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SPOTLIGHT

The second frontier

Electrification of trucks is accelerating

Heavy goods vehicles (HGVs) contribute 25% of global transport CO₂ emissions and are harder to decarbonise than other transport segments

Momentum for electrification has been building and higher for longer diesel prices should add urgency; the battery vs hydrogen electric HGV debate remains very much alive

We outline how manufacturers are stepping up ambitions and helping to solve key infrastructure challenges

This is an abridged version of a report by the same title published on 31 March 2022. The full note is available to clients of HSBC Global Research and contains a further look at the topic at hand. Please contact your HSBC representative or email <u>AskResearch@hsbc.com</u> for more information.

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Accelerating towards cleaner fuel and trucks

Increasing emissions and fuel costs

According to the IEA, the percentage share of CO_2 from heavy-duty vehicle CO_2 relative to all trucks has been increasing since 2002 (%)

Higher for longer diesel prices have led the total cost of ownership of a diesel HGV to rise by 30% in the US since March 2020 (USD)



What's needed to make battery and hydrogen truck 'cost of ownership' competitive with diesel?*

Total cost of ownership parity with diesel for electric long-haul trucks can be achieved by 2025 with a mix of purchase incentives and a cut in fuel and maintenance costs for EV and H₂ trucks. Electric charging/hydrogen refuelling infrastructure rollout is key for driving down electric opex costs.





*Using a pre-pandemic diesel fuel price of USD3.06 per gallon, assuming 7 miles to the gallon and USD0.15/mile O&M costs, the breakeven cost of charging a BET would be USD0.17/kWh and for refuelling a HET would be USD1.55/kg Source: IEA, ICCT, HSBC



Electrification of trucks is accelerating

- Policy and manufacturers are aligning on an electric future for trucks, with many new models in the medium- and heavy-duty segments
- The battery electric vs hydrogen electric debate is likely to be determined by miles travelled, with hydrogen better suited for long-haul
- Structurally higher diesel prices could accelerate the customer shift to electric, in our view

In our previous deep dive into the decarbonisation of heavy duty road freight transport in May

What a difference 24 months make

	2020, we concluded that, among the technology choices available, natural gas was the most mature in terms of commercial deployment but manufacturers and policies had begun to lean in favour of electrification, via batteries or via hydrogen.
Higher emphasis on lowering emissions from trucks	The pace of change has accelerated over the past 24 months. Firstly, EVs are fast becoming mainstream in the passenger car segment and EVs are becoming important drivers of regulatory compliance for manufacturers. Secondly, trucking has emerged as a clear structural winner from our greater reliance on home deliveries as a result of the COVID-19 pandemic, which places greater emphasis on the importance of lowering the sector's emissions. Most recently, a realisation that diesel prices are set to stay higher for longer as the result of the Russia-Ukraine situation is most likely another catalyst to drive fleet operators to embrace electric.
Manufacturers plan to scale up electric vehicles	The major manufacturers have laid out clear plans to develop and scale up electric vehicles and are scaling up R&D. In 2020 Volvo and Daimler formed cellcentric, a EUR1.2bn JV focused on commercialising hydrogen electric technology for HGVs. Leading Chinese OEM Weichai is building a production plant for hydrogen trucks. As a sign of further OEM alignment, on 16 March truck market leader Traton raised its electric mobility R&D budget by over 60% (EUR2.6bn to 2026) as it seeks to close the gap to its peers which have moved faster on transitioning to commercial vehicles powered by alternative drives. Importantly, Traton also announced it is scaling back its investments in conventional drives.
TaaS seen as an option to switch to low carbon trucks	Unlike the passenger segment, where vehicle sales are consumer driven, the truck segment is based more clearly on an economic decision reflecting total cost of ownership (TCO) over a vehicle's lifetime. When deciding to move to lower-carbon options, customers are faced with a high upfront bill so incentives are important as well as the relationship with the producer, who can provide financing and leasing options. We note that a new model centred around a Truck-as-a-Service (TaaS) is proving a popular route to help truck fleet owners make the switch to low-carbon alternatives. The need to build specialist infrastructure, both for electric charging

and hydrogen refuelling, may yet prove a bottleneck to wider uptake.



Many factors impact scalability of truck electrification tech

Economics of the fleet disruption

HSBC Disruptive Technology Framework: electrification of trucks

From an investor's perspective, it's key to understand how mature a technology is today. However, this is only one part of the puzzle of how to evaluate the scalability of a technology – especially in complex, hard-to-decarbonise, transport sectors like HGVs (heavy goods vehicles). To give readers guidance, we show the HSBC Disruptive Technology framework below for lower-carbon transportation, focusing on commercial HGVs - in relation to passenger vehicle technology for BEVs (battery electric vehicles) and FCEVs (fuel cell electric vehicles).

