



**Smart Freight
Centre China**



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Moving Toward Zero Emission: A Preliminary Exploration of Zero-Emission Heavy-Duty Trucks Deployment in China

— Industry Research, Analysis, and Recommendations

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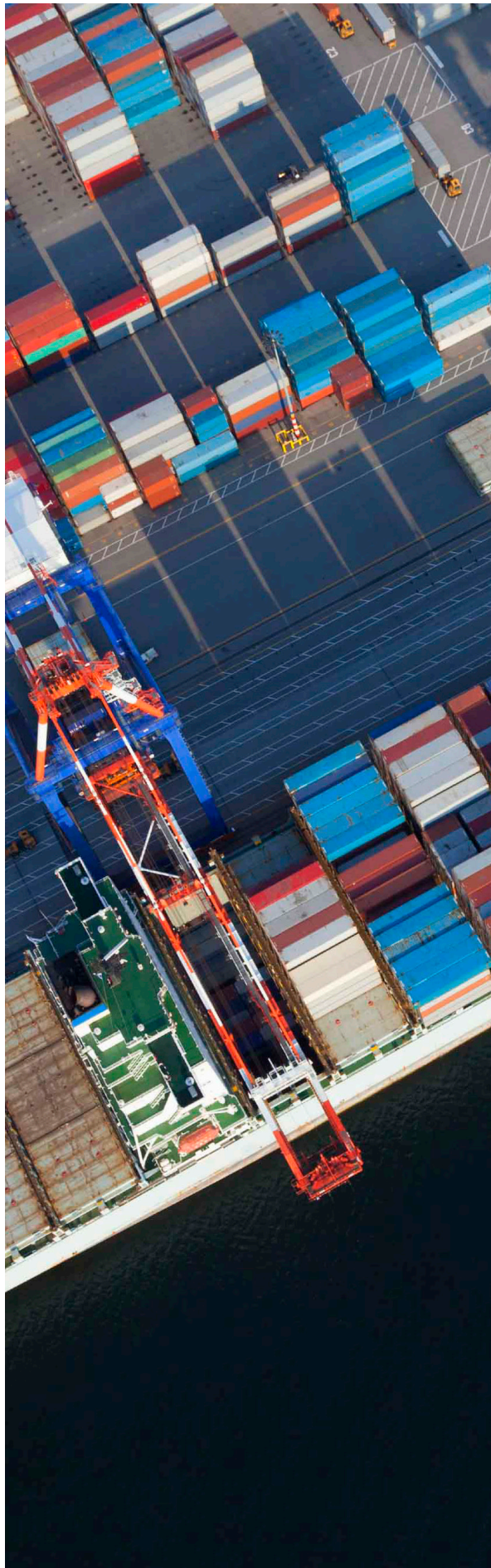


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April 2025



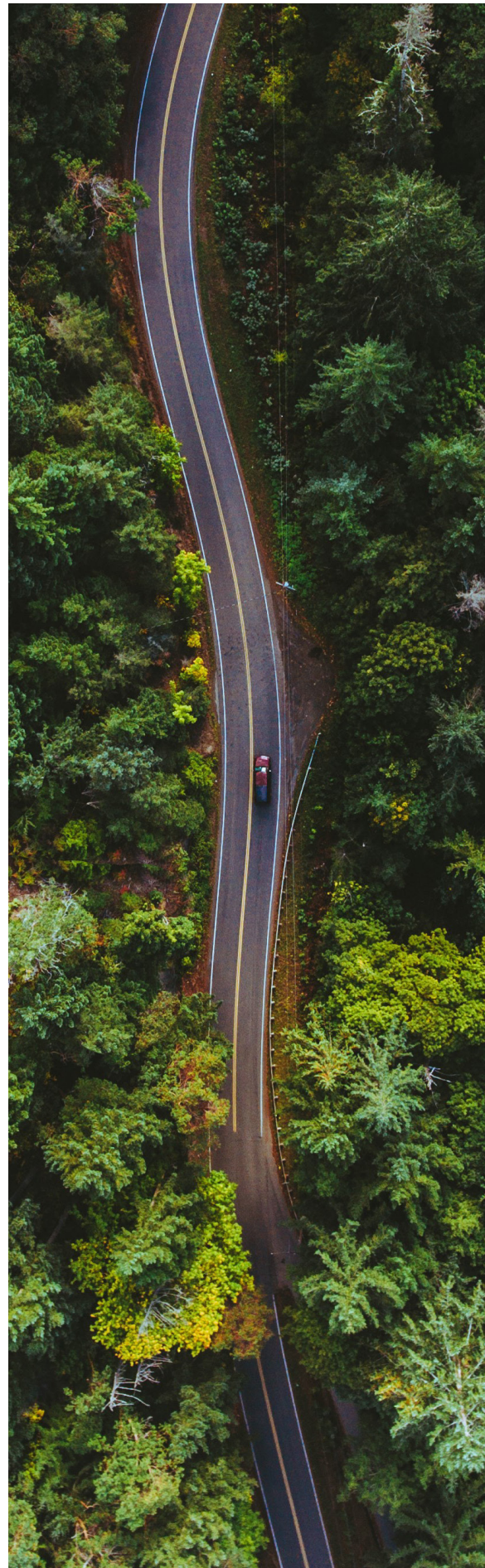


Acknowledgements

The successful completion of this publication would not have been possible without the active support and collective efforts of numerous stakeholders.

We extend our sincere gratitude to all the companies and organizations that participated in the survey—including cargo owners, logistics service providers, carriers, and solution providers. Their strong interest in and active engagement with the topic of green freight has been truly encouraging. The real-world experiences and valuable insights they shared during the research process greatly enhanced the relevance and practical value of this publication. We would also like to express our special thanks to Mr. Wang Xin, Senior Technical Advisor at Smart Freight Centre China, for his professional suggestions for this publication.

We hope this publication can serve as a catalyst for further cross-sector collaboration and concrete action in the journey toward zero-emission freight and contribute meaningfully to the green and low-carbon transformation of China's transport sector.



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Suggested citation: Smart Freight Centre China. Moving Toward Zero Emission: A Preliminary Exploration of Zero-Emission Heavy-Duty Trucks Deployment in China — Industry Research, Analysis, and Recommendations. 2025.

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About Smart Freight Centre China

Smart Freight Centre China's vision is an efficient and zero emission global logistics sector. Smart Freight Centre China's mission is to collaborate with the organization's global partners to quantify impacts, identify solutions, and propagate logistics decarbonization strategies. Smart Freight Centre China's goal is to guide the China logistics industry in tracking and reducing the industry's greenhouse gas emissions to reach zero emissions by 2050 or earlier, consistent with a 1.5°C future.

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01

Overview



Background

Global Warming: Trends and Negative Impacts

Since the Industrial Revolution, human activities have led to a dramatic increase in greenhouse gas emissions. According to the latest data from the United Nations Environment Programme (UNEP), the global average temperature has already risen by 1.3°C compared to pre-industrial levels. If current policy trajectories remain unchanged, temperatures could increase by 2.6°C to 3.1°C by the end of this century¹. A 3°C temperature rise would push the world toward systemic ecological collapse, including risks such as polar ice sheet disintegration (triggering rises in sea-levels), degradation of the Amazon rainforest, and pushing us past irreversible tipping points^{1,2}. Long-term climate changes will also accelerate the frequency of extreme weather events, public health crises, damage to infrastructure, and sharp declines in vital resources^{2,3,4}. To address these challenges, urgent action is needed by leveraging diversified pathways—including innovations in regulatory policy, clean technology innovation, and market incentives—to drive low-carbon transformation across entire industrial chains.

1 United Nations Environment Programme. "Emissions Gap Report 2024: No more hot air ... please! With a massive gap between rhetoric and reality, countries draft new climate commitments". Knowledge Repository - UNEP. UNEP. 2024. Web. 25 Mar 2025 <<https://wedocs.unep.org/20.500.11822/46404>>

2 Romanello, Marina et al. "The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action." Lancet (London, England) vol. 404,10465 (2024): 1847-1896. doi:10.1016/S0140-6736(24)01822-1

3 Intergovernmental Panel on Climate Change. "Sections." Climate Change 2023: Synthesis Report: Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Edited by H. Lee and J. Romero, IPCC, 2023, pp. 35-115. <https://doi.org/10.59327/IPCC/AR6-9789291691647>

4 World Meteorological. 2024 State of Climate Services. United Nations, 2024, <https://doi.org/10.18356/9789263113634>.

Global Climate Action

In recent decades, an international consensus has gradually formed surrounding climate change mitigation. The Kyoto Protocol, adopted in 1997, marked the first legally binding global agreement to reduce greenhouse gas emissions, mandating quantified reduction targets for developed nations. In 2015, the Paris Agreement, ratified by 178 parties, established the overarching objective of limiting rises in global temperatures to well below 2°C, with an ideal target lying below 1.5°C, relative to pre-industrial benchmarks. This landmark accord redefined the architecture of post-2020 global climate governance.

China's "Dual Carbon" Target and Policy

China has consistently demonstrated its commitment to ecological civilization and proactive engagement in international climate governance. In September 2020, the Chinese government formally announced its "Dual Carbon" target to achieve carbon emissions peaking by 2030 and carbon neutrality by 2060. In 2021, two foundational policy documents were released: *Guidelines for the Comprehensive Implementation of a New Development Philosophy to Realize Carbon Peaking and Carbon Neutrality* and the *Carbon Peaking Action Plan Prior to 2030* (hereafter referred to as the *Action Plan*). These two documents are the foundation for China's "1+N" Dual Carbon Policy Framework with the Action Plan serving as its central pillar.

It is worth noting that the *Action Plan* designates green and low-carbon transportation as a priority sector. Key measures include accelerating the deployment of heavy-duty freight vehicles that are powered by electric, hydrogen-powered, and liquefied natural gas (LNG) technologies, coupled with a phased reduction in the number of conventional fuel-powered trucks. The *Action Plan* requires 40% of newly added freight vehicles to utilize zero-emission or clean energy sources by 2030, which positions zero-emission heavy-duty transport as a linchpin of the industry's decarbonization strategy.

Currently, China's zero-emission freight sector is undergoing a critical transition from pilot initiatives to large-scale commercialization and industry maturation. To optimize policy design and ensure implementation efficacy, a granular understanding of market dynamics is imperative — including the primary drivers and barriers in enterprise adoption, operational challenges in real-world applications, and actionable pathways for systemic decarbonization. To this end, this study has conducted an exploratory analysis of these pivotal issues, with the dual objectives of providing policymakers with critical decision-making information and providing industry stakeholders with important strategic insights. By fostering cross-sectoral alignment and collaborative innovation, we hope to further drive the green transformation in China's logistics industry.

Objectives



This market research report investigates the drivers, adoption, challenges, and policy needs of the zero-emission truck (primarily electric truck) market with the goal of providing policymakers and industry stakeholders with actionable insights that will facilitate the green and low-carbon transformation of China's logistics sector while laying the groundwork for future pilot project designs.

Key objectives include:

1. Analyzing Market Drivers for Electric Trucks

We will examine the core motivations for shippers and logistics service providers/carriers (LSPs/carriers) in adopting zero-emission freight solutions, including their willingness to embrace such technologies and attitudes toward green cost premiums in order to identify key factors influencing market growth.

2. Assessing the Current Adoption and Application of Electric Trucks

We will investigate the current status of the adoption and application of electric trucks, barriers to their adoption, and cost perceptions to evaluate the progress and challenges in deploying zero-emission freight solutions.

We anticipate that our research findings will be useful in influencing the development of future pilot initiatives. By gaining a deeper understanding of market conditions and industry needs, this study will further facilitate public-private collaboration, bringing together shippers, logistics service providers/carriers, original equipment manufacturers (OEMs), and energy providers to explore early-stage demonstration projects for zero-emission heavy-duty trucks in selected regions and develop replicable green logistics solutions for broader industry adoption.

3. Identifying Key Challenges in Electric Truck Deployment

We will study operational difficulties faced by enterprises, including operational viability, capacity matching, infrastructure availability, calculating carbon reductions, and policy implementation to better assess the impact on industry development.

4. Clarifying Policy Expectations in the Industry

We will survey enterprise policy demands, such as fiscal incentives, charging/refueling infrastructure, green financing, and establishing industry standards, in order to provide practical recommendations for optimizing government support measures.

Methodology



The core findings of this report are based on enterprise survey data. The surveyed companies primarily consist of those already engaged with green logistics initiatives or those that have had prior collaboration/exchanges with the Smart Freight Centre. They represent a core group with certain foundational knowledge and a willingness to explore solutions to the transition to zero-emission freight. Questionnaires were distributed to enterprises mainly through email, WeChat and other social media channels.

During the design phase, the questionnaire divided enterprises into three categories - shippers, logistics service providers/carriers, and other relevant stakeholders (including those engaged in transport equipment manufacturing, energy infrastructure, platform services, etc.). Differentiated question modules were developed according to enterprise types to accurately capture their respective roles, focus areas, and practical differences in the zero-emission freight transition process.

The questionnaire was structured around four key research dimensions – market drivers, the state of adoption, challenges, and policy demands - aiming to examine the progress of their transition to zero-emission freight while identifying barriers and potential policy breakthroughs.

