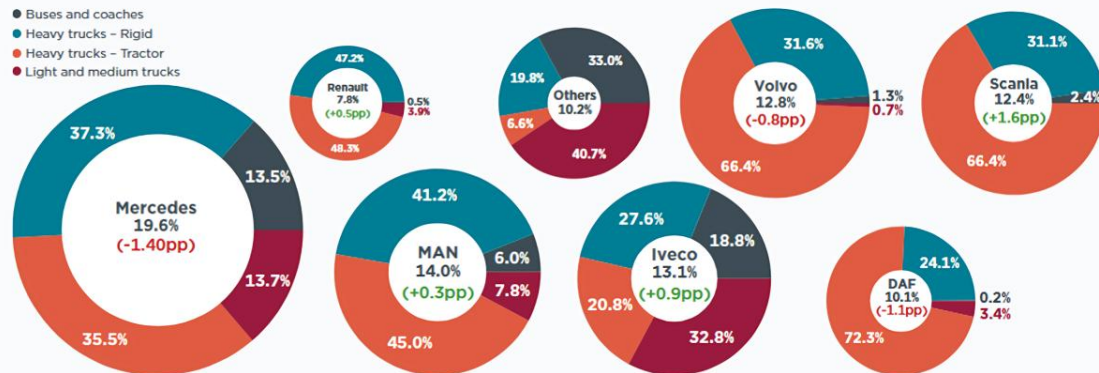
Battery Electric Trucks: Status Quo

■■■■ Around 400,000 Battery Electric Trucks globally

■■■■ Most of them in China (360,000 or 90%)

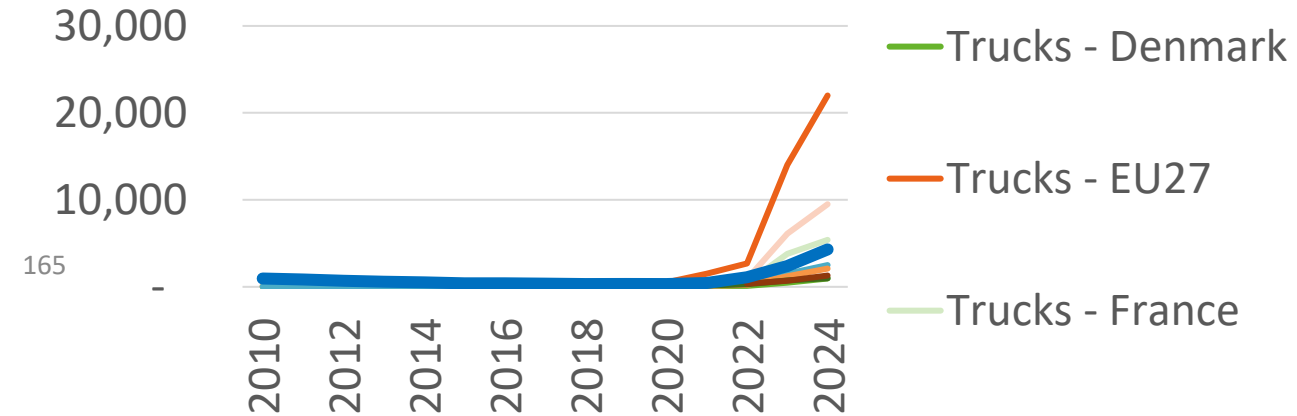
■■■■ Big markets in Europe are Germany, France, the UK, the Netherlands, Norway and Switzerland

Manufacturer market share by segment for full year 2024 with brackets showing the change in the market share in percentage points relative to full year 2023



Source: International Council on Clean Transportation, European Heavy Duty Vehicle Market Development Quarterly 2024

European stock of Battery Electric Trucks



Source: International Energy Agency Global EV Data Explorer (accessed July 2025)