In addition to the maturity of the technology, within the realm of decarbonising HGVs, there are other factors to take into consideration. For example, in commercial HGVs, TCO (total cost of ownership) of the vehicle plays a key role when thinking about the fleet. We believe that despite larger upfront costs for BETs (Battery Electric Trucks) in relation to fossil fuel equivalent vehicles, TCOs of BETs are becoming increasingly more attractive, especially given the high price fossil fuels. We view this as an accelerator for low-carbon HGV technology.

HSBC Disruption Framework: Electrification of trucks



Source: HSBC

Furthermore, geopolitics of fuel inputs is likely also a drive more supportive global policy for alternative transportation technology like BETs and FCEVs within the HGVs landscape. This includes both fiscal and purchase subsidies. We are seeing growing policy support globally, including parts of the US such as the California Air Resources Board (CARB), within Europe with The European Roadmap, and mainland China's government support for FCEV cities and bonus payments - all in action now or over the coming few years.

However, a bottleneck for the technology transition to lower carbon HGVs includes the lack of infrastructure in place. Even as recently as 2018 there were only 380 hydrogen refuelling stations globally, with Japan having 26% of the share, followed by Germany with 18% and the US at 17%. Although things could be set to improve as European countries have announced more than 6,000 new hydrogen refuelling stations by 2025-30 with an investment of EUR8.5bn by 2030 alone. Also, mainland China and the US are each targeting 1m FCEVs by 2030s, with Japan aiming for 800k, South Korea 500k and Europe 3.7m.

Another possible differentiation between HGVs for BEVs and FCEVs is energy efficiencies. For example, passenger vehicle BEVs have 73% efficiency but hydrogen-powered electric vehicles only have 22% efficiency. See page 25.

Fuel geopolitics and government support of disruption

Refuelling infra is bottleneck for the tech?



HGV BET vs FCEVs tech is complementary

Taking into account the technology and scalability threads we outlined above, including the costs of running HGV fleets, combined with fuel geopolitics, government support and infrastructure bottlenecks, we place HGV BETs in the earlier phase of the "real applications" phase (relative to passenger BEVs) but can see this accelerating over the coming few years, especially for HGVs under the range of 350 miles.

We believe FCEVs are more attuned for longer-range HGVs, for example greater than 350 miles, and in fact are complementary to HGV BEVs. We place FCEVs slightly behind BETs in our framework but as infrastructure grows with government support and commercial investment, this could also accelerate over the coming few years.

ESG: Commitments to Science Based Targets with OEMs at different stages

Commitments to ESG targets vary by manufacturer

Volvo, Scania (owned by Traton) and Paccar all have emission reduction plans that have been validated by the Science Based Targets initiative (SBTi). MAN Truck and Bus (also owned by Traton) is committed as are lveco and Tesla. While Navistar, Nikola and Daimler Truck have yet to commit to Science Based Targets they are committed to climate change scenarios generally acknowledging the need to keep warming well below 2 degrees. Of this latter group of companies Daimler Truck has the most comprehensive set of targets with the 2039 targets for CO₂ neutral vehicle sales (in major regions) and production plants more specific than lveco's commitment to be fossil free by 2040.

Decarbonisation of HGVs touches various themes. Energy Transition should be resilient Given the urgency to decarbonise and reduce emissions we think energy transition related spending could be more resilient were the global economy to weaken. We would hope that decarbonisation spending is less likely to be affected and could perhaps to some extent reduce although by no means mitigate the cyclicality of the truck sector.

Future transport dominates thematic exposure



BEV trucks and vans FCEV MD and HD trucks Charging infrastructure Hydrogen infrastructure Autonomous technology Transport as a Service (TaaS) Battery as a Service (BaaS) Predicitve maintenance Connected services Recycled materials Source: HSBC



Electrification Hydrogen roll out Use of green energy sources Charging infrastructure Hydrogen infranstructure



Autonomous technology Transport as a Service (TaaS) Predicitve maintenance Connected services Software updates



Eletcric buses and coaches for urban mobility Charging infrastructure e-commerce electrification Transport as a Service (TaaS)

This is an abridged version of a report by the same title published on 31-Mar-22.

The full note is available to clients of HSBC Global Research and contains chapters on: why decarbonise trucks?, sizing the market, policy momentum, FCEV vs BEV, how manufacturers are aligned, and the HGV infrastructure challenge.

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