Zero-Emission Trucks: A Factsheet Series

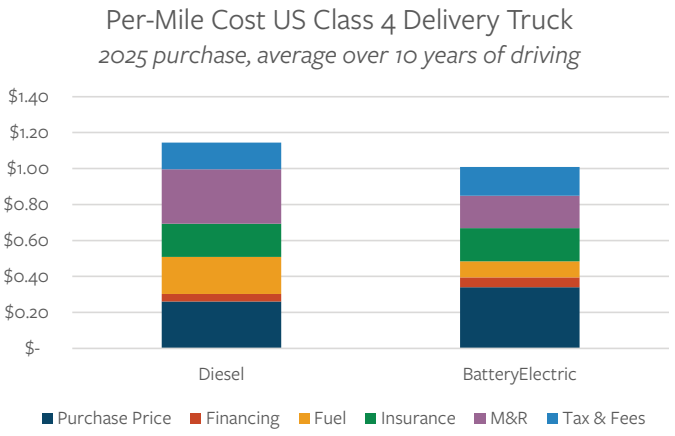
#2: REGULATING ZERO-EMISSION TRUCK SUPPLY: SAVINGS POTENTIAL

Berkeley Law | Center for Law, Energy, & the Environment

Total cost of ownership benefits and how financing can increase investment.

HIGHER UPFRONT COST BUT LOWER OPERATIONAL COSTS

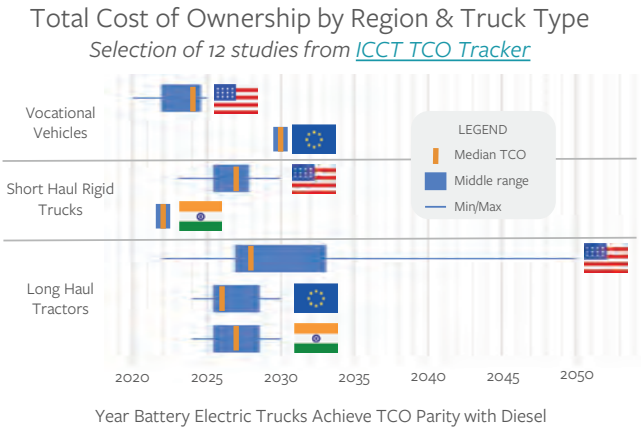
Zero emission trucks (ZETs) currently have higher price tags than diesel trucks, but this gap is expected to narrow as the market evolves. Despite the upfront costs, ZETs can offer considerable savings in operational expenses. Since most commercial trucks accumulate extensive mileage, fuel expenses are the majority of lifetime costs. Battery electric trucks offer the advantage of markedly lower fuel costs compared to diesel trucks. Moreover, the simpler mechanical design of ZETs, characterized by fewer moving parts than their internal combustion counterparts, leads to lower maintenance costs. Together, these factors contribute to substantial financial savings over the life of the vehicle.



Per-Mile Cost US Class 4 Delivery Truck 2025 purchase, average over 10 years of driving. Source : Argonne National Laboratory (2021)

TOTAL COST OF OWNERSHIP SAVINGS

Many ZETs currently have a higher purchase price compared to diesel trucks. However, when considering purchase price and lower operational costs together as the total cost of ownership (TCO), most urban delivery and some regional haul ZETs already offer savings over the life of the vehicle. The remaining urban/regional ZETs will reach total TCO parity or superiority between 2025 and 2035, with long haul following shortly after. These TCO savings are an attractive opportunity for private fleets and will continue to improve over time.



Total Cost of Ownership by Region & Truck Type. Source : ZEV Transition Council, TCO Tracker (2024)