■■■■ Traditional players dominate the electrified heavy duty market

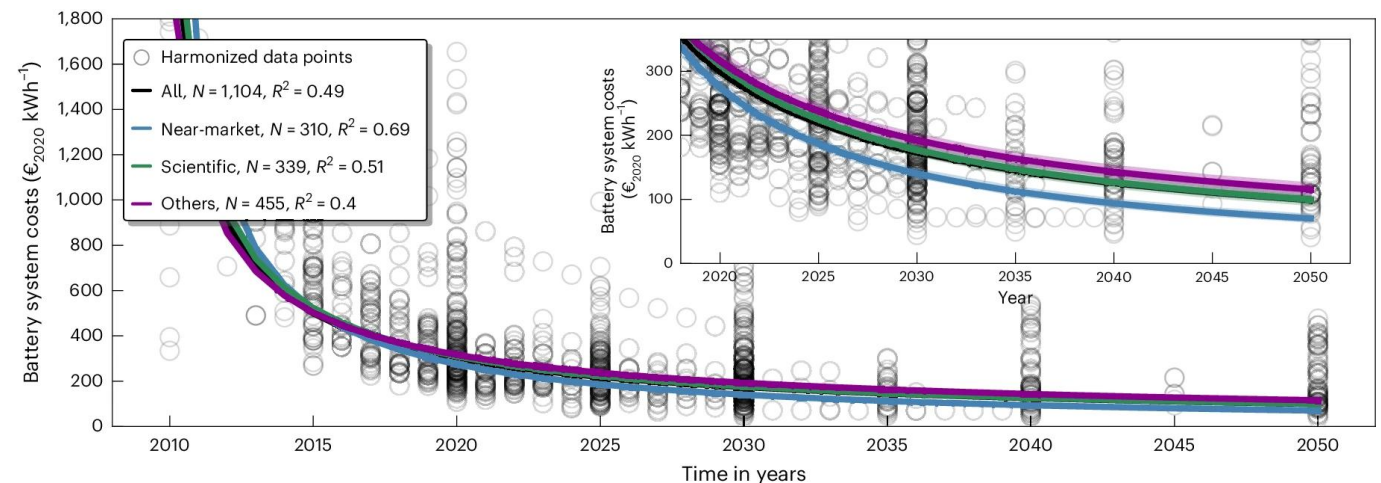


What is driving Heavy Duty electrification?

- ■ ■ ■ ■ Rapid drops in battery costs for trucks
- ■ ■ ■ ■ Policies to reduce emissions and urban air pollution
- ■ ■ ■ ■ Requirements for larger companies to report emissions:
 - Streamlined Energy and Carbon Reporting (SECR)
 - Corporate Sustainability Reporting Directive (CSRD) in the EU



Projections for heavy ZET battery system costs



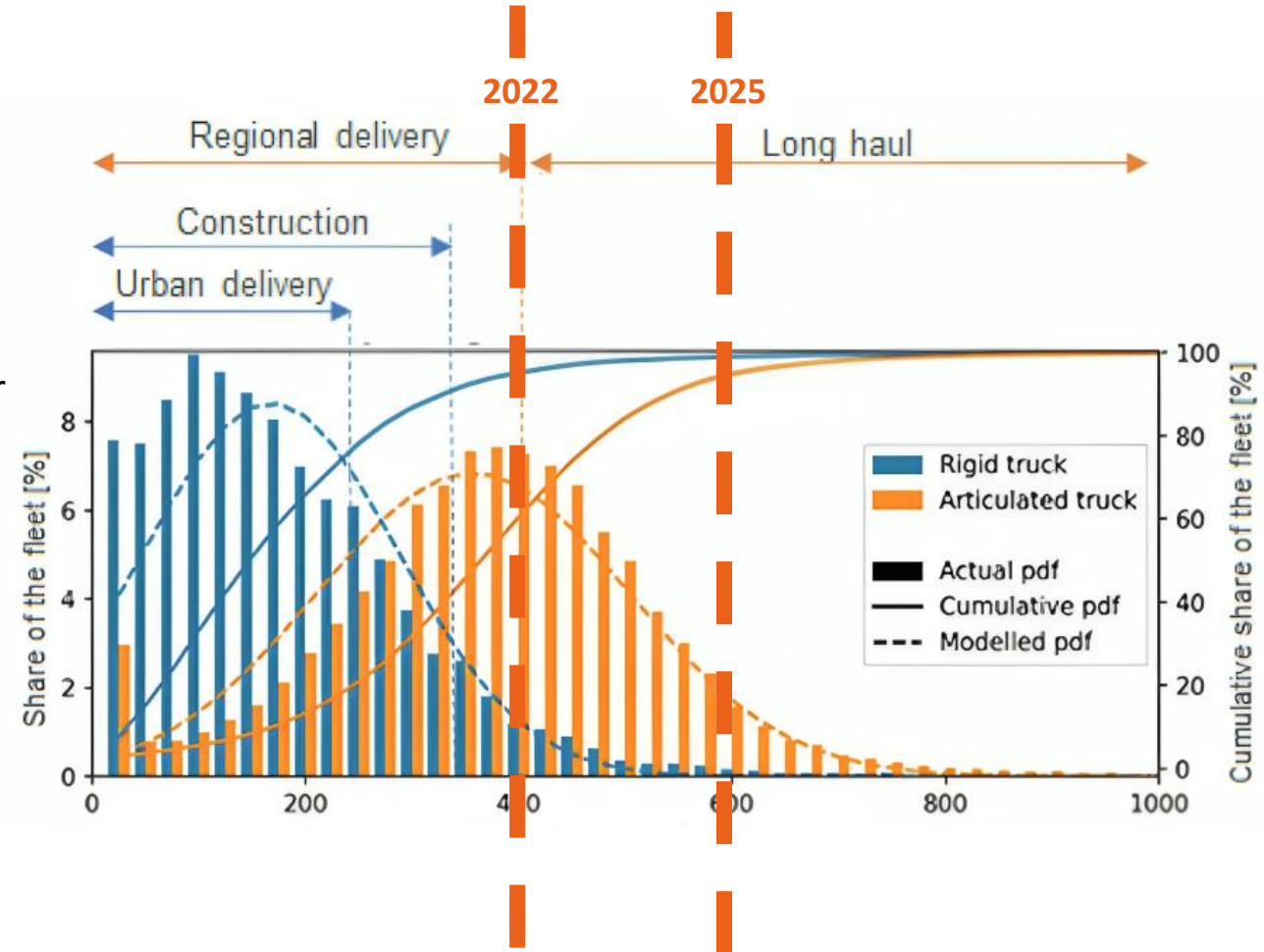
Source: Link, S., Stephan, A., Speth, D. et al. Rapidly declining costs of truck batteries and fuel cells enable large-scale road freight electrification. Nat Energy 9, 1032–1039 (2024).
<https://doi.org/10.1038/s41560-024-01531-9>



