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Accelerating Zero-Emission Trucking Policies

A Global Policy Handbook with a Roadmap for India



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Executive Summary



Trucks account for just 4% of the global on-road fleet but are responsible for 27% of on-road greenhouse gas emissions and 60% of nitrogen oxide emissions.[1] With trucking demand projected to double by 2050, transitioning to zero-emission trucks (ZETs) is critical for mitigating environmental and public health impacts.[2] Beyond reducing emissions, ZETs offer significant benefits, including lower operating costs, reduced oil imports, enhanced energy independence, and strengthened industrial competitiveness.

Global ZET sales are gaining momentum, reaching 54,000 in 2023 — a 170% increase since 2020.[3] Adoption is concentrated in China, Europe, and the United States, with emerging activity in India, Australia, Brazil, and Japan. Key drivers include supportive policies, ambitious ZET targets, the growing availability of ZET models, and deployment efforts by industry leaders.

Policy support is a crucial enabler of ZET adoption, sending strong market signals for near-term investment. In leading regions (China, Europe, and the United States), over 60 ZET-specific policies are driving progress in demand, supply, and infrastructure.[4] Demand-side policies reduce costs for fleet operators and signal sustained market growth. Supply-side measures encourage manufacturers to scale ZET production, improving economies of scale. Infrastructure policies enable the widespread deployment of charging and refueling networks, ensuring seamless operations.

Regions with limited ZET uptake can learn from the experiences of policy development in regions with relatively mature ZET markets and apply those learnings to initiate momentum toward ZET adoption. Key policy solutions along with specific examples are shown in Exhibit ES1.

Exhibit ES1 ZET-specific demand, supply, and infrastructure policy measures and key examples

Demand-side policy interventions	Supply-side policy interventions	Infrastructure-related policy interventions
Purchase subsidies for ZETs can effectively reduce the up-front costs. The Netherlands has allocated around €97 million for purchase subsidies to incentivize more than 1,000 ZETs.	**ZET sales requirements** mandate a minimum percentage of ZET sales for manufacturers, with credits earned for each ZET sold that can be used to offset deficits or traded. California's Advanced Clean Trucks Regulation requires manufacturers of medium- and heavy-duty vehicles to sell ZETs at an increasing percentage of their annual sales from 2024 to 2035.	**Infrastructure development along corridors** strategically deploys ZET infrastructure along major transportation routes and highways. In the United States, the National Zero-Emission Freight Corridor Strategy practices a phased approach for ZET corridor development prioritizing policy development and investment in key regions.
Loan interest subvention by governments directly subsidizes a portion of the interest on ZET loans. The BNDES Climate Fund Program in Brazil offers interest subvention on loans for electric and hybrid trucks at a maximum interest rate of 4% annually with no minimum loan amount and allows financing of up to 80%.	Implementing **stricter fuel economy standards** for trucks can incentivize OEMs to produce more efficient trucks. The EU's strengthened CO_2 emissions standards for heavy-duty vehicles require a significant increase in ZET production to meet targets, with annual sales reaching close to 400,000 units by 2040.	**Incentives/grants for infrastructure equipment and installation** can offset the high up-front costs of charging/refueling infrastructure for ZETs. California's EnergIIZE Commercial Vehicles Program incentivizes 50%–75% of the costs for ZET infrastructure equipment and one-time software costs.
Grants for ZET pilot deployment enable testing of ZET technical, operational, and economic viability in real-world settings. Australia's Driving the Nation Fund has allocated AU$127.9 million to support the integration of heavy battery-electric vehicles (BEVs) into the Australian transportation landscape.	**Domestic manufacturing and R&D grants** provide fiscal support to boost ZET manufacturing and promote technological innovation. In the United States, programs such as Advanced Technology Vehicles Manufacturing (ATVM) and Domestic Manufacturing Conversion Grants (DMCG) provide loans to support EV production and grants to retool existing manufacturing plants.	**Concessional land** measures include minimum lease rentals, revenue-sharing models, and property tax incentives to mitigate the high land acquisition costs for supporting infrastructure. Delhi EV Policy offers subsidized land rates to private entities under a revenue-sharing model for deploying public charging stations and battery-swapping facilities.
Exempting ZETs from certain taxes and tolls can reduce operational costs for fleet operators. Under Denmark's new road-use tax system, trucks with higher emissions incur higher taxes, at rates determined by their CO_2 emissions class.	**Skill development programs** can ensure that the workforce has the necessary skills to support the transition to ZETs. In Germany, the Vocational Education and Training program trains participants in high-voltage ZET systems, battery technology, renewable energy integration, and other skills — preparing them for roles in EV manufacturing, maintenance, and infrastructure.	**Upgrading upstream infrastructure** facilitates ZET infrastructure deployment by streamlining power availability for ZET refueling needs. Germany's Master Plan for Charging Infrastructure II tasks government agencies with assessing ZET charging needs through 2035 to secure investments and support upstream infrastructure planning.
Increasing the weight and dimension allowances for ZETs can help mitigate the payload disadvantage compared with diesel trucks. The EU's Weights and Dimensions Directive amendments allows ZETs to carry about 4 tonnes more payload than diesel trucks by 2050.		**Tariff management** involves designing tariffs to encourage sustainable charging practices, manage peak demand, and ensure grid stability. San Diego Gas and Electric (SDG&E) has introduced an EV high-power charging (EV-HP) tariff with time-of-use rates, offering up to 51% lower costs during off-peak hours for electric truck charging.
Scrappage incentives encourage the replacement of older, polluting diesel trucks with cleaner ZETs. China's vehicle scrappage policy offers purchase subsidies ranging from RMB 30,000 to RMB 80,000 for the replacement of older diesel trucks with low-emissions alternatives.		
Purchase mandates for fleet operators ensure an increasing portion of ZETs as part of their overall fleet each year. California's Advanced Clean Fleets mandates that fleets purchase ZETs with different compliance requirements based on fleet type.		

This report also presents an example of how these policy measures can be contextualized to develop a phased policy roadmap to accelerate ZET adoption in India. As a growing market with an expanding trucking sector, India holds a critical role in global supply chains presenting an opportune moment to focus on transitioning to ZETs. Key efforts are already in place, such as plans to incentivize ZET purchase through national level programs, subnational efforts on corridor development, ZET demand aggregation, ZET pilot deployment at ports, etc.

To build on these efforts, this roadmap presents recommendations for policymakers at national and subnational levels to prioritize short-term measures that can be implemented within two years, such as introducing nonbinding ZET adoption targets, purchase subsidies, reduction of toll taxes, and ZET corridor development. Meanwhile actions in the medium and long term that can be implemented beyond two years include introducing ZET purchase and sales requirements, aggregating demand, and strengthening fuel consumption standards. The recommendations allow time to implement and launch the policies, but the policies' applicable horizon periods can be longer.

Overall, policy measures for ZETs can act as a catalyst, guiding market actors to accelerate deployment and drive tangible progress. Policymakers must lead by introducing and refining strategies that enable swift market action, while industry stakeholders play a complementary role by providing critical on-ground insights to shape effective policies. Tailored, region-specific measures aligned with the respective stage of ZET deployment maturity will be essential to unlocking the full potential of zero-emissions trucking and creating a sustainable freight future.

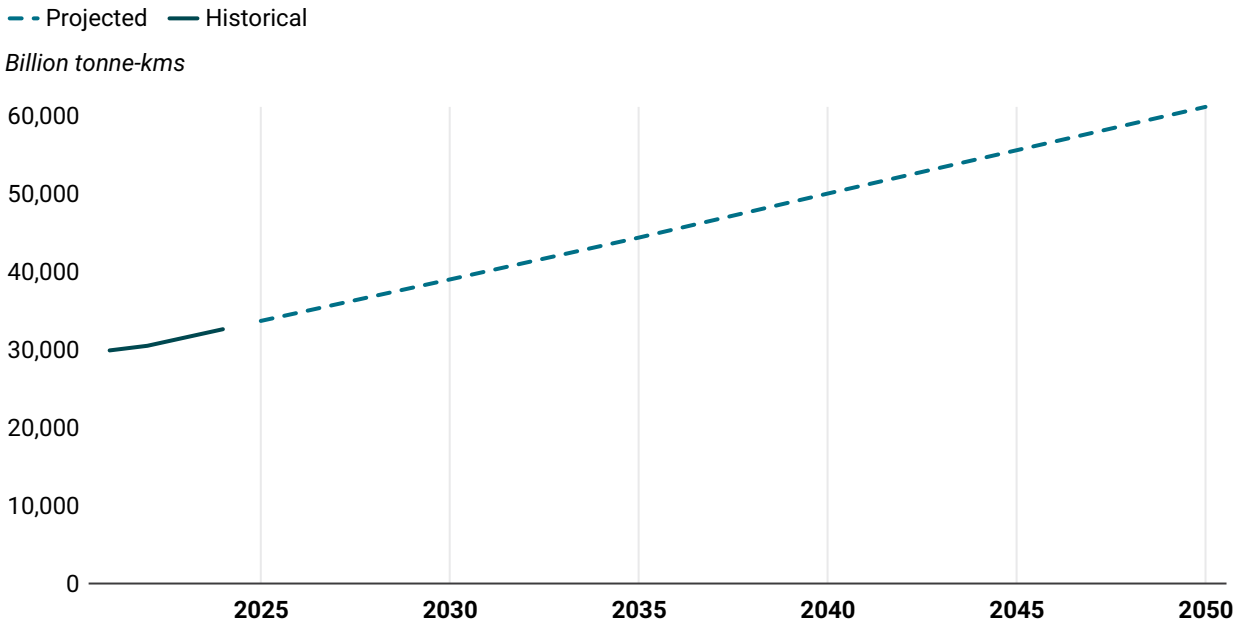
Introduction

The trucking sector plays a critical role in driving the economic growth of a country by transporting goods throughout the supply chain, from raw material sourcing to production, distribution, and consumption. It ensures the smooth functioning of the economy.

As the global economy recovers and grows in the coming years, following declines during and after the pandemic, demand for trucking services is set to rise accordingly.[5] Between 2021 and 2024, freight demand from trucks increased by 9%, and it is projected to nearly double over the next two and a half decades in a business-as-usual (BAU) scenario (see Exhibit 1).

Exhibit 1

Global freight demand from trucks is predicted to nearly double by 2050

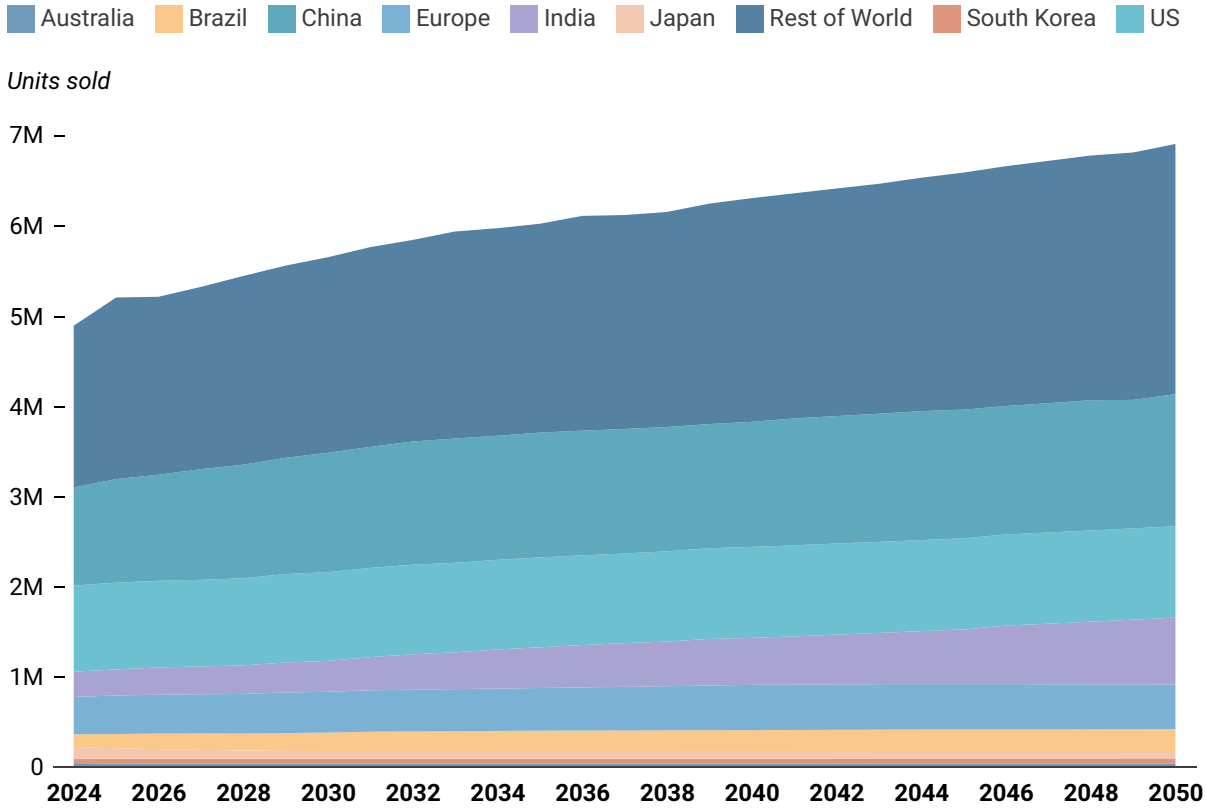


RMI Graphic. Source: RMI analysis of ***World Energy Outlook 2023***

To satisfy this growing demand, global truck sales will need to grow accordingly. Truck sales are expected to increase by 41% over current levels by 2050 in a BAU scenario (see Exhibit 2). Eight regions (Australia, Brazil, China, Europe, Japan, India, South Korea, and the United States) will account for about 60% of total truck sales in 2050. Within these eight regions, India, Brazil, and China showcase the highest growth in sales through 2050 with increases of around 165%, 73%, and 35% over current levels, respectively, which can be attributed to higher rate of economic growth in these countries.[6]

Exhibit 2

Global annual truck sales are projected to increase by 41% by 2050



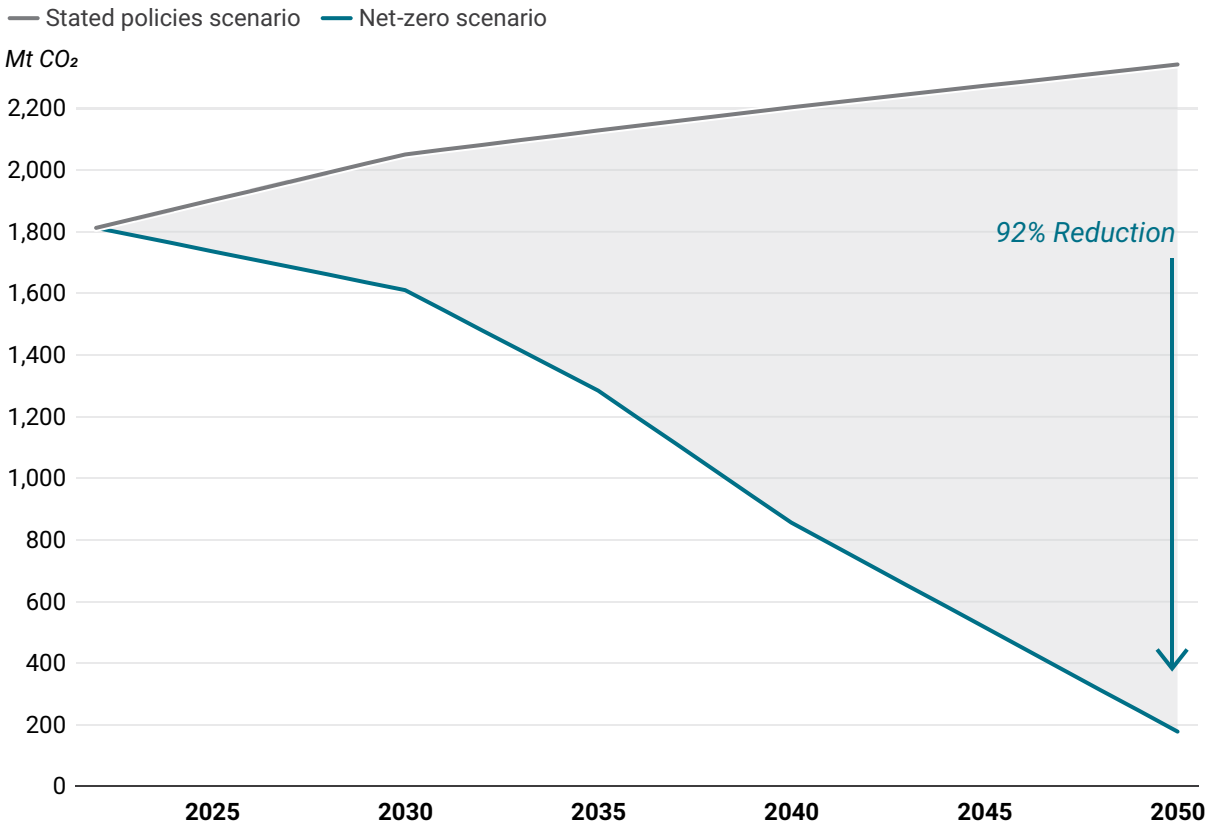
RMI Graphic. Source: RMI analysis of BloombergNEF's ***Electric Vehicle Outlook 2024***

With trucking demand on the rise and trucks accounting for only 4% of vehicles on the road globally, while emitting a disproportionate 27% of on-road greenhouse gases, we urgently need cleaner alternatives.[7] Zero-emissions trucks (ZETs) present a compelling solution, offering significantly lower CO_2 emissions (depending on the truck type and grid mix), eliminating tailpipe pollution, and reducing operational costs.

