Zero-Emission
Commercial Vehicles

Building Momentum

2026 Factbook for Investors

Sept. 17, 2026

Smart Freight Centre

Ministry of Infrastructure and Water Management of the Netherlands

TRATON

BloombergNEF

Contents

About this report

Road freight underpins modern economies, but its energy use and emissions continue to rise. Growing energy security concerns around the world and the development of new supply chains for materials and energy technologies are also reshaping government and corporate strategies.

This report looks in detail at the state of the clean truck market. It shows that technology improvements, infrastructure investments, market dynamics and new financing models support a rapidly growing industry. Still, challenges remain with high vehicle costs, uneven charging networks and bespoke funding structures limiting scale.

The report was produced by BloombergNEF in partnership with the Smart Freight Centre, the Dutch Ministry of Infrastructure and Water Management and Traton SE.

Smart Freight Centre

Smart Freight Centre (SFC) is a globally active non-profit organization for climate action in the freight sector. Our goal is to mobilize the global logistics ecosystem, in particular our members and partners, in tracking and reducing its greenhouse gas emissions. We accelerate the reduction of logistics emissions to achieve a zero-emission global logistics sector by 2050 or earlier, consistent with 1.5C pathways.

Ministry of Infrastructure and Water Management of the Netherlands

Dutch Ministry of Infrastructure and Water Management, responsible for the implementation of the mobility agreements of the Dutch Climate Agreement.

TRATON

Traton SE designs and manufactures commercial vehicles, especially heavy-duty trucks and buses.

BloombergNEF

BloombergNEF (BNEF) is a strategic research provider covering global commodity markets and the disruptive technologies driving the transition to a low-carbon economy. Our expert coverage assesses pathways for the power, transport, industry, buildings and agriculture sectors to adapt to the energy transition. We help commodity trading, corporate strategy, finance and policy professionals navigate change and generate opportunities.

Introduction and key messages

The global market for medium- and heavy-duty zero-emission trucks continues to expand rapidly on the back of improving technology, increased infrastructure investment and a renewed focus on energy security. Beyond established markets such as China and Europe, sales activity is also emerging elsewhere. Market growth and strengthening economics are attracting more capital for electric fleets and charging infrastructure, but financing still relies on bespoke structures and terms.

- **Zero-emission truck sales keep growing**. Global sales expanded 75% in the first half of 2026 from a year earlier, making zero-emission vehicles an increasingly distinct part of the broader truck industry. Medium- and heavy-duty electric trucks are likely to exceed 9% of global truck sales in 2026. Sales remain concentrated in China, while volumes are also rising in several European markets. Sales are also growing in India, Brazil and Southeast Asia, albeit from a low base. Almost all zero-emission trucks sold between January and June 2026 were battery electric.

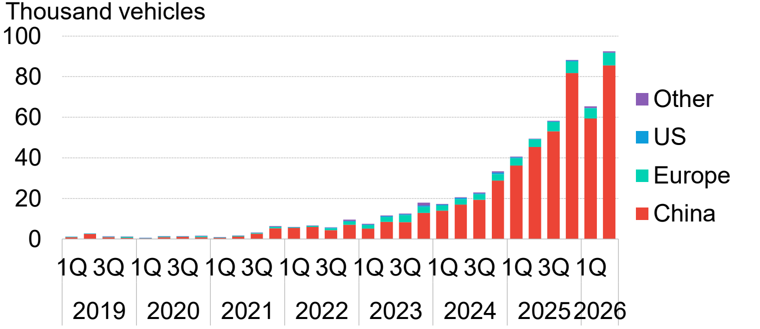
- **Battery-electric trucks are already economically competitive in several use cases.** The addressable market for battery trucks is already sizable, even where they remain more expensive than diesel trucks under average market conditions. Electric trucks benefit from high utilization, and differences in daily driving distances mean a substantial share of use cases can already reach economic competitiveness. That share can approach 50% of the fleet depending on capital and energy costs. Electric truck prices are likely to decline as battery costs fall, but charging costs may vary widely, particularly between depot and public charging.

158,000 Electric trucks sold globally in 1H 2026, up 75% year on year

25-50% Addressable market of battery-electric heavy-duty, long-haul trucks in Germany, depending on energy costs

0-20% Representative range of residual values assigned to electric trucks after three-to-five years of use

Global sales of zero-emission medium- and heavy-duty trucks



Source: BloombergNEF; see full list of sources in the Appendix. Note: Europe includes the EU-27, the UK, Norway, Switzerland, Iceland and Liechtenstein. Includes medium- and heavy-duty trucks.

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Introduction and key messages

- **Battery technology continues to improve and support market growth.** Prices for truck battery packs are still falling, though the rate of decline has slowed in the past couple of years. Battery packs for commercial vehicles averaged $108 per kilowatt-hour in China and $182 per kilowatt-hour (kWh) elsewhere. With rising production volumes and higher electric truck sales, battery prices are likely to fall further over the next several years. Battery packs are also improving as manufacturers deepen their technical knowledge and build production expertise.
- **Electrification offers newcomers a route into a truck industry with high barriers to entry, while exports provide a foothold in new markets.** The market for battery trucks in China and Europe is more fragmented than the overall truck market. In China, incumbent manufacturers hold a much lower share of the electric truck market, with companies in adjacent sectors, such as buses and machinery, holding sizable shares. Chinese manufacturers also use the technology to enter markets in Southeast Asia, South America, Africa and Europe, but signs of local opposition are emerging. Chinese manufacturers exported about 2,000 heavy-duty electric truck tractors in the first half of 2026.
- **The US market is falling further behind on electric trucks,** with only a few hundred units sold in the first half of 2026. That is due to a lack of suitable vehicles, high upfront costs and a weakening regulatory environment. While federal rules are unlikely to become more supportive in the next few years, state-level subsidies and other measures for electric trucks remain in place. Even so, development of truck charging stations continues apace, as fleet operators anticipate deliveries of the Tesla Semi and the vehicle's production ramp-up. Relatively low electricity costs and high annual mileage could also support electrification in the US.
- **Financing of fleet electrification is emerging but remains highly varied.** Raising funds to purchase electric trucks relies on securing revenue through contracts for transport work and valuing environmental benefits, such as emission reductions. The market for financing electric trucks is far less mature than that for diesel vehicles. Still, fleet operators, infrastructure developers and financiers have developed customized approaches to support further deployment.
- **Energy security and independence are now central issues globally.** Road freight consumes around 19 million barrels of oil per day. The sector's electrification can help reduce exposure to geopolitical disruptions, fuel-supply constraints and price volatility. Government and corporate strategies will need to adapt to accelerate the development of domestic electricity generation and new supply chains.

Zero-emission commercial vehicle market

Adoption is gaining speed, with new growth patterns emerging

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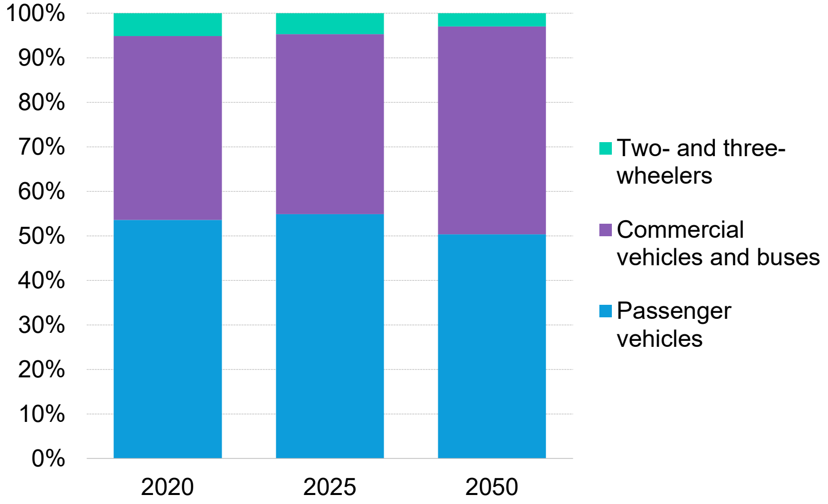
Commercial vehicle emissions decline only modestly through 2050

Distribution of CO_2 emissions from road transport



Source: BloombergNEF. Note: Chart shows BNEF's 2026 Electric Vehicle Outlook Economic Transition Scenario. Includes emissions from fuel combustion and upstream emissions from electricity generation. The scenario assumes no new policy intervention through 2050.

Global road transport emissions reached about 6.0 billion metric tons of carbon dioxide (GtCO2) in 2025, with the mix changing only slowly despite record electric vehicle sales.

Passenger vehicles emitted 3.3GtCO2 and remained the largest source at over half of the total. About 21 million electric cars were sold in 2025, accounting for around a quarter of new-car sales. Still, fleet turnover is slower than sales growth and most of the world's 1.3 billion cars still burn gasoline or diesel fuel.

Vans, trucks and buses generated 2.4GtCO2 in 2025, just over 40% of road emissions. While they are far fewer than cars on the road, trucks and vans are heavier, travel farther and are used more intensively.

The transition is also more uneven. Electric trucks in China have reached mass adoption in several segments, while most other large markets remain at low single-digit shares. BloombergNEF expects more than 80% of trucks and 52% of vans on the road in 2040 to use combustion engines.

Based on today's trajectory, commercial vehicles are set to represent an increasing share of global road transport emissions. In BNEF's Economic Transition Scenario, commercial vehicle emissions fall only to 1.9GtCO2 by 2050, representing 47% of road transport emissions.

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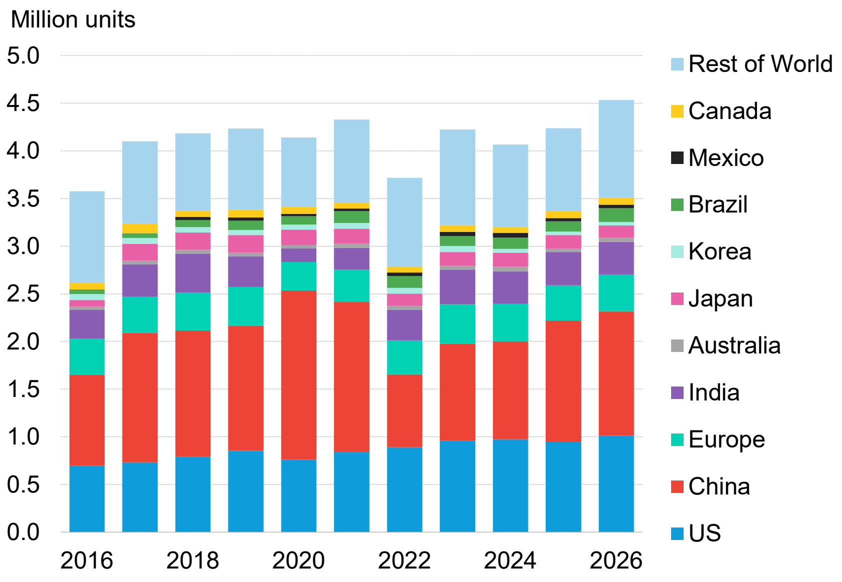
Global heavy-duty commercial vehicle sales are rising again, led by China

Global sales of commercial vehicles by region



Source: BloombergNEF; see full list of sources in the Appendix. Note: Figures for 2026 are BNEF estimates. Europe includes the EU-27, the UK, Norway, Switzerland, Iceland and Liechtenstein.

Global medium- and heavy-duty truck sales rose 4% in 2025 to 4.2 million vehicles, reversing the 2024 decline. BNEF estimates another 7% increase to just over 4.5 million in 2026.

Sales in China jumped 23% to 1.3 million in 2025 and are growing further in 2026, with policies supporting fleet turnover and the adoption of electric trucks. The 2026 scrappage program offers up to 140,000 yuan ($20,800) for replacing an older truck with an electric model. In the US, about 950,000 trucks were sold in 2025, down 2% from the previous year, while sales in Europe fell 5% to 371,000.

China and the US together accounted for 52% of global sales, with Europe contributing 9%. These shares also reflect the type of vehicles used in each market. Delivery vans in Europe, which are not included in these numbers, are typically smaller than those in the US and China.

Growth beyond the largest markets is uneven. Sales in Brazil are growing, while the market in India remains broadly flat.

This report covers medium- and heavy-duty vehicles and excludes light commercial vans, which is a market roughly twice as large. While vans and trucks share some similar technology options, they differ markedly in engineering, manufacturing, energy requirements and customization.

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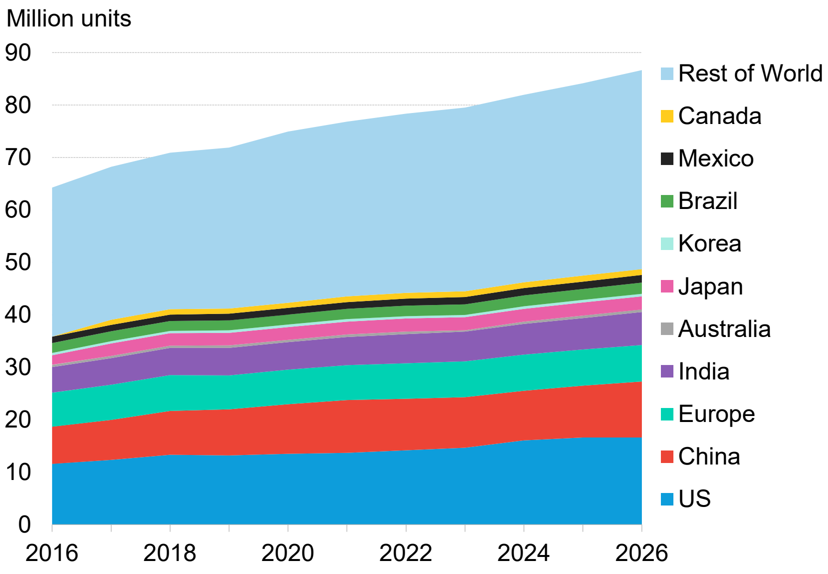
Commercial vehicle growth patterns are shifting globally

Global fleet of commercial vehicles by region



Source: BloombergNEF; see full list of sources in the Appendix. Note: Figures for 2026 are BNEF estimates. Europe includes the EU-27, the UK, Norway, Switzerland, Iceland and Liechtenstein.

The global fleet of medium- and heavy-duty trucks exceeded 84 million vehicles at the end of 2025, up 2.7% in a year. BNEF estimates it will grow another 3% to almost 87 million in 2026.

About 40% of the fleet is concentrated in the US, China and Europe. The US alone has close to 17 million trucks, compared with 10 million in China and 7 million in Europe. India's fleet has been growing rapidly and at about 6 million vehicles it is 14% smaller than Europe's.

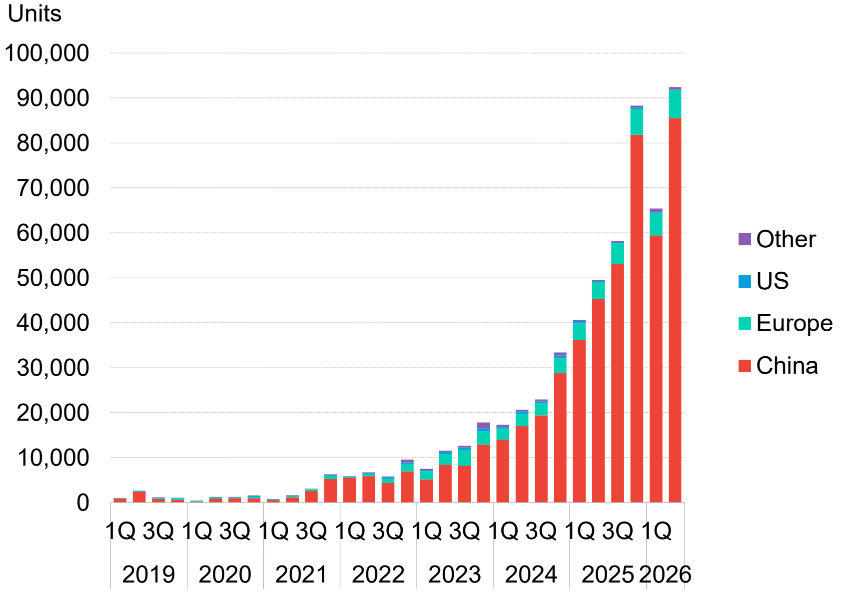
In China, India and markets in the Rest of World segment, the fleet continues to grow. These markets account for more than 90% of the increase in the global fleet in 2026.

That changes how cleaner powertrains enter the market. In Europe and the US, where the fleet is either flat or growing modestly, electric trucks must displace existing diesel vehicles in a slow replacement cycle.

In faster-growing economies, new trucks not only replace existing vehicles but also meet rising freight demand. That gives zero-emission technologies a broader potential market as fleets expand. However, these vehicles must still meet the operational needs of both existing and new users.

Clean truck uptake diverges with China leading and US falling further behind

Global sales of electric and fuel-cell medium- and heavy-duty trucks by region



Source: BloombergNEF; see full list of sources in the Appendix. Note: Europe includes the EU-27, the UK, Norway, Switzerland, Iceland and Liechtenstein.

Global low- and zero-emission truck sales reached almost 158,000 units in 1H 2026, up 75% from a year earlier and more than eight times the 1H 2023 level.

China accounted for more than nine out of 10 vehicles sold, as volumes jumped 78% to nearly 145,000. Scrappage incentives, lower battery costs, battery swapping and a deep supply chain are reinforcing the advantage of SANY, XCMG and other local manufacturers.

Sales in Europe rose 50% to more than 11,200 units as fleets prepared for tighter CO_2 standards. Volvo remains a leading supplier, while Daimler Truck, MAN and Scania are broadening the range of electric models.

The US market is moving in the other direction and sales fell 63% to a few hundred units. The commercial clean-vehicle credit expired, California's Advanced Clean Trucks waiver was overturned and federal emissions standards were weakened.

Sales elsewhere tripled to almost 1,400 units but remained below 1% of the global market. India, Southeast Asia, Latin America and Australia are becoming export outlets for Chinese truck makers, albeit at small volumes.