What's Possible Today

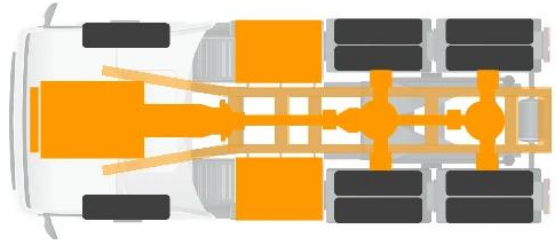
- BEV range: easier to cover existing urban and regional delivery fleets with lower mileage
- Typical longhaul daily mileage is higher
- Newer Heavy-Duty BEV models can cover the required range for an increasing percentage of typical longhaul applications

Today's (2025) highest range Heavy Duty Trucks.
New models from Mercedes Benz, Scania, Renault and MAN have spec sheet ranges of 600 km.



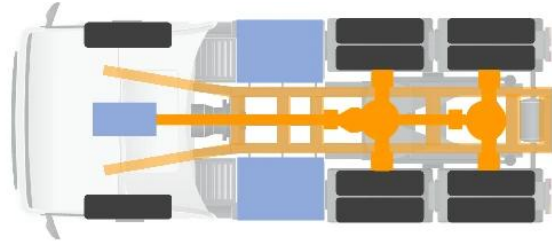


What's next?



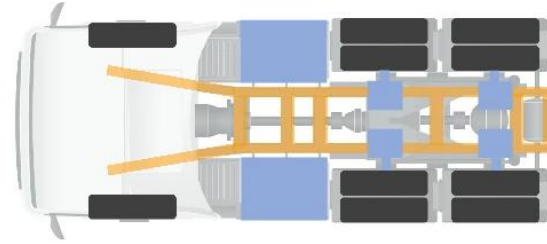
Traditional diesel truck

Diesel motor, gearbox, driveshaft, differentials, diesel tanks, ladder frame



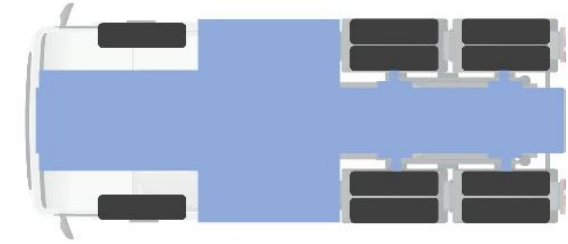
1st generation eTruck

Diesel motor and tanks replaced by electric motor and batteries



2nd generation eTruck

Multiple motors close to the wheels free up space and reduce truck weight by up to 2500 kg



3rd generation eTruck

Battery replacing ladder frame creates space and reduces truck weight by up to 1000 kg

Technological improvements:
Truck architectures, holistic design approach

Operational Improvements:
Replanning/optimised fleet routing
Smart management, predictive maintenance

TCO parity with diesel is in the next few years for last-mile, urban applications, even without subsidies. Longhaul applications will be later but also improving

Source: Hoekstra, A., Alkemade, F. Using learning curves to guide the energy transition with the example of heavy electric trucks. *npj. Sustain. Mobil. Transp.* 2, 14 (2025). <https://doi.org/10.1038/s44333-025-00029-5>