By transitioning to ZETs, global economies can significantly reduce their environmental impact. According to the International Energy Agency (IEA), a net-zero scenario in the trucking sector can help reduce about 29 gigatonnes (Gt) of cumulative CO_2 through 2050 relative to the IEA's reference Stated Policies Scenario (see Exhibit 3).[i] To achieve this, by 2050 almost all trucks sold globally must be ZETs.[8]

i The IEA's baseline scenario, the Stated Policies Scenario, considers the impact of current policy ambitions and existing measures.

Exhibit 3 Global CO_2 emissions reduction from trucking



RMI Graphic. Source: RMI analysis of IEA's *World Energy Outlook 2024*

Beyond the emissions reduction benefits, ZETs also present an opportunity to ensure economic viability for fleet operators in the long run. Typically, ZETs offer lower operational costs (fuel and maintenance) than diesel trucks. Moreover, ZETs can achieve around 30% total cost of ownership (TCO) savings relative to diesel trucks in the next 5–10 years in most regions of the world.[ii,9] This will be driven primarily by technology advancements in battery and fuel cell technologies and increasing scale in production of these components. ZETs will also lead to a reduction in oil imports and promote energy independence.

Overall, ZETs are central to decarbonizing the highly polluting road freight sector and enhancing economic viability of trucking operations, thereby contributing to long-term sustainability of the sector.

ii Total cost of ownership is the cost of ownership, which is the cost to own and operate a truck over its lifetime.





Box 1

ZET technology options

There are various ZET technology choices, and the landscape is evolving rapidly. There is no one-size-fits-all solution, as a diverse array of technologies will coexist, each tailored to meet specific use cases. Some of the key technology choices are:

- **Battery-Electric Trucks (BETs):** Rely on fixed/swappable batteries and electric motors to power the trucks. Various BET technology options serve different charging needs:
    - **Depot charging:** BETs with fixed battery charging at depots with chargers that have slower charging speeds leading to longer charging time, suitable for trucks parked overnight or for extended periods with predictable schedules
    - **En route fast and ultra-fast charging:** BETs with fixed battery charging along highways at high-powered charging stations that allow for significantly faster charging times with minimal downtime, ideal for quick top-ups during long-haul journeys
    - **Swapping:** BETs with batteries that can be swapped at dedicated swapping stations along corridors or in city centres with minimal downtime
    - **Catenary:** BETs running along fixed highway lengths powered by overhead electrical lines similar to electrified rail, suitable for long-haul routes with predictable traffic patterns and limited stops
    - **Induction:** BETs running along fixed highway lengths powered by underground coils ideal for fixed routes with minimal traffic
- **Hydrogen-based trucks:** Rely on green hydrogen through refueling stations to power trucks. Two key options are based on power train configuration:
    - **Hydrogen ($H_{2)}$ fuel cell:** Trucks powered by a combination of fuel cells, batteries, and electric motors
    - **H_2 internal combustion engine (H_2 ICE):** Trucks powered by an ICE engine similar to diesel trucks

Exhibit 4 ZET technology comparison

Vehicle type	Technology choice	Pros	Cons	Relevant use cases
BETs	Depot charging	High vehicle efficiency, technology maturity	Higher payload penalties and longer refueling time	Fleets with return-to-base operations covering small to regional daily distances and carrying volume-constrained loads like white goods, industrial parts, etc.
	En route fast charging	High vehicle efficiency, technology maturity, faster refueling than depot charging	High payload penalties	Fleets traveling along high-traffic corridors with sufficient charging and grid infrastructure network with moderate downtime availability (< 2 hours)
	Swapping	High vehicle efficiency, faster refueling time	Lesser technology maturity, some impact on payloads	Fleets traveling along closed loop systems with minimum downtime availability
	Catenary	High vehicle efficiency, faster refueling time	Risk of technology lock-in, limited technology maturity	Fleets catering to fixed, short routes with minimum downtime availability and regular power supply
	Induction			
H_2 based	Fuel cells	Faster refueling, lesser payload penalties, medium-high vehicle efficiency	Limited technology maturity, risk of investment in stranded assets	Fleets moving heavy goods like bulk commodities and covering longer daily distances
	ICE	Faster refueling, lesser payload penalwties	Least efficient, limited technology maturity	

RMI Graphic.

This report provides an overview of the existing global ZET market, key barriers inhibiting ZET adoption on a wide scale, and a host of policy interventions needed to overcome the barriers and fast-track ZET adoption. It explores policy levers deployed across different countries, with specific case studies and examples highlighting successes — serving as a comprehensive handbook of policy solutions governments can adopt.

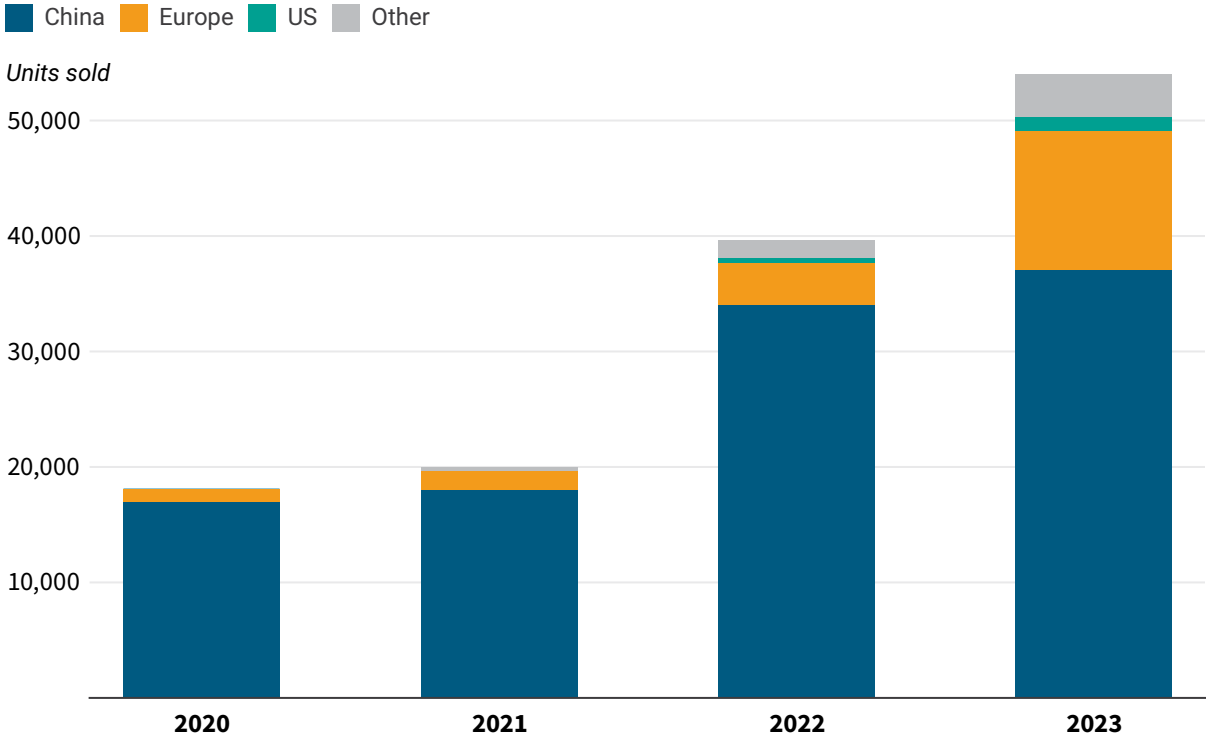
Additionally, the report includes a focused analysis of ZET policy recommendations for India, the world's third-largest truck market. With truck sales and stock projected to grow fourfold by 2050,[10] India presents a significant opportunity for ZET adoption. The report proposes a policy roadmap tailored to the Indian context, featuring near- and medium-term policy solutions that integrate global best practices while addressing India's unique challenges and opportunities.

Global Overview of ZET Adoption

As countries strive to meet their climate goals and net-zero targets, the transition to ZETs is becoming a cornerstone strategy. Between 2020 and 2023, global ZET sales increased threefold, with sales in 2023 hovering around 54,000 (see Exhibit 5).[11] This translates to a 1% sales share for ZETs globally, which the IEA projects will grow to 4% by 2025, 15% by 2030, and 29% by 2035 as per its Announced Pledges Scenario.[iii] This would lead to sales of almost 2.75 million ZETs globally by 2035.[12]

Exhibit 5

Global ZET sales increased threefold between 2020 and 2023



RMI Graphic. Source: RMI analysis of *Global EV Outlook 2024*

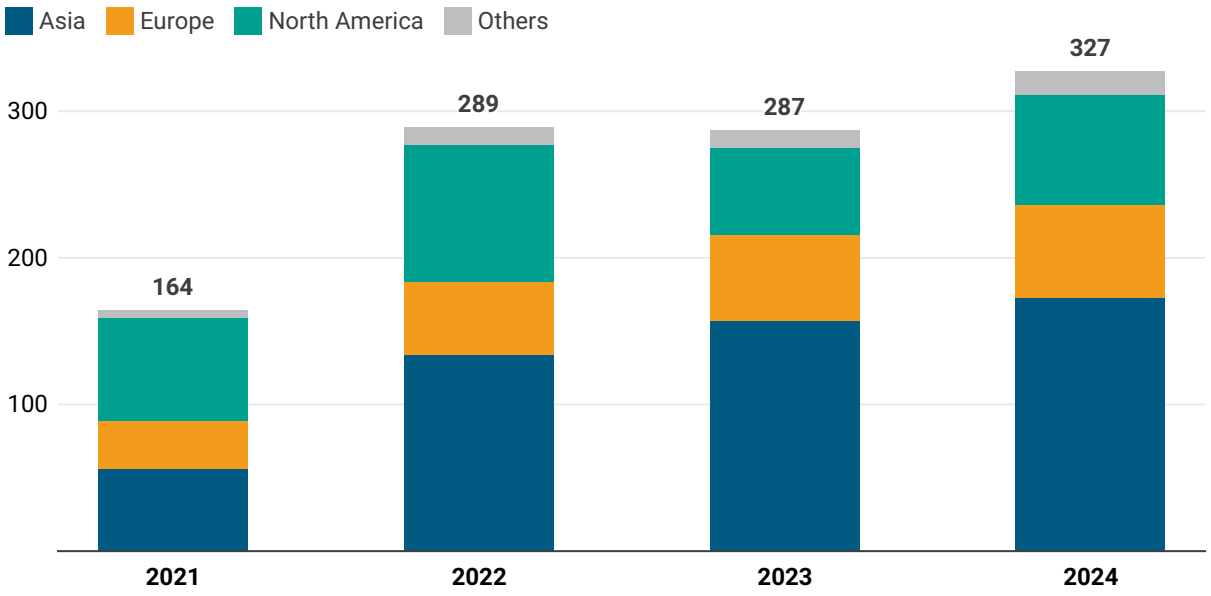
When analyzing geographic trends, it becomes evident that certain regions, such as China, are leading the ZET market. In 2023, China accounted for nearly 70% of all ZET sales worldwide, with sales evenly split between battery-electric trucks (BETs) using fixed charging and BETs with battery swapping; hydrogen fuel cell trucks made up the remaining 8.5%.[13] While China leads in overall sales, Europe has demonstrated the fastest growth in ZET adoption, with an 11-fold increase in sales between 2020 and 2023. In the United States, the market is beginning to develop, with approximately 1,200 ZETs sold in 2023. Elsewhere, ZET sales in 2023 were mainly concentrated in Japan, India, Brazil, and Australia.[14]

iii The IEA's Announced Pledges Scenario considers the announced ambitions and targets set by countries and to what extent they can help achieve net-zero emissions by 2050.

Several drivers are contributing to the increased global sales of ZETs, including the growing availability of ZET models, ambitious targets set by governments, supportive policies, and industry-led demonstration projects for ZET and infrastructure deployment. These factors collectively help accelerate the transition to zero-emissions trucking, facilitating wider adoption and scaling up of clean transportation solutions.

First, a key factor driving the increased growth in ZET adoption is the expanding availability of models. As of now, over 325 ZET models are available globally — nearly double the number in 2021 (see Exhibit 6). About half of the existing ZET models are in Asia, 95% of which are concentrated in China. Europe has 63 ZET models, while North America has around 75, with 85% of them available in the United States. This growing availability of a variety of models plays a crucial role in expanding market adoption across regions.

Exhibit 6 Available ZET models are growing globally

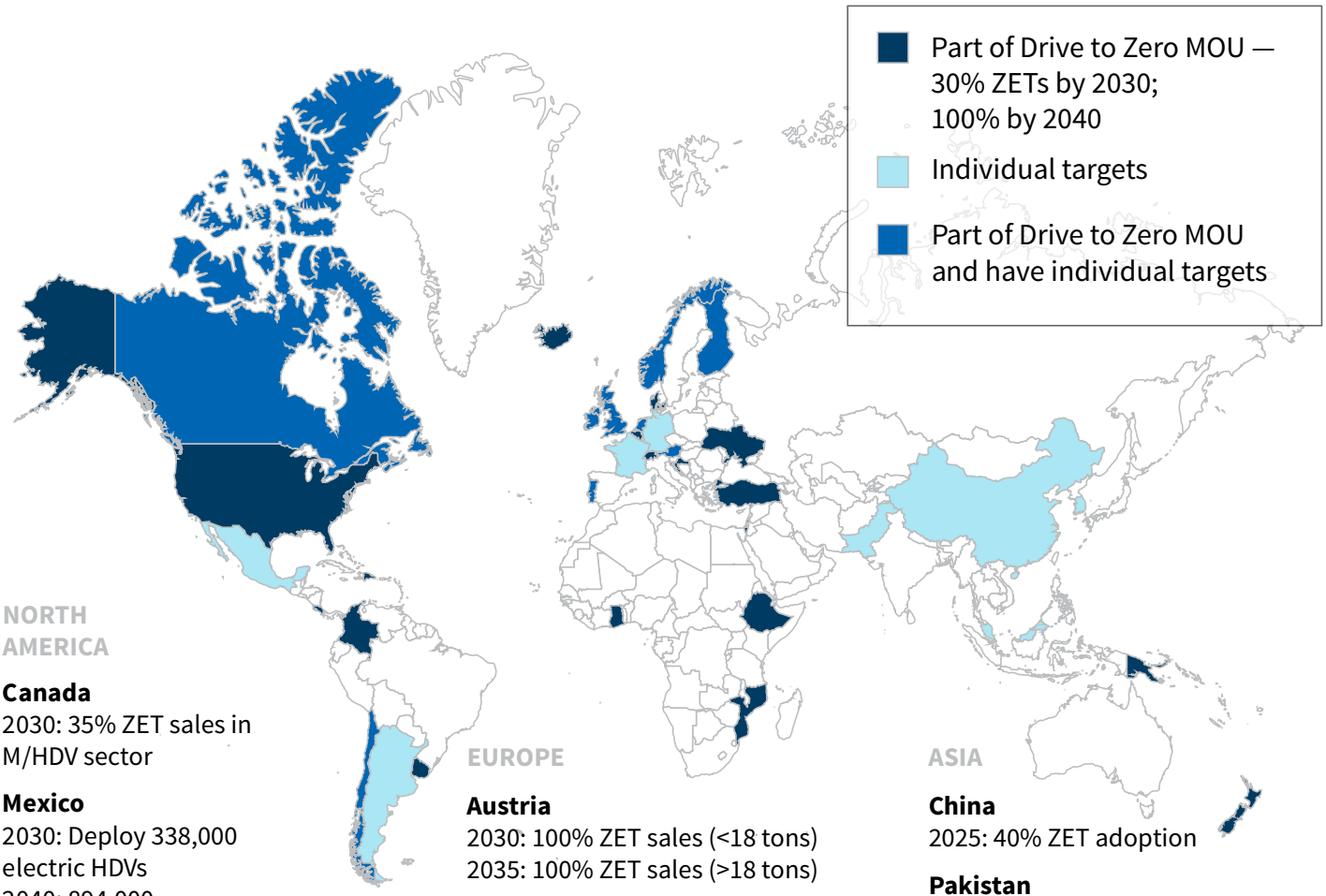


RMI Graphic. Source: Global Commercial Vehicle Drive to Zero

Apart from China, Europe, and the United States, ZET models are increasingly being commercialized in other emerging markets. For example, eight ZET models are now available in India from both international and domestic original equipment manufacturers (OEMs).[15] The first ZET model was recently launched for Southeast Asia markets, covering countries such as Malaysia, the Philippines, Singapore, and Thailand.[16] Similarly, Africa is seeing its first wave of ZET models, with Volvo commercializing trucks in Morocco and Daimler introducing trucks in South Africa.[17] These developments signal the growing global reach of ZETs, as markets across diverse regions begin to embrace cleaner transportation solutions.

A second key factor driving the growth of ZETs is the adoption of ambitious targets and supportive policies to accelerate market development and deployment. Currently, around 45 countries have set some form of ZET adoption or ICE vehicle phase-out targets (see Exhibit 7).[18]

Exhibit 7 **Global ZET targets**



NORTH AMERICA

Canada
2030: 35% ZET sales in M/HDV sector

Mexico
2030: Deploy 338,000 electric HDVs
2040: 894,000
2050: 987,000

SOUTH AMERICA

Argentina
2041: 100% ZEV sales in M/HDV sector

Chile
2045: 100% ZEV sales in M/HDV sector

EUROPE

Austria
2030: 100% ZET sales (<18 tons)
2035: 100% ZET sales (>18 tons)

France
2040: Ban ICE sales in HDV sector

Finland
2030: 4,600 electric truck stock

Netherlands
2025: 3,000 FCEVs in HDV sector

United Kingdom
2035: 100% ZEV sales (<26 tons)
2040: 100% ZEV sales

ASIA

China
2025: 40% ZET adoption

Pakistan
2030: 30% EV share in trucks
2040: 90%

South Korea
2040: 70,000 FCET stock

Malaysia
2030: 40% ZET in public vehicles

Note: Under the Drive to Zero Memorandum of Understanding (MOU), countries commit to working together to enable 100% zero-emissions new medium- and heavy-duty truck and bus sales by 2040 with an interim goal of 30% zero-emissions vehicle sales by 2030.