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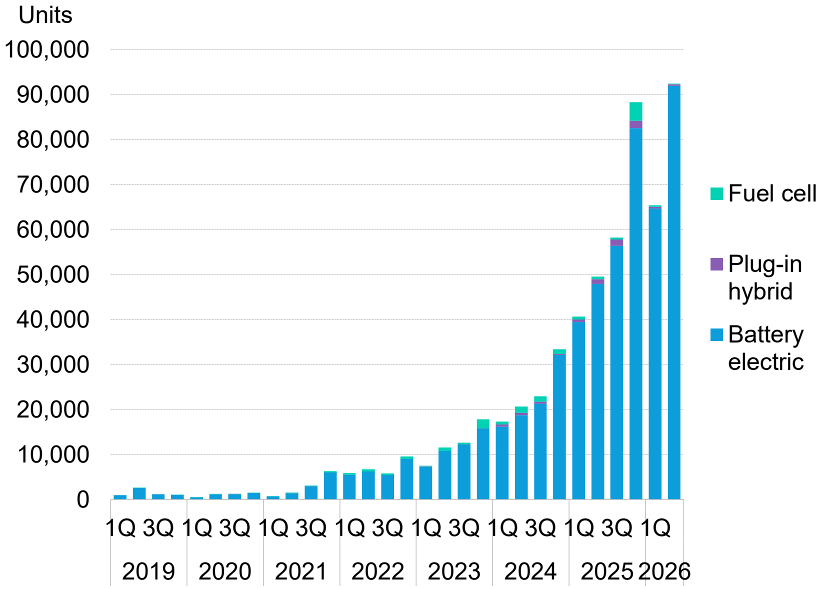
Batteries continue to dominate commercial EV sales as fuel cells retreat

Global sales of electric and fuel-cell medium- and heavy-duty trucks by fuel



Source: BloombergNEF; see full list of sources in the Appendix.

Fully electric vehicles (battery-electric vehicles, or BEVs) now account for virtually all clean truck sales. Volumes rose 79% to almost 157,000 units in 1H 2026, capturing more than 99% of the market. Mature supply chains and falling battery costs have made batteries the default option.

All-battery trucks can cover most urban and regional duty cycles and start to serve longer routes as well. Chinese suppliers use lithium-iron-phosphate (LFP) packs, combined with an expanding charging network and battery swapping. In Europe, electric tractors can drive for 500-600 kilometers and megawatt charging is entering deployment.

Plug-in hybrid trucks remain niche. A brief sales surge in China did not last and about 720 units were sold in 1H 2026, down 56% from a year earlier.

Still, PHEVs outsold fuel-cell trucks, whose sales declined 55%, to just over 500 units, or 0.3% of the market. High vehicle and fuel prices, and sparse heavy-duty truck refueling infrastructure continue to constrain adoption.

As battery range, charging speed and utilization improve, BEVs have taken more of the market once considered addressable by fuel cells. Hydrogen could retain a role in a few demanding duty cycles, but scale and cost advantages now overwhelmingly favor batteries.

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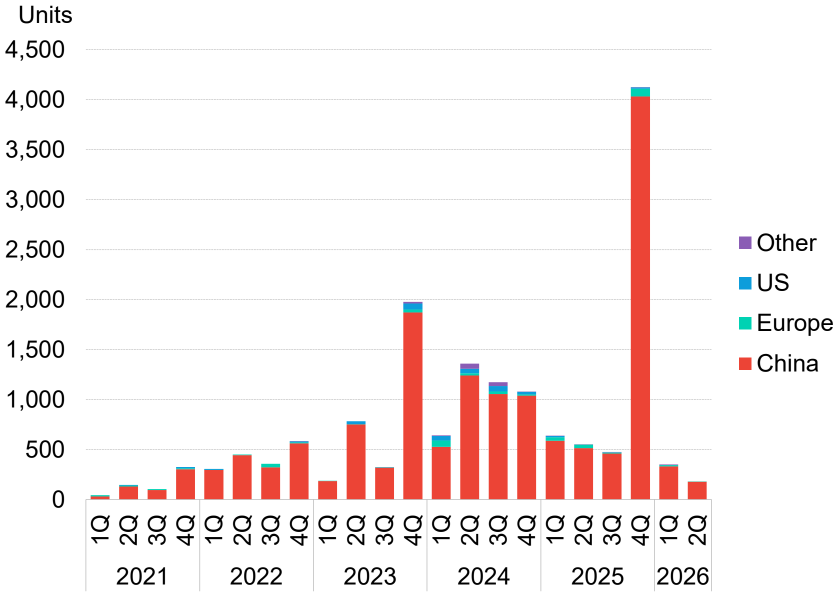
Fuel-cell truck sales continue to slide

Global sales of fuel-cell medium- and heavy-duty trucks



Source: BloombergNEF; see full list of sources in the Appendix. Note: Europe includes the EU-27, the UK, Norway, Switzerland, Iceland and Liechtenstein.

Global fuel-cell truck sales fell 55% year on year to around 530 units in 1H 2026. About 95% of these – 507 units – were sold in China. Still, sales were less than half the level in 1H 2025. The strong sales peak in 4Q 2025 was likely a result of expected policy expirations and sales continued their downward trajectory in 2026.

Sales in the US and Europe were fewer than two dozen units. Startups have largely exited the market, while incumbent manufacturers are still developing the technology. Daimler Truck plans customer deployment of its NextGenH2 from the end of 2026, cautioning that hydrogen infrastructure is still at an early stage.

Hydrogen-combustion trucks are also moving into limited trials and small series production. The technology still shares the same core constraint as fuel cells, as hydrogen fuel remains scarce and expensive.

The prospects for hydrogen in road transport have weakened further in recent years. Vehicle and fuel costs remain high and infrastructure readiness is poor. At the same time, battery-powered trucks have become suitable for an increasing number of use cases, as their costs continue to drop.

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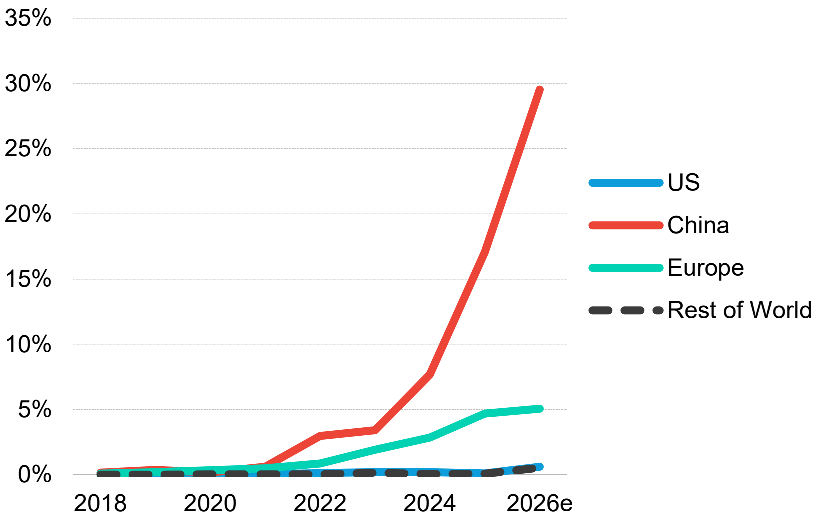
China pulls further ahead in zero-emission truck adoption

Sales share of electric and fuel-cell medium- and heavy-duty trucks by region



Source: BloombergNEF; see full list of sources in the Appendix. Note: The 2026 adoption rate is based on sales from January through June. Includes battery-electric, fuel-cell and plug-in hybrid medium- and heavy-duty trucks.

Regional adoption of zero-emission medium- and heavy-duty trucks diverged sharply in 2025. Electric trucks accounted for 17% of new sales in China and 4.7% in Europe. In the US, adoption rates remained very low, as in the rest of the world.

In China, electric truck adoption has quadrupled since 2024 and should approach 30% of total sales in 2026. The foundations for an emerging technology, such as lower battery costs, strong economics, expanding charging network and policy support, are pushing the market forward.

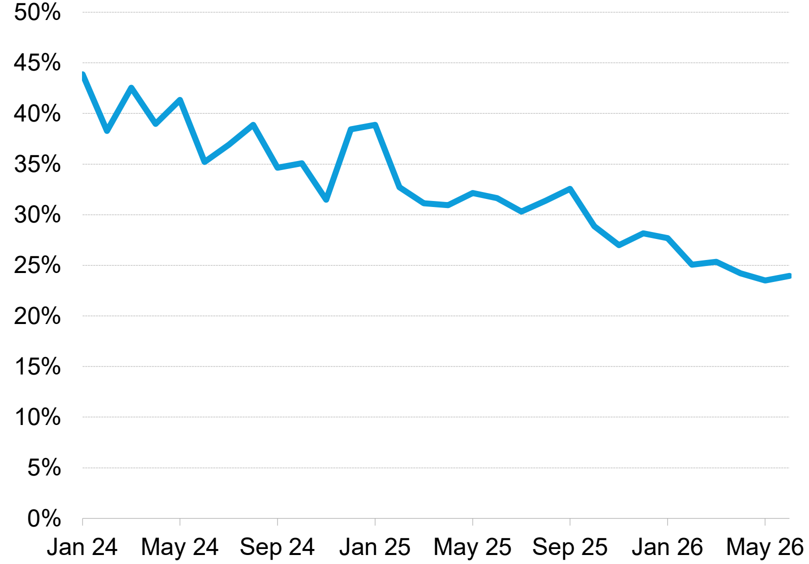
In Europe, adoption also rises quickly albeit not at the pace experienced in China. While sales are growing, high vehicle costs, uneven charging access and fragmented support continue to limit faster expansion.

The US electric truck sales share remains well below 1%. Policy uncertainties at the federal and state level continue to weigh on the market and companies have responded by slowing down development of the supply chain.

Elsewhere, electric truck sales shares increase from a very small base and adoption rates remain low. Chinese manufacturers use electric trucks and buses to enter Latin America, Southeast Asia and Africa, but deployments remain concentrated in a few fleets and duty cycles.

Battery swapping continues to expand, but its share is falling in China

Share of battery-swappable heavy-duty trucks in China's battery-electric truck sales



Source: BloombergNEF, cnworld.cn. Note: Not all trucks capable of battery swapping use this capability; some may instead charge conventionally.

Battery swapping remains part of China's electric-truck story. Sales of electric trucks with swappable batteries increased more than a third in 1H 2026, compared with the same period in 2025. The technology is concentrated in high-utilization, fixed-route work around ports, mines, steel plants and logistics corridors.

Nonetheless, China's electric-truck market has expanded faster than the sales growth of battery-swappable trucks. As a result, the share of sales of these vehicles within all electric trucks dropped more than 10 percentage points throughout 2025. The trend continued and, in June 2026, they accounted for just under a quarter of sales.

Battery swapping offers benefits to manufacturers and operators, such as lower downtime and more efficient financing. However, it requires substantial investment in swap stations and a high degree of standardization across vehicles and battery packs.

CATL had deployed more than 300 QIJI truck-swap stations by April 2026 and plans more than 900 nationwide this year, backed by Sinopec, truck makers and logistics groups.

Outside China, truck swapping remains mostly at pilot scale. Still, in Europe, CATL partnered with Octopus Energy to build a network of more than 30 stations by 2035.

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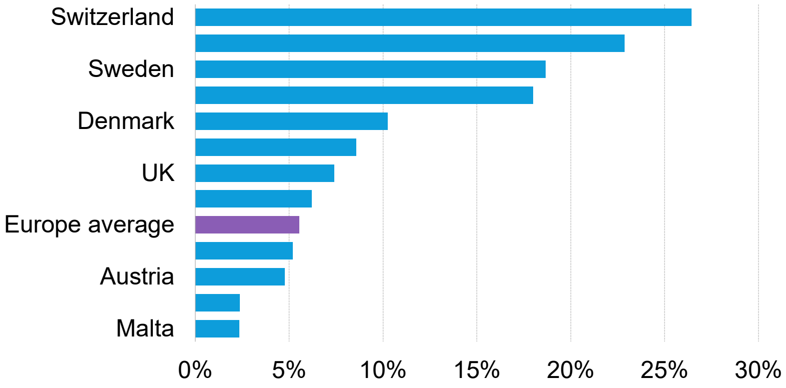
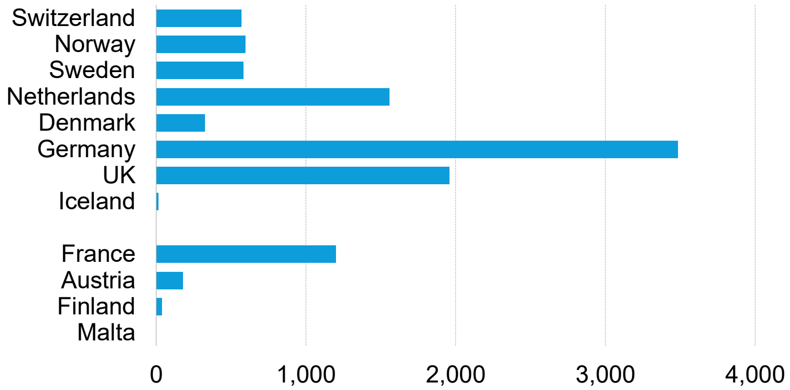
E-truck sales grow steadily in Europe, with a few markets jumping ahead

Electric and fuel-cell truck share of sales, 1H 2026



Electric and fuel-cell truck sales, 1H 2026



Source: BloombergNEF; see full list of sources in the Appendix. Note: Includes medium- and heavy-duty trucks. Includes battery-electric, plug-in hybrid and fuel-cell vehicles.

European electric truck sales rose just over 50% year on year to more than 11,000 units in 1H 2026. Germany was the largest market by volume, with almost 3,500 trucks, followed by the UK at close to 2,000 and the Netherlands at 1,600. Electric trucks have already reached significant sales shares in some markets. Such vehicles exceeded 26% of sales in Switzerland and reached 23% in Norway, 18.6% in Sweden and 18% in the Netherlands. The European average is still relatively low at 5.5%, while five countries exceeded a 10% share.

As electric truck sales expand, operating economics and national policy continue to shape adoption patterns. Purchase subsidies, road tolls and the development of charging infrastructure create different business cases across countries. Urban distribution, municipal services and construction remain the core uses. Long-range tractors and expanding high-power charging corridors are set to further support regional and long-haul routes.

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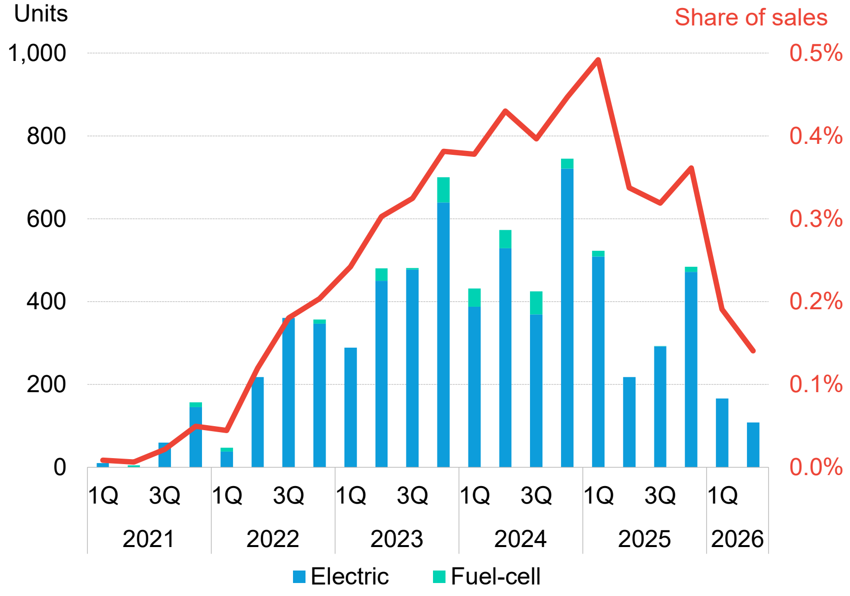
US electric truck market slows to a near standstill

Electric and fuel-cell truck sales and share of sales in the US



Source: BloombergNEF; see full list of sources in the Appendix. Note: Includes battery-electric, plug-in hybrid and fuel-cell vehicles.

The US zero-emission truck market slowed down in 1H 2026, with only a few hundred battery-electric trucks sold. Regulatory uncertainties weigh heavily on the market. At the federal level, the Environmental Protection Agency repealed greenhouse gas standards for medium- and heavy-duty trucks. These targets would have incentivized manufacturers to develop zero-emission vehicle technologies in the near term. In addition, Congress revoked California's Advanced Clean Trucks waiver and the state stopped enforcing waiver-dependent fleet rules. Still, some state policy support remains, such as California's and Texas' purchase and infrastructure grants.

In response, truck manufacturers have reassessed their product strategies in the country. Development of manufacturing plants has slowed and projects have been canceled, with tariffs and other trade restrictions introducing additional uncertainties. As a result, electric trucks remain expensive and the limited fleet means that residual values are also challenging to specify. Higher fuel costs this year due to the US-Iran conflict have not yet offset the dropoff in policy support.

Large truck charging projects are still being developed. For example, WattEV added a seventh California depot in June 2026, and the state awarded more depot grants.

Electric trucking's newer markets

Ambition and activities rise in India, Brazil and elsewhere, even as challenges remain

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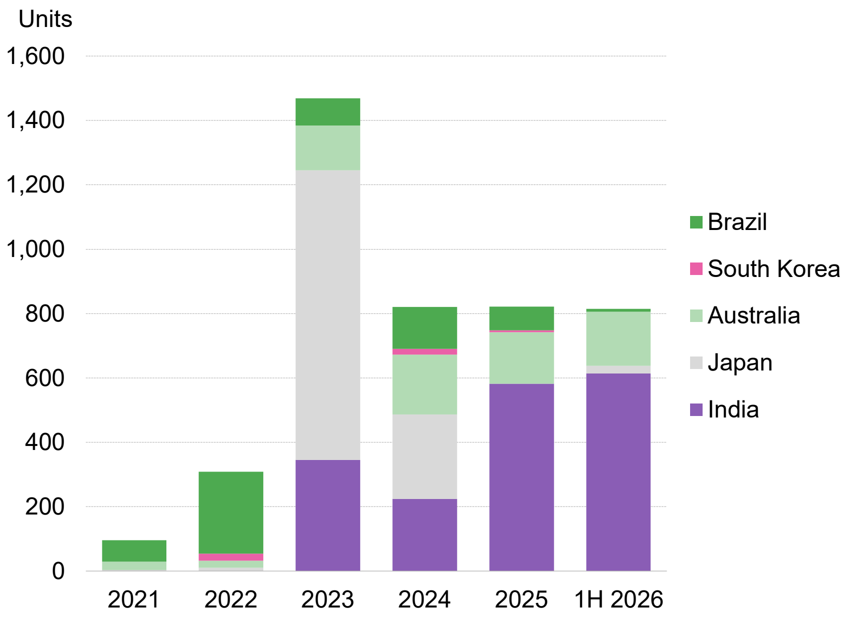
Ambitions are high in India and Brazil for electric trucks despite their small markets

Zero-emission truck sales in selected markets



Source: BloombergNEF; see full list of sources in the Appendix.

Electric truck markets outside China, Europe and the US remain small and uneven with total sales coming in at about 800 vehicles in 2025.

In 1H 2026, electric medium- and heavy-duty truck sales in India were over 600 units and have already exceeded those in full 2025. Several projects and demand from specific sectors are set to further support the market. The PM E-DRIVE truck program targets the deployment of more than 5,000 trucks with a total budget of 5 billion rupees ($52.4 million).