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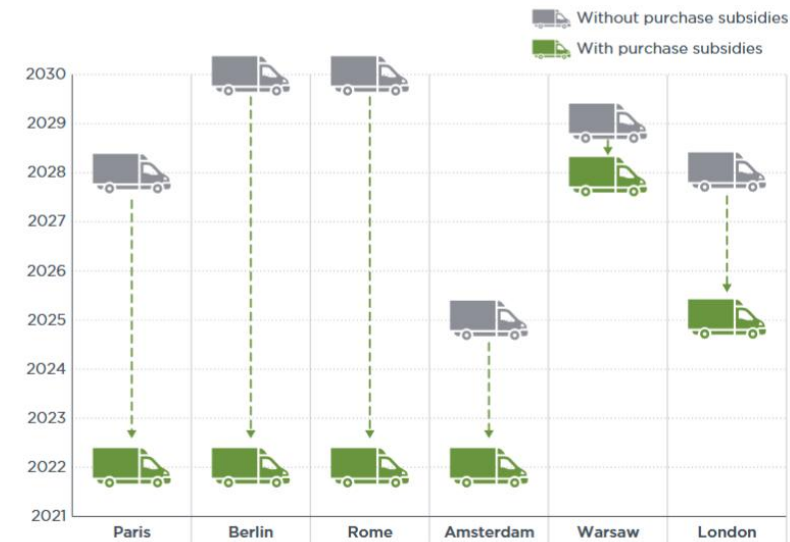


Figure ES1. The year battery-electric trucks achieve total cost of ownership parity relative to diesel trucks with and without purchase subsidies.

Source: Basma et al., Electrifying Last Mile Delivery - A total cost of ownership comparison of battery-electric and diesel trucks in Europe, 2022





Today's challenges

- Availability of electric trucks
- Access to financing (upfront costs remain high)
- Clarity on current possible range vs fleet requirements
- Reliable information on costs of truck and depot electrification
- Timely & affordable access to grid connections
- Availability of public and shared charging infrastructure
- Development of electricity market knowledge for lowering costs

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Today's challenges

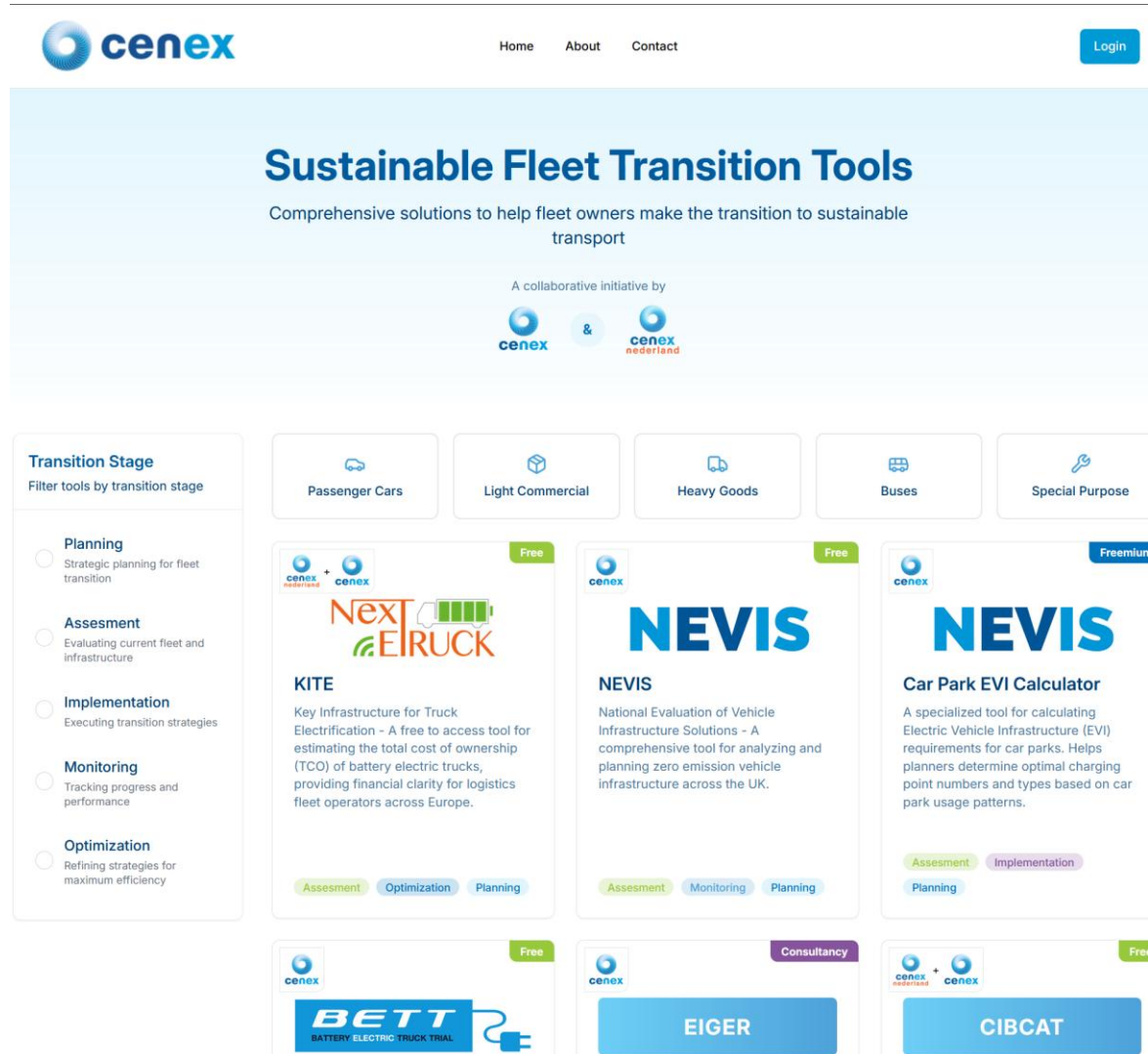
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Cenex tools