RMI Graphic. Source: Transition Council Phase-Out Targets: Trucks; and Global Commercial Vehicle Drive to Zero MOU Nations

Although most of these targets are in North America, Europe, and Asia, countries in other regions like Africa and South America are also starting to adopt ambitious targets. Setting such targets sends strong signals to the public sector to facilitate ZET adoption through regulations and to industry to take faster action on innovation and enabling scaled ZET deployment.

With these targets as the foundation, key regulatory measures are being launched to help decarbonize the trucking sector. The EU recently approved stricter CO_2 emissions standards for trucks, with targets to reduce emissions by 90% by 2040 relative to 2019 levels.[19] Manufacturing and adopting ZETs will be crucial to meeting these ambitious emissions reduction goals. Similarly, in the United States, the Environmental Protection Agency has revised greenhouse gas regulations, targeting ZETs to account for 25% to 60% of new truck sales, depending on the vehicle type.[20] Especially in places where ZET deployment has become more prominent, such as China, Europe, and the United States, policy support has also increased accordingly. More than 60 policies specific to ZETs are now on the books in these regions, up from just 30 in 2020.[21]

Along with regulations, new ZET-related projects are taking shape across various countries for truck and infrastructure deployment. For example, China, the leading nation in terms of ZET sales, is witnessing faster deployment among BETs with swappable batteries, owing to its mature battery supply chain and use of standardized batteries.[22] By the end of 2023, China fully operationalized the Chengdu-Chongqing corridor to facilitate movement of electric heavy-duty trucks — facilitated through six battery swapping stations performing 168 swaps per day.[23]

In the United States, ZETs are gaining ground for yard operations in and around ports. The ports of Los Angeles and Long Beach, California, are investing around $25 million in truck charging to electrify their fleets of yard trucks.[24]

In Europe, BET projects are materializing faster and at scale — DSV, a global logistics company, is partnering with Volvo to deploy 300 BETs in its fleet, making it the biggest fleet of ZETs in Europe.[25] Additionally, efforts to test other ZET technologies are taking shape in Europe; at least eight pilot projects have been announced or are in motion to deploy H_2-ICE trucks.[26]

Deployment is starting in other regions too. India has signaled a demand for 7,750 ZETs by 2030 from 16 companies to transport goods including cement, food and fast-moving consumer goods, dairy, etc.[27] In Africa, the Northern Corridor Green Freight Strategy has been launched to create EV-ready corridors across Kenya, Uganda, Rwanda, Burundi, South Sudan, and parts of the Democratic Republic of the Congo by 2030.[28] In South America, Brazil is paving the way for ZET deployment. Specifically, Iberdrola Brazil has established “The Green Corridor” in partnership with Neoenergia which covers a total length of 1,200 km and will have 12 fast chargers and 6 slow chargers to serve ZETs.[29] Overall, ZET deployment has kicked off, with some countries transitioning toward scaled deployment while many others are introducing pilot projects and deployment initiatives.

Global experience clearly shows that successful deployment of ZETs requires a combination of on-the-ground action and clear signals from the public sector. While regions like China, Europe, and the United States still have room to expand and refine policy solutions to help ZET sales reach a tipping point, emerging regions such as South and Southeast Asia, Africa, and South America can begin adopting favorable policy measures to give the ZET market a boost. These targeted policy interventions will be crucial in accelerating the global shift toward zero-emissions trucking.

Barriers to ZET Adoption and the Need for Policy Actions to Overcome Them

The widespread adoption of ZETs faces several critical barriers that must be addressed through thoughtful and strategic policy interventions (see Exhibit 8).

Exhibit 8 **Roadblocks to ZET adoption**



RMI Graphic.

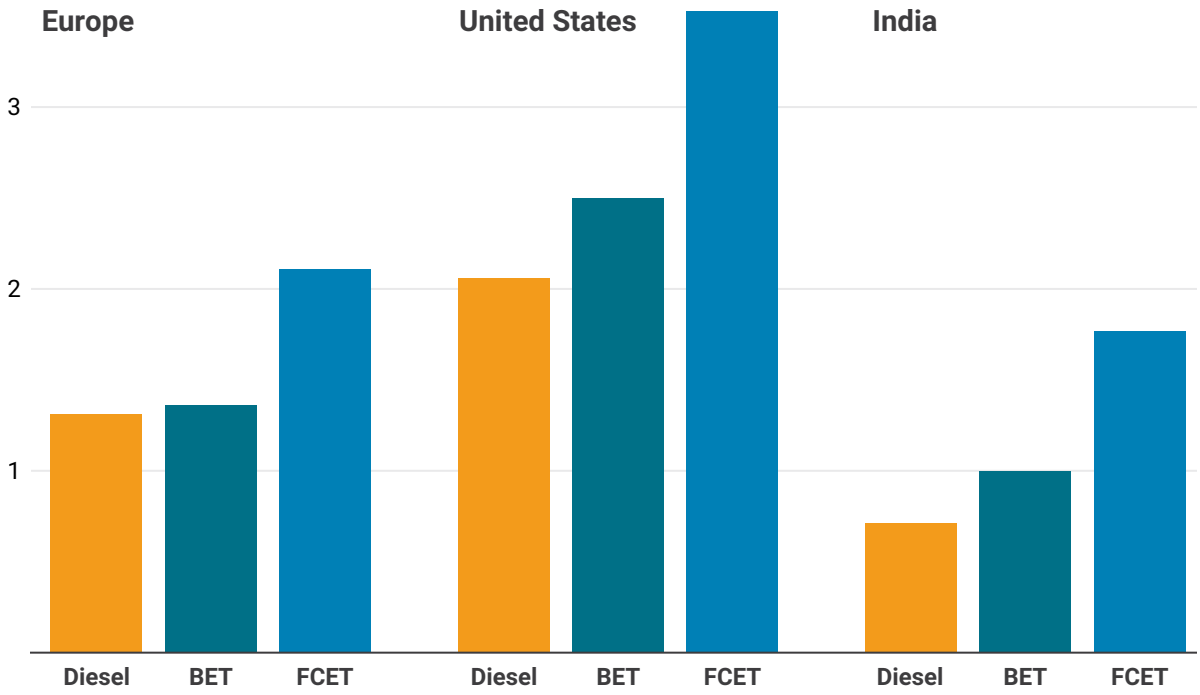
While each region and country faces unique challenges based on their economic context, infrastructure maturity, and regulatory landscape, there are some underlying similarities in these barriers, as detailed below:

1. **Lack of ZET target setting:** While some countries have set ZET-related adoption targets, most still lack such targets or ambitions. This inhibits clear market signals for industry to make a near-term push toward ZET adoption.

2. **High total cost of ownership (TCO):** The TCO is typically higher for ZETs than for diesel trucks. In Europe, the TCO of a BET is about 4% higher than that of a diesel truck, and the TCO of a fuel cell electric truck (FCET) is about 60% higher.[30] In the United States, the TCO for a BET is about 21% higher than that of a diesel truck, while FCETs are around 71% higher.[31] Similarly, in India, TCO is 46% higher for BETs than that of their diesel counterparts, and the TCO for FCETs is 43% higher (see Exhibit 9).[32]

Exhibit 9 Total cost of ownership comparison

($/kms)



RMI Graphic. Source: ICCT, RMI analysis

One of the reasons for the higher TCO of ZETs is the high purchase price of these trucks. For BETs, the biggest component of the purchase price is the cost of the battery pack, currently exceeding $210 per kilowatt-hour (kWh).[33] For FCETs, the fuel cell system is the biggest cost driver with prices exceeding $1,000/kW for heavy-duty vehicles.[34]

3. **Nascency in infrastructure development:** Large-scale transition to ZETs is contingent on a robust infrastructure to provide smooth and uninterrupted trucking operations. However, various factors are inhibiting the pace of infrastructure development. First, ZETs typically have higher power requirements to accommodate larger battery/H_2 fuel cell and storage tank and shorter downtimes. BETs require high-powered chargers (ranging from 100 kW to 1 megawatt [MW] or more), which are only beginning to become available.[35] Similarly for FCETs, availability of larger capacity refueling stations for heavy vehicles is limited.[36] Additionally, existing power grids across the globe require substantial upgrades, which can be costly and time consuming.[37]

4. **Lack of financing options:** Financiers can be apprehensive about financing ZET assets due to perceived risks linked to customers lacking formal credit history, nascent ZET technology, and asset utilization. This challenge is particularly acute in developing countries where the trucking industry is often fragmented, and fleet operators may lack strong balance sheets and credit histories. For instance, in Mexico, over half of the vehicles and trailers on the road are controlled by independent owner-operators and small companies.[38] In India, 75% of the trucking market is made up of small fleet operators or owner-operators with fewer than six trucks.[39] Moreover, more than two-thirds of trucking

loans are provided by non-bank financial companies (NBFCs), which typically charge higher interest rates.[40]

5. **Limited model availability*:*** The availability of ZET models is heavily concentrated in just a few places — China, Norway, and the United States — which together accounted for 88% of the 327 models available worldwide in 2024.[41] In other places, limited availability of ZETs makes it harder for fleet operators to find options tailored to their operations and access affordable alternatives suited to their needs.

6. **Driver acceptance and training:** The transition to ZETs requires a shift in driver behaviors and skill sets. Drivers might have limited access to training resources and may struggle to adapt to the advanced technical requirements specific to ZETs, such as charging procedures, route planning, braking, etc.

7. **Technology nascency:** ZETs are still in a nascent stage of development, both in vehicle technology and supporting infrastructure across different technologies. Progress in charging and refueling networks is ongoing to meet the demands of heavy-duty freight operations, with each technology presenting distinct advantages and limitations. These trade-offs underscore the early-stage nature of ZETs, often delaying fleet operators' decision-making and investments in ZETs. Additionally, limited data on long-term vehicle performance, battery degradation, and residual value creates uncertainty for fleet operators and financiers, complicating financing. Without established benchmarks for reliability and life-cycle costs, the secondary market for ZETs remains underdeveloped. Additionally, there is at present limited planning for battery recycling infrastructure, given that the market is still emerging and most ZET batteries haven't reached their end of life.

A dedicated policy push can break down these barriers and nudge market creation in the near term, which can eventually lead to scaled adoption in the medium and long term. Well-developed ZET-related policies that target the demand side through incentives and financing schemes can address challenges around high costs and lack of affordable financing. Demand-side measures like fleet purchase requirements, purchase subsidies and supply-side policies like manufacturing incentives, sales requirements, and fuel economy norms can enable wider ZET model availability and technology innovation. Infrastructure-related polices, like a focus on corridor development and making ZET-ready infrastructure, can enable robust and smooth ZET operations for fleet operators.

The following sections of the report will delve into various policy measures required to accelerate ZET adoption and specific examples of these measures applied in different parts of the world.

Handbook on ZET Policies



This section outlines a comprehensive suite of policy solutions categorized into three main subsections: demand-side policies, supply-side policies, and policies for ZET infrastructure. These three subsections reflect a comprehensive approach to addressing the multifaceted challenges associated with transitioning to ZETs.

Demand-side policies for ZETs

Demand-side policy formulation plays a pivotal role in jump-starting market demand for ZETs by focusing on fleet operators, which are the primary purchasers and operators of these vehicles. Their procurement decisions are driven by the commercial viability of ZETs, which is heavily influenced by the TCO. Demand-side policies aim to lower the overall TCO of ZETs and strengthen the business case for investment, thereby accelerating adoption. Increased demand, in turn, drives supply-side economies of scale, reducing production costs and further enhancing the market competitiveness of ZETs.

Exhibit 10 highlights key policy interventions that can encourage and incentivize ZET adoption. Purchase subsidies, concessional loans, and grants for pilot deployment alleviate the up-front financial burden on fleet operators by lowering the initial capital costs and interest. Additionally, exempting tolls and taxes and increasing payload capacity make operating ZETs more cost-effective by reducing operational expenses and increasing truck space utilization. Lastly, scrappage and buyback programs along with purchase mandates incentivize fleet operators to retire older, polluting vehicles, creating demand for new ZETs.

Exhibit 10 Demand-side measures to fast-track ZET deployment

Policy	Description	Case study
Purchase subsidies	Direct financial support to offset up-front costs for acquiring ZETs	Purchase subsidy for ZETs, the Netherlands
Loan interest subvention	Direct government subsidies for a portion of the interest on ZET loans to reduce financing costs	Interest subvention by Brazilian Development Bank (BNDES) Climate Fund Program, Brazil
Grants for ZET pilot deployment	Fiscal grants to support ZET pilots to instill confidence in ZET technology and operational feasibility	ARENA grants for Driving the Nation Program, Australia
Exemption of tolls and taxes	Waivers or discounts on tolls and taxes associated with ZET operations	Road-use tax for trucks based on emissions class, Denmark
Increasing payload carrying capacity for ZETs	Measures to increase gross vehicle weight rating (GVWR)* and dimension allowance to compensate for increased weight of ZET drivetrains	EU Weights and Dimensions Directive for zero-emissions HDVs, EU
Scrappage and buyback programs	Incentives for retiring older, high-emission vehicles in exchange for environmentally friendly ZETs	Scrappage policy for diesel trucks, China
Purchase mandates for fleet operators	Requirements that fleet operators incorporate a number of ZETs in their fleets	Advanced Clean Fleets regulation, California, United States

*GVWR refers to gross vehicle weight rating, the maximum weight that a vehicle can transport safely. Gross vehicle weight (GVW) is the total weight of all the axles below the chassis. It is calculated as the unladen weight of the vehicle plus payload.

RMI Graphic.

Purchase subsidies

Purchase subsidies are aimed at decreasing the high up-front cost of a ZET, which in turn leads to reduction in the TCO and helps ZETs achieve TCO parity with diesel counterparts earlier. This helps improve the business case for fleet operators to invest in ZETs. These subsidies can take a few forms — up-front incentives, tax credits or rebates, or at point of sale — all of which directly lower the financial burden on buyers.

Governments at both national and subnational levels across different countries are embracing purchase subsidies as a key measure to spur ZET adoption because they are relatively easy to implement and have high impact potential. For instance, the United States' Inflation Reduction Act (IRA) offers tax credits of up to $40,000 or 30% of the vehicle price,[42] while states like California provide incentives ranging from $45,000 to $240,000 depending on truck type.[43] The Canadian government, under its Incentives for Medium-Heavy Duty Zero Emission Vehicles, offers incentives in the range of CA$10,000–CA$200,000.[44]

In Europe, the Netherlands provides up to €115,200 per truck,[45] and Germany, until recently, covered 80% of the cost gap between ZETs and diesel trucks.[46] China's New Energy Vehicles purchase subsidy previously offered RMB 35,000–RMB 50,000 for trucks, although this program has been phased out.[47]

These subsidies have significantly advanced TCO parity timelines, with the IRA in the United States accelerating parity by five years,[48] and European subsidies advancing parity by 1–7 years depending on the country and subsidy level.[49]

Case study

Purchase subsidy for ZETs, the Netherlands



In 2022, the Netherlands introduced the Aanschafsubsidie Zero-Emissie Trucks (AanZET) scheme to incentivize fleet operators to adopt ZETs by providing purchase subsidies to bridge the cost gap with diesel trucks. The subsidy amounts are structured to increase with the gross vehicle weight rating (GVWR), addressing the higher costs associated with heavier trucks. Additionally, the scheme incorporates an equity-based approach by offering larger subsidies to smaller companies, which often lack the financial resources of larger businesses, while allocating relatively smaller subsidies to bigger companies. This ensures a fair distribution of funds and wider adoption across various fleet operators. Exhibit 11 lays out subsidy details for 2024.

The scheme has been renewed every year and has incentivized an increasing number of ZET purchases. In 2023, the scheme — with a budget of €30 million — subsidized 400 ZETs, exhausting the entire budget within a day.[50] In March 2024, the scheme was renewed, and it subsidized 600 new ZETs with a budget of €45 million.[51] Recognizing this success, the program received additional funding of €22.2 million to further increase ZET uptake in 2024, and new funding has been made available with a budget of €35.3 million for the first round starting January 28, 2025, and €30 million for the second round starting September 30, 2025.[52]

Exhibit 11

Purchase subsidy percentage and amount for ZETs in 2024

Vehicle category	Large company		Medium-sized enterprise		Small business and nonprofit	
	Subsidy amount (share of purchase cost)	Maximum subsidy	Subsidy amount (share of purchase cost)	Maximum subsidy	Subsidy amount (share of purchase cost)	Maximum subsidy
N2 (GVWR between 4.25 and 12 tonnes)	6.1%	€7,500	12%	€14,700	14.8%	€18,000
N3 (GVWR between 12 and 18 tonnes)	10.3%	€31,100	20%	€60,500	28.6%	€86,600
N3 (GVWR of more than 18 tonnes)	11.1%	€43,900	21%	€83,200	29%	€115,200
N3 tractor	11.1%	€43,900	21%	€83,200	29%	€115,200

RMI Graphic. Source: AanZET

Loan interest subvention

Government can introduce interest subvention as a targeted policy tool that helps reduce financing costs by directly subsidizing a part of the interest on ZET loans. These loans are offered through multilateral development banks, NBFCs, or other public financial institutions within the country. The government may allocate dedicated funds or use existing development funds from its budget to cover the interest subvention provided to lending institutions. Subvention schemes often also include additional requirements, such as buyback guarantees from OEMs or extended warranties to further de-risk loans for financial institutions. By alleviating the interest burden, interest subvention enables fleet operators to manage the high up-front costs of ZETs.