In South America, electric trucks are being deployed in live route operations, following trials in earlier years.

In Chile, Maersk and Sotraser use Volvo and Foton heavy trucks from a 1.2MW charging site serving urban, port and mining routes. In Australia, a dedicated truck charging hub opened in December 2025, albeit for lighter trucks, and an A$70 million financing package supports local manufacturing and offers discounted leases and residual value financing.

In Brazil, the e-Dutra project was launched in November 2025. It aims to support the movement of 1,000 electric trucks daily along a corridor connecting Sao Paulo to Rio de Janeiro.

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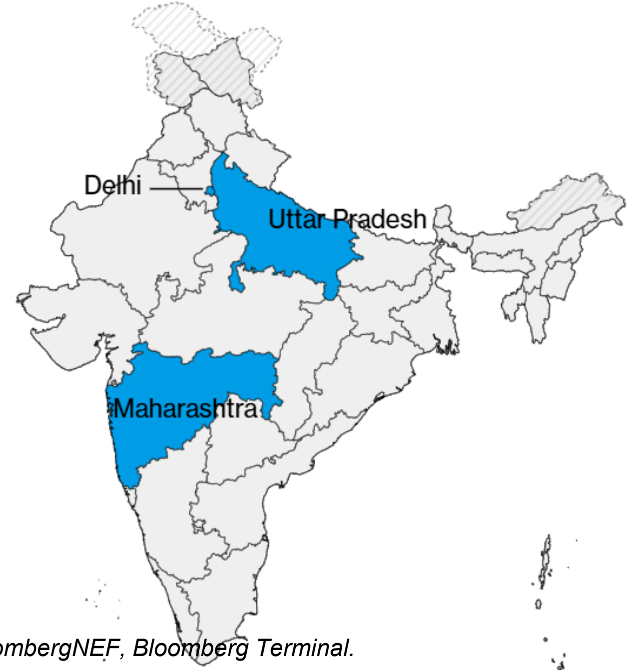
India offers limited policy support for electric heavy commercial vehicles

Indian states that offer vehicle purchase subsidies to electric commercial vehicles



Source: BloombergNEF, Bloomberg Terminal.

In India, policy support for EV adoption in the commercial vehicle segment remains limited, with most measures focused on light-duty commercial vehicles (LCVs). However, heavier trucks are beginning to benefit from federal subsidies and initiatives in the Delhi capital region.

At the **federal** level, vehicle purchase subsidies were available for electric LCVs between 2015 and 2019.

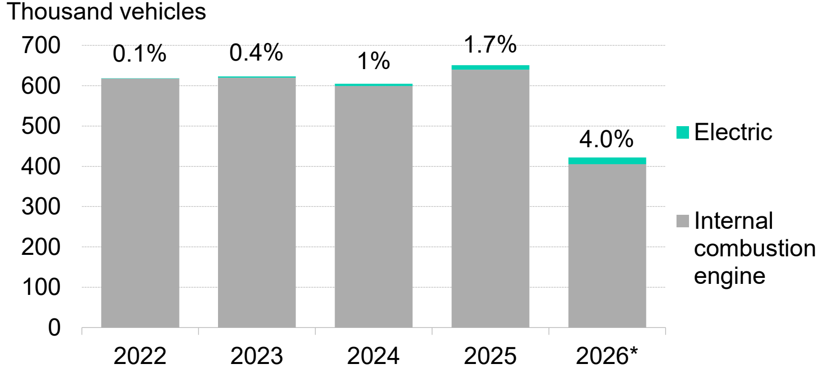
In 2024, the government launched its first-ever demand-side incentive for heavier electric trucks, which became operational in July 2025. Goods-carrying vehicles weighing 3.5 metric tons or more are eligible for subsidies. The subsidy is capped at the lowest of three values: 5,000 rupees ($52) per kilowatt-hour of vehicle battery capacity, 10% of the ex-factory price, or the applicable weight-based cap. As with China’s scrappage scheme, beneficiaries must scrap older vehicles to qualify.

Only **four out of 36 states and union territories** (geographic areas governed by the federal government) – Maharashtra, Chandigarh, Delhi and Uttar Pradesh – offer vehicle purchase incentives for commercial vehicles. While all four subsidize electric LCVs, only Maharashtra extends purchase incentives to medium- and heavy-duty trucks.

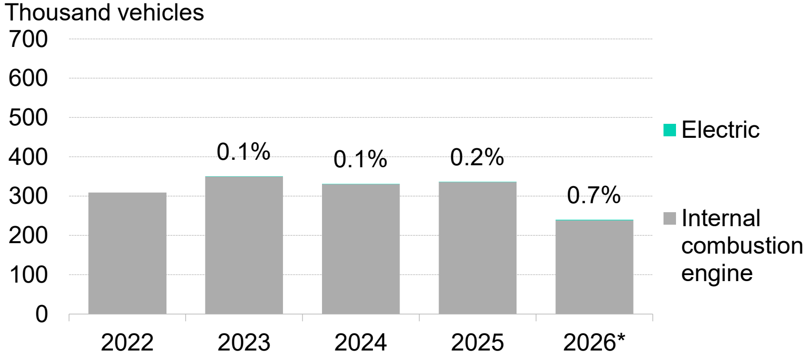
Electric trucking's newer markets

Vans and lighter trucks dominate EV uptake in India

India's light commercial vehicle sales by drivetrain, and share of electric



India's medium- and heavy-duty commercial vehicle sales by drivetrain, and share of electric



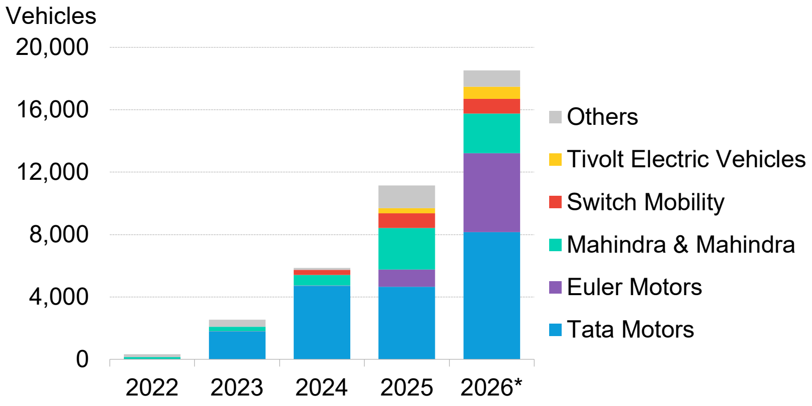
*Source: India's Ministry of Road Transport and Highways, BloombergNEF. Note: *2026 data until August 31. Percentages above bars signify EV share of total sales.*

Nearly 18,700 battery-electric commercial vehicles have been sold in India so far this year, surpassing 2025 totals by 59%. Electric vehicles account for 2.8% of all commercial vehicles sold in India. Around 91% of all commercial EVs sold so far in 2026 were light-duty. Demand is driven by companies looking to decarbonize their last-mile and intra-city delivery and logistics fleets.

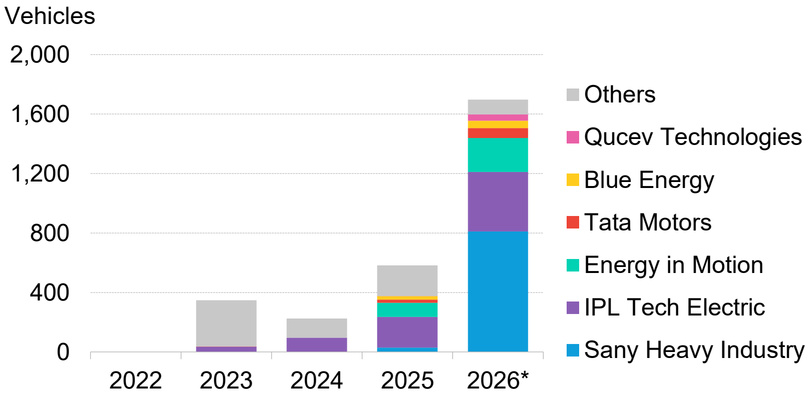
Sales of heavier electric trucks have surpassed 1,650 vehicles so far in 2026, nearly triple the 2025 total. Slower electrification in the sector is due to higher costs, lack of comprehensive policy support and a shortage of suitable electric models. Demand is emerging from pilots focused on duty cycles that cover relatively short distances over closed-loop routes, such as port operations. A notable use case is taking place in the cement sector with heavy-duty electric trucks transporting intermediate products.

Chinese truck makers are securing electric truck volumes in India

India's light commercial vehicle sales by manufacturer



India's medium- and heavy-duty commercial vehicle sales by manufacturer



*Source: India's Ministry of Road Transport and Highways, BloombergNEF. Note: *2026 data as of Sept. 16.*

Tata Motors has been the top seller of electric light-duty commercial vehicles in India since 2023. While the company's sales volumes have remained stable, its market share has declined in recent years as Euler Motors and Mahindra & Mahindra have gained ground.

In heavier segments, Murugappa Group-backed IPLTech Electric has historically led the market. Still, since 2025, more automakers have begun selling electric trucks and tractors. Some of the players rapidly gaining market share are Chinese, such as Energy in Motion (EIM) and Sany Heavy Industry. EIM, backed by solar project developer Ravindra Energy, sells battery-swappable heavy electric trucks developed by Beiqi Foton Motor. As of Sept. 16, Chinese manufacturers account for over 61% of the relatively small market for heavier electric trucks in India.

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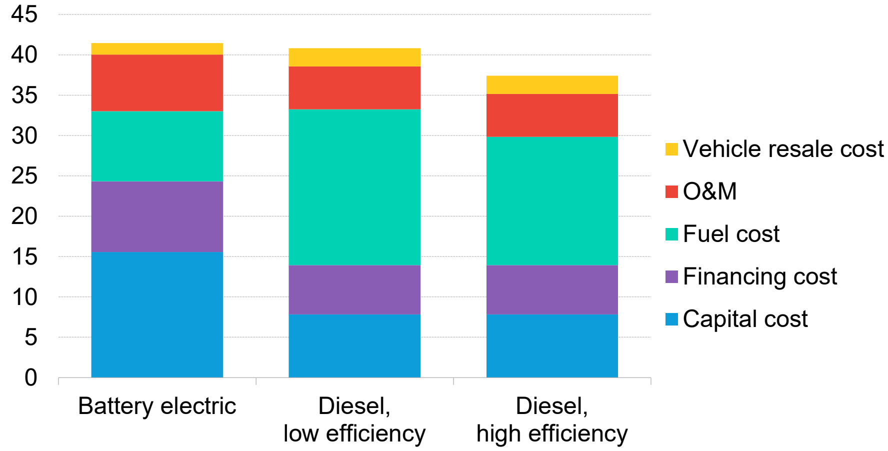
Electric truck prices remain high, but cost parity is still possible

Total cost of ownership of 55-metric-ton battery-electric and diesel trucks in India



Source: Smart Freight Centre, BloombergNEF. Note: O&M refers to operation and maintenance. Cash flows have been discounted using a weighted average cost of capital of 11%. Assumes trucks cover 250 kilometers per day with usage of 320 days per year. High diesel efficiency is 3.4 kilometers per liter (8 miles per gallon, or mpg) and low diesel efficiency is 2.8 kilometers per liter (6.6 mpg). Battery truck efficiency is 1.18 kilowatt-hours per kilometer. For detailed assumptions, see Appendix.

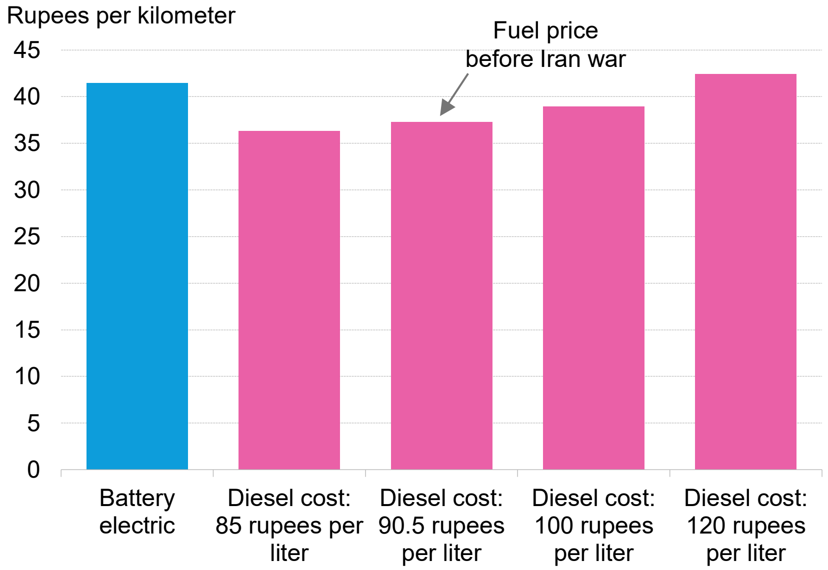
In India, the total cost of ownership (TCO) of a 55-metric-ton electric truck covering 80,000 kilometers per year remains between 5% and more than 15% higher than that of a diesel equivalent today, depending on the combustion engine vehicle's efficiency (for other assumptions underlying the calculations, see Appendix).

Various levers can close the cost gap, with some being policy-driven and others based on operational characteristics. Some of these levers include:

- A 55-ton battery-electric truck currently costs nearly twice as much as an equivalent diesel truck. At the lower end of the TCO difference, a subsidy of about 28% on the electric truck's upfront price could bring its TCO to parity with diesel.
- In turn, charging costs need to be about 5 rupees per kWh – about 42% lower than current electricity tariffs – to close the TCO gap, when diesel costs just about 94 rupees per liter.
- Higher mileage can also help due to the high efficiency of electric drivetrains. Increasing average utilization by about 88% to 470 kilometers per day helps reach parity between the two technologies.

Fuel price hikes in India bring battery trucks closer to outright parity

Total cost of ownership of 55-metric-ton battery-electric and diesel trucks in India



Source: Smart Freight Centre, BloombergNEF. Note: Total cost of ownership corresponds to high efficiency diesel. For detailed assumptions, see Appendix.

As fuel prices make up the bulk of TCO, any variation in diesel costs will notably impact the TCO premium of electric trucks. Diesel prices as high as 100 rupees per liter would make electric trucks only about 7% more expensive, with cost parity reached at just under 120 rupees per liter. Relative to low-efficiency diesel trucks, TCO parity is achieved at fuel costs of less than 100 rupees per liter.

This sensitivity has become more relevant as geopolitical tensions expose India to higher fossil-fuel costs. The country deregulated retail fuel pricing years ago, but the government had effectively frozen pump prices for nearly four years.

That changed in May 2026 when state-run refiners, which control most of the retail market, raised prices for the first time since 2022. Current diesel rates are 95.20 rupees per liter in Delhi, 97.97 rupees in Mumbai and 99.56 rupees in Chennai.

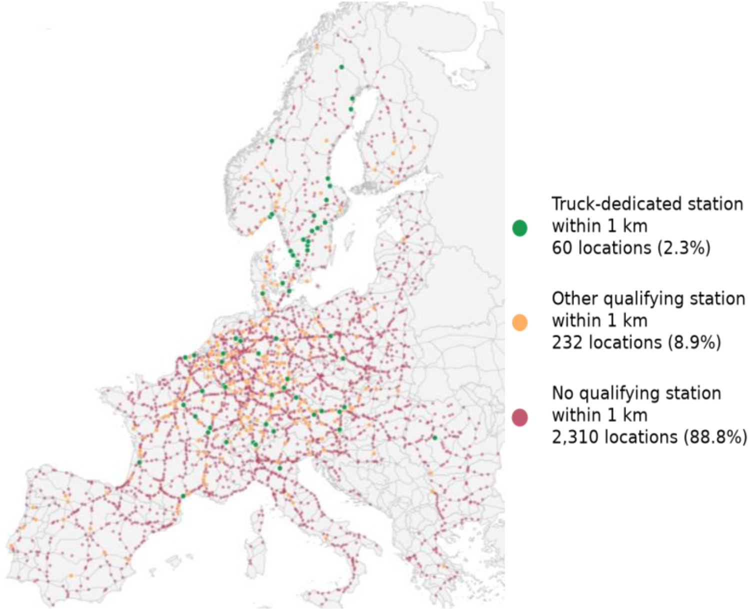
The cost trajectory for electricity has been more stable. India's average commercial electricity tariffs – typically the tariff paid by charging point operators – have grown at a compound annual growth rate of 1.2% over the past 10 years.

Electric truck charging

Charging infrastructure expands to support more duty cycles

European charging coverage at key truck parking sites is low but growing

European charging coverage versus truck parking sites



Source: BloombergNEF, Fraunhofer, Amazon, Eco-Movement. Note: Each dot represents a truck parking site identified in the Fraunhofer analysis. Green dots indicate sites with at least one 350-kilowatt charger.

Enabling long-haul operations for battery-electric trucks requires the development of vehicles with suitably high driving ranges and adequate charging infrastructure.

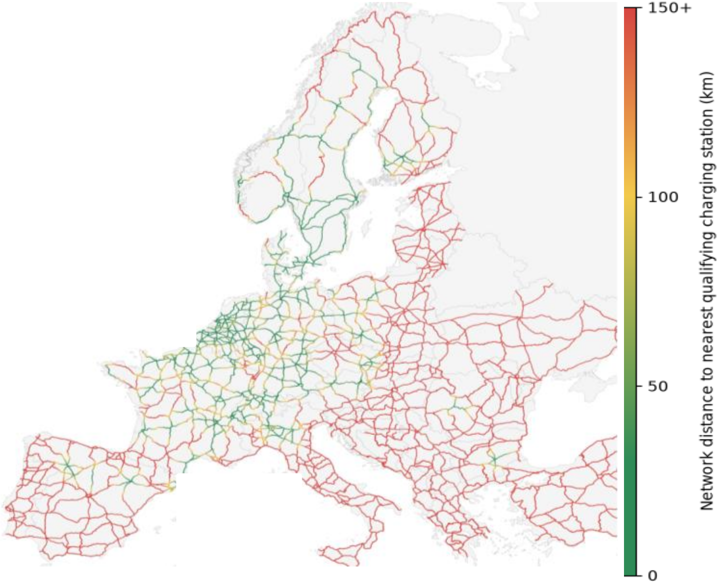
Demand centers for cargo and consumer products shift only gradually over time. Therefore, truck chargers will likely need to be built alongside existing logistics infrastructure, such as highway truck stops.

Suitable truck charging stations are already being developed along freight routes in Europe. Still, as of June 2026, less than 2.5% of truck stops are within one kilometer of a dedicated truck charging station equipped with chargers that can dispense at least 350 kW. Another 9% of truck stops are within one kilometer of charging stations that can serve electric trucks with high-power charging, alongside passenger cars.