<https://cenex-tools.io/>
<https://cenex.cademy.io/>

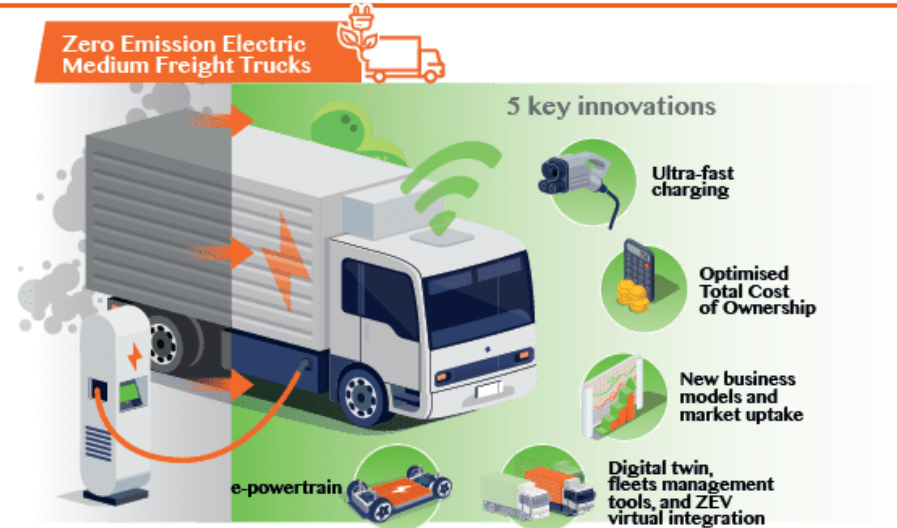


- Range of digital tools to help with various stages of fleet decarbonisation
- Heavy duty, passenger cars, micromobility, shared mobility, etc.
- Many tools are free, created from research projects
- Online course for Continuous Professional Development or general learning



– in brief

- European EU-funded project on medium freight haulage
- Various innovations from charging, digital tools and business models
- Includes demonstration in 3 countries
- Cenex's role (UK + NL) as a knowledge partner

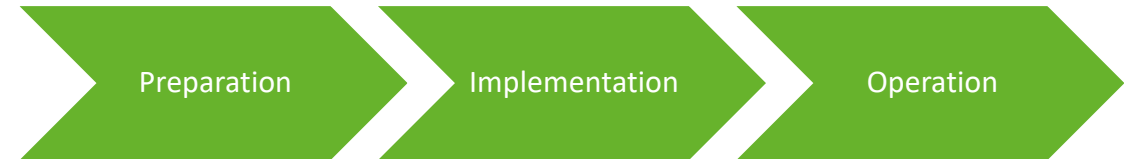




KITE – Key Infrastructure for Truck Electrification



- Developed as part of NextETruck
- Fully online, no downloading of executables
- Free to access
- Target audience: Logistics operators in small companies (<20 trucks)
- Knowledge pre-requisite: Requires understanding of fleet operations, shift patterns, charging concepts, cash flow curves, total cost of ownership concept



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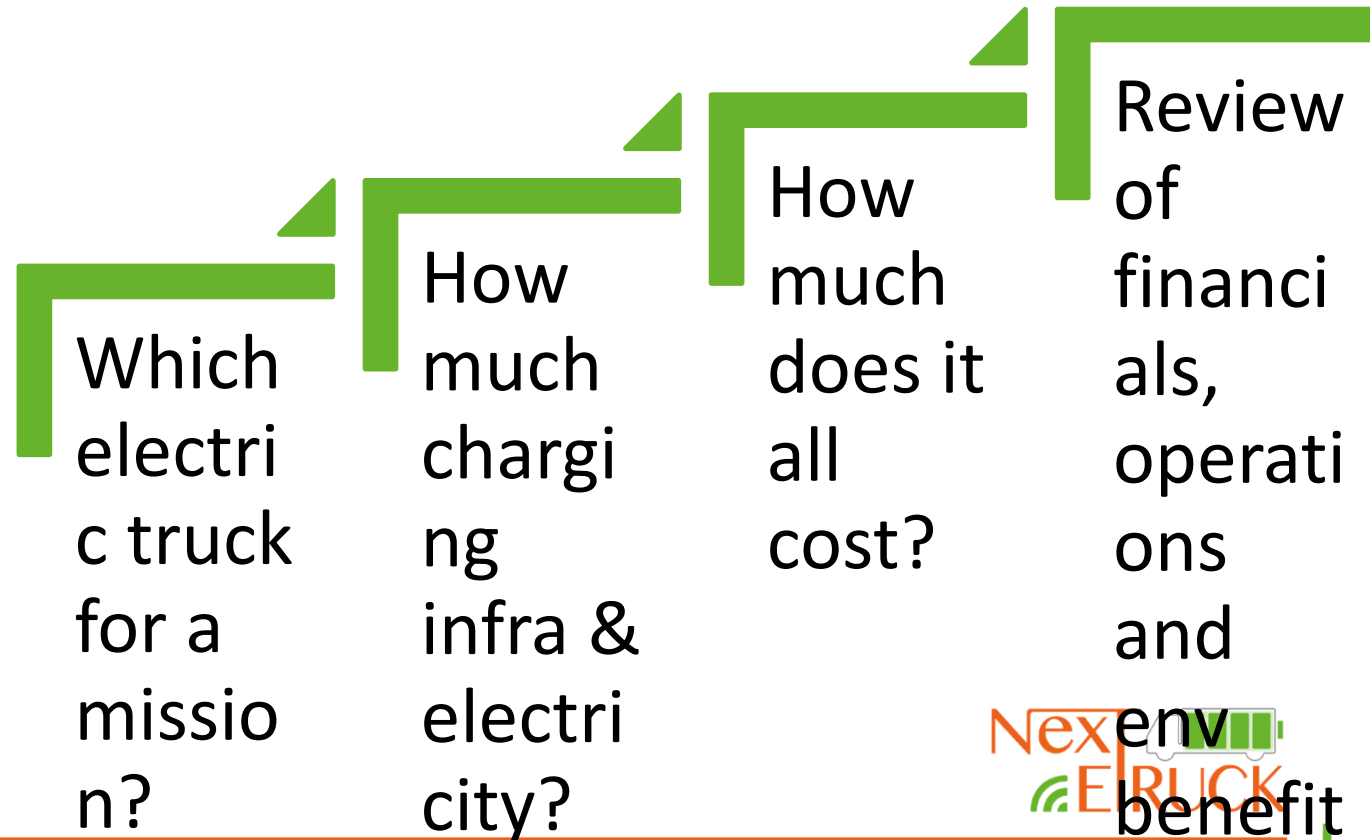
- **Assessment**
 - charging needs
 - possible solutions
 - existing loads and infrastructure
- Contact grid company
- Place order
- Grid extension
- Retrofit of electrical connection
- Cable laying
- Charge point acquisition
- Installation and Commissioning
- Maintenance
- Billing and access management

Position of KITE in the process flow of electrification




KITE – what can it be used for?


- Check the average capabilities of various types of electric trucks
- Estimate the truck charging infrastructure required
- Estimate the total cost of ownership (TCO)
- Identify truck routes where the TCO of electric trucks is low
- Match truck with lowest TCO route.






KITE – process flow



 Units

English 

Login

Fleet decarbonisation strategy tool



The fleet decarbonisation tool supports fleet manager in assisting logistics companies transitioning to electric trucks. Using fleet details as input, it estimates the quantity, power capacity and the costs of investment of the charging infrastructure required at their depots.


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Partners




**Benefit**


Select your vehicle type you would like to run a calculation against.

**Fine tune**

Fine tune your results with the available parameters.

**Daily distance**

Enter the estimated daily distance for the selected vehicle to calculate a result.

**Calculator**

Select your vehicle type you would like to run a calculation against.


Financial charts

Fleet comparison

Charger insights

Information

Fleet insights



Charging 51.11%

Charging daily 22.5%





KITE – main advantages and limitations

Advantages

- Includes many features
 - Infra sizing
 - TCO
 - Grid upgrade estimation
 - Battery salvage
 - GHG emissions
- Default values for many European countries
- Highly customisable for local requirements

Limitations

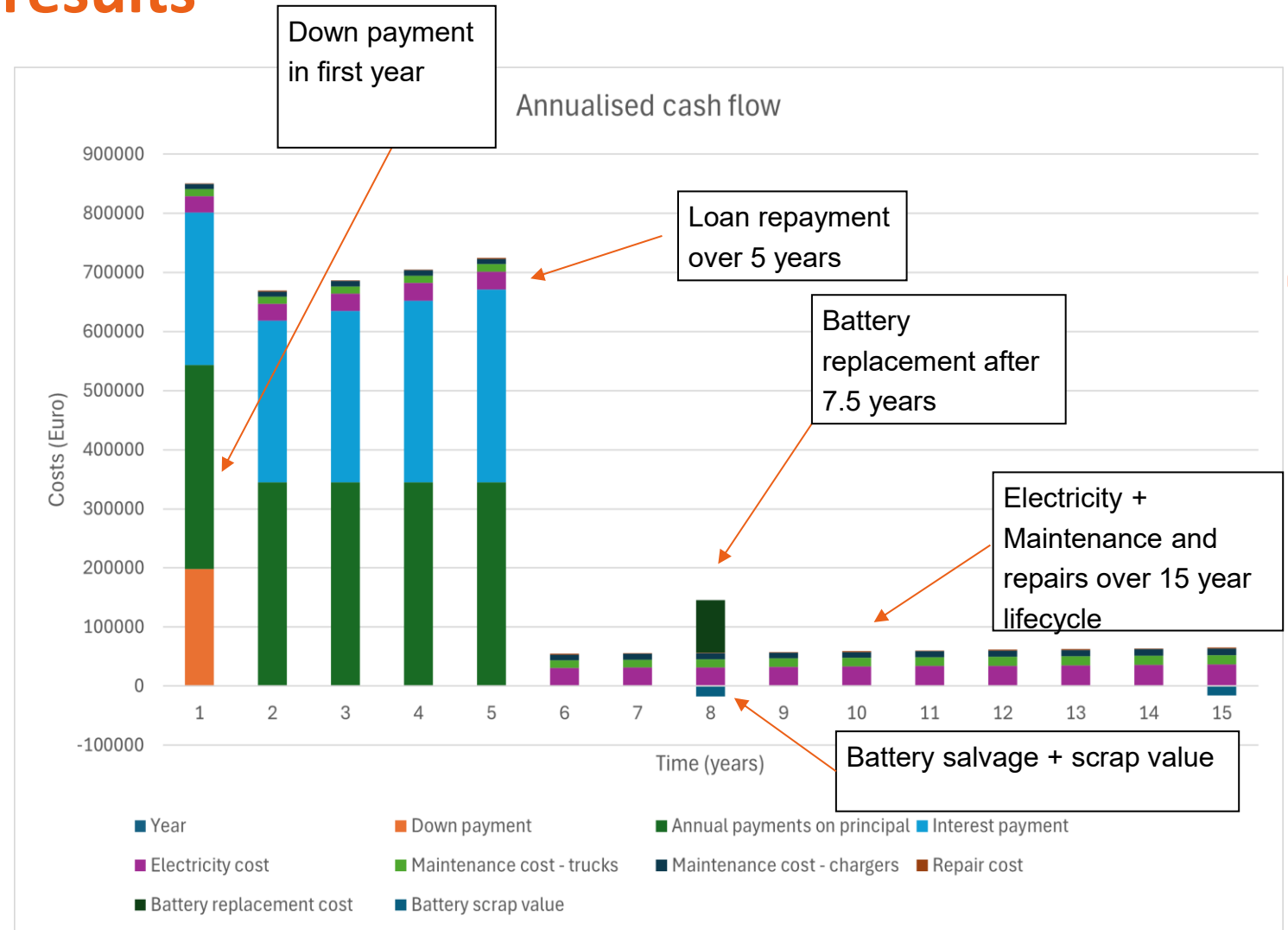
- Mainly focused on depot charging at a single depot.
- No national and sub-national level subsidies
- 176 ■■■■ Does not consider time-of-use tariffs, V2G or stationary battery storage





KITE – Analysing the results

- Upfront costs of battery electric trucks remain 1.5 to 3 times as high as diesel.
- Battery replacement is needed around 7 to 8 years
- TCO per km is very sensitive to
 - 1) Lifetime of operation
 - 2) Electricity price
 - 3) Discount rate





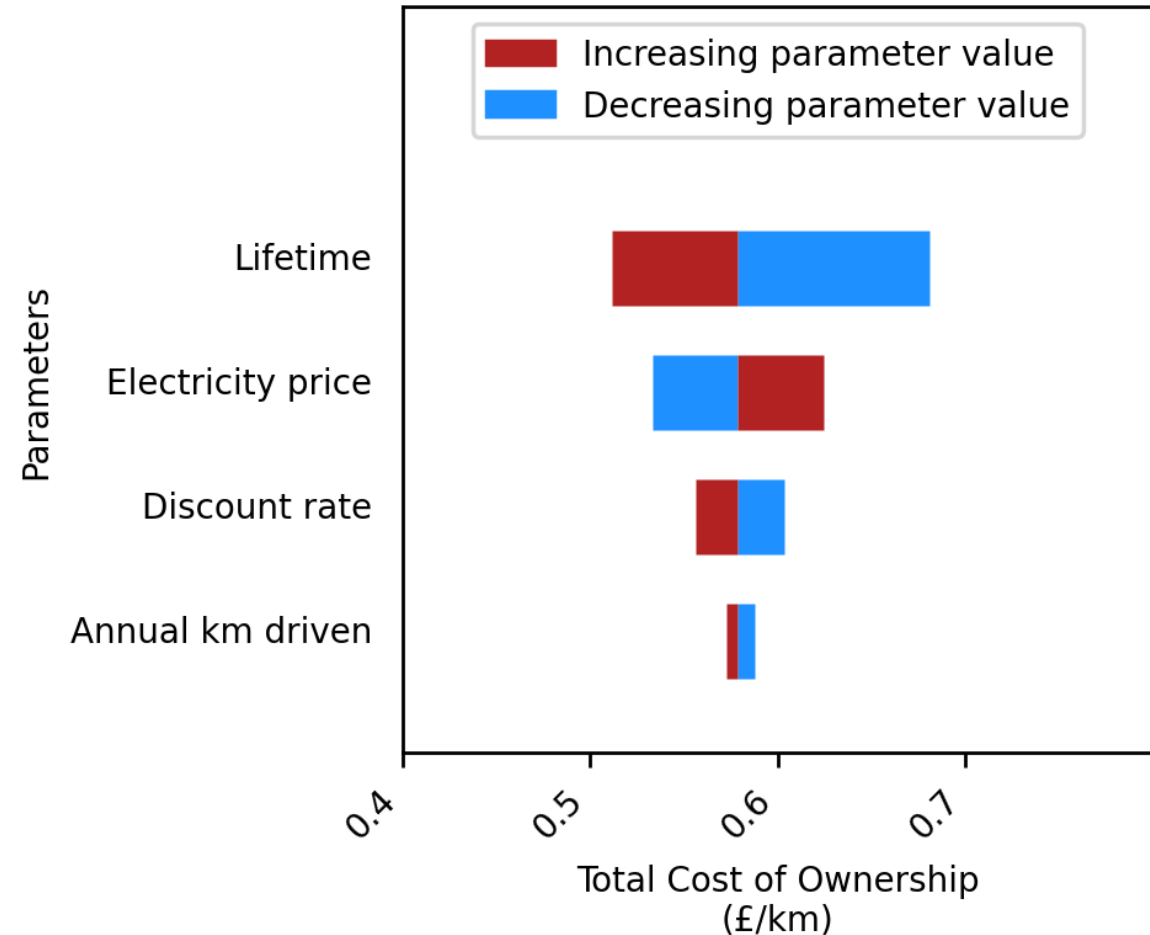
KITE – Sensitivity of etruck TCO – UK case study

TCO/km is sensitive to various parameters

Longer lifetime, lower electricity price, higher discount rate and higher km driven all reduce the TCO.

TCO/km is most sensitive to lifetime and electricity prices

Actual TCO is very sensitive to km per year, effect less visible per km





Main takeaway messages

- Battery electric trucks are close to diesel in total cost of ownership. For some fleets, battery electric is cost competitive.
- The main reason is lower cost per electric-km.
- The number of fleets for which battery electric trucks are cost competitive will increase.
- TCO/km reduces with longer lifetime, lower electricity prices and longer annual distances.
- There is considerable scope for further reduction in TCO¹⁷⁹ of battery electric vehicles due to vehicle design improvements, battery cost reduction and digitalisation/optimisation of route-planning.
- The KITE tool is freely available to help with planning for electrification.





Special Issue on Zero Emission Buses

Special Issue

Zero Emission Buses for Public Transport

Message from the Guest Editors

In this Special Issue, Zero-Emission Buses for Public Transport, we aim to present the latest developments towards zero-emission buses. We invite original research papers in the following areas:

- Bus powertrain optimisation;
- Bus charging and fuelling infrastructure;
- Infrastructure planning for zero-emission buses;
- Route planning and scheduling for zero-emission buses;
- Energy storage systems for zero-emission buses;
- Case studies on zero-emission bus deployment;
- Developments in technical standards and tendering requirements in zero emission buses;
- Emerging business models for zero-emission buses;
- Life cycle assessments and environmental impacts of zero-emission buses.

Guest Editors

Dr. Rishabh Ghotge

Prof. Dr. Omar Hegazy

Dr. Thomas Geury

Deadline for manuscript submissions

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■■■■ KITE tool validated in peer reviewed publication

■■■■ The bus sector is further ahead in electrification and there is lots to learn

■■■■ Please get in touch if you work with Zero Emission Buses

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