Case study

Loan interest subvention by Brazilian Development Bank (BNDES) Climate Fund Program, Brazil



The BNDES Climate Fund Program, a government-led initiative with an initial funding limit of R$200 million (about US$33 million), later augmented by an additional R$580 million from the Ministry of Environment (MMA),[53] offers interest subvention on loans for electric and hybrid trucks to reduce greenhouse gas emissions in Brazil.

Using MMA resources, the program offers loans at a maximum interest rate of 4% per year with no minimum loan amount and allows financing of up to 80% of the equipment's value. Typically, interest rates for heavy-duty trucks range upward of 10%.[54] Additionally, borrowers are given a flexible repayment term of up to 12 years, including a grace period ranging from 3 to 24 months. Loans can be accessed through any of the public banks accredited by BNDES, enabling streamlined approvals and enhanced accessibility for micro and small enterprises transitioning their fleets to zero-emissions trucks.

By 2020, the fund's portfolio had approved over 860 financing operations, allocating more than R$700 million (about US$111 million) in funding, reflecting its significant impact in advancing sustainable transportation in Brazil.[55]

Grants for pilot project development

Pilot projects for ZET deployment are crucial to instilling confidence among market players related to ZET technology, operational feasibility, and economic viability under real-world conditions. Prioritizing deployment of such pilot projects can serve as the springboard for ZETs to transition from nascency to widespread adoption. Countries are introducing fiscal grants to support such pilot projects.

For instance, in San Diego, California, and in New Zealand, fiscal grants are supporting ZET pilot deployment by funding 25% to 90% of the cost of heavy-duty ZETs.[56] Setting aside a dedicated pool of funding for a certain number of ZETs can create near-term momentum for ZET adoption while complementing other policy solutions to drive scale.

Case study

ARENA grants for Driving the Nation Fund, Australia



The Australian Renewable Energy Agency (ARENA) Driving the Nation Fund has allocated AU$500 million in grants to support the integration of battery-electric vehicles (BEVs) into heavy vehicle fleets, development of new technologies, and deployment of charging infrastructure.[57] To access this funding, businesses submit project proposals outlining their innovative solutions and demonstrating a commitment to reducing emissions in the heavy transport sector. Projects must address critical areas like charging infrastructure, up-front vehicle costs, and operational integration.

ARENA's Driving the Nation Fund has already supported several key projects, including Global Express's Depot of the Future, which deployed 60 battery-powered delivery vehicles in one of the largest electric truck trials globally. Additionally, 112 battery-electric trucks are set to be deployed for last-mile deliveries in Australian metro areas, supported by AU$12.8 million in funding.[58] Furthermore, ARENA has allocated AU$28.6 million to two major logistics providers, Linfox and Toll Group, leveraging over AU$124 million in total investment to expand electric truck fleets and develop charging infrastructure.[59]

Exemption/reduction of tolls and taxes

Tolls are a major expense for truckers globally, with a significant impact on their operational costs. For instance, in China, tolls can add up to as much as 20% of a driver's revenue, representing a substantial financial burden.[60] In India, truckers heavily rely on national highways, where toll charges are significant: truckers pay upwards of INR 17 lakh (US$20,200) over their truck's lifetime.[61] In the United States, toll costs per mile have increased by 22% from 2022 to 2023, rising faster than all other operational cost categories.[62]

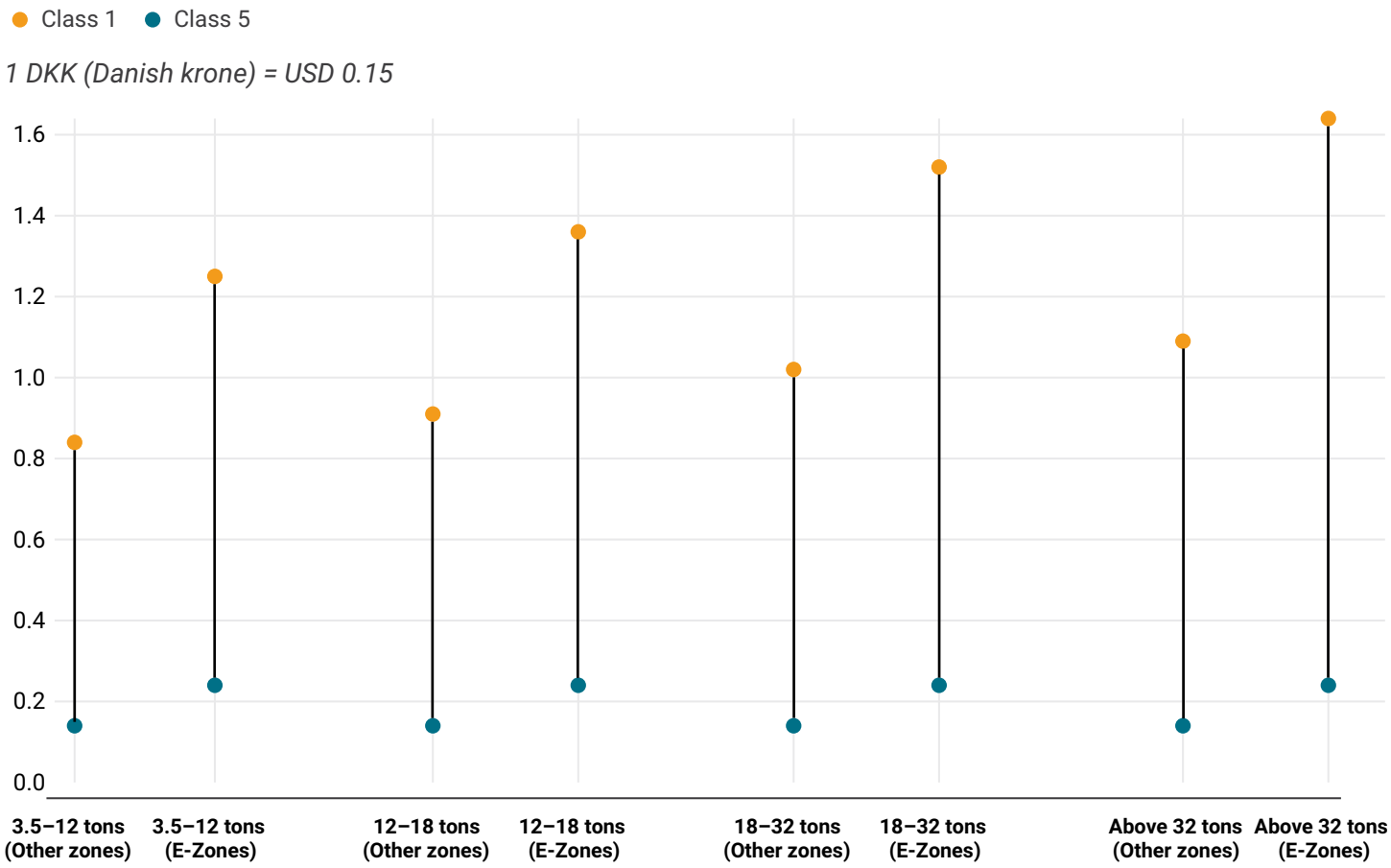
In several countries, truckers are also subject to various other taxes and fees, in addition to tolls. For example, in the UK, fleet operators must pay a Vehicle Excise Duty,[63] an annual tax based on a truck's weight, emissions class, and engine size to ensure compliance with environmental standards. Similarly, Switzerland charges a distance-related heavy vehicle fee based on the total weight of the vehicle, the distance traveled, and emissions.[64] Governments can introduce policy mechanisms to waive toll charges and road and other forms of taxes to help reduce ZET operational expenses.

Case study

Road-use tax for trucks based on emissions class, Denmark

Denmark's climate law aims for 70% reduction in greenhouse gas emissions from the current level by 2030.[65] To support this goal, the country has introduced a road-use tax in 2025 based on vehicle emissions class and distance traveled. Under this system, trucks with higher emissions incur higher taxes, determined by their CO_2 emissions class (Class 1 being the most polluting and Class 5 the least). Additionally, Denmark has designated four "environmental zones" (e-zones) in its most populated cities: Copenhagen, Aalborg, Aarhus, and Odense. Trucks operating within these zones face higher road-use taxes. The tax rate structure for 2025–27 is detailed in Exhibit 12.

Exhibit 12 **Road-use tax structure for trucks in Denmark, 2025-27**



RMI Graphic. Source: KmToll



ZETs, which fall under CO_2 emissions Class 5, will benefit significantly from this road tax structure since they have the lowest road-use tax of all the emissions classes (80%–85% lower compared with emissions classes 1–4). The tax differential between emissions classes becomes more pronounced as truck size increases, providing additional incentives for ZET adoption, particularly in heavier truck segments. Furthermore, the difference in road tax between e-zones and other zones is minimal for ZETs, while it is substantially larger for other emissions classes. The new road-use tax structure is expected to reduce CO_2 emissions by approximately 272,155 tonnes in 2025 and 362,873 tonnes in 2030 compared with current levels.[66]

Increasing payload carrying capacity for ZETs

A limiting factor for economical operation of ZETs is that they generally have less payload capacity than equivalent ICE trucks.[iv] BETs tend to have lower payloads because of the greater weight of their batteries, which in turn have a lower gravimetric energy density than those in diesel-fueled vehicles. FCETs can sometimes have lower payloads since they require more space to house the hydrogen tank, which in turn has lower volumetric energy density than diesel. The reduced payload capacity in turn leads to higher cost per tonne-km for fleet operators compared with ICE trucks.

A policy measure to increase maximum weight and dimension allowance for ZETs can help to negate this effect. This would lead to lower cost per tonne-km, since a fleet operator would not need to invest in more ZETs to move the same weight or volume of cargo. Such a policy can be implemented by providing extra allowances for a ZET equivalent to the difference in payload gap in terms of weight or volume, relative to an ICE truck.

Case study

Weights and Dimensions Directive for zero-emissions HDVs, EU



The EU regulates the weight and length of heavy vehicles like trucks to ensure safety, limit damage to roads, and ensure the long-term health of road infrastructure under its Weights and Dimensions Directive. Because of limits on the weight and length of the trucks, ZETs can't carry the same amount of load as their diesel counterparts owing to heavier battery packs and space-consuming hydrogen tanks. BETs can lose up to 4 tonnes of load, and FCETs may require 0.5–0.9 meter of additional length compared with diesel trucks, causing 10% less payload.[67]

To address this, the EU has amended its Weights and Dimensions Directive and increased the weight and length limits for ZETs. Specifically, the GVWR for ZETs was increased from 40 tonnes to 44 tonnes, the maximum permissible length was increased by 0.9 meters, and axle weight allowance was increased by 1 tonne.[68]

The revised directive — which gives ZETs an additional 4-tonne allowance compared with diesel trucks — is expected to lead to savings of around €3.9 billion for fleet operators between 2025 and 2050.[69] The promotion of ZETs through this measure is also expected to reduce energy consumption by 12 million tonnes of oil equivalent by 2050,[70] translating to a reduction of 27.8 million tonnes of CO_2 emissions.[71]

Scrappage and buyback programs

Scrappage incentives and buyback programs are essential tools for accelerating the transition to ZETs by addressing both cost barriers and fleet modernization.

Scrappage programs offer financial rewards — such as cash payments, tax credits, or trade-in bonuses — to

iv Payload capacity is the actual weight of the load a truck can carry. It's usually expressed as gross vehicle weight rating (maximum allowable weight of the truck including its own weight) minus curb weight (weight of the truck without any load).

consumers who retire their older, polluting diesel trucks in favor of cleaner alternatives. These programs can be designed to prioritize the most polluting trucks by considering factors like the truck's age, distance traveled, and CO_2 emissions levels. To further incentivize the adoption of ZETs, rewards can be tiered, offering the highest benefits for replacing older trucks with ZETs and gradually reducing them for other lower-emissions technologies. Buyback programs offer truck owners a guaranteed residual value for their vehicles, helping to mitigate financial risks associated with battery degradation and resale value uncertainty.

These programs play a critical role in reducing up-front costs and enhancing the economic case for transitioning to ZETs, especially in emerging economies where the average age of truck fleets is quite high. For example, the average fleet age in Mexico, Brazil, and India is around 15, 12, and 10 years, respectively, highlighting the urgent need for modernization.[72] Additionally, these programs promote the recycling and responsible disposal of end-of-life vehicles, supporting the efficient utilization of resources and helping to mitigate waste generation.

Case study

Scrappage policy for diesel trucks, China



China has set an ambitious goal to peak CO_2 emissions before 2030, as outlined in its comprehensive action plan.[73] Within the transportation sector, the plan targets 40% of new vehicles, including trucks, to be powered by new or clean energy by 2030.[74] Additionally, the Diesel Truck Pollution Control Action Plan aims to increase the share of ZETs and National VI emissions standard trucks to 40% of the fleet by 2025.[v,75] To support these objectives, China has implemented a robust subsidy structure to incentivize the replacement of older diesel trucks with low-emissions alternatives:[vi]

- A subsidy of RMB 80,000 (US$11,281) for purchasing a low-emissions truck when scrapping a diesel truck below National III emissions standards
- A subsidy of RMB 35,000 (US$4,935) for purchasing a low-emissions truck if no truck is scrapped
- A subsidy of RMB 30,000 (US$4,230) for early scrapping of an old diesel truck

This policy framework is expected to double the volume of scrapped vehicles by 2027 compared with 2023 levels, simultaneously driving demand for new, cleaner trucks.[76] The increased subsidy for a ZET when an older truck is scrapped makes up about 12%–15% of the purchase cost of a BET (6%–7% in the case of an FCET), compared with the previous subsidy of RMB 35,000, which is about 5%–6% of the BET purchase price, or 2%–4% in the case of an FCET.[vii]

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v The National VI emissions standard in China is a regulatory framework aimed at reducing vehicle emissions of pollutants like nitrogen oxides, particulate matter (PM), and hydrocarbons to improve air quality.

vi "Low-emissions trucks" refers to trucks that either run on clean energy or have low emissions. These can include ZETs or even fossil fuel trucks that conform to the National VI emissions standards in certain cases.

vii Assumes BET cost of RMB 620,000 (US$87,160) and FCET cost of RMB 1.3 million (US$182,756) in China.

Purchase mandates for fleet operators

ZET purchase mandates require fleet operators to incorporate an increasing number or share of ZETs in their fleet over time. It can also require them to purchase only ZETs and phase out diesel trucks from a given year, with penalties for nonadherence. These mandates are crucial as they stimulate demand for OEMs, which leads to increased investment across the supply chain, ultimately driving down manufacturing costs.

During the initial phases, these mandates can be combined with various incentives such as purchase subsidies for the fleet operators to help alleviate some of the financial burden in the near term. Purchase mandates can be complemented with a sales requirement for OEMs, which would increase the availability of ZETs in the market, ensuring that fleet operators have adequate selection to support daily operations when switching over to ZETs.

Case study

Advanced Clean Fleets regulation, California, United States



The California Air Resources Board (CARB) has launched purchase mandates through the Advanced Clean Fleets (ACF) regulation with a goal of 100% ZET sales in the MDT and HDT sector by 2045.[77]

Fines of up to $10,000 per vehicle per day can be imposed on fleet operators if purchase mandates are not met.[78] The mandates are set out for specific use cases:

- **Drayage fleets:** The ACF highlights that all drayage fleets (referring to trucks operating in seaports and rail yards) must use only ZETs by 2035. To meet this goal, starting in 2024, all new trucks registered must be ZETs while existing ICE trucks can be operated until end of life.

- **Federal fleets:** Fleets at the federal (national) level must ensure that 50% of new truck purchases between 2024 and 2026 are ZEVs. Starting in 2027, all new purchases must be ZEVs.

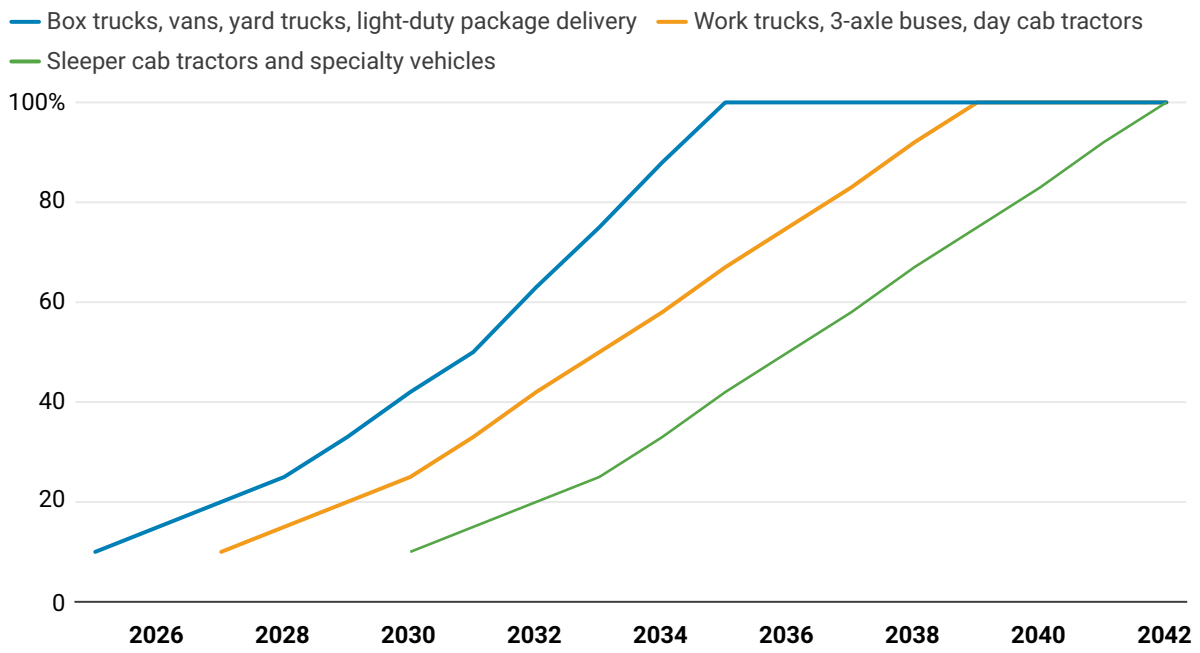
- **High-priority fleets:** High-priority fleets with either 50 or more trucks or which have a minimum gross annual revenue of $50 million have two choices for compliance:

    1. **Model year schedule:** Starting in 2024, fleet operators can purchase only ZETs and starting in 2025 must scrap ICE vehicles at the end of their life. While it is a straightforward rule, it mandates ZET purchase in all use cases, some of which might not be favorable for ZET adoption in the near term.