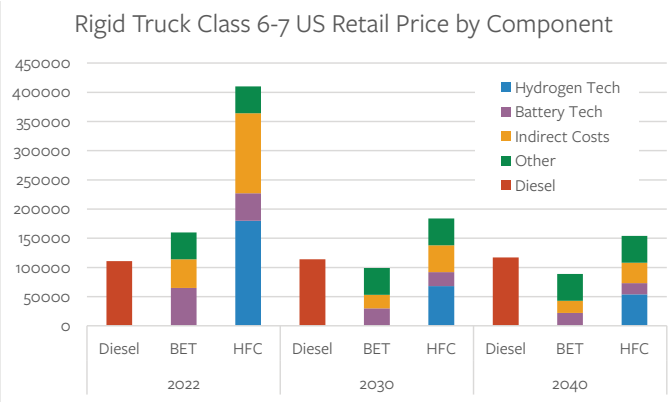
MARKET BENEFITS OF REGULATIONS

Regulations have been shown to increase manufacturer investment and innovation in technology. By setting gradually increasing requirements for the sale of new trucks, regulations create economic certainty - now the market can plan around a predictable ZET deployment timeline. This accelerates economies of scale across all ZET products, services, and supply chains. Economies of scale at the manufacturing level can bring down marginal production costs; economies of scale at a market level can encourage further cost reductions by increasing diversity and competition. Economic certainty is also key to investor confidence in new technologies and can motivate innovative financing mechanisms and business models that help small businesses overcome high capital costs and unlock cost savings.

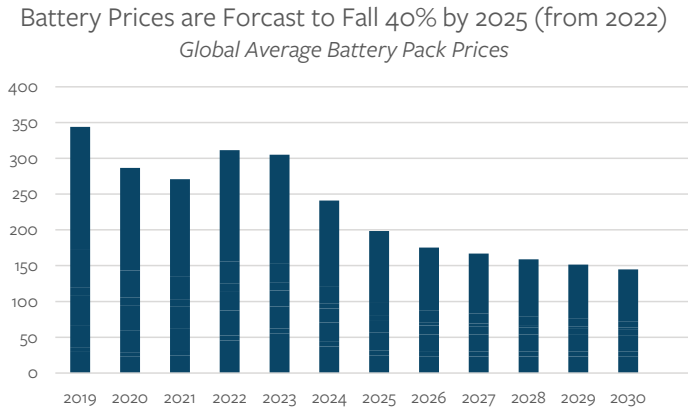
Regulations can also enable 'self-financing' by the industry, including for new entrants, through credit trading: those who can produce ZETs at least cost are financially incentivized by the opportunity to sell their extra credits to those manufacturers who need more time to scale up production.

EXPECTED COST REDUCTIONS

Regulations could accelerate expected reductions in ZET purchase price and operational costs. While ZETs have grown in popularity and availability in recent years, with over 850 zero-emission models capable of meeting the majority of commercial truck needs, there are still substantial opportunities for manufacturer learning and economies of scale. Economic analyses of clean technologies have found significant and sustained learning curves, predicting much more rapid cost declines than previous technological advancements. Primary technology improvements and related savings will be in ZET batteries, fuel cells, and drive trains. Global average battery prices are forecast to fall 40% by 2025 and even battery costs for heavy duty (sleeper and day cab tractor) trucks are expected to halve by 2030 compared to 2022. The energy density of batteries is expected to continue increasing, allowing greater range and higher payload capacity as battery weight decreases. The cost of manufacturing chargers for trucks are expected to follow a similar learning curve, as, for example, US level 2 charger costs fell 66% from 2010 to 2019.



Rigid Truck Class 6-7 US Retail Price by Component. Source : The International Council for Clean Transportation (2023)



Battery Prices are Forcast to Fall 40% by 2025 (from 2022) Global Average Battery Pack Prices. Source: Goldman Sachs Analysis (2023)

INNOVATIVE FINANCING CAN UNLOCK SAVINGS

While larger fleets have better access to capital for financing the upfront purchase price of ZETs and charging infrastructure, most fleets globally are small businesses with limited capital and less ability to maintain and repair new technologies like ZETs. Business models such as truck-as-a-service (TaaS) and battery-as-a-service (BaaS), allow small businesses to access ZET benefits without having to purchase the truck and/or the battery. These "as-a-service" models are rental or leasing packages that use operational savings to cover the higher capital costs of ZETs and can also reduce small business concerns around the unfamiliarity of new technology by including maintenance, insurance, and shared charging. Other mechanisms such as extended warranties, loan loss reserves, residual value guarantees, and credit enhancements can help reduce risk, increasing access for small businesses and attracting additional private capital.