The dataset of truck stops was produced by Fraunhofer and Amazon. It selects truck stops using projected freight flows in 2030, driving break requirements and limits on how many trucks each site can serve. Nonetheless, it remains uncertain whether the necessary grid connections exist to build charging stations near these truck stops.

Truck charging coverage on European freight corridors expands, but remains patchy

Distance to nearest commercial vehicle charging station



Source: BloombergNEF, Eco-Movement. Note: The analysis considers stations within 3 kilometers of the TEN-T network that meet the 2025 Alternative Fuels Infrastructure Regulation (AFIR) requirements of at least two 350-kilowatt chargers and at least 1,400 kilowatts of total power.

The European Union has set ambitious targets for the development of truck charging stations along the TEN-T network of major highways across the continent.

Suitable chargers and stations that meet the targets of the EU's Alternative Fuels Infrastructure Regulation (AFIR) are already in place. These are mostly concentrated in Central and Northern Europe, including Germany and Scandinavia. Large parts of the TEN-T network there are within 25 kilometers of charging stations with six or more chargers with a power of at least 350 kW.

Coverage is far lower elsewhere, especially in Southern and Southeastern European countries such as in Spain, Italy and Greece. There, some TEN-T routes are more than 300 kilometers away from a qualifying station.

Long gaps in the charging network can hinder route planning and deployment of electric freight by limiting operational flexibility.

Methodology: The TEN-T core, extended core and comprehensive road networks were split into segments of no more than 5 kilometers and colored according to the shortest distance to the nearest qualifying charging station.

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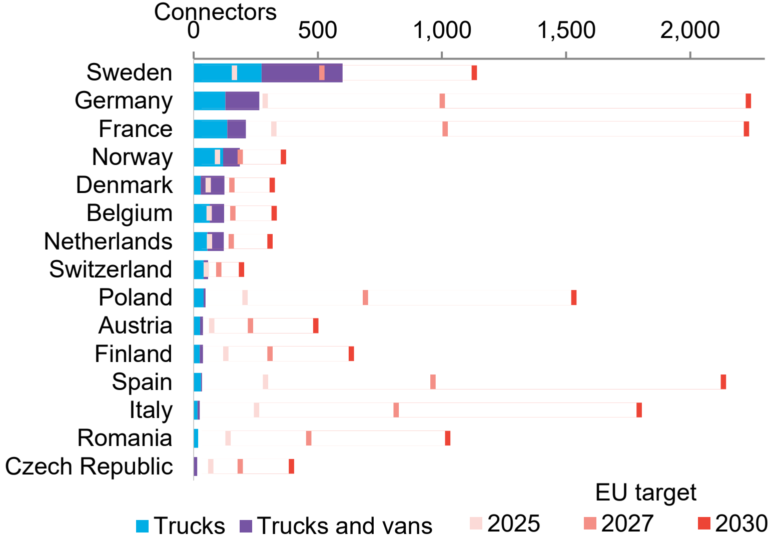
Electric truck charging

Truck charger installations still follow adoption, even as EU targets add pressure

Installed truck connectors as of June 2026 versus chargers needed to meet EU target, by market



Source: BloombergNEF, Eco-Movement, European Commission. Note: Alternative Fuels Infrastructure Regulation connector targets are modeled by BNEF and represent the minimum infrastructure required. Includes only commercial vehicle connectors installed within 3 kilometers of TEN-T roads.

The EU's recently proposed Electrification Action Plan marks the latest major government effort to boost truck electrification. The plan builds on truck charger targets under the bloc's existing AFIR and aims for a 40% battery-electric fleet share, supported by the deployment of sufficient grid connections for heavy-duty vehicle charging infrastructure.

By 2030, AFIR requires complete coverage along the TEN-T road network within the EU. Stations should be located between 60 and 100 kilometers apart in each driving direction and have between 1.5 and 3.6 megawatts of charging power depending on their location in the network. The development of the charging network along freight corridors will help advance the adoption of electric trucks across numerous duty cycles.

Deployment of truck charging stations differs widely by country. Most chargers are concentrated in countries with high electric-truck adoption, such as Sweden, Germany, France, Norway, even though the total truck fleet is more widely distributed across Europe.

Some countries are closer to their targets than others. The number of truck chargers in Sweden, Norway and a few other markets has likely exceeded the requirements under AFIR. Deployment lags far behind targets elsewhere, including in Germany, France, Poland and Spain.

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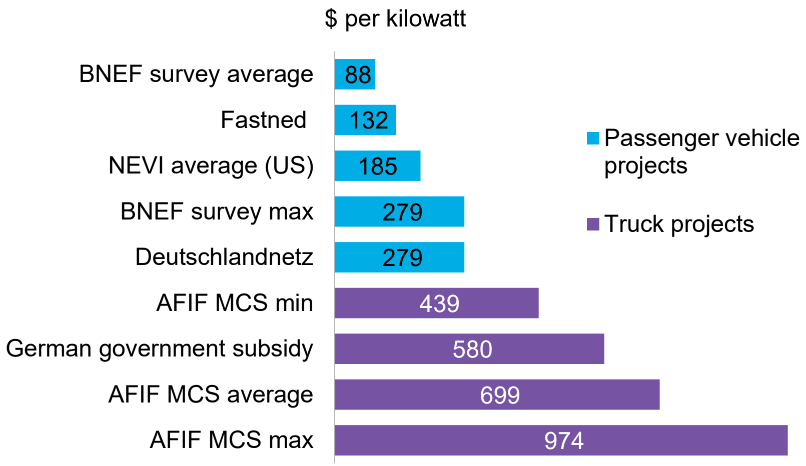
The costs for megawatt chargers exceed those for passenger vehicles

Megawatt charging versus fast-charger project costs



Source: BloombergNEF, Fastned, European Commission, German Federal Ministry of Transport (BMV). Note: Survey data refer to BNEF's survey of project costs for stations with chargers rated above 100 kilowatts. MCS refers to the Megawatt Charging Standard; data are from grant recipients under the European Alternative Fuels Infrastructure Facility (AFIF).

High-power – in particular, megawatt-level – charging is set to play an important role in the wider adoption of electric heavy-duty trucks serving some of the most demanding applications, such as those of carrying cargo over long distances. The deployment of megawatt charging will depend on whether it is less costly to increase truck driving range through larger batteries or build a denser, megawatt-capable charging network.

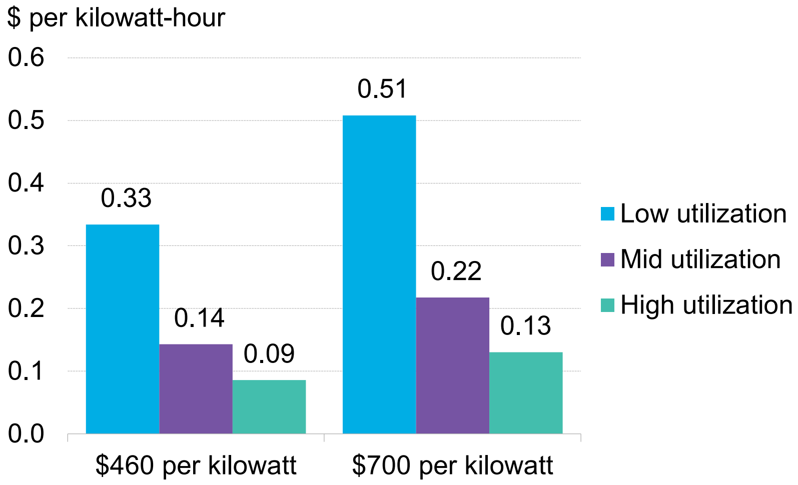
Capital costs for such stations are becoming clearer as more are being built and government funding flows into the sector across Europe. Data from the EU's Alternative Fuels Infrastructure Facility indicate that costs for projects which install megawatt chargers exceed $400 per kilowatt and can reach close to $1,000 per kilowatt.

High-power chargers for passenger cars average less than $90 per kilowatt, according to data collected by BNEF, while Fastned's costs are around $130 per kilowatt.

While there is a difference between project costs for cars and trucks, results may not be directly comparable, depending on whether stations include the relatively high costs of grid connections. High-power truck charging stations are more likely to require a larger, and potentially upgraded, grid connection.

Truck charging costs can be affordable for fleets due to high throughput

Public megawatt charging price above delivered electricity cost needed for a 20% return over 10 years, by capex scenario



Source: BloombergNEF. Note: Assumes annual maintenance and operating costs equal to 7% of original capital expenditure. For the low-, mid- and high-utilization scenarios, average charging power is 350, 600 and 1,000 kilowatts, respectively, and daily utilization is 2.2, 3 and 4 hours.

The large investments required to build megawatt-level charging stations affect the price of electricity and, therefore, the competitiveness of heavy-duty electric trucks in long-haul operations. The economics of megawatt charging projects vary widely with utilization, the average charging power, and the cost to build the station.

In addition to the cost of electricity delivered to users, operators add a margin to make a return on their investments. That additional cost ranges widely, from $0.09 per kilowatt-hour to at least $0.51 per kWh in the scenarios analyzed by BNEF.

The lower end of that range corresponds to low capital costs and relatively high utilization given the small size of Europe's current electric truck fleet. That can result in competitive electric truck economics, with truck drivers paying less than passenger car drivers.

By contrast, high capital costs and lower utilization can raise the cost of charging at a megawatt-capable station enough to wipe out the fuel efficiency advantage of electric trucks.

These estimates highlight how the initial buildout of high-power truck charging stations is best focused on favorable locations with high traffic and accessible power.

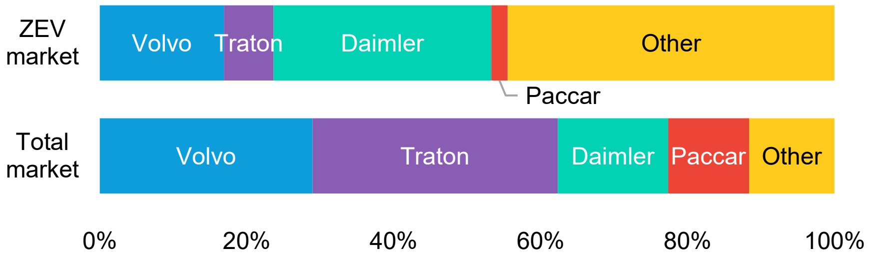
Manufacturers

Electrification opens door for newcomers as Chinese players expand abroad

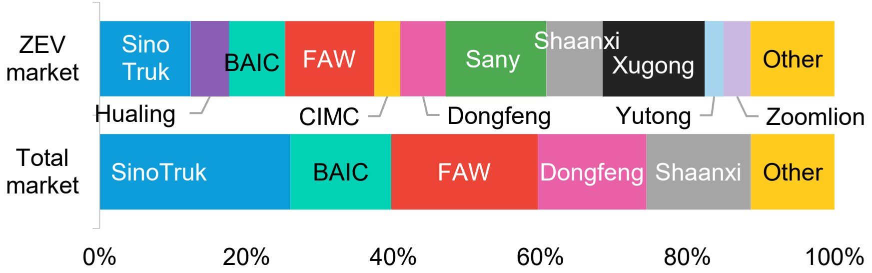
BloombergNEF

Challengers use electric trucks to break barriers in a hard-to-enter market

Manufacturer market shares in Europe



Manufacturer market shares in China



Source: BloombergNEF; see full list of sources in the Appendix. Note: Shows shares of medium- and heavy-duty trucks, as defined in the Appendix, in 2H 2025-1H 2026. ZEV refers to zero-emission vehicles and includes battery-electric and fuel-cell trucks.

Truck manufacturing requires significant long-term investments, depends on established and deep supply chains, and relies on exceptional product quality. These characteristics have created significant barriers to entry.

Electrification is offering a limited window of opportunity for new entrants to capture market share. These companies are not necessarily startup manufacturers, but corporations – sometimes well-capitalized – from adjacent sectors.

Europe's largest manufacturers make up almost 90% of the total market but just over a third of zero-emission vehicle (ZEV) sales. Specialist producers, large e-van makers and retrofitters make up the rest.

Startup manufacturers have gained little market share in Europe or the US. Still, newcomers like Harbinger Motors, XoS, Workhorse and others produce and sell electric trucks in the US.

Similarly in China, just five companies account for about 90% of overall sales. However, more than twice as many have sizable market shares in the ZEV market, with several having no prior strong experience in truck manufacturing. Companies such as Hualing, CIMC, Sany, Xugong, Yutong and others are machinery, rolling stock or bus manufacturers, with little or no combustion-engine truck production.

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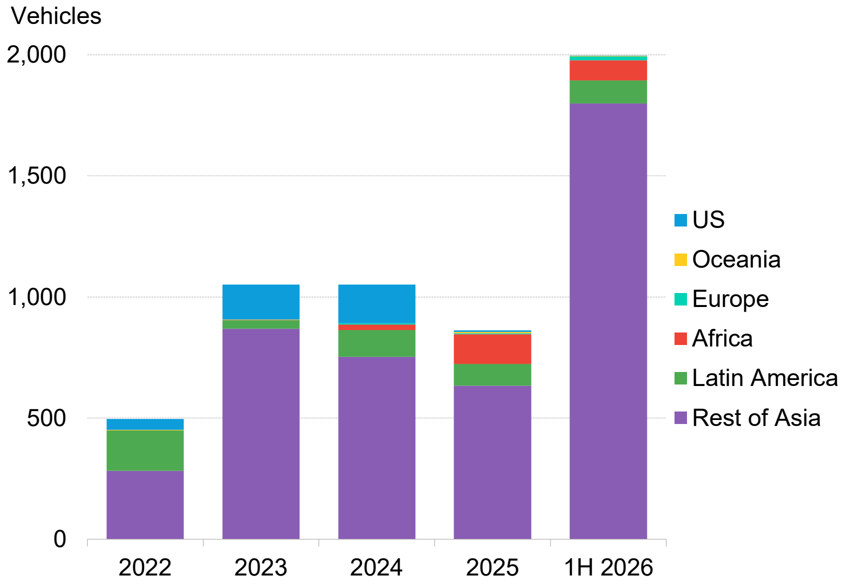
Chinese electric truck exports soar but protectionism may stymie progress

China's exports of electric on-road heavy-duty truck tractors



Source: BloombergNEF, General Administration of Customs of the People's Republic of China.

Chinese electric truck makers are expanding overseas as the domestic market becomes fiercely competitive. Over the first half of 2026, China's electric on-road tractor exports grew to nearly 2,000 vehicles, more than double full-year 2025 exports in the segment.

Over half of China's e-tractor exports went to India, with Vietnam and Thailand being the next top destinations. In addition to e-tractors, demand for electric mining trucks has also been rising in Southeast Asia and Australia, with Chinese manufacturers seizing the opportunity.

With a mature domestic value chain, Chinese electric truck makers are able to deliver at speed and scale. For example, equipment manufacturer Sany cited a maximum daily production capacity of 240 electric trucks, while it reported an overseas order of 880 electric tractors in June. Other major Chinese exporters include XCMG and BYD. Each has delivered around 200 electric medium- and heavy-duty trucks in other markets in 1H 2026, according to BNEF estimates.

However, protectionist policies may hinder the global expansion of Chinese truck makers. This June, India launched an anti-dumping investigation concerning electric tractor imports from China. India may consider raising import duties on tractors to 40%, from the current 10% following pressure from domestic automakers.

BloombergNEF

Chinese electric truck manufacturers are gaining traction abroad

Manufacturer	Vehicle types	Regions and markets
BAIC Foton / Auman / Aumark	Light-duty trucks Heavy-duty trucks	Thailand >700 delivered in Thailand
BYD eTrucks	7.5 metric ton trucks Class 8 tractors	US, Netherlands, Brazil 200 US and 10 NL orders; ~45 operating in Brazil
SANY Truck / Mining	Terminal tractors Mining trucks	India, Thailand, Indonesia 20 delivered in India; port + mining fleets
XCMG Automobile	Heavy-duty trucks Mining trucks	Thailand, Guinea, Southern Africa 300 Thailand orders; 30 operating in Guinea
SAIC Hongyan	Heavy-duty trucks	Thailand 1,000-unit deal; first batch shipped
江汽集团 JAC GROUP JAC light trucks	Light-duty trucks	France, Spain, Mexico, Brazil 100 deliveries in both Europe and Mexico
SUPERPANTHER eTopas 600	Heavy-duty tractors	Several European countries Series deliveries started in Europe

Source: BloombergNEF, company announcements, news reports. Note: The list is indicative and shows various manufacturer brands. Numbers show a combination of orders, deliveries and trials.

Chinese manufacturers active in other markets deploy electric trucks in applications that have already shown promise in the domestic market. Their models abroad operate in existing areas of expertise, including in applications such as urban logistics, port drayage, mining and transport along fixed, return-to-base routes.

Some major destinations for these manufacturers are in Southeast Asia, such as Thailand, as well as in South America and Africa.

Producers of machinery, buses and batteries, as well as electric truck-only players are using the new technology as a foothold in trucking and in foreign markets where competition among e-truck makers is less intense.

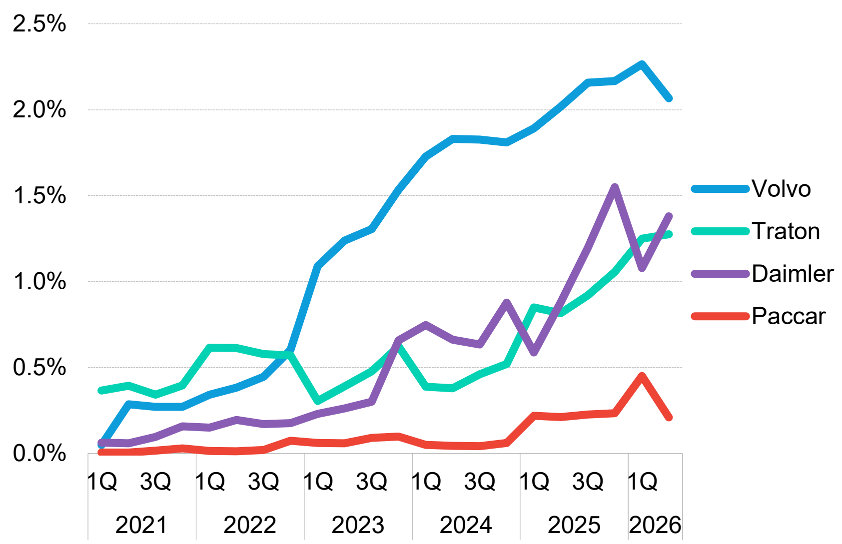
Typically, companies enter a market using trials and by collaborating closely with large fleets. They then move to provide services, such as maintenance and parts, as well as charging. Only after that do they attempt to establish some form of local production.

Other Chinese manufacturers exploring overseas markets with deliveries and trials include Yutong, Sinotruck, Farizon, DeepWay, Brenton and Tonly.

Manufacturers

Europe, US incumbent truck makers' ZEV sales grow modestly

Global zero-emission vehicle share of sales for Volvo, Daimler, Traton and Paccar



Source: Bloomberg Terminal, BloombergNEF, company reports. Note: Shows each manufacturer's year-to-date zero-emission vehicle share of medium- and heavy-duty truck and bus sales.

Some of the largest global truck makers are broadening their ZEV product portfolios, but sales remain far below their 2030 ambitions. Adoption rates of zero-emission trucks and buses remain at around 2% or less for Daimler, Volvo, Traton and Paccar in 1H 2026. In the last few months, ZEV orders for the Europe-based manufacturers have caught up with sales, implying a relatively muted short-term outlook.

Still, they are introducing new vehicles, primarily in Europe, targeted at a variety of use cases including long-haul operations. Volvo launched the FH Aero Electric with a range of 700 kilometers (435 miles), and DAF started series production of its XG long-haul models in May 2026.

Incumbents continue to adjust their electrification manufacturing plans. Volvo now expects to start producing battery cells at the Mariestad plant in Sweden after 2030. In the US, Daimler, Paccar, Cummins and EVE Energy – partners of the Amplify battery cell joint venture – deferred development of their 21-gigawatt-hour plant. Daimler also canceled the development of a battery-electric truck platform in the country.

These manufacturers are streamlining operations and implementing cost-cutting programs to weather the volatile truck market and trade uncertainties. Building the manufacturing plants and supply chains necessary for battery-electric truck production remains costly.

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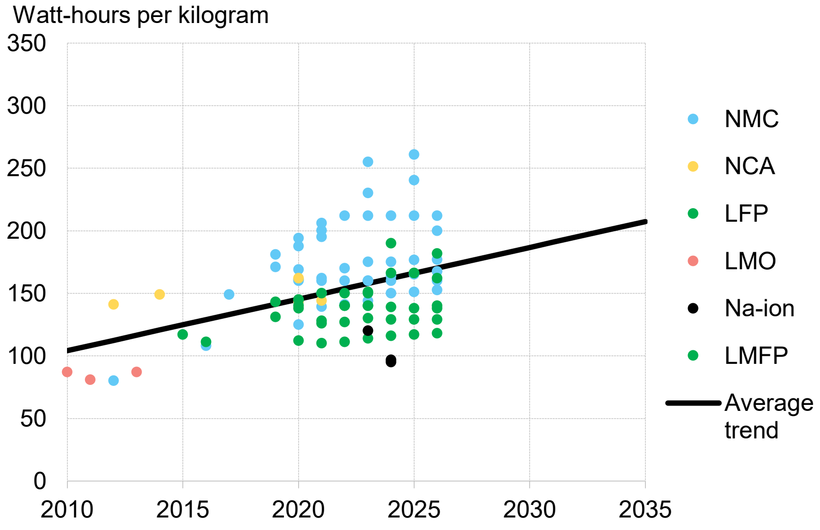
Technology and economics

Batteries improve and expand the addressable market for electric trucks

BloombergNEF

Batteries have steadily improved over time

Historical and estimated changes to battery-pack energy density



Source: BloombergNEF. Note: NMC is nickel manganese cobalt oxide; NMCA is nickel manganese cobalt aluminum oxide; NCA is nickel cobalt aluminum oxide; LFP is lithium iron phosphate; LMFP is lithium manganese iron phosphate; LMO is lithium manganese oxide; Na-ion is sodium ion.

Battery technology improves continuously as companies accumulate more fundamental knowledge and build up manufacturing experience. One metric of that improvement is the average battery pack energy density, which directly impacts vehicle efficiency and cost.

The average energy density of electric vehicle packs varies widely with chemistry and ranged from around 120 watt-hours per kilogram (Wh/kg) to over 250Wh/kg in 2025. It has been growing at about 2.7% annually and, based on the current trajectory, is set to surpass 200Wh/kg by 2035.

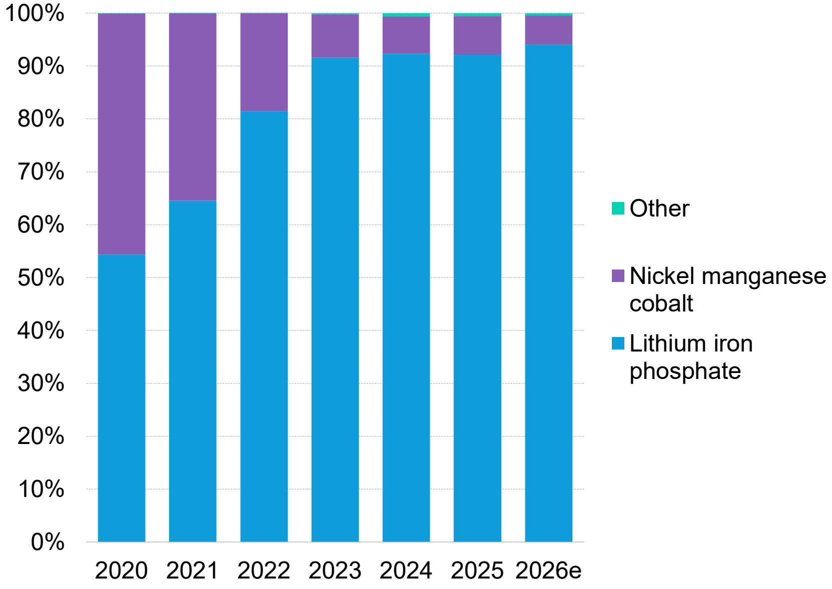
Nickel manganese cobalt oxides have the highest energy density. Production versions of these batteries routinely exceed 200Wh/kg, and the trend may be accelerating. To date, most of these high-performing batteries have been deployed in passenger electric cars.

Lithium iron phosphate technology, which is used in most e-trucks, also continues to progress. These batteries have lower energy densities than NMC, but have longer lifetimes and are cheaper. Chinese battery makers dominate the technology and supply chain for these packs, though production is also increasing elsewhere.

Batteries with higher energy density have lower material and manufacturing costs and are lighter, resulting in higher vehicle efficiency.

Truck makers are turning to lower-cost LFP batteries

Battery cathode chemistry mix of electric medium- and heavy-duty truck sales



Source: BloombergNEF, EV Volumes. Note: Includes batteries used in vans, trucks and buses.

Lithium iron phosphate (LFP) batteries dominate commercial vehicles and buses. More than 90% of capacity deployed in trucks in 2025 used the chemistry, and the share is set to grow further.

LFP combines low cost, safety and long cycle life. Although energy density is often 20-30% below NMC, cell-to-pack design and durability offer advantages for fleet owners.

While LFP deployment was concentrated mostly in China, more truck makers are using the technology in their battery truck platforms. In 2025, more than half of total battery capacity installed in commercial vehicles outside of China was based on LFP.

Daimler and Paccar are set to use the chemistry in their US vehicles, following construction delays at a plant run by their Amplify joint venture. Daimler has also equipped the long-haul eActros 600 with 621kWh LFP packs for the European market.

Traton’s brands, Scania and MAN, are focused more on nickel manganese cobalt oxide (NMC) technology but are investing increasingly in LFP. Volvo uses nickel cobalt aluminum oxide (NCA) chemistries in its trucks.

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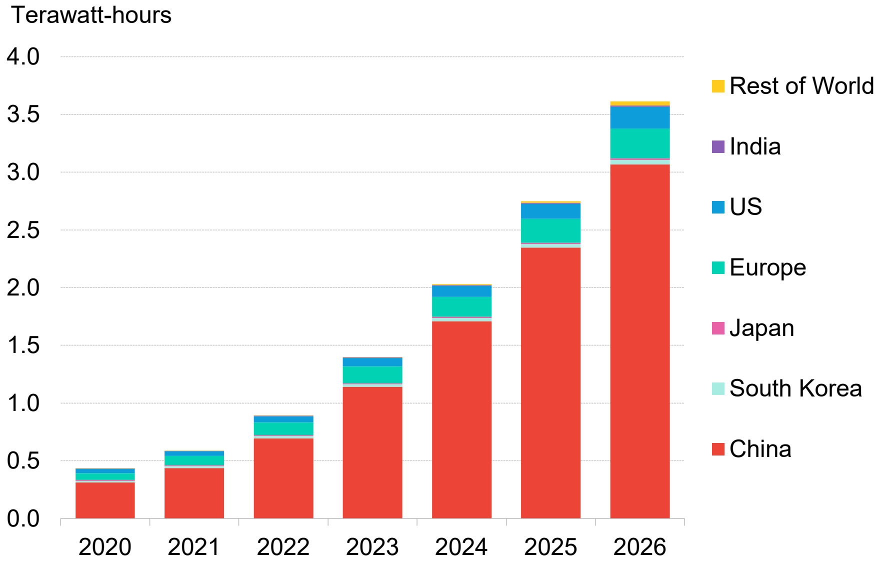
Battery manufacturing capacity keeps increasing globally

Lithium-ion battery cell manufacturing capacity, commissioned and planned



Global battery manufacturing capacity is on track for eightfold growth between 2020 and 2026, and BNEF expects it to more than double again by 2030. While heavily concentrated in China, new cell manufacturing capacity in Europe – and increasingly in the US – is ramping up to support demand, primarily driven by the passenger car market. This could see China's share of global cell manufacturing capacity drop to 81% by 2030, from 85% at the end of 2026.

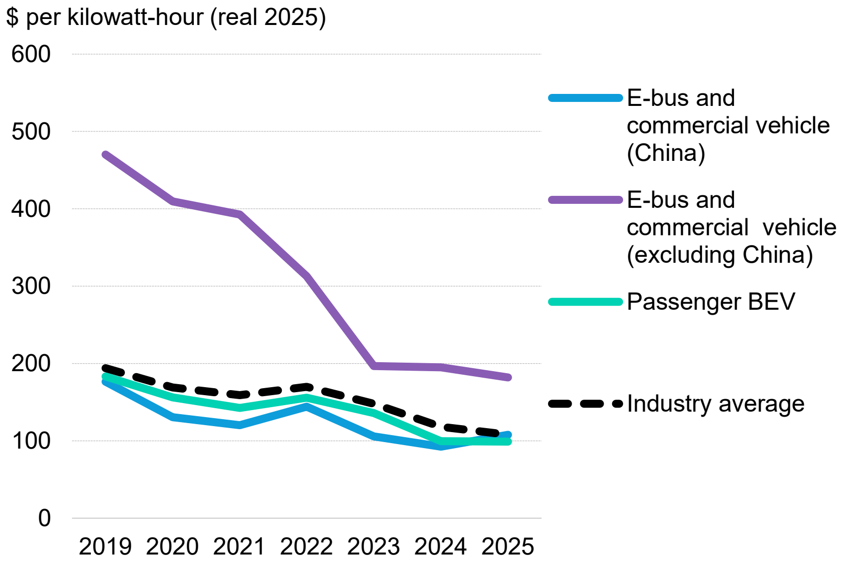
Global lithium-ion cell capacity was over 2.7 terawatt-hours (TWh) at the end of 2025, up more than a third from a year earlier. In 2026, capacity is set to exceed 3.6TWh. Such growth will result in far more available production than expected demand. Overcapacity is more acute in China, where industry-average utilization rates ranged between 40% and 60% from 2022 to 2025.

As a result, major manufacturers are increasingly expanding into stationary energy storage, looking for new growth opportunities.

Source: BloombergNEF. Note: Data from 2026 onward include announced, under-construction and fully commissioned capacity. Regional data are adjusted using BNEF's risk-adjustment methodology. Data as of May 18, 2026.

Battery prices dropped last year, but the rate of decline is slowing

Historical volume-weighted average lithium-ion battery pack prices by sector



Source: BloombergNEF. Note: Passenger battery-electric vehicle (BEV) prices are a global average.

The volume-weighted industry-average battery pack price fell 8% to $108 per kilowatt-hour in 2025, a new low despite higher lithium and cobalt prices. A range of diverse factors contributed to last year's price drops: persistent manufacturing overcapacity, slower-than-expected EV demand growth and continued adoption of lower-cost LFP chemistries.

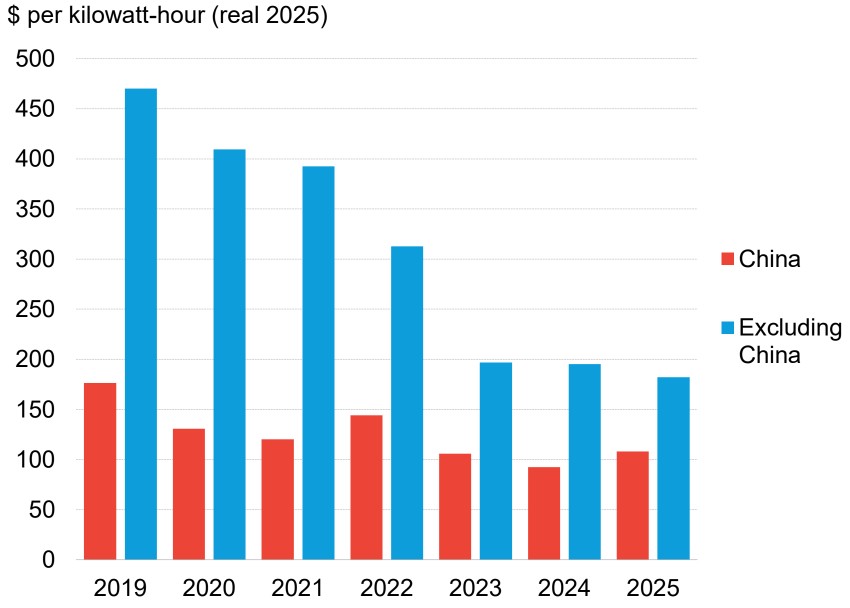
Across cars, vans, trucks and buses, LFP packs averaged $81/kWh in 2025 versus $128/kWh for NMC, while cell-to-pack design and manufacturing improvements cut non-cell costs.

Prices vary significantly by sector, depending on differences in pack design, performance requirements and production scale. Truck and bus battery prices remained largely flat in 2025 compared to 2024, with small declines in prices outside China and a slight increase for packs in the country.

Battery prices are set to follow a declining long-term trajectory and BNEF expects them to fall below $60/kWh by 2035. Still, battery cell prices rose across all segments in early 2026 in China. This is primarily driven by higher raw material costs, especially lithium and cobalt, along with shifting policies and market dynamics.

Truck makers' battery price premium outside of China narrows

Average lithium-ion battery pack prices for commercial vehicles and buses



Source: BloombergNEF 2025 battery price survey

Truck battery packs in China have been consistently cheaper than elsewhere, due to the choice of LFP chemistry and the more mature supply chain in the country.

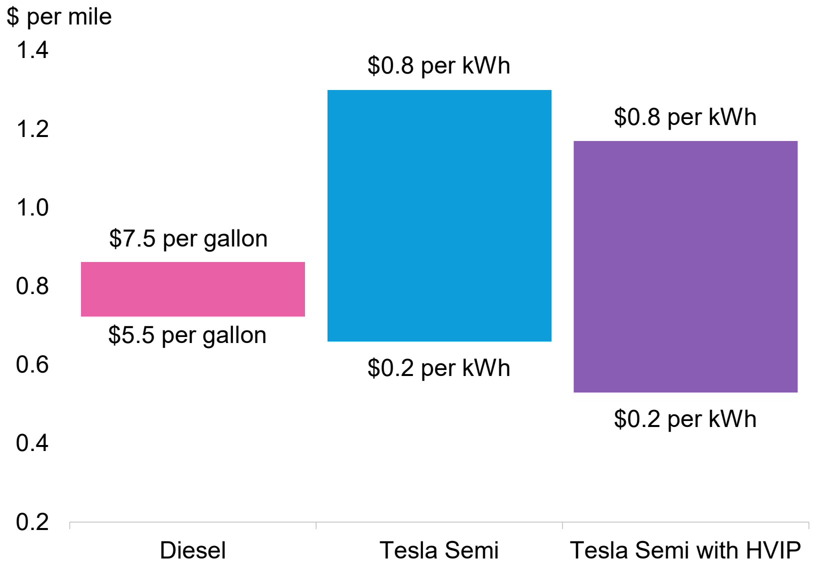
Still, the price gap between batteries sold in Europe and the US versus those sold in China has been closing. From a high of 2.7 times in 2019, packs outside of China were about 70% more expensive in 2025.

Batteries can account for 15-50% of the price of an electric truck, and the range varies by vehicle configuration and region. In China, vehicles are priced more competitively, so the battery can make up half of e-truck costs. Although the average prices for truck and bus batteries rose slightly in 2025, the government's scrappage subsidies for purchasing new vehicles and replacing bus batteries can offset some of that price increase.

While truck battery prices in China edged higher in 2025, they decreased about 7% elsewhere. Relatively low e-truck production volumes and ongoing use of more costly nickel-based chemistries may limit sharp price declines in the near term. Still, LFP battery usage is expanding to e-trucks outside China and could contribute to further average price declines.

Favorable economics could lift sluggish US electric truck market

Total cost of ownership (TCO) and fuel prices for long-haul heavy-duty trucks in the US in 2026



Source: BloombergNEF, Eco-Movement, company announcements. Note: kWh is kilowatt-hour. Assumes Tesla Semi base price of $300,000 and diesel vehicle prices of $180,000. HVIP is the Clean Truck and Bus Voucher Incentive Project.

The US electric truck market may seem lackluster in the absence of federal-level incentives and regulatory drivers, but advantageous total cost of ownership could still provide a boost. With low charging prices, long-haul operations could further amplify the cost of ownership benefits of electric trucks. A heavy-duty electric truck priced at $300,000 would be cheaper to operate than diesel in 40% of long-haul routes, according to BNEF estimates.

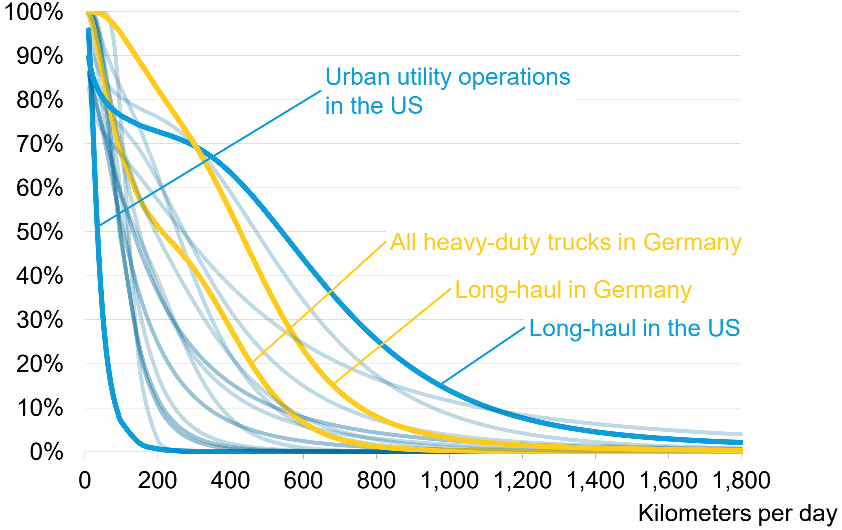
Models such as the Tesla Semi may have already reached that price point. Moreover, California incentives such as the Clean Truck and Bus Voucher Incentive Project (HVIP) could even bring these electric trucks to upfront price parity with equivalent diesels.

Policy support and charging infrastructure continue to drive the market today, but regions with lower electricity prices should be more suited to electric truck deployment in the longer term. Current US truck charging prices can range from around $0.2 per kilowatt-hour in Texas to well over $0.5 in California.

Procuring electricity in bulk could potentially reduce charging costs further. While individual fleets may find it difficult to match short-term freight demand with long-term energy contracts, electric truck service providers could potentially act as demand aggregators.

Trucks perform a vast range of transport work

Heavy-duty truck driving distance distributions in the US and Germany



Source: BloombergNEF, National Laboratory of the Rockies (NLR), Fraunhofer. Note: Shows the share of trucks driving more than a given distance across duty cycles including refuse collection, food distribution, warehouse deliveries, long-haul operations and others.

Commercial vehicles perform a wide range of tasks daily, from delivering packages and collecting waste in city neighborhoods to transporting goods across vast countries. Such variability in operations results in highly customized vehicles with different prices, as well as a wide variation of daily driving patterns.

The distributions of truck driving distances show the richness of use cases encountered in practice. For example, about half of heavy-duty trucks in long-haul operations in Germany drive up to around 275 miles (440 kilometers) daily, while those in the US can travel more than 320 miles. However, a share of vehicles may be used for as few as 150 miles daily while others may exceed 500 to 600 miles.

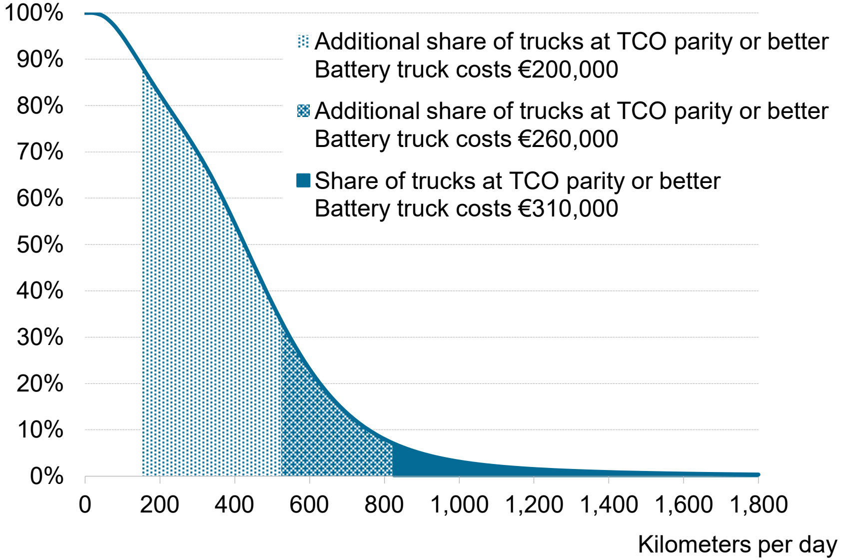
Predictable mileage and lower truck costs make urban routes more feasible to electrify, and their market can expand quickly. That is due to more predictable operations such as moving goods between warehouses or municipal services, which result in far narrower and steeper driving distributions.

Still, fleet owners may require greater versatility from other vehicles. A rigid truck in Europe, for example, could move goods long-haul or serve the hospitality industry within a city, resulting in a wider distribution of distances driven.

BloombergNEF

Current distance distributions provide substantial electrification opportunities

Daily driving distance distribution of tractor-trailer trucks in Germany



The variability of driving patterns directly affects the addressable market for battery-electric trucks, which achieve better economics the longer they are driven. Even when these vehicles are more expensive than equivalent diesels, they can still be cheaper to own and operate beyond a certain daily driving distance.

The total cost of ownership of electric tractors carrying trailers in Germany can be as low as that of diesel vehicles for daily driving longer than about 800 kilometers at prevailing electric truck prices in 2026. About 7% of such vehicles on the road drive at least that distance.

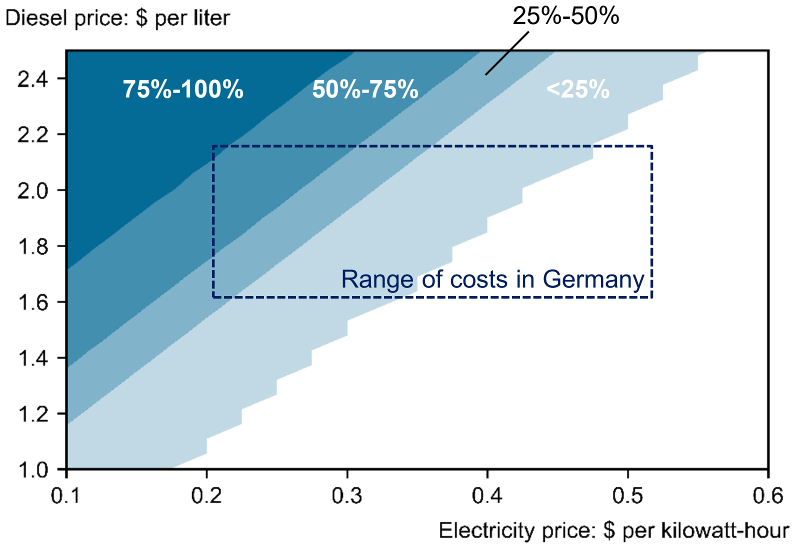
Prices for electric trucks to be delivered by the first half of 2027 are set to be well below €300,000. These costs would increase the addressable market for electric tractor-trailers to about a third of all such vehicles.

Battery prices are set to decline further over the next few years. By 2030, manufacturing costs for long-haul, battery-electric tractors could approach €200,000. Such low costs would transform the economics of road freight, and electrification would be the cheapest option for most – even close to 90% – of these vehicles.

Source: BloombergNEF, Fraunhofer. Note: TCO refers to total cost of ownership. Shows the share of trucks traveling more than a given distance per day; for example, 70% of trucks travel more than 300 kilometers per day. In the TCO calculation, the diesel truck costs €130,000, diesel costs €1.80 per liter and electricity costs €0.35 per kilowatt-hour.

Electric trucks can already address much of Germany's long-haul market

Share of battery-electric heavy-duty, long-haul trucks at TCO parity with diesel in Germany



Source: BloombergNEF, Fraunhofer. Note: Shows the share of tractor-trailer trucks based on the distance distribution on page 41. Assumes a diesel truck cost of $150,000 (about €130,000) and ***a battery-electric truck cost of $360,000 (about €310,000).*** *TCO is total cost of ownership.*

The addressable market for battery-electric trucks is the maximum share of all trucks on the road that can be replaced by the new technology. The addressable market is different across duty cycles and segments, and varies widely with vehicle costs, and diesel and electricity prices.

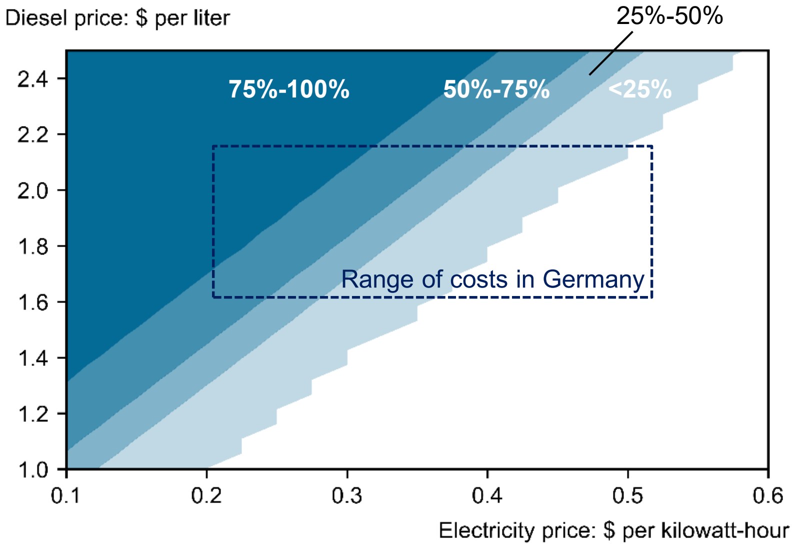
With current heavy-duty truck prices and observed variability of fueling costs in Germany, the economic performance of battery-electric heavy-duty trucks ranges from entirely uncompetitive to being capable of matching that of three-quarters of trucks on the road. In the US, where diesel fuel is cheaper than in Europe, battery big rigs need low electricity costs to expand their addressable market.

Diesel fuel and charging costs vary for different reasons. Diesel fuel reflects the variation in the input price of oil, refining capacity, cross-country demand for the fuel, taxes, and other factors. Diesel prices fluctuate over time but change relatively little across fuel suppliers and within a country, especially in Europe.

Electricity prices for charging tend to be more stable over time, even though they can change throughout the day, but may vary widely between suppliers and locations. That is due to different setup costs, such as grid connections, tariff regimes and other reasons.

Lower electric truck prices are within sight and will grow the addressable market

Share of battery-electric heavy-duty, long-haul trucks at TCO parity with diesel in Germany



Source: BloombergNEF, Fraunhofer. Note: Shows the share of tractor-trailer trucks based on the distance distribution on *page 41**. Assumes a diesel truck cost of $150,000 (about €130,000) and* ***a battery-electric truck cost of $300,000 (about €260,000).*** *TCO is total cost of ownership.*

Electric truck prices in Europe have been declining, as competition intensifies and production scales. Chinese truck manufacturers are also eyeing the European market and could exert pressure on the continent's truck makers to offer more competitively priced vehicles.

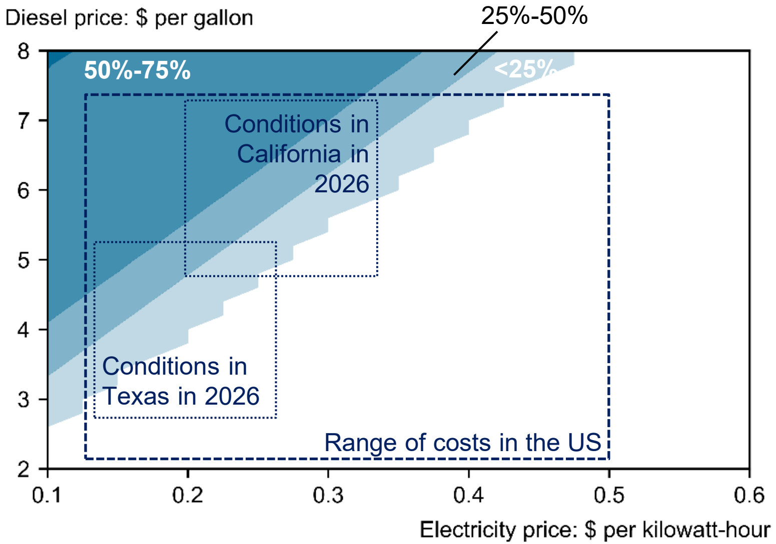
Heavy-duty, battery-electric truck prices at the levels quoted for delivery in the next several months, at well under €300,000 in Europe, could rapidly expand the market potential of electric trucks. These lower capital costs, combined with 2026 energy prices, could allow electric trucks to economically replace well over half of long-haul trucks.

In Germany, battery truck prices below €280,000 make these vehicles economically competitive with at least a quarter of trucks on the road at prices under €280,000 and charging costs below $0.3 per kWh, which are common among depot and public stations today.

This year's volatility in diesel prices was the result of severe disruptions in the global oil market. Under historical energy price conditions, long-haul electric trucks' addressable market is somewhat lower. Still, the relative stability of electricity costs may also weigh on fleet owners' purchase decisions.

US is more challenging for electric trucks – but not everywhere

Share of battery-electric heavy-duty, long-haul trucks at TCO parity with diesel in the US



Source: BloombergNEF, National Laboratory of the Rockies. Note: Shows the share of tractor-trailer trucks based on the distance distribution on *page 41**. Assumes a diesel truck cost of $180,000 and* ***a battery-electric truck cost of $360,000.*** *TCO is total cost of ownership.*

In the US, battery-electric trucks still cost far more than equivalent diesel vehicles, with prevailing prices around $350,000 to $400,000 for Class 8 battery tractors. These vehicles start to become economically competitive once their price drops to around, or below, $300,000.

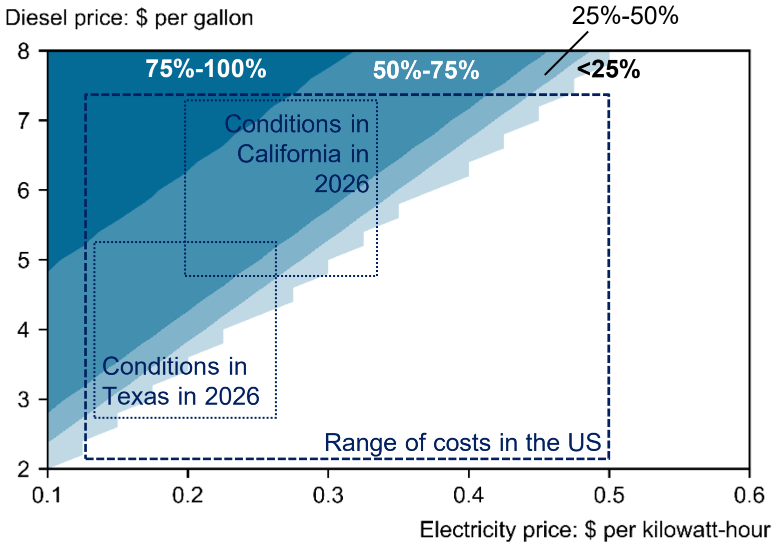
However, achieving these prices in the near term is not straightforward in the US. The country’s supply chain for commercial vehicle batteries and motors is developing slowly, and incumbent manufacturers’ production remains limited. Still, Tesla’s heavy-duty Semi battery-electric truck could potentially disrupt the market, especially at prices lower than $300,000.

If upfront prices remain high, expanding the addressable market for these vehicles requires favorable electricity-to-diesel price ratios. With charging costs of around $0.2 per kWh and diesel prices at over $4 per gallon, electric trucks could become economically competitive in about a quarter of the long-haul US truck market.

Such conditions have been at least partially realized in California, where diesel prices are relatively high, and Texas, where electricity prices are relatively low.

Cheaper electric truck models can kickstart the US market

Share of battery-electric heavy-duty, long-haul trucks at TCO parity with diesel in the US



*Source: BloombergNEF, National Laboratory of the Rockies. Note: Shows the share of tractor-trailer trucks based on the distance distribution on page 41. Assumes a diesel truck cost of $180,000 and **a battery-electric truck cost of $280,000.** TCO is total cost of ownership.*

While the supply of suitable vehicles remains limited in the US, the wider ecosystem continues to develop. High-power truck charging stations are being built, and new business and financing models are emerging.

In parallel, the introduction of reasonably priced vehicles may become a major catalyst for the near-term expansion of the US electric-truck market. Tesla started series production of the Tesla Semi in the first half of 2026. Based on industry interviews, the vehicle is priced between $250,000 and $300,000, depending on specifications and order volume.

Such prices can fundamentally expand the potential of battery-electric trucks in the US. In California, based on average energy prices over the last several years, electric trucks could be the most economical option for well over half of long-haul transport work.

In Texas, average energy price conditions would result in more than 25%, and potentially over 50%, of heavy-duty, long-haul trucks on the road benefiting from switching to battery power.

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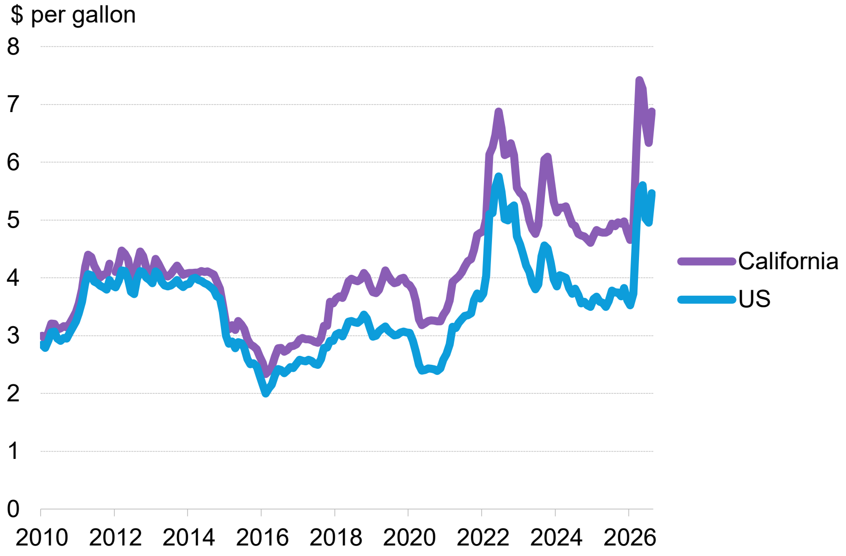
Diesel prices in the US are near historical highs

Retail diesel prices in the US



Source: Energy Information Administration, BloombergNEF. Note: Prices include all taxes and represent the average for each geography. EIA's diesel price is designed to estimate the retail cash price of self-serve, motor vehicle diesel fuel.

Fuel is one of the largest expenses for a heavy-duty truck fleet, especially for long-haul operations. Price volatility affects the planning and the profitability of these fleets, as other costs are more stable.

In recent years, diesel prices have become more volatile and trade at the highest end of their historical ranges. These costs alter the relative economics of diesel and electric vehicles and make more use cases economical for battery-electric heavy-duty trucks.

Diesel prices in the US hovered between about $2 per gallon and $4 per gallon from around 2010 to late 2021. That range kept fuel between 30% and 50% of the total cost of ownership of a heavy-duty diesel truck in long-haul operations.

However, US diesel prices have fluctuated around higher levels from about 2022, following the conflicts in Ukraine and Iran. As a result of supply disruptions and frictions in refinery output, on-highway diesel prices in the US have exceeded $5.5 per gallon in both 2022 and 2026.

Diesel price increases have been particularly acute in states like California. There, prices have maintained a consistent, and rising, premium over the US average price since about 2016. Fleets in the state are some of the earlier adopters of battery-electric heavy-duty trucks.

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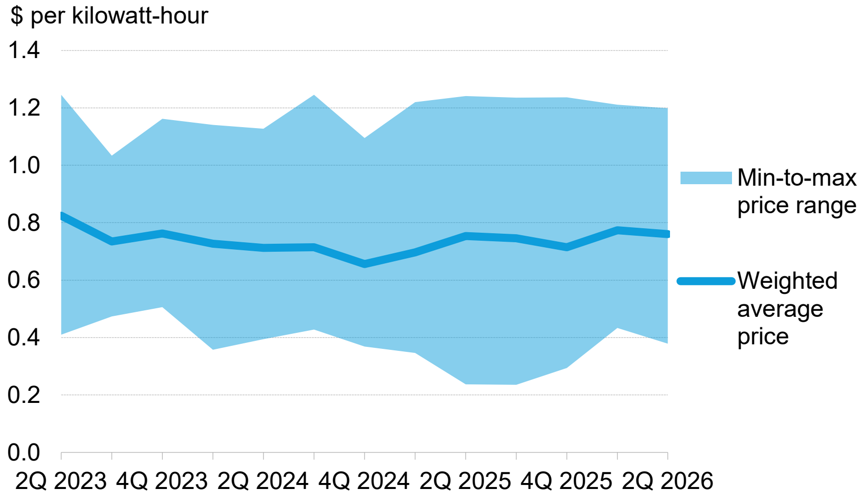
Public charging prices for electric trucks remain high, but variable, in Europe

Electricity prices at fast public truck chargers in Europe



Source: BloombergNEF, Eco-Movement. Note: Shows the connector-weighted average ad hoc charging cost at chargers rated at 50 kilowatts or more that can accommodate trucks across 19 European countries. Data reflect a snapshot of prices available on the last day of each quarter and are not comprehensive. Includes VAT.

In Europe, the average price advertised by fast public chargers that accept trucks, as of 2Q 2026, was $0.76 per kilowatt-hour (kWh), significantly higher than the average electricity rates that depots can secure through industrial and commercial tariffs. These averaged between $0.19 and $0.26 per kWh across EU-27 countries in 2H 2025, depending on consumption, according to Eurostat.

While public charging prices seem high, they may not capture every ad-hoc tariff available across Europe and include value added taxes (VAT). Cheaper rates are often available through subscriptions and fuel cards, and drivers who seek out lower-cost options can find rates from $0.38 per kWh. Excluding VAT, the average ad-hoc fast public truck charging price in June 2026 was $0.63 per kWh.

Pricing also varies considerably by market. In key markets like France and Sweden, average fast charging prices including VAT were below the European average in 2Q 2026, at $0.64 per kWh and $0.59 per kWh, respectively, likely helped by lower wholesale electricity costs.

Outside of depot charging, publicly available slow charging can provide a cheaper alternative, with prices averaging $0.60 per kWh including VAT across eight European markets for which data was available.

Electric truck and battery operational and financial lifecycle

The current state of financing electric trucks and charging stations

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Electric truck and battery operational and financial lifecycle

Electric-truck economics continue to improve, but the market is still too immature for financing to be fully standardized. Fleets have limited operating histories, residual values remain uncertain, and the availability of high-power charging is uneven. These gaps make it difficult to apply the depreciation curves, collateral assumptions and operating flexibility that underpin conventional diesel-truck finance.

Nevertheless, electric-truck financing is underway. The principal finding from BNEF's interviews for this year's Factbook is that transactions are increasingly underwritten against the contracted transport operation around the truck, rather than the vehicle's resale value alone. Freight receivables, predictable vehicle utilization, potential environmental-attribute revenue, full amortization, guarantees and other credit protections can provide repayment support. The result is a functioning but bespoke financing market, rather than a repeatable template.

Conventional diesel-truck finance benefits from established depreciation curves, deep used-vehicle markets, mature lending and leasing channels, and the ability to redeploy vehicles across customers and routes. Electric trucks do not yet have the same foundations. Their financing terms therefore depend more heavily on the fleet's operating profile, customer contracts, counterparties and allocation of technology and residual-value risk.

BNEF conducted 15 interviews with financiers, fleet and cargo owners, truck charging station developers, logistics operators and brokers in Europe, the US and China. Given the market's limited scale and the confidentiality of individual transactions, the following findings should be read as a qualitative synthesis rather than as market-wide benchmarks.

- **Residual value assumptions vary widely**. We heard a wide range of residuals, from zero to around 20% of the purchase price of an electric truck after three to five years of use. That variability reflects the specific circumstances of different companies. But it is also a result of the thin market for second-hand vehicles, which further consists mostly of earlier-generation battery trucks.
  - Electric truck residual values are closely tied to battery lifetime and performance. Various industry participants mentioned that heavy-duty vehicle batteries are continuously improving, and they tend to last longer than originally expected. While much of that insight comes from deployments of electric buses with fewer electric trucks on the road, expectations are that truck batteries are also set to last longer than initially estimated. Achieving such performance requires careful management of the vehicle's operation and charging.

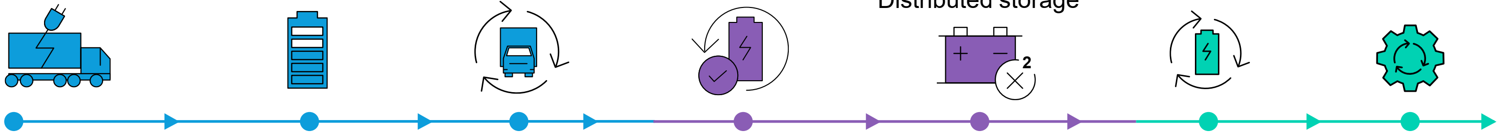
Electric truck and battery operational and financial lifecycle

   - Vehicle ownership patterns may also differ across technologies, as the first operator of a new electric truck may use it for a longer period than the equivalent diesel. That results in different resale cycles, which also impact residual values and total cost of ownership considerations.

- **Contracts that award relatively long-term freight work are valuable, especially if they cover specific routes**. Such agreements are typically signed between large cargo owners and carriers. They provide predictability of operations around distance traveled and vehicle utilization, expected charging windows and electricity demand, as well as the potential to secure cargo for the return leg of a journey. In contrast to booking an electric truck in the spot market, these contracts can help secure financing.
- **Environmental attributes can provide additional cash flows and better security to financiers**. These attributes can be either regulated credits derived from the use of low-carbon fuels or directly related to emissions reductions that can be valuable to large corporations with decarbonization plans and internal carbon costs.
- **Truck-charging infrastructure also partly relies on utilization contracts with fleets**. Agreements structured around minimum kilometers, electricity volumes, subscriptions or recurring service fees can establish a baseline revenue stream. Then, third-party charging can provide additional revenue.
- **Truck charging station investors must underwrite the mismatch between contracts**: fleet contracts may last three to seven years while land or site rights can extend for 15 to 50 years. Station operators should optimize site quality, grid access, electricity procurement and the ability to replace or renew anchor customers.

The conceptual pages that follow explain these findings in more detail. Given the small scale of the market, they emphasize financing structures, contractual relationships and risk allocation rather than representative prices, residual values or leverage benchmarks.

Electric truck and battery operational and financial lifecycle



Phases	Vehicle use			Repurposing		Recycling	
	Truck usage and charging	Battery degradation	Additional truck owners	Battery repackaging	Second-life use Grid storage / Distributed storage	Cell recycling	Material reuse
Stakeholders	Charging station operator Fleet operator	Fleet and charging operator Truck and battery manufacturer		Fleet and charging operator Truck and battery manufacturer	Storage service provider Charging station operator	Storage service provider Charging station operator	

Key risks and uncertainties

Vehicle use: **Operational** and **asset-level** risks.

Lack of **real-world e-truck usage and charging data** prevents optimized vehicle deployment, and **unknown battery degradation** creates uncertainties in depreciation rates and results in higher financing rates.

Repurposing: **Warranty and financing** risks, as well as **asset liabilities** for second-life battery users.

A variety of **safety regulations**, requirements to **store and transport** large volumes, and technology and engineering complications of used electric truck batteries.

Recycling: **Investment, financing** and **operational** risks.

Volatile material prices and **competition with second-life** applications, as well as diverse battery designs may result in high initial and operational costs.

Source: BloombergNEF

Electric truck financing is underway, but underwriting remains bespoke

Existing electric truck financing structures

Fully amortizing loan or lease
Principal repaid over financing term

Separation of assets and operations
Vehicle ownership ring-fenced from fleet operations

Vehicle-as-a-service
Truck and operating services bundled

Lease-to-own / financial lease
Ownership transfers to fleet operator at lease end

Underwriting terms

Set deal by deal across all structures

- Residual value
- Amortization schedule
- Leverage / debt-to-equity ratios
- Lease or loan duration
- Lending rates
- Guarantees and collateral

Several financing structures are already being used to underwrite the purchase and operation of electric truck fleets, with capital being deployed in China, Europe and the US.

Financing mechanisms range from standard term loans to newer concepts for this market, such as bundling the vehicle and its operations within a subscription or separating the ownership and operation of the trucks. Some of these may also be used in combination.

Deals become bankable by adjusting financing terms case by case, and considering operational and commercial characteristics, such as long-term agreements with cargo owners. While such customization may be standard practice, financing terms can vary materially with residuals, rates, tenors and other financing terms varying over a wide range.

A repeatable template has yet to emerge at scale. Some of the financing mechanisms, such as term loans or financial leases, are widely used for fleet financing. Others, such as separating the assets and the operations or providing a vehicle-as-a-service offering are new to the trucking industry but have been used in other sectors.

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Contracted cash flows, rather than residual value alone, can support financing

Financing the vehicle in isolation

Limited repayment certainty from asset value alone

- Uncertain residuals
- Few comparable transactions
- Small secondary market

versus

Financing based on contracted cash flows

Contract

Shipper or cargo owner

- Commits freight volumes

Operations

Carrier or operator gains:

- Predictable utilization
- Known route and charging needs

Revenue

Recurring revenue from:

- Freight
- Environmental attribute revenue

Financing

Contracted cash flows support debt repayment

Instead of depending on the vehicle alone, electric truck financing also relies on the visibility of cash flows to support underwriting.

A typical chain may involve the award of a contract for transport work for a specific volume, along specific routes and, even, with some flexibility on delivery timelines. This creates some operational predictability for the carrier, including vehicle utilization and access to charging infrastructure.

In addition, environmental attributes may also have value. These can be carbon credits from regulated markets or voluntary emissions reductions from large corporate clients. The recurring revenue stack can then create enough cash flows to support debt repayment.

The approach is already being used, but long-term shipper commitments remain difficult to secure. Utilization can also fall if operators cannot fill a truck on both legs of a journey.

Large cargo owners with stable demand, internal carbon pricing and demand-aggregation programs may be better positioned to provide the necessary commitments.

Fleet contracts can bolster truck charging station financing, but risks remain

Distribution of site energy capacity

Contracted fleet use
Minimum kilometers or electricity volume commitments

Third-party traffic
Provides additional revenue

Unused capacity
Not required for repayment

Illustrative and not indicative of actual site energy capacity distribution.

Fleet contracts are shorter than asset commitments

Illustrative ranges from interviews

The economics of truck charging stations depend on contracted site utilization with fleets. Usage is ultimately about the amount of total energy delivered to a fleet, with contracts taking several forms, such as a recurring subscription, a fee per kilometer and others. Such agreements with fleets can provide a revenue baseline and make stations easier to finance. Ad hoc traffic from third-party users can provide additional revenue.

Some operators further reduce volume and power-price risk by purchasing electric trucks in bulk to lease out to fleet owners or entering multi-year electricity-procurement arrangements.

Beyond utilization and cost uncertainties, station operators also face a mismatch between the lifetime of the contracts they may sign with fleets and that of other assets they hold, primarily the station’s land and grid connection. That leaves them exposed to renewing revenue-generating contracts far in the future.

Developers and operators try to manage such risks by building sites at high-traffic locations and partnering with large cargo and real estate owners. Government subsidies and other policy support can also reduce initial capital expenditure.

Corridors enable electric freight and charging offtake

Examples of European freight corridor coverage

Source: Smart Freight Centre. Note: "TCO in progress" means the detailed total cost of ownership in these countries is still being scoped out.

Contracted transport work is becoming the foundation of electric truck financing, in which visible cash flows underwrite the funds committed to purchase the vehicles. Scaling up that pool of capital means matching a fragmented supply side for freight services – that is, the carriers owning and operating electric trucks – with shipper demand.

A freight corridor is a concept that can facilitate that matching by aggregating demand from freight buyers along highways with high truck traffic and favorable electric truck economics. That creates the necessary volume, helping early adopters of such vehicles secure transport work and the associated recurring revenue, while charging infrastructure developers increase station utilization. In turn, financial risk can drop, attracting more capital to the sector.

Such programs are already in place in Europe, the US, Brazil, India, China and Africa. They are at different stages of development, with some already having meaningful impacts.

We estimate that more than a dozen freight corridors are established, or about to be, led by groups like the Smart Freight Centre and Calstart. Some governments are also developing corresponding roadmaps and frameworks, while private infrastructure developers are creating their own networks of truck charging stations along high-traffic highways.

Electric freight corridors are proliferating

Examples of freight corridors coordinated by the Smart Freight Centre

Corridor and geography	Year
Shenzhen-Dongguan-Huizhou Corridor (China)	2024
Western Corridor (Europe)	2025
Poland-Germany Corridor (Europe)	2026
Iberia Consortium (Europe)	2026
Bengaluru-Mumbai Corridor (India)	2027
Delhi-Jaipur Corridor (India)	2027

Corridor and geography	Year
US Interstate 10 Corridor (United States)	2027
e-Dutra Coalition* (Brazil)	2027
Central Corridor (Eastern Africa – Tanzania, Rwanda, Burundi, DRC)	2027-2028
Northern Corridor (Eastern Africa – Kenya, Uganda, Rwanda)	2027-2028
Eastern Canada Corridor (Canada)	TBD

*Source: BloombergNEF, company and organization releases. Note: The list is indicative and does not include government programs or private networks. Year refers to the year in which the corridor became, or is set to become, operational, based on the year of the first pilot, charging hub or route operation. TBD means that the initiative is active, but a formal launch date is not available. * Coordinated by the Smart Freight Centre and Calstart.*

Freight corridors are also being established in markets set for high growth of the overall fleet, such as India and Brazil, not just in those where electrification is already underway, such as in European countries and China, or those with large fleets, like the US.

Freight corridor programs attempt to achieve a wide range of operational, environmental and financial goals. Targets typically also include the number of electric trucks deployed and the volume of electricity. For example, the e-Dutra Coalition in Brazil aims for 1,000 battery-electric trucks to operate daily by 2030.

Such schemes have also been developed in Africa. There, the high fiscal burden of imports of oil products in some countries can shape decisions to explore the potential of freight electrification.

Coordinated large-scale procurement lowers costs and de-risks financing

ZET SCALE alliance

Coordinated purchase of 10,000 Class 8 battery-electric trucks in North America

Smart Freight Centre

CATALYST MOBILITY

10,000	300+	10+	15+
Class 8 BEVs targeted in joint purchase	Mile range, MCS-capable	Freight hubs targeted	Shippers engaged in program

The US electric truck market has been in limbo since the start of 2025. Still, alongside Tesla’s Semi and new truck charging stations, industry consortia already point to latent demand for road freight electrification.

ZET SCALE (Zero-Emission Truck Shipper-Carrier Alliance Leading Electrification) combines the procurement of freight services, electric trucks and charging to create sufficient demand to help financiers underwrite investments in fleet electrification.

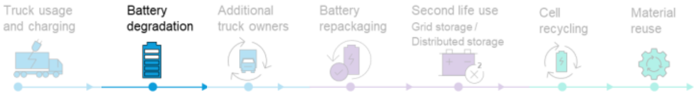
For financiers, such demand aggregation plays a critical role. Contracted freight across a pool of trucks gives lenders and lessors visibility into utilization, routes and charging access – the same contracted cash flows this report identifies as central to bankability – rather than exposure to a single asset with an uncertain residual. Concentrating volume around key hubs also lets charging investments be underwritten against predictable throughput, easing a financing bottleneck that persists when demand is dispersed.

Volume-based pricing for vehicles and energy is already in use in the US. During interviews, industry participants shared insights about discounts available for ordering several trucks rather than just one, and for committing to some target utilization of charging stations.

Vehicle deployment for ZET SCALE is concentrated on at least ten hubs with high freight volume and favorable economics for electric trucks. Some of the program’s freight routes are in California, Texas and Illinois – states with high diesel costs or low electricity costs.

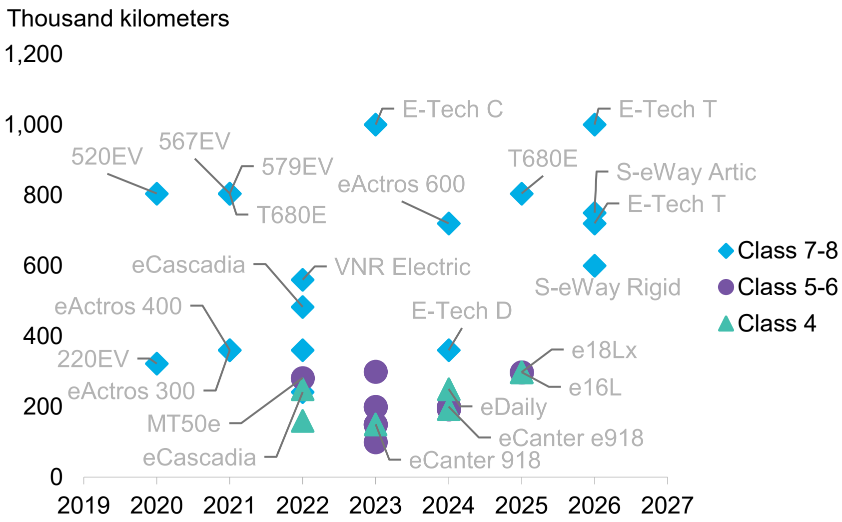
The program’s initial coordinated purchase targets 2,500 heavy-duty battery-electric trucks. While that is around 1% of the total annual heavy-duty truck market, it is far higher than existing sales of electric variants. At the same time though, that volume is just under twice the pending deliveries of the Tesla Semi through a single subsidy program, California’s HVIP.

Note: MCS refers to the Megawatt Charging Standard



Electric truck warranties are long, but do not yet match vehicle lifetimes

Battery-electric medium- and heavy-duty truck range under battery warranty



Source: BloombergNEF, company announcements. Note: Warranty conditions vary and typically cover battery state of health down to 70%-80%, though definitions may differ across manufacturers. The vehicle list is non-exhaustive. Reflects the year each vehicle was introduced.

As manufacturers expand their electric-truck model offerings, more information is becoming available on the expected lifetime of their batteries.

Truck makers have been gradually increasing the driving distance covered under warranty. Heavy-duty electric trucks are routinely sold with battery life expectations exceeding 700,000 kilometers. The warranties for smaller electric trucks typically range between 100,000 and 300,000 kilometers.

Electric truck owners face asset-level and operational risks caused by uncertainties in the longevity of batteries. Manufacturer warranties for these batteries are indications of lifetime performance. They can provide confidence in long-term use and can serve as estimates for potential further applications.

These warranties normally set a lower threshold of 70% to 80% of the battery's state of health during the warranty period. More recently, warranties have also been determined based on the battery's maximum charging cycles or total energy throughput. For example, Iveco's S-eWay Artic covers 750,000 kilometers with a maximum 1,200MWh of total energy through the battery, corresponding to under 2,000 charging-discharging cycles.

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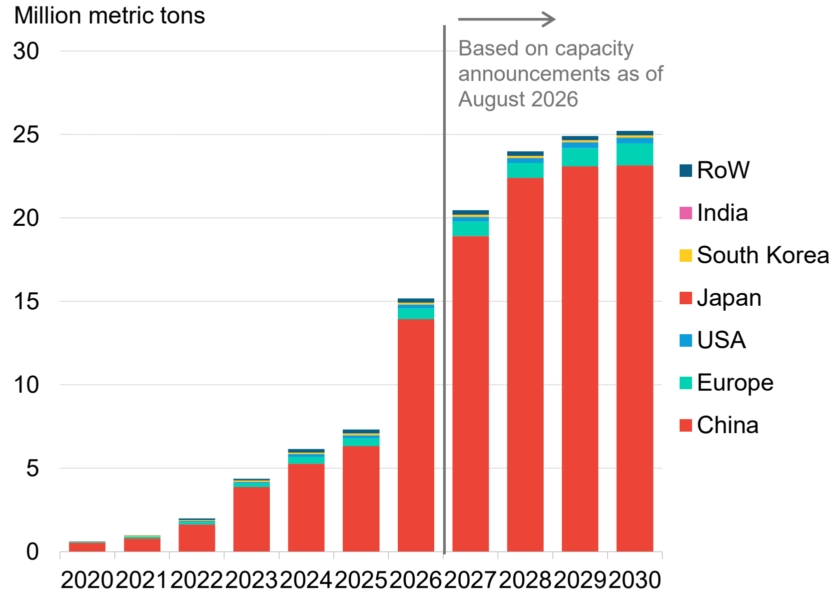
Electric truck and battery operational and financial lifecycle

Battery recycling is set to expand as companies position for growth

Global announced nameplate battery recycling capacity



Source: BloombergNEF. Note: Data as of August 2026. RoW refers to Rest of World.

Global battery recycling capacity exceeded 7 million metric tons in 2025 and is set to increase further, particularly in China. By 2030, almost 3.5 times more capacity may be available than in 2025, based on the announced pipeline. However, that may far exceed material available to recycle across all parts of the recycling process.

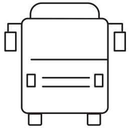
Governments in China and Europe have implemented policies that mandate material recovery rates, establish collection networks, and require lifetime battery traceability to facilitate the market's expansion.

Companies are building up capacity, and some already operate recycling plants. Examples include Redwood Materials in the US, Hydrovolt in Norway, as well as CATL subsidiary Brunp Recycling, GEM, Ganfeng Lithium and Huayou Recycling and others in China.

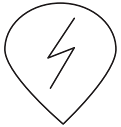
Truck and bus batteries can be difficult to disassemble, and second-life use is still at the pilot stage. While most countries have yet to implement decisive regulatory measures, China has explicitly banned the use of second-life batteries in areas like energy storage systems with capacity higher than 100 kilowatt-hours for safety reasons. Some fleets still use second-life batteries as small-scale storage at private charging depots globally, but more formalized procedures to detect battery health are needed to ensure safety.

BNEF take: Why batteries will win in long-haul trucking

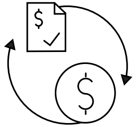
The data and calculations in this Factbook reveal the underappreciated impact that battery technologies will have on energy use in road freight, including in long-haul applications. The benefits of electrification revolve around rapidly **declining costs**, the development of **affordable high-power charging** and newly formed **dedicated freight corridors.** BNEF also expects electric truck **residual values to become comparable with those of diesel vehicles** as battery durability becomes clearer and secondary markets develop. As a result, incumbent and startup companies are developing and deploying **new models to finance and operate** fleets of electric trucks.



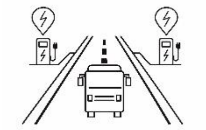
High utilization puts the economics of heavy-duty, long-haul electric trucks on par with diesel for a growing share of the fleet.



High-power truck charging is expanding and can be economical in large stations fitted with sizable grid connections.



Improving battery technology, simple electric powertrain designs, and new business models can make battery residual values comparable to those of diesel vehicles.



Freight corridors generate concentrated haulage demand and support the deployment of fast charging stations.

Appendix

Description of the electric truck battery lifecycle – *Vehicle use phase*

Truck usage and charging

Description

Truck utilization patterns vary widely between segments and use cases, as routes adapt to trade and traffic patterns, as well as customer needs.

For electric trucks, matching driving range with the availability of charging infrastructure and the cost of electricity poses an additional complication.

Key barriers and challenges

While fleet operators have experience with route planning and refueling, they **lack data on electric truck usage and charging patterns.** That can prevent optimizing truck deployment in use cases with favorable TCO.

Such uncertainty can create **operational risks** for fleet owners and charging station developers, for which utilization is a critical parameter influencing their profitability.

Battery degradation

Description

Truck batteries lose some of their capacity with use, affecting their capability to perform useful transport work.

Degradation depends on battery technology and engineering, duty cycle and environmental conditions, as well as charging patterns throughout the electric truck's lifetime.

To date, few battery trucks have been driven to the end of their lifetime, outside of China.

Key barriers and challenges

The **scarcity of real-world degradation data** can obscure actual performance of electric truck batteries and create **uncertainties in depreciation rates**. That may create **asset-level risks** for owners and manufacturers.

With such limited data, truck makers may be conservative in setting warranty limits. Still, some advertise batteries that can last for more than 1 million kilometers and as long as 1.6 million kilometers (1 million miles), even though battery warranties typically cover a shorter overall driving distance.

Description of the electric truck battery lifecycle – *Vehicle use phase*

Additional truck owners

Description

A new truck will remain with the first owner for a few years, depending on the segment and duty cycle. For example, fleets may keep new heavy-duty trucks in long-haul operations for about five years.

Owners of second-hand vehicles can deploy them in entirely different applications than the original buyer, as some costs, such as for maintenance and fuel, increase with the truck’s age.

Owners of second-hand electric trucks need to match the reduced battery capabilities with the requirements of new use cases.

Key barriers and challenges

Smaller fleets and even individual owners are more likely buyers of second-hand electric trucks. These operators typically have **reduced access to equity capital** and have **higher financing costs**.

They face similar **operational risks** as first owners, but with additional uncertainties related to the technical capabilities of e-trucks with degraded batteries.

Description of the electric truck battery lifecycle – *Repurposing*

	Description	Key barriers and challenges
Battery repackaging	End-of-life batteries need to be collected, transported, tested, sorted, disassembled and stored before being reused or sent for recycling. Depending on the volume of the batteries and the duration of storage, such activity can result in high costs.	Stakeholders need to account for various storage and transport **safety regulations**, especially when crossing state and national borders, limit **transport distances**, and minimize the time- and energy-intensive **testing and sorting** processes. Intermediary companies may be holding **large asset liabilities** during that time. Manufacturer warranties are likely not valid once the battery is removed from the vehicle, while they have not yet been assembled in revenue-generating products.
Grid storage **Behind-the-meter storage**	Second-life batteries are best suited for applications with low power demand, low power-to-energy ratios, short cycle life requirements, and less frequent charging and discharging cycles, often in small- and medium-scale systems.	Original battery manufacturers may avoid associating themselves with second-life systems due to concerns about safety incidents and potential brand damage from degraded performance. This transfers the responsibility for providing warranties to the second-life battery producers, who may assume **warranty and liability risks**.

Description of the electric truck battery lifecycle – *Recycling*

	Description	Key barriers and challenges
Cell recycling	Cell recycling typically involves crushing end-of-life batteries and then separating their components, such as cathode material, anode material, electrolytes, and electrodes, for material recovery. Two main methods are used: pyrometallurgical and hydrometallurgical processes.	Recovered materials can be used in manufacturing new batteries and can also contribute to supply chain resilience. The conditions favoring cell recycling and material reuse relate to the condition of the battery, such as its state of health and its chemistry, as well as the market prices for the various metals recovered. **Stakeholders face uncertainty and potential volatility** in raw material prices. Other challenges include **high initial costs**, **diverse battery designs**, and **competition with second-life battery applications**. Companies employing integrated repurposing and recycling business models can efficiently direct batteries that fail second-life qualification directly into the recycling stream at the same facility, optimizing logistics and costs.
Material reuse	The most critical and valuable metals recovered from recycling are cobalt, nickel, and lithium. Copper, manganese, and graphite can also be recovered. The recovery rates can range from 25% to 96% of the materials in a lithium-ion battery cell.	

Defining commercial vehicles

	Vehicle segment	Typical use cases
Main focus of the report	Heavy-duty commercial vehicle (HCV)	Refuse, drayage, construction, freight
Main focus of the report	Medium-duty commercial vehicle (MCV)	Distribution, utility and municipal services, freight
	Light-duty commercial vehicle (LCV)	Last-mile delivery, distribution
	Municipal buses and coaches	Urban and inter-city people transport

Source: BloombergNEF. Note: Segmentation is for the purpose of clarifying content in this report. For gross vehicle weight rating thresholds in different markets, see page 69.

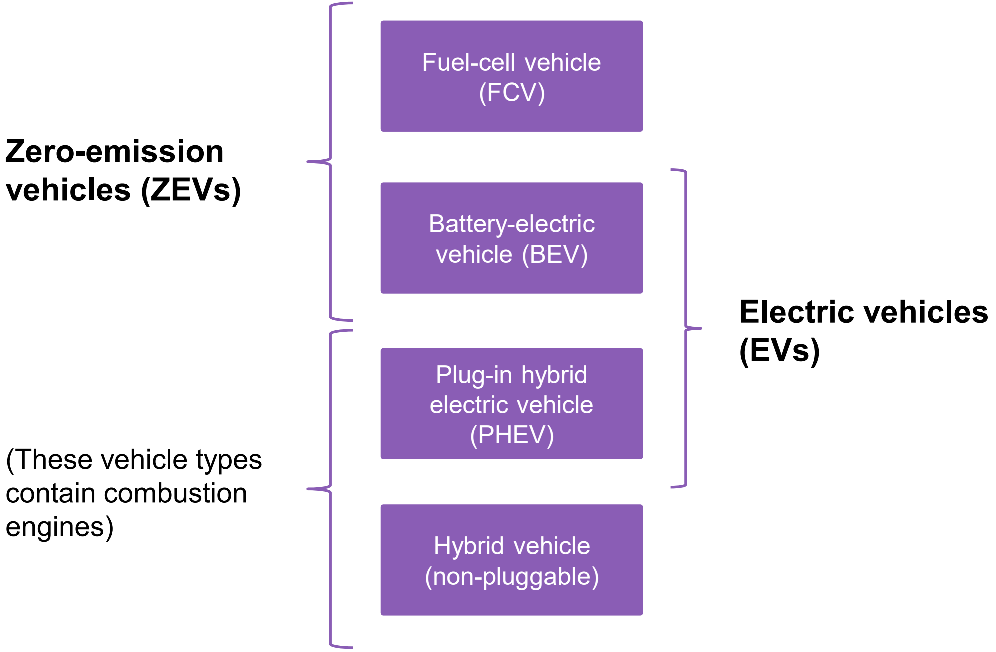
Commercial vehicles come in many types and perform several functions. Their operations vary widely, even for similar vehicles in the same weight segment.

Light-duty commercial vehicles are typically vans or small trucks that operate within and around cities. They are the largest segment in terms of fleet and sales within the sector. Zero-emission models mostly consist of battery-electric vehicles, and adoption has been growing globally, albeit at different speeds across countries.

Medium- and heavy-duty trucks are used in several, disparate duty cycles. These include infrastructure maintenance, municipal services, urban distribution, and short- and long-haul goods movement, among others.

While these vehicles' sales and fleet size are considerably lower than those of light-duty commercial vehicles, they consume more energy.

Defining electric vehicles (EVs) and zero-emission vehicles (ZEVs)



Source: BloombergNEF. Note: Categorizations are only for the purpose of clarifying content in this report.

For the purposes of this report, zero-emission vehicles (ZEVs) are defined as vehicles that do not emit carbon dioxide from their tailpipes.

This means that in our categorization, ZEVs only include pure battery-electric vehicles (BEVs) and fuel-cell vehicles (FCVs), neither of which have internal combustion engines.

It is understood that these vehicles should be fueled from clean electricity or hydrogen if they are to be truly zero-emission in operation.

Electric vehicles (EVs) as a category are commonly understood to include plug-in hybrids (PHEVs).

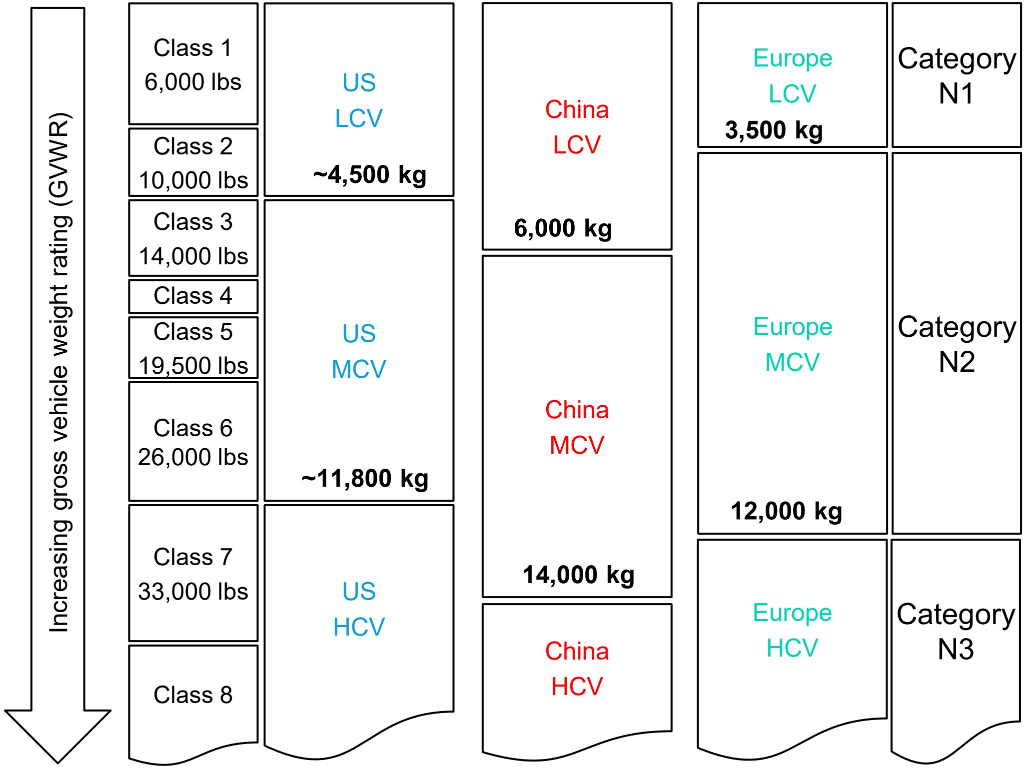
In this report, as in all other BNEF publications, we include PHEVs in our definition of EVs, alongside pure BEVs.

However, PHEVs are excluded in some portions of this report that focus on ZEVs, as defined above.

Pages that focus on the broader category ‘EVs and FCVs’ encompass all of the above.

Hybrid vehicles that cannot be charged from an external power source are not included in our definitions of ZEV or EV.

Commercial vehicle classification



- The weight thresholds between segments follow the classification of registered commercial vehicles as used in different countries.
- In the US, Class 2 vehicles are chosen as the threshold for light-duty commercial vehicles (LCVs) to be as close as possible to both the European and Chinese limits.
- A truck is a rigid vehicle which includes the cabin, drive unit and other components, as well as the platform where the cargo is placed. A tractor is the individual traction unit alone, without the trailer.

Note: LCV, MCV, and HCV refer to light-, medium-, and heavy-duty commercial vehicles, respectively.

Inputs for total cost of ownership calculation of 55-metric-ton truck in India

Category	Drivetrain	Units	Value
Upfront price (on-road including trailer)	Diesel	Rupees	6 million
	Battery-electric	Rupees	11.5 million
Vehicle driving range	Battery-electric	Kilometers	200
Battery capacity		Kilowatt-hour	282
Fuel efficiency	Diesel	Kilometers per liter	2.80, 3.40
	Battery-electric	Kilometers per kilowatt-hour	0.85
Diesel cost		Rupees per liter	91.26
Electricity cost (inclusive of service charge)		Rupees per kilowatt-hour	12.42
Annual distance traveled	All drivetrains	Kilometers	80,000
Battery duty cycles completed before replacement	Battery-electric		2,800
Vehicle loan rate	Diesel	%	9
	Battery-electric	%	11
Maintenance cost	Diesel	Rupees per kilometer	6.70

Source: Smart Freight Centre, BloombergNEF.

Data sources for sales and fleet

- BloombergNEF
- Bloomberg Terminal
- China Automotive Technology and Research Center
- FTR Associates
- WardsAuto
- European Automobile Manufacturers' Association (ACEA)
- European Alternative Fuels Observatory
- South Korea's Ministry of Trade, Industry and Energy (MOTIE)
- EV Volumes
- Japan Automobile Dealers Association (JADA)
- India's Ministry of Road Transport and Highways
- Australia's Bureau of Infrastructure and Transport Research Economics (BITRE)
- Brazil's Ministry of Transport
- Brazilian Association of Automotive Vehicle Manufacturers (ANFAVEA)
- Various other national registration agencies

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Nikolas Soulopoulos
Head of Commercial Transport, BNEF

Maynie Yang
Associate, Commercial Transport, BNEF

Ryan Fisher
Head of EV Charging Infrastructure, BNEF

Ash Wang
Senior Associate, EV Charging Infrastructure, BNEF

Hongyan Li
Editor, BNEF

Madeleine Brolly
Associate, EV Charging Infrastructure, BNEF

Komal Kareer
Senior Associate, India, BNEF

Andy Leach
Senior Associate, BNEF

Colin McKerracher
Head of Clean Transport, BNEF

Andrew Logan
Editor, BNEF

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