    2. **ZEV milestone schedule:** Fleet operators can also choose to meet ZET targets as a percentage of total fleet composition each year, based on the vehicle class, as shown in Exhibit 13. This allows operators to comply incrementally without having to only purchase ZETs from 2024. However, they must hit the composition targets each year, which might also require retiring ICE vehicles before end of their operational life.

Exhibit 13

ACF ZEV milestone schedule for high-priority fleets



RMI Graphic. Source: RMI

The ACF regulation is expected to complement the Advanced Clean Trucks regulation in California.[viii] The regulations will result in 510,000 ZEV sales (including ZETs) in the state by 2035, rising to 1.35 million by 2045 and 1.69 million by 2050.[79] It is expected to result in healthcare savings of $26.5 billion for the state due to improved air quality.[80] It will also save fleet owners around $48 billion cumulatively by 2050 due to reduced operating costs for ZETs.[81]

Supply-side policies for ZETs

Ensuring a regular and sufficient supply of ZETs is equally crucial to generating a robust ZET demand, and quite often these measures need to happen in tandem. This ensures that fleet operators have the right set of products available for their varied trucking operations and in turn demand more products, further strengthening the supply and so on. Supply-side policies focus on creating a favorable ecosystem that enhances investment and innovation, boosts model availability, and enables economies of scale.

Exhibit 14 outlines the wide array of supply-side strategies along with global case studies that policymakers could deploy depending on the national/subnational objectives. ZET sales requirements compel OEMs to sell ZETs at an increasing rate each year while also enabling wider model availability. Fuel economy norms incentivize OEMs to flexibly introduce cleaner truck alternatives while indirectly compelling them to sell ZETs in the long run. Domestic manufacturing and R&D grants ensure that investments are tailored toward ZET manufacturing to create scale and introduce technological innovation to eventually reduce costs. And skills development programs help enhance workforce skill sets to smoothly carry out ZET manufacturing, operations, and maintenance.

viii The Advanced Clean Trucks regulation implemented by the CARB requires manufacturers to sell an increasing number or share of ZETs each year.

Exhibit 14 Supply-side policies to foster ZET manufacturing in India

Policy	Description	Case study
ZET sales requirements	Set a minimum percentage of ZET sales for manufacturers, with credits earned per ZET sold, considering factors like range and efficiency	Advanced Clean Trucks Regulation, California
Fuel economy norms	Incentivize fuel-efficient vehicle production, penalizing OEMs with inefficient truck fleets and fostering innovation in ZET technology	Strengthened CO_2 emissions standards for new heavy-duty vehicles, Europe
Domestic manufacturing and R&D grants	Encourage domestic ZET manufacturing via incremental localization, synergizing with financial incentives and specific grants for technology development and innovation	Domestic manufacturing grants, United States
Skill development programs	Enhance workforce capabilities through skills training programs for a ZET ecosystem, covering technical, operational, and managerial aspects crucial for development and maintenance of ZETs	Vocational education and training programs, Germany

ZET sales requirements

A ZET sales requirement ensures that manufacturers meet a certain percentage of sales through zero-emissions vehicles. Usually, the percentage of ZET sales required increases each year, becoming gradually stricter. Manufacturers earn credits for each ZET sold, based on factors like range and efficiency. These credits can be used to offset sales requirements or can be traded. Excess credits can be saved for future compliance or sold to manufacturers with deficits. For these programs, monitoring mechanisms can be implemented to ensure adherence, and penalties may be introduced for noncompliance.

The adoption of a ZET sales requirement offers several benefits. First, the program enforces ZET market scaling by compelling OEMs to meet designated sales targets, enhancing model availability, and sending strong market signals to fleet operators to purchase trucks suitable for their needs. Second, by focusing on sales rather than production, the requirement ensures a practical transition for OEMs, allowing them to continue diesel truck production while prioritizing the introduction of ZET alternatives. This approach aligns with market demands and offers flexibility for OEMs to transition gradually. Third, the policy rewards early moving OEMs with revenue from trading or selling excess credits, providing a competitive edge and incentivizing further investment in ZET production and innovation.

Case study

Advanced Clean Trucks regulation, California



California's Advanced Clean Trucks (ACT) regulation, enacted in 2021, aims to accelerate the transition to zero-emissions medium- and heavy-duty vehicles in the state. The regulation is essential for California to meet its ambitious target of reducing greenhouse gas emissions by 80% by 2050.[82]

Under ACT, manufacturers of medium- and heavy-duty vehicles are required to sell ZETs as an increasing percentage of their annual sales from 2024 to 2035.[83] By 2035, sales of 55% of Class 2b–3 (3.8–6.3 tons) pickup trucks and vans, 75% of Class 4–8 (6.3 tons and above) rigid trucks, and 40% of Class 7–8 tractor trailers (11.7 tons and above) need to be ZEVs.[84] For each ZEV sold, manufacturers are eligible to earn credits specific to the weight class of the ZEV. These credits can be traded, sold, or transferred to other manufacturers and can be used to satisfy deficits incurred for the sale of ICE vehicles.

The ACT regulation targets were surpassed in California in its first year of compliance in 2024, with manufacturers selling more single-unit medium- and heavy-duty ZEVs than required for the year.[85] Overall, the ACT regulation is expected to reduce 29 million tonnes of CO_2 cumulatively between 2020 and 2040,[86] while also providing economic and health-related benefits worth US$11.2 billion over the same period.[87]

Fuel economy norms

Fuel economy norms are standards set by governments which set targets for OEMs to achieve reduction in fuel consumption or CO_2 emissions from trucks.[ix] These targets can be applied at the fleet level, where the average emissions across the entire fleet that OEMs manufacture adhere to the target, or at the individual level, where every truck in the fleet must adhere to the target. The key aim is to encourage OEMs to produce diesel trucks that emit less and are more energy efficient or increase ZET production. For meeting or exceeding the standards, OEMs are typically offered credits, which can be traded, carried forward, or exchanged with other OEMs lacking credits while penalties are imposed for nonadherence.

Imposing fuel economy norms promotes a technology-agnostic approach to emissions reduction. While OEMs can continue to reduce fuel consumption of diesel trucks, it may be more economical to switch to ZETs in the future owing to their falling production cost. Indirectly, these norms compel OEMs to produce more ZETs.

Countries like Japan and the United States implemented these standards as early as 2006 and 2014, respectively, and have since strengthened them.[88] The EU adopted these standards in 2019 and recently revised them to align with the latest climate neutrality targets.[89] China recently made its fuel consumption standards for heavy-duty trucks more stringent, requiring reduction of 12%–16% compared with its previous iteration.[90] In 2023, India adopted its first fuel consumption standards for heavy-duty trucks.[91] The fact that countries are adopting these standards and strengthening them with time highlights the importance they place on this measure and can bolster confidence in other countries to implement it.

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ix Fuel economy norms, or their equivalent, may exist under different names, but they serve the same goal. For example, in the United States, Canada, and the EU, they are termed GHG/CO_2 emissions standards, while China abides by the Corporate Average Fuel Consumption (CAFC) Standards. In Japan they may be referred to as Average Fuel Efficiency Standards and in India as Fuel Consumption Standards.

Case study

Strengthened CO_2 emissions standards for new heavy-duty vehicles, Europe

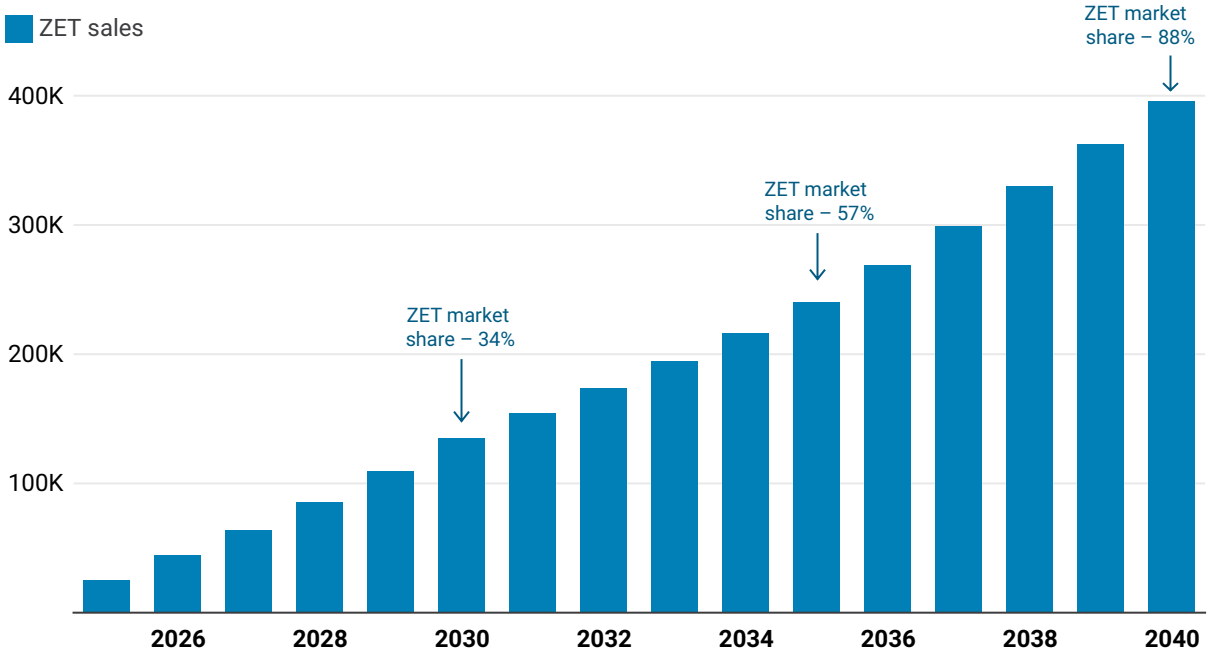


EU emissions standards for trucks and lorries target a 45% reduction in CO_2 emissions by 2030, 65% by 2035, and 90% by 2040 compared with 2019 levels. These are considered the most ambitious such standards to be proposed globally.[92] Manufacturers will have to meet these targets for new trucks sold in a year and can accrue credits if their average CO_2 emissions are below the reduction trajectory, while penalties are imposed if they exceed the established limits. The proposed standards cover around 80% of all new heavy vehicle sales in the EU.[93]

To comply with such stringent CO_2 reduction targets, OEMs will need to produce an increasing number of ZETs each year. To meet these targets, ZET production would need to reach 7% in 2025, 34% in 2030, and 88% by 2040, reaching 3.1 million in sales between 2025 and 2040 (see Exhibit 15).

Exhibit 15

Annual ZET sales and share needed to meet the EU's strengthened CO_2 emissions standards



RMI Graphic. Source: RMI analysis of BloombergNEF's *Electric Vehicle Outlook 2024*

This proposed revision aligns with the EU goal of achieving climate neutrality by 2050 and is expected to offset 1.8 billion tonnes of CO_2 emissions through 2050.[94] Air pollutant emissions are projected to decrease by 66%–80% by 2050.[95] Furthermore, the overall cost of fossil fuel imports by the EU is estimated to fall by €150 billion–€200 billion over the 2031 to 2050 period.[96]

Domestic manufacturing and R&D grants

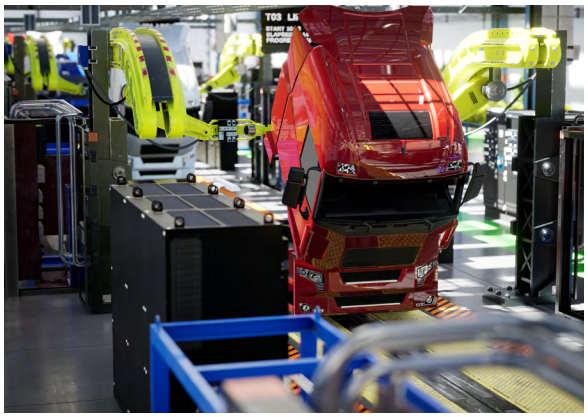
Domestic manufacturing grants are targeted financial aid to support the establishment, expansion, or conversion of manufacturing facilities involved in ZET production and their components. The grants cover a certain percentage of the associated costs for equipment, the cost of training workers, etc. These grants aim to build a robust domestic supply chain, reduce reliance on imports, and ensure that the benefits of the ZET transition are maximized within the country. They also play a critical role in indirectly boosting auxiliary industries such as raw material suppliers, logistics, and maintenance services.

At the same time, grants for R&D provide financial support to accelerate the commercialization of ZET technologies. Such grants can include funding innovation in energy-dense battery designs, grid integration and load management, and ultra-fast charging prototypes for BETs. For FCETs, this innovation may include improving hydrogen fuel cell power density and efficiency as well as improving fuel cell stack design.

These grants help foster innovation, bring products to market quickly, and improve economies of scale, potentially leading to more competitive pricing for ZETs.

Case study

Domestic manufacturing grants, United States



The United States has introduced several grants and loans to strengthen domestic ZEV manufacturing, boost competitiveness for local automakers, and create jobs for domestic workers across the EV value chain. Two key programs supporting ZEV manufacturing include:

- **The Advanced Technology Vehicles Manufacturing (ATVM) loan program:** This program, introduced in 2008, provides loans to support the manufacturing of vehicles, including EVs, and their components using advanced technologies. The program was expanded to include projects for manufacturing of medium- and heavy-duty vehicles under the IRA. Further, it has earmarked $3 billion in credit subsidies for loans taken under the program, resulting in an estimated $40 billion of direct loans.[97]

- **Domestic Manufacturing Conversion Grants (DMCG) program:** The DMCG, introduced as part of the IRA, will provide grants to support the retooling of plants manufacturing EVs and associated equipment, and rehiring workers in these plants. Manufacturers can claim grants for up to 50% of the costs associated with retooling and rehiring. The first tranche will provide $2 billion in grants.[98]

The accessibility of grants and loans helps to ease the burden of high capital investments associated with ZEV manufacturing, leading to increased investment across the supply chain. The ATVM program, after

being revamped under the IRA, has provided around $13.5 billion in loans to both new and existing players across the EV supply chain.[99] This has led to the creation of around 11,000 construction jobs and 12,000 operations jobs.[100] The DMCG program has provided $1.7 billion in support to convert 11 shuttered or at-risk auto manufacturing and assembly facilities in eight states.[101] These projects are expected to create around 3,000 new jobs and retain over 15,000 existing workers.[102]

Skill development programs

To fill the skills gap arising from the ZET transition, governments can introduce programs to train new talent and upskill existing workers. This includes training in areas such as battery management, electric motor repair, charging infrastructure installation, and ZET maintenance. These programs are often offered in partnership with public institutions to make them widely accessible and affordable. For instance, in China, Germany, Mexico, and the United States, specialized ZEV training programs are offered in collaboration with community colleges, vocational institutes, and even relevant industry partners.[103] By equipping the workforce with the technical capabilities, these programs directly contribute to minimizing operational disruptions with the newer ZET technologies, increase technology confidence, and alleviate concerns from financiers and fleet operators about risks linked to after-sales services.

Case study

Vocational education and training programs, Germany



The German government, in collaboration with industry leaders and academic institutions, has established the Vocational Education and Training system, providing training in high-voltage systems for ZETs, focusing on safety protocols, diagnostics, and maintenance. The system also offers specialized training in battery technology, including battery chemistry, thermal management, and life-cycle diagnostics. Additionally, participants are trained in renewable energy integration, covering topics such as smart grid compatibility and energy storage solutions. These programs prepare participants for immediate roles in ZET manufacturing, maintenance, and infrastructure development.

The program is run by Germany's federal government. It offers a total of over 330 skill development courses.[104] The Federal Institute for Vocational Education and Training guides the structure of the programs to meet the skills gap, and the Federal Employment Agency, Planet-Beruf.de, ensures that these courses are meeting German employers' needs. The program remains a key contributor to Germany's skilled workforce — with about half a million participants entering each year.[105] Additionally, host companies participate in the programs and recruit participants for jobs in the process. This highlights how these programs translate into tangible employment opportunities and enable the participants to fill the skills gap in the workforce created by the rapid transition to ZETs.

Policies for ZET infrastructure

A well-developed support infrastructure consisting of charging stations, battery swapping stations, hydrogen refueling stations, and supportive grid systems forms the backbone of the ZET ecosystem. Developing this infrastructure is crucial to addressing daily refueling needs, alleviating concerns related to range anxiety, executing smoother trucking operations, and bolstering confidence among fleet operators to adopt ZETs.

Developing the right infrastructure requires careful consideration of where and when trucks need to be refueled, infrastructure equipment and fuel prices, land availability, upstream fuel availability constraints, etc. Exhibit 16 outlines key policy interventions that take these considerations into account. Governments can strategically identify key corridors with high truck traffic. For these corridors, incentives can be provided to bear the cost of hardware and installation along with offering land at concessional rates for infrastructure setup with proactive upstream planning and development. Finally, to reduce stress on the grid and reduce operating costs for fleets, policies to support tariff management can be introduced.

Exhibit 16

Policies for infrastructure development

Policy	Description	Case study
Infrastructure development along corridors	Strategically deploys ZET infrastructure along major transportation routes and highways	National Zero-Emission Freight Corridor Strategy, United States
Incentives/grants for infrastructure equipment and installation	Provides financial support for the purchase and installation of charging infrastructure and equipment	Energy Infrastructure Incentives for Zero-Emissions (EnergIIZE) Commercial Vehicles, California
Concessional land	Offers cost-effective and easily accessible land for the establishment of charging stations.	Revenue-sharing model under Delhi's Electric Vehicle Policy, India
Upgrading of upstream infrastructure	Facilitates ZET infrastructure deployment by operationalizing pre-installation of necessary electric infrastructure, reducing barriers for future charging station deployment	Master Plan for Charging Infrastructure II for heavy-duty vehicles and megawatt charging, Germany
Tariff management	Implements dynamic pricing based on time or vehicle type, encouraging charging when electricity demand is lower, optimizing grid efficiency	San Diego Gas and Electric (SDG&E) commercial EV rate reform, California

Infrastructure development along corridors

Corridors are the backbone of freight transportation, accounting for a significant portion of total road freight traffic of any country. For instance, in India, about 50% of total road freight traffic moves along major corridors.[106] In the United States, 10% of the country's trade corridors move 79% of all goods.[107] About 12% of Brazil's primary paved highways support about 70% of its domestic road freight traffic.[108] In Sub-Saharan Africa, around US$200 billion worth of goods are transported over 10,000 km of corridors across the region each year.[109]

Given the disproportionate share of corridors in road freight movement across countries, it's imperative to make corridors ZET ready. ZET corridors are highway stretches running between points A and B equipped with necessary infrastructure. ZET corridors enable better returns on investment by concentrating resources and investments in areas with maximum demand, help minimize risk by ensuring higher utilization of assets and lower costs, and act as a test bed for technology deployment.

Governments can identify suitable corridors for ZET deployment by considering factors like high truck traffic, industrial clusters, and warehouses as origin-destination points; sufficient upstream power and substation access; favorable regional policies; and suitable highway conditions like flat terrain. Once suitable corridors are identified, governments can plan asset deployment by understanding use cases and truck travel patterns, thereby deciding the right infrastructure configuration that can be scaled along a particular corridor. Once plans are developed, the right funding sources can be identified to finance infrastructure development.

Case study

National Zero-Emission Freight Corridor Strategy, United States



The National Zero-Emission Freight Corridor Strategy was released to accelerate adoption of ZETs by prioritizing policy development and investment at key regions of the National Highway Freight Network (NHFN) in a phased manner until 2040 (see Exhibit 17).[110, x] The strategy is divided into four phases:[111]

- **Phase 1 (2024–27):** This phase is focused on identifying corridor segments originating from key high truck traffic hubs such as truck parking spots, intermodal facilities, and ports. The early movers will most likely be medium-duty vehicles with return-to-base operations. Overall, 23% of total corridor miles of the NHFN will be prioritized for ZET deployment in Phase 1.

- **Phase 2 (2027–30):** Key hubs through the corridor segments identified in Phase 1 are to be connected. The focus will expand to long-haul use cases, with an emphasis on BET charging and some FCET refueling. Almost 36% of corridor miles under NHFN will be prioritized for ZET deployment by the end of Phase 2.

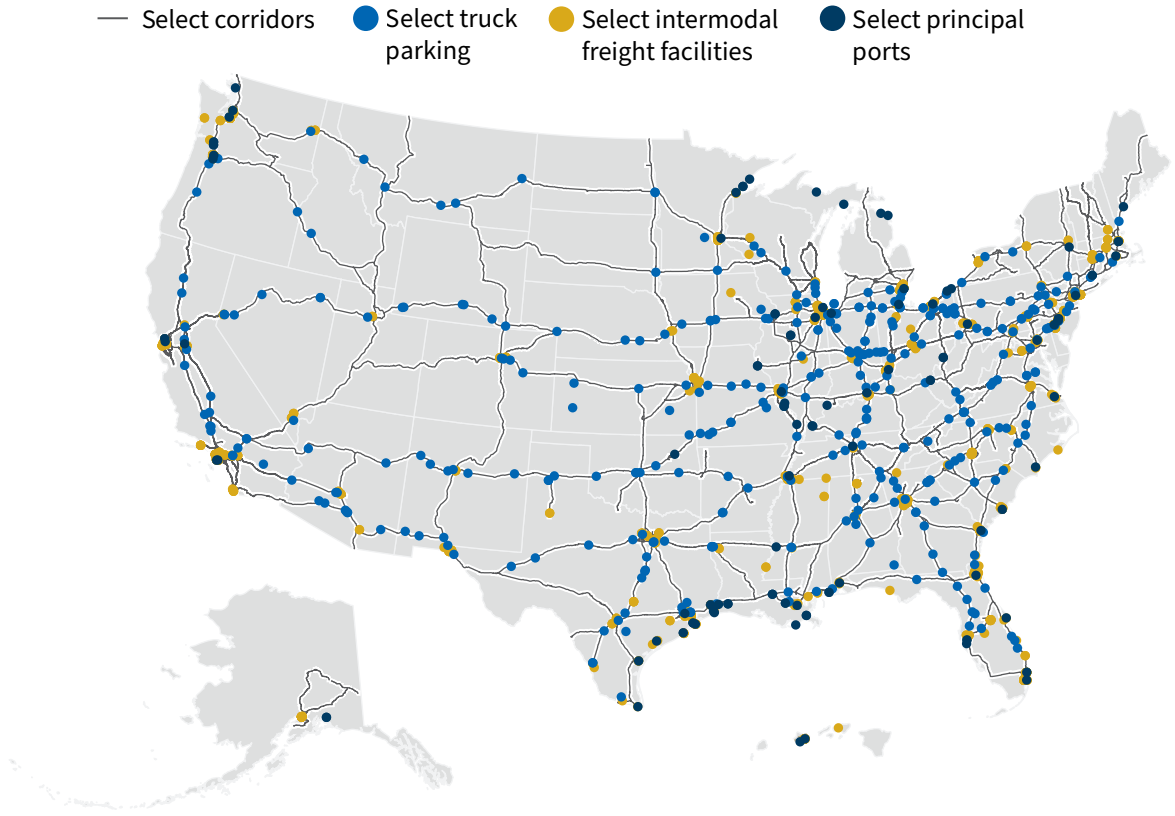
x NHFN comprises 60,110 miles of highways across the United States where freight is typically moved.

- **Phase 3 (2030–35):** Corridors connecting existing hubs are to be expanded to incorporate newer hubs and logistics facilities. This phase will witness rapid deployment of both BETs and FCETs, and around 72% of the NHFN network will be prioritized for ZET deployment.

- **Phase 4 (2035–40):** The NHFN is outfitted for widespread access to charging and refueling infrastructure for all use cases and truck types.

Exhibit 17

Expected ZET infrastructure network by 2040



Note: Select corridors includes National Highway Freight Network
RMI Graphic. Source: US Joint Office of Energy and Transportation

The strategy is intended to serve as a guide for public and private stakeholders to better target investment in a phased approach for ZET corridor development. By 2040, the project will cover 94% of the NHFN and decarbonize the movement of more than 2 billion tonnes of goods annually.[112]

Incentives/grants for infrastructure equipment and installation

Infrastructure equipment including charging stations, battery swapping stations, and hydrogen refueling stations for trucks are expensive to build and install. For example, a high-powered charger (150–350 kW) can cost $85,000–$250,000 in the United States.[113] A battery swapping station for heavy-duty trucks in China costs over $1.5 million.[114] A hydrogen refueling station typically costs $2 million–$3 million globally.[115]

Fiscal incentives and grants in the early years to offset potential revenue losses and mitigate risk due to the lower expected utilization of infrastructure assets will help attract private investments toward ZET infrastructure. Additionally, these incentives enhance the return on investment (ROI) for infrastructure providers.

Case study

Energy Infrastructure Incentives for Zero-Emission (EnergIIZE) Commercial Vehicles Project, California



EnergIIZE is an infrastructure incentive project funded by the California Energy Commission's Clean Transportation Program. The project offers incentives to fleet owners or infrastructure providers for purchasing infrastructure equipment and software for medium- and heavy-duty EVs and hydrogen fuel cell vehicles.[116]

Funding is provided for both fleet charging and public/shared charging projects, and varies based on the stage of planning the project is in. Projects receive extra funding if they are developed in low-income areas. The funding can cover 50%–75% of the total project cost, up to $750,000 for BET charging stations, and up to $4 million for FCET refueling stations.[117]

EnergIIZE Commercial Vehicles has already awarded over $140 million to approximately 250 applications.[118] Around $37 million of this was allotted to hydrogen refueling stations for FCETs, $65 million for private medium- and heavy-duty truck charging infrastructure, and around $9 million for public/shared charging infrastructure.[119] As a result, over 3,500 chargers or refueling stations have been funded under the program.

Concessional land

Availability of land is crucial in the context of ZETs as they require commercial space for charging, swapping, or refueling infrastructure. This real estate can be expensive to access and adds to the infrastructure setup costs for fleets and infrastructure providers, which can drive up refueling costs. Governments can introduce concessional land measures to mitigate the costs, mortgages, and logistical hurdles of identifying and securing appropriate land for infrastructure. These measures can be offered through several channels:

1. **Minimum lease rentals:** Governments provide public lands to private entities at subsidized rates, thereby reducing the capital expenditure for infrastructure setup.

2. **Revenue-sharing model:** Government allocates public land for charging/refueling/swapping and subsequently receives a percentage of the revenue generated from the station.

3. **Zoning adjustments:** Modifications are made to land-use regulations to integrate mixed-use, commercial, or public areas. This can enhance accessibility and flexibility for site selection.

4. **Property tax incentives:** Government offers property tax cuts or exemptions for land that is earmarked for ZET infrastructure, lowering operational expenses.

Case study

Revenue-sharing model under Delhi's EV policy



Delhi is prioritizing land concessions to private entities for the deployment of public charging stations and battery swapping facilities. As a key component of Delhi's EV policy, this initiative aims to enhance the financial viability of private investments in EV infrastructure by providing discounted land rates, along with additional incentives such as subsidies for electrical infrastructure and charger installation.

The land allocation process involves the Delhi government categorizing and tendering different locations based on detailed site assessments. To ensure equitable access, the policy mandates a specific number of slow and moderate/fast chargers at each location. The concessionaires are then selected through a competitive bidding process. The selected concessionaire pays a subsidized land rate, and a revenue-sharing fee of INR 0.70/kWh of power sold to the land-owning agency. [120]

This model addresses the challenge of land scarcity and ensures the strategic placement of charging stations across the city, including underserved areas. With a combination of land concessions and other infrastructure incentives, Delhi now boasts over 1,900 charging stations and more than 230 battery swapping stations across the city, providing a robust infrastructure network.

Upgradation of upstream infrastructure

The global shift toward zero-emissions transportation necessitates significant improvements in upstream infrastructure. This includes strategic enhancements to electricity transmission facilities, grid management systems, and distribution networks to accommodate the escalating charging and refueling demands of heavy-duty trucks.

To facilitate these upgrades, a combination of fiscal and nonfiscal incentives is crucial. One of the key fiscal measures is performance incentive mechanisms where utilities are incentivized by regulators if they prioritize minimizing grid interconnection times for e-truck charging.[121] Other fiscal measures can include incentives for equipment like new transformers, substations, and switch gears. Meanwhile, nonfiscal approaches to grid modernization include prioritizing proactive planning by regulatory authorities, states, and utilities to assess where charging loads for ZETs will most likely occur based on customer demand and ZET growth. Additionally, streamlining the processing of permits for grid upgrades can minimize delays, reduce costs, and support faster rollout of high-powered chargers required to support ZET adoption.

Case study

Master Plan for Charging Infrastructure II for heavy-duty vehicles and megawatt charging, Germany

The National Centre for Charging Infrastructure (NCCI) in Germany launched a Master Plan for Charging Infrastructure II to guide charging infrastructure development in the country.[122] One of the key pillars of the master plan is seamless integration of upstream grid with charging infrastructure by focusing on the following measures:

- Federal Ministry for Economic Affairs and Climate Action (BMWK) is making information around power lines location and capacities readily available through a publicly accessible platform.

- NCCI and the Federal Ministry for Digital and Transport are assessing infrastructure and power demand for electric trucks till 2035. This information will be provided to grid operators and utilities to better plan grid infrastructure upgrades.



- BMWK is accelerating efforts to digitize and harmonize the permitting process for grid upgrades for high-powered public fast chargers, based on the success of similar efforts for low-powered private chargers.

- BMWK will establish processes and binding timelines for certain information around grid connection costs and time requirements by grid operators. This is intended to speed up grid connection times and generate wider transparency with infrastructure development plans.

- BMWK is expected to implement harmonized technical grid connections to help streamline infrastructure deployment by charging providers along different grid boundaries.

These measures highlight the crucial roles that central ministries can take to collaborate with different utilities and regulators at regional levels to help plan requisite grid upgrades proactively.

Tariff management

ZETs pose high power demands owing to larger battery sizes and the need for faster charging to accommodate their limited downtime for daily operations. Hence, power tariffs to satisfy ZET charging pose an additional financial burden to fleet operators. This necessitates measures for tariff management to help optimize energy use, balance grid loads, and incentivize off-peak charging. Governments can introduce two key measures:

- A special EV tariff is a pricing strategy that offers preferential electricity rates for charging ZETs and other EVs. Under this approach, electric utilities apply discounted rates specifically for electricity used in charging, distinguishing it from standard residential, commercial, agricultural, or industrial rates.

- Time-of-use (TOU) rates, as an EV tariff management practice, assign the electricity price per kilowatt-hour according to the time of day — including peak period, off-peak period, and sometimes shoulder periods. This tariff structure serves as an effective tool for utilities to manage and flatten the load curve, thereby promoting the efficient use of the electrical grid, reducing peak demand spikes, and enhancing grid stability. These rates incentivize ZET owners to charge their vehicles during off-peak hours when prices are lower as overall electricity demand is lower.

Case study

San Diego Gas and Electric commercial EV rate reform, California



The California Public Utilities Commission (CPUC), aiming to encourage the use of charging stations during periods of excess grid capacity, has authorized San Diego Gas and Electric (SDG&E) to implement an electric vehicle high-power charging (EV-HP) tariff rate tailored for medium- and heavy-duty electric vehicles.[123] This initiative complies with the directives of the CPUC, which mandates utilities to accelerate transport electrification.

The EV-HP rate incorporates seasonal charges and TOU energy charges ($/kWh), based on when and how the energy is being consumed. With defined periods — namely "peak," "off-peak," and "super off-peak" as shown in Exhibit 18 — customers benefit from differential rates, promoting charging during low-demand hours.[124] For instance, during summer peak hours, the rate is approximately $0.16/kWh, while off-peak and super off-peak hours offer a reduced rate of about $0.078/kWh — a notable 51% decrease.[125] This pricing structure incentivizes fleet customers to charge during periods of lower demand, benefiting both utilities and fleet operators. With the EV-HP rate in place, fleet operators can realize substantial monthly savings ranging from 20% to 50%.[126]

Exhibit 18 Distribution of TOU charges under EV-HP pricing

		Summer	Winter
Peak	All days: 4 p.m.–9 p.m.		
Off-peak	Monday to Friday: 6 a.m.–4 p.m.; 9 p.m.–12 a.m. Weekends and holidays: 2–4 p.m.; 9 p.m.– 12 a.m.		
Super off-peak	Monday to Friday: 12–6 a.m.; 10 a.m.–2 p.m.; March and April only Weekends and holidays: 12 a.m.–2 p.m.		

Note: Summer pricing runs June through October. Winter pricing is applicable November through May.

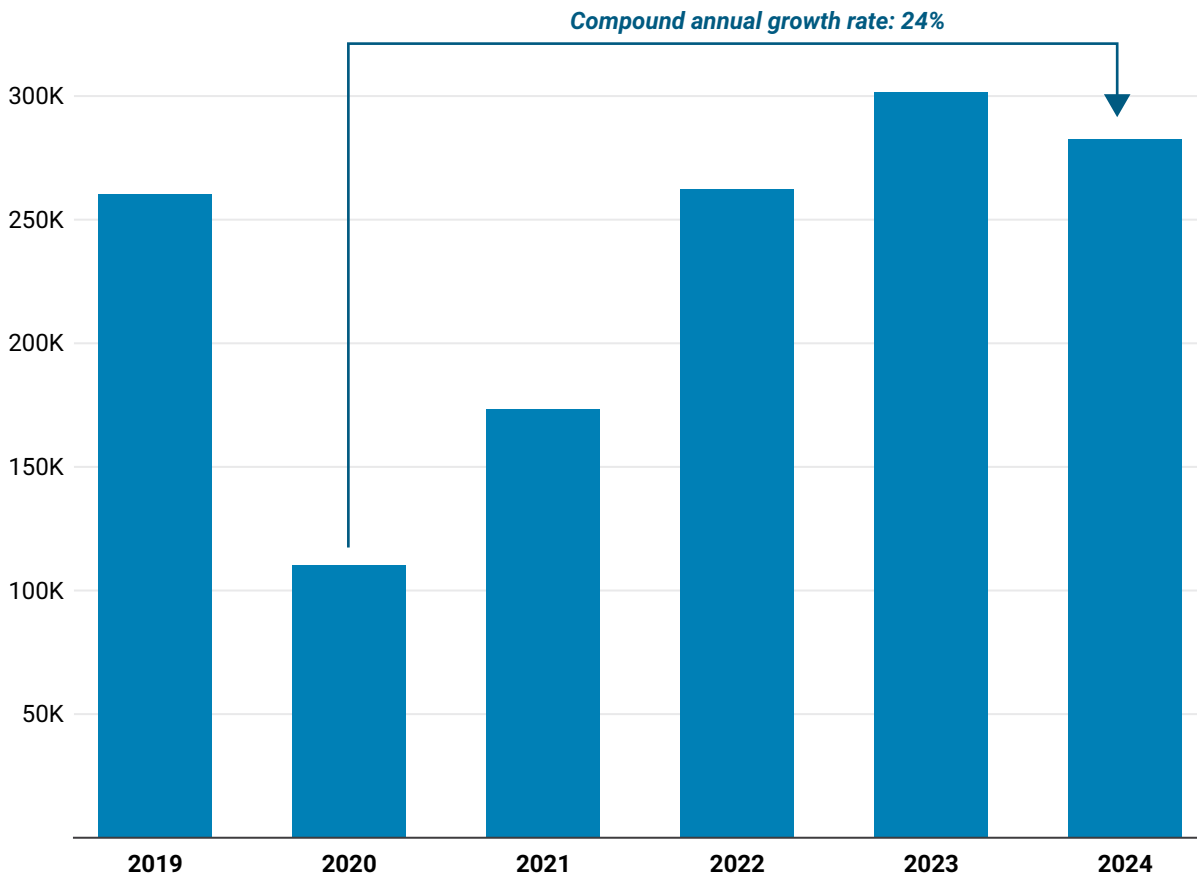
Source: SDG&E

ZET Opportunity for India

Trucking, serving as the lifeline for the transportation of goods across vast expanses of India, plays a pivotal role in the nation's economic growth. Medium- and heavy-duty trucks carry 68% of total road freight in the country.[127] Around 320,000 trucks were registered in 2024, an exponential increase from 2020 (see Exhibit 19). With growing demand for goods, truck sales are expected to increase fourfold by 2050.[128] Accordingly, the trucking stock is expected to increase by 3.5 times between 2024 and 2050.[129]

Exhibit 19

Medium- and heavy-duty truck registrations in India, 2019-24



RMI Graphic. Source: India Ministry of Road, Transport and Highways

Despite its indispensable contribution, the sector's heavy reliance on diesel-powered trucks poses significant environmental concerns. The trucking fleet is just 3% of the total vehicle fleet but accounts for over 34% of CO_2 and 53% of particulate matter (PM) emissions from the transport sector.[130] It's also responsible for around 57% of India's transportation-related petroleum use.[131]

In the face of environmental and economic challenges, there is an urgent need to introduce cleaner alternatives in the trucking sector. Transitioning from diesel trucks to ZETs can be that crucial and

necessary intervention. ZETs can achieve 85% sales share by 2050 through a set of supportive policies and industry efforts to drive scale. This can help avoid 2.8 Gt of CO_2 emissions and save INR 116 lakh crore in oil expenditures and 24.5 million tonnes of nitrogen oxides emissions cumulatively through 2050.[132]

National and subnational governments understand the need and urgency to decarbonize the trucking sector and are introducing concrete measures to initiate ZET adoption across the country. Some key recent developments include:

- **PM E-DRIVE Scheme:** Following the successful implementation of Faster Adoption and Manufacturing of Electric Vehicles (FAME) I and II to provide demand- and infrastructure-related incentives, the Government of India has launched the PM E-DRIVE Scheme to further incentivize EV adoption. This scheme, with a total outlay of INR 10,900 crore, will provide incentives for vehicle purchase across different segments, infrastructure development, and EV manufacturing for two years.[133] Around INR 500 crore has been allocated to incentivize e-trucks. The incentives will be provided against a scrapped ICE truck of equal or higher GVWR with approved scrappage certificates by Ministry of Road Transport and Highways. Specific details of incentive amount per truck are yet to be announced.

- **The Bharat Zero Emission Trucking (ZET) Policy Advisory:** The Office of the Principal Scientific Adviser (PSA) to the Government of India has recently launched an advisory for policy recommendations to advance ZET adoption. The advisory proposes targeted fiscal incentives, including subsidies, tax breaks, and concessional loans, to reduce the financial burden on fleet operators. Additionally, it calls for strategic infrastructure investments, such as the development of charging and refueling networks along key freight corridors.[134]

- **Ministry of Power (MoP) Charging Infrastructure Guidelines:** The MoP's latest guidelines on EV charging installation and operation target e-truck movement along key corridors and highways — with suggested setup of fast charging stations every 100 km along both sides of highways.[135]

- **National level roadmaps:** The Office of PSA has launched two technical roadmaps for ZET deployment in India.[136] The roadmaps highlight key aspects of field research for ZET corridor and infrastructure development, ZET technologies development, refinement of standards, and execution of ZET pilots. In addition, the office has launched a detailed technology assessment for ZET deployment along the Delhi–Jaipur corridor which can serve as a blueprint for overall corridor development in the country.[137] This assessment offers cost and operational comparison for ZETs and associated infrastructure for differing ZET technologies including battery electric (charging, swapping, catenary, and induction) and hydrogen (internal combustion and fuel cell). Moreover, the PSA Office has launched the "E-mobility R&D Roadmap for India" to help guide the country to self-reliance in EV technology within the next five years.

- **Demand aggregation initiatives:** The Government of India's policy think tank, NITI Aayog, is spearheading efforts to aggregate ZET demand in order to provide necessary market signals to OEMs to manufacture ZETs at scale. Through its e-FAST platform,[xi] NITI Aayog has facilitated active collaboration between manufacturing companies and logistics service providers generating a demand for 7,750 ZETs from 16 corporations through 2030.[138]

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xi Electric Freight Accelerator for Sustainable Transport (e-FAST) is a national platform spearheaded by NITI Aayog focused on building awareness, sharing knowledge, and engaging stakeholders to fast-track freight electrification in India.

- **Subnational efforts to ZET corridor development:** Various states are spearheading the charge to ZET adoption by focusing on key corridors. In pilot projects, Gujarat and Maharashtra are deploying 550 ZETs along selected corridors in collaboration with the private sector and the Ministry of Ports, Shipping, and Waterways in the next two years.[139] Tamil Nadu, in collaboration with National Highways for Electric Vehicles, is hosting trial runs for ZET movement along the Chennai–Trichy Corridor, learnings from which will help with infrastructure planning.[140]

- **Efforts at Indian ports:** The Harit Sagar Guidelines issued by the Ministry of Ports, Shipping, and Waterways in May 2023 outline a strategy for reducing carbon emissions and developing environmentally sustainable practices in major ports of India.[141] As part of these guidelines, all truck operators at ports are recommended to use greener alternatives such as BETs, hydrogen, and compressed/liquefied natural gas (CNG/LNG). Therefore, Indian Ports Association (IPA)[xii] is spearheading pilots of ZET technologies at pivotal ports, exploring multiple zero-emissions technologies for trucks. As part of this initiative, Jyoti Transport and Energy in Motion deployed two BETs for movement from container yard to rail yard at Jawaharlal Nehru Port Authority (JNPA).[142] OEM Ashok Leyland along with fleet operator Transvolt and terminal operator DP World also piloted a BET for intra-terminal movement at JNPA.[143] Longer term, JNPA has committed to replacing 6,500 diesel trucks operating between terminals and container freight stations with ZETs in the next three to five years.[144]

Policy roadmap for driving ZET adoption in India

A dedicated focus on policy measures is required to build on this momentum and provide near- term impetus to initiate ZET market development in India. This section delves into developing a strategic roadmap for ZET adoption in India, addressing near-, medium-, and long-term policy interventions that government officials can undertake to accelerate the transition. This roadmap builds upon international lessons and ongoing national efforts, proposing actionable steps tailored to India's unique needs and objectives. Recommendations are split into two categories:

- **Short-term interventions:** Practical and immediate steps that can be implemented within two years, drawing on proven strategies from other transportation segments to stimulate demand effectively.

- **Medium- and long-term interventions:** Forward-looking recommendations designed for implementation beyond two years, focusing on creating a robust and supportive ecosystem for zero-emissions truck operations as adoption scales up.

Short-term interventions

Implement purchase subsidies for end consumers: Purchase subsidies for EVs have already seen success in the country in the two-wheeler (2W) and three-wheeler (3W) vehicle sectors to achieve faster TCO parity. Similarly, ZET-specific subsidies can be added to existing policy measures at the national level (under PM E-Drive) or subnational level (state EV policies). Governments can consider introducing subsidies worth INR 15,000/kWh of battery size for ZETs to bridge the TCO gap with diesel trucks (see *Impact of proposed incentives on TCO of a BET*, page 46).

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xii The Indian Ports Association (IPA) is the apex body of major ports in India. It is instrumental in facilitating port development, fostering collaboration among port authorities, and advocating for policies supporting the maritime sector's growth and sustainability.

For instance, an INR 15,000/kWh subsidy can help reduce the up-front cost by **33%–36%**, resulting in an approximately 20% reduction in TCO.[145]

Relevant government stakeholders: Ministry of Heavy Industries (MHI), state governments

Introduce nonbinding targets/ambition for ZET adoption: Industry stakeholders rely on market signals to initiate investments, and ZET targets can serve as a foundation for deployment of vehicle and infrastructure assets. India can consider aligning with international initiatives or platforms and set nonbinding targets for ZET adoption for 2030, 2040, and 2050 time frames.

Relevant government stakeholders: National government ministries, state governments

Reduce tolls and taxes for ZETs: Around 10% of overall TCO for trucking operations constitutes road tolls and taxes, registration costs, and environment taxes.[146] Government can implement a revised toll and tax system for ZETs, wherein toll and taxes could either be exempted or reduced. A 50% toll and other tax waivers can reduce the TCO for a heavy-duty (HD) BET by approximately 2% to 4% amounting to savings of more than INR 7 lakh over a truck's lifetime, depending upon the truck size, use case, and route driven (see *Impact of proposed incentives on TCO of a BET*, pages 46).[147]

Relevant government stakeholders: Ministry of Road Transport and Highways (MoRTH) and National Highway Authority of India for toll tax waivers, state transport agencies for road tax waivers

Interest subvention for ZET purchases: Interest subvention is a policy lever to reduce interest rates and ultimately the equated monthly installment of ZETs for fleet operators.[xiii] Favorable lending terms with interest rates reduced by up to 5% can be offered (based on similar reductions considered in Delhi's EV policy), which would lower the TCO of heavy-duty BETs by approximately 5% (see *Impact of proposed incentives on TCO of a BET*, page 46).[148] This can be combined with an extended loan tenure to align with the annual maintenance contract provided by OEMs.

Relevant government stakeholders: State governments

Increase maximum GVWR and vehicle dimensions for ZETs: Currently, heavy-duty BETs can carry about 3 to 4 tonnes less payload than diesel trucks due to the heavier weight of the batteries.[149] Similarly, FCETs can lose about 0.76 meter of payload span due to the extra housing length of the fuel cell.[150] Government could increase the GVWR by 4 tonnes and the permissible length by 0.8 meter for ZETs, based on allowable road safety conditions in India.

As battery technology improves, batteries are becoming lighter and the payload gap between BETs and diesel trucks is expected to shrink. Hence, the government can reduce the GVWR allowance to 2.5 tonnes by 2035 and 1 tonne by 2045.

Relevant government stakeholders: MoRTH, state regional transport offices

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xiii While there are multiple financial interventions critical to drive ZET adoption, interest subvention is the most relevant one from a policy standpoint.

Direct charging infrastructure investment toward key trucking corridors: Identifying key trucking corridors and directing investment to deploy charging infrastructure across them will play a crucial role in accelerating ZET deployment. This can be done by prioritizing policy measures and capital investments along corridors with high-volume trucking traffic, such as multimodal logistic parks, ports, and other major industries. Grants and incentives awarded for deploying charging infrastructure or purchasing ZETs can be strategically combined with the above roadmap to better use the pool of funds for supporting ZETs in the country. Further, the MoP in its charging guidelines has stipulated a 90-day maximum period for approving an energy distribution license if extension of existing power lines is required. This period can be reduced for connections that need to be created for infrastructure across these corridors.

Relevant government stakeholders: MoRTH, MHI, MoP

Implement pilot programs: Pilot programs spurred by early adopters provide a testing ground to improve technology, build consumer confidence, and better refine policies and financial mechanisms for ZET adoption. Government can support pilot programs for deployment of around 500 ZET trucks along identified hubs and corridors or targeting newer use cases to create an overall ecosystem and provide robust feedback for future policies.

Relevant government stakeholders: MHI, NITI Aayog, MoRTH, state governments

Implement incentives and grants for installation of infrastructure: India can provide subsidies to fleet operators or charge point operators for the equipment and installation of infrastructure for ZET charging and refueling. Providing a subsidy worth 20% of the equipment and installation cost would lead to a savings of INR 1.7 lakh within the first year of investing in ZETs, reducing the burden of the up-front capital required (see *Impact of proposed incentives on TCO of a BET*, page 46).[151]

Relevant government stakeholders: MHI, MoP, state governments

Provide discounted energy tariffs for ZETs

State governments are already implementing preferential electricity rates for EVs in various states. While these can be favorable for low-tension (LT) connections, the tariffs still remain higher for high-tension (HT) connections which the majority of trucks will use. Governments can introduce an additional 20% discount in these HT EV tariffs, which would allow operators to save more than INR 5 lakh in charging costs over a truck's lifetime (see *Impact of proposed incentives on TCO of a BET*, page 46).[152]

Relevant government stakeholders: MoP, state/regional governments, power departments

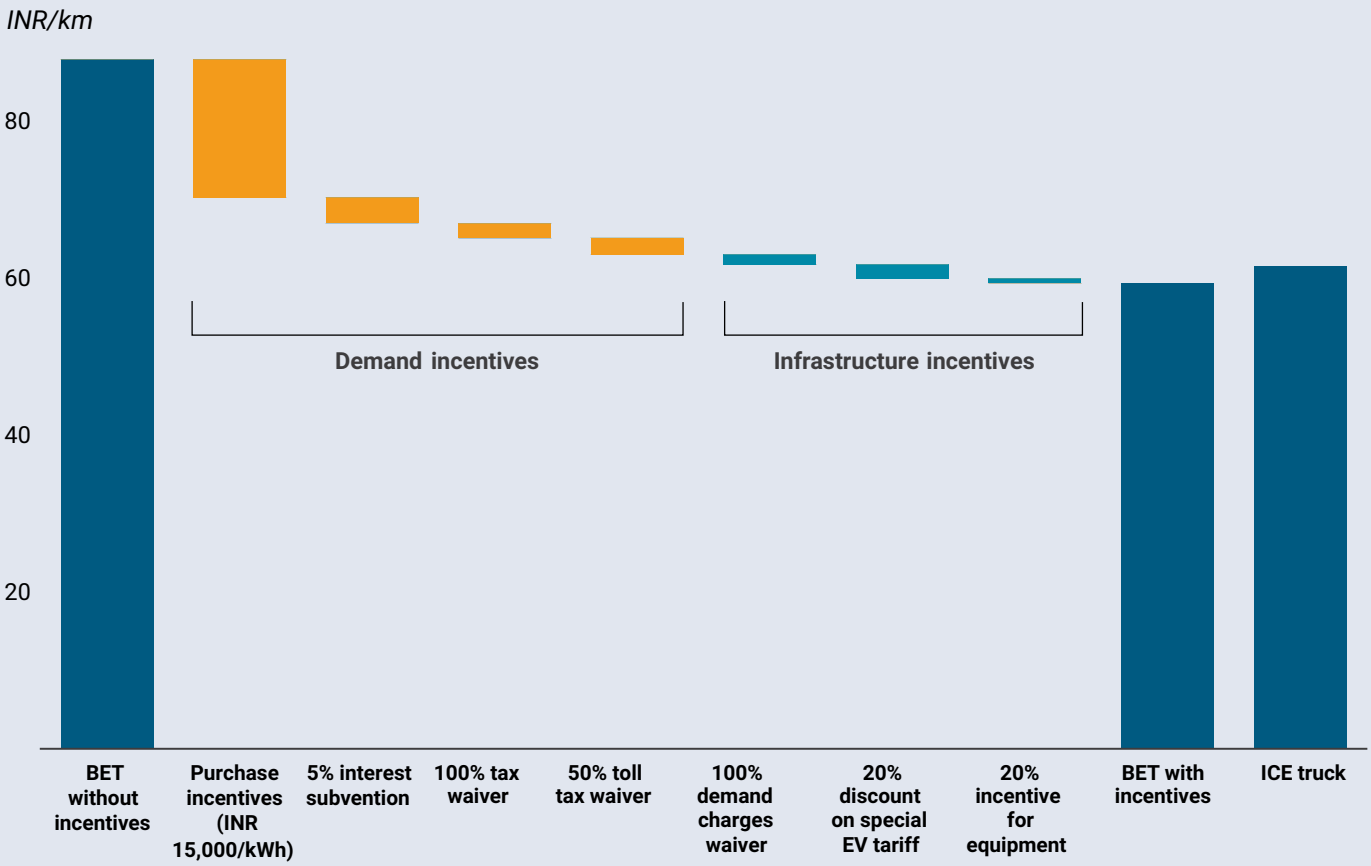
Introduce skill development programs for ZET manufacturing: India is already a major hub for automotive manufacturing, and growing ZET production provides an opportunity to upskill the workforce to meet this demand and create new jobs across various allied industries. India can leverage programs such as the National Apprenticeship Training Scheme, which forms partnerships among students, companies, and educational institutions to impart industry-ready training. Governments can introduce ZET-specific technology courses, and subsidized training can be provided to the workforce at large to improve their skills. OEMs can partner with the government to provide after-sales support training on ZET-specific technology for employees in service centers. This can further be combined with training programs for truck drivers on best practices for driving and operating ZETs.

Relevant government stakeholders: Ministry of Skill Development and Entrepreneurship

Box 2 **Impact of proposed incentives on TCO of a BET**

Exhibit 20 represents a detailed analysis conducted to evaluate the impact of demand and infrastructure policy incentives on the TCO of a truck. It compares a 55-tonne electric truck with a ~300-kWh battery, operating 130 km daily over a seven-year life span, to its diesel counterpart.

Exhibit 20 **Impact of proposed incentives on the TCO of a 55-tonne BET**



Note: Taxes and fuel prices are based on the average across three states with the highest truck sales in India: Maharashtra, Rajasthan, and Tamil Nadu.

RMI Graphic. Source: RMI analysis

The analysis indicates that without any incentives the total cost of ownership of a 55-tonne BET is approximately 44% higher than that of a diesel truck. However, when demand (truck) and infrastructure incentives are effectively implemented, the TCO of BETs undercuts that of ICE trucks by close to 1.5%, thereby achieving cost advantage. This translates to approximately INR 2.5 lakh in savings over the truck's lifetime. Major reductions in the TCO are due to reductions in the capital expenditures component. These incentives help reduce the up-front cost associated with truck and infrastructure equipment by approximately 34%.[153]

Similarly, Exhibit 21 illustrates how incentives for smaller BETs (14-tonne GVWR) can help reduce the TCO by about 32%, thereby almost achieving cost parity with their diesel counterparts.[154]

Exhibit 21 Impact of policy incentives on TCO of 14-tonne BET

	BET TCO without incentives	Demand(truck) incentives				Infrastructure incentives			BET with incentives	ICE truck
		Purchase incentives (INR 15,000/ kWh)	5% interest subvention	100% tax waiver	50% toll tax waiver	100% demand charges waiver	20% discount on special EV tariff	20% incentive for equipment		
Total cost of ownership (INR/km)	41	33	32	32	30	29	28	28	28	27

RMI Graphic. Source: RMI analysis

This analysis underscores the pivotal role of policy interventions in driving the adoption of ZETs in India. By creating a supportive policy environment, the government can accelerate the transition to cleaner transportation, particularly in the early stages when market forces may not be sufficient to level the playing field.

Medium- and long-term interventions

Implement ZET purchase mandates for fleet operators: Government can set targets for ZET adoption for fleet operators which in turn can provide direction to the industry for strategic investments based on future demand. The policy can begin with targets for government-owned and -operated trucks (for example garbage collection, waste management, and municipal trucks, followed by private sector fleets. The government can also consider different criteria for setting targets. Early moving applications (e.g., cement industry, port operations) and applications with high trucking CO_2 emissions can be prioritized in the near term, and stricter targets can be set for larger fleet operators. Purchase targets can be implemented in phases, with an increasing share of ZETs in the overall trucking fleet of the operator each year.

Relevant government stakeholders: MoRTH, MHI, state governments

Aggregate demand through corridor development: Corridor development can lead to demand aggregation from fleet operators and other buyers. This would create continuous demand for OEMs while combining common use cases between operators. Government can identify sectors and businesses best suited economically for ZET aggregation along the top identified corridors. Key stakeholders can be convened (fleet operators, charge point operators, OEMs, etc.) to formulate and implement mechanisms around ZET financing and infrastructure development.

Relevant government stakeholders: MoRTH, MHI, NITI Aayog, MoP, state governments, power distribution companies (DISCOMs)

Strengthen fuel economy/fuel consumption standards for truck manufacturers

India has introduced its first set of fuel consumption standards. There is potential to make them more stringent in line with other regions such as the United States, the EU, China, and Japan.[155] Updating and strengthening the standards can help fast-track ZET adoption as introducing ZETs' better vehicle efficiency and lower emissions intensity provides a clear pathway to compliance. Government can adopt the following:

- **Consider updating standards from compliance for individual vehicles to fleet average for vehicles produced by the OEMs:** Instead of applying the standards for each vehicle produced, an OEM can instead meet an average fuel consumption standard across all the vehicles it produces in a given year. This would allow OEMs more flexibility and enable them to make different choices, including producing ZETs and making improvements in the powertrain of ICE trucks, etc. This can help ease the burden of direct transition to ZETs while still achieving decarbonization benefits.

- **Consider strengthening the standards in accordance with global benchmarking:** Over time, the standards can be strengthened to better match global benchmarks such as those of the United States and the EU. This will ensure gradual uptake of ZETs as it will become more cost-effective to achieve compliance by producing ZETs rather than making improvements in ICE trucks.

Relevant government stakeholders: MoRTH, Bureau of Energy Efficiency, Automotive Research Association of India, International Center for Automotive Technology

Implement ZET sales mandates for OEMs

Like purchase mandates for fleet operators, a supply-side mandate can be introduced for OEMs requiring that ZETs make up a certain percentage of their total sales. This can be complemented with a credit program, where credits can be traded or banked for offsetting. Government can initially allow 1:1 (or higher) offsetting of credits and then reduce the ratio each year.

Relevant government stakeholders: MHI, MoRTH

Offer concessional land for setting up ZET infrastructure

A concessional land allocation model can be set up for ZET-specific charging. Using this approach, land would be leased to private operators at subsidized rates or under a revenue-sharing model. This is akin to the existing model in Delhi's EV policy which has led to successful build-out of charging infrastructure. Priority can be given to operators who set up high power stations (such as megawatt charging), or to hydrogen refueling stations across areas with higher FCET penetration. These land allocations could align with key trucking corridors, supporting efficient ZET operations. A phased approach could start with high-priority routes based on market demand, ensuring timely and cost-effective infrastructure rollouts.

Relevant government stakeholders: State governments, municipal corporations, urban development authorities

Waive demand charge for charging infrastructure

The demand charge for high-tension EV charging connections in India can vary from INR 25 kilo-volt-amperes (kVA) per month to INR 250/kVA/month.[156] This increases costs for charge point operators, especially those operating high-powered chargers for ZETs. Those costs are eventually passed down to the fleet operators, leading to higher TCO. Waiving this demand charge can lead to savings of more than INR 4 lakh over a truck's lifetime.

Relevant government stakeholders: MoP, state and regional power departments

Upgrade upstream grid infrastructure

If India achieves 86% ZET adoption by 2050, annual energy demand from charging could reach 531 terawatt-hours in the same period.[157] Investment into new infrastructure and upgrades of existing power infrastructure to reduce strain is of critical importance. This would involve laying out high-voltage transmission lines for high-powered DC charging and upgrading or adding existing distribution transformers. Total required investment is estimated at INR 10,000 crore by 2030 and INR 70,000 crore by 2035.[158]

India launched the Revamped Distribution Sector Scheme in 2021 with an outlay of INR 3.04 lakh crore from FY2021 to FY2025, with the focus on reducing aggregate technical and commercial losses and bridging the gap between supply cost and revenue.[159] Additionally, the PM E-DRIVE scheme has allocated INR 2,000 crore for setting up public fast charging stations, of which INR 346 crore will be used to subsidize upstream infrastructure for e-trucks and e-buses.[160] The scheme can be expanded to prioritize and incentivize upgrades to support ZET charging. This can involve grants or loans and reducing permitting delays for such projects. Further, DISCOMs can be incentivized to upgrade distribution systems where charging station locations are identified as part of the MoP's latest charging guidelines.

Relevant government stakeholders: MoP, state and regional power departments

Conclusion

The global ZET market stands at the brink of transformation, driven by the urgent need to reduce emissions and operational costs in freight movement. While ZET adoption has gained momentum in regions such as China, the United States, and parts of Europe, the market remains in its infancy in many other parts of the world. Robust policy frameworks have been instrumental in advancing clean transportation, as evidenced by the global uptake of light-duty EVs. In regions with more mature ZET markets, policy mechanisms have spurred technology innovation, initiated dedicated production lines, generated demand through cost reductions, and established robust supporting infrastructure.

Key policy measures for accelerating ZET adoption can be broadly categorized into demand-side, supply-side, and infrastructure-related interventions. Demand-side policies, such as purchase incentives, tax exemptions, increased payload allowances, and fleet purchase mandates, reduce TCO and create a stable demand pipeline for ZETs. These measures incentivize fleet operators to adopt ZETs while enabling manufacturers to scale production. Supply-side policies, including sales mandates, fuel economy standards, manufacturing grants, and workforce training programs, ensure the availability of affordable ZET models while promoting industrial competitiveness and cost reductions. Infrastructure-focused policies, such as the development of ZET corridors along high-traffic routes, equipment setup incentives, tariff management, and upgrades to upstream infrastructure, mitigate operational risks, lower costs, and ensure reliable charging solutions.

A balanced mix of these policy solutions, fostered through collaborative engagement between public and private stakeholders, is essential to catalyzing the ZET market. Governments in regions with mature ZET adoption can refine existing policies to support scale, while those in emerging markets can learn from global best practices, tailoring them to regional contexts to achieve near-term gains. Industry input is critical to shaping policies that address on-the-ground challenges, making them more effective and actionable.

Global platforms such as the G20, Clean Energy Ministerial, and United Nations Climate Change Conference serve as vital conduits for sharing knowledge, fostering collaboration, and disseminating successful policy examples. Policymakers can exchange insights, adapt proven strategies, and contextualize them to accelerate ZET adoption worldwide.

India, with its booming economy and growing demand for freight transport, is uniquely positioned to become a global leader in the ZET transition. By drawing inspiration from successful international policies, India can adopt a phased approach to develop a ZET ecosystem that balances short-term market stimulation with long-term sustainable growth. Near-term interventions, such as purchase subsidies for ZETs, toll and tax waivers, grants for infrastructure installation, and energy tariff subsidies can generate immediate demand. Medium- to long-term measures, such as ZET purchase mandates for fleet operators, sales mandates for fleet operators, and demand charge waivers can harmonize demand and supply to ensure sustained adoption at scale.

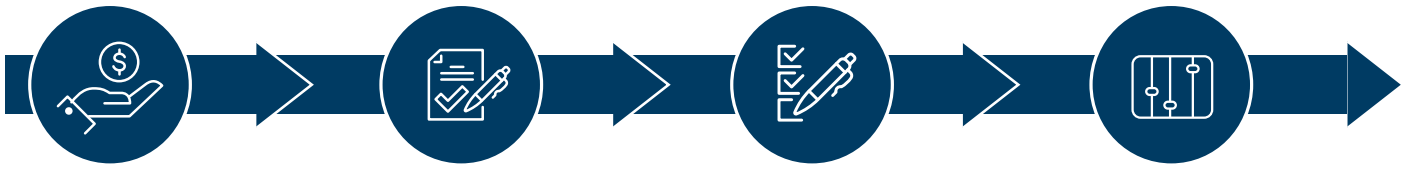
Ultimately, the growth of the ZET market hinges on four critical levers: policy, infrastructure, finance, and technology. Among these, policy must act as the catalyst, setting the stage for advancements in other areas. Well-designed, supportive policies can drive the global transition to ZETs, decarbonizing freight transport, reducing air pollution, and lowering logistics costs for a sustainable future.

Appendix

Modeling methodology

The objective of the TCO analysis was to evaluate the economic viability of BETs compared with diesel trucks and assess the impact of targeted incentives on achieving cost competitiveness. Initially, the TCO was calculated under existing market conditions to establish a baseline comparison. Following this, an incentive package, encompassing demand- and infrastructure-related incentives, was designed to reflect potential policy interventions. Lastly, the incentives were calibrated to ensure that BETs achieve cost parity or become more cost competitive than diesel trucks (see Exhibit 22).

Exhibit 22 Logical flow of the modeling approach



Establish baseline TCO
Calculate TCO under existing market conditions to create a benchmark.

Design incentive package
Determine demand- and infrastructure-based incentives for policy intervention.

Evaluate impact
Reassess the TCO by applying the incentives.

Calibrate incentives
Align incentives to ensure BETs achieve cost parity with diesel trucks.

RMI Graphic.

This TCO analysis examines the economic viability of electric trucks compared with their ICE counterparts by evaluating two primary cost components: capital expenditures and operational expenses. Capital expenditures encompass up-front costs such as the down payment, principal payments with interest, registration and one-time taxes, and charging infrastructure setup expenses. Operation expenses, on the other hand, include recurring costs like taxes, insurance fees, battery replacement, maintenance, and refueling or charging expenses. Additionally, the analysis evaluates the impact of demand-side incentives — such as purchase subsidies, interest subvention, and tax waivers — and infrastructure incentives, including equipment discounts, EV tariffs, and demand charge waivers, on both capital expenditures and operational expenses.

To align the TCO comparison with real-world operations, two BETs were considered for comparison: a 14-tonne truck equipped with a 201-kWh battery, modeled with a daily duty cycle of 200 km over 350 working days annually, and a 55-tonne truck with a 301-kWh battery, operating 130 km daily for 350 days each year. These scenarios, summarized in Exhibit 23 and detailed below, reflect diverse operational demands and provide a comprehensive basis for evaluating costs across vehicle segments.

Capital expenditures

Purchase costs

For BETs, the purchase costs were based on the ex-showroom price of the available models in the market (see Exhibit 23). Similarly, for diesel trucks, purchase costs were calculated by determining the average ex-showroom price of the five most popular models in each of the weight categories, ensuring a representative and consistent basis for comparison.

Financing model

The financing approach was aligned with prevalent practices for truck purchases in India, assuming 80% of the acquisition cost is financed with varying interest rates for ICE vehicles and BETs. BETs were assigned a higher interest rate to reflect the perceived financial risks associated with emerging technologies, consistent with observed market trends for electric truck financing in India. For detailed rates and terms, see Exhibit 23.

Registration cost or one-time tax

This cost, due at the time of purchase, was calculated based on the average rates across Maharashtra, Rajasthan, and Tamil Nadu, the three largest states by truck sales volume. This approach ensures that the analysis reflects realistic and regionally representative cost variations for registration, aligning with market-specific data.

Charging infrastructure cost

For BEVs, a charging infrastructure setup cost was included in the analysis, calculated based on the balance of public and overnight charging, set at 25% and 75%, respectively. This cost was factored in because fleet operators are expected to establish charging facilities at their premises to ensure operational efficiency. Incorporating this component aligns with the practical requirements of fleet operations and reflects the additional capital investment necessary for adopting BEVs.

Operational expenses

Maintenance costs

Maintenance costs for ICE trucks were obtained through stakeholder interviews to establish a baseline for comparison. In the initial years, BETs incur higher maintenance costs than ICE trucks despite having fewer moving parts, as parts often require full replacement rather than repair. Over time, costs decline with improved repairability and component longevity. However, over a seven-year lifespan, BET maintenance costs average out to be similar to those of ICE trucks.

Fuel costs/charging costs

Fuel costs were calculated for both truck categories, incorporating an annual 1% increase in the cost of fuel for ICE trucks. For ICE trucks, fuel charges were determined using the average diesel prices across Maharashtra, Rajasthan, and Tamil Nadu. Similarly, recharging costs for BEVs were based on the average EV charging rates and demand charges in these states. This approach ensures a regionally representative and realistic assessment of fuel and charging expenses, tailored to the operational geography of trucks.

Battery replacement

Battery replacement costs are incorporated into the overall vehicle cost, as batteries generally have a shorter life span than the vehicles. This is due to reduced efficiency in trucking applications once the battery's capacity falls below 80%, requiring replacement. The lifetime battery range is determined by multiplying the number of charging cycles by the battery's range. The replacement schedule is then calculated based on the lifetime battery range and the total distance traveled by the vehicle, ensuring an accurate representation of long-term operational costs.

Insurance costs

Insurance costs for both trucks were calculated as a percentage of the vehicle's purchase price, with the amount depreciated annually over the vehicle's useful life. This approach ensures that insurance costs align proportionally with the declining value of the vehicle, offering a realistic estimate of long-term ownership expenses.

Annual taxes

Annual taxes, including road tax and environment tax, were calculated based on the vehicle's weight and applied across the life span of the vehicle. These calculations were aligned with the taxation framework detailed in the Registration Cost and One-Time Tax sections to ensure consistency in methodology. Toll taxes, however, were derived from interview data due to their variable nature across regions and corridors, ensuring a more accurate representation of real-world operating costs.

Exhibit 23 Key assumptions and considerations

Parameter	Unit	14-tonne GVWR		55-tonne GVWR	
		ICE	BET	ICE	BET
Up-front purchase price	INR (Ex-showroom price)	2,758,750	8,500,000	4,547,250	13,500,000
Battery size	kWh	NA	~200	NA	~300
Average life	Years	7			
Financed amount	% of up-front price	80%			
Loan term	Years	5	5	5	5
Operating days	Days	350			
Daily distance traveled	km	200		130	
Insurance premium	%	3%			
Fuel cost	INR/L	91.45, with an annual increase of 1% YOY			
Electricity cost	INR/kWh	7.09			
Toll taxes	INR/Year	240,000			

Incentive modeling

The incentive package considered for the analysis was composed of demand-side and infrastructure-related incentives, based on existing policies implemented globally or at the state level in India for two-wheelers, three-wheelers, and four-wheelers. These incentives were rooted in realistic, actionable frameworks that reflect market trends and regulatory practices, ensuring reasonable and practical applicability. The demand-side incentives included measures such as purchase subsidies, interest subvention, and tax waivers, while the infrastructure incentives focused on EV tariff reductions, equipment discounts, and demand charge waivers. The entire package was applied to its pertaining TCO component and subsequently calibrated to ensure that the TCO for BETs, across both truck categories, achieved cost parity or became more cost-competitive than diesel counterparts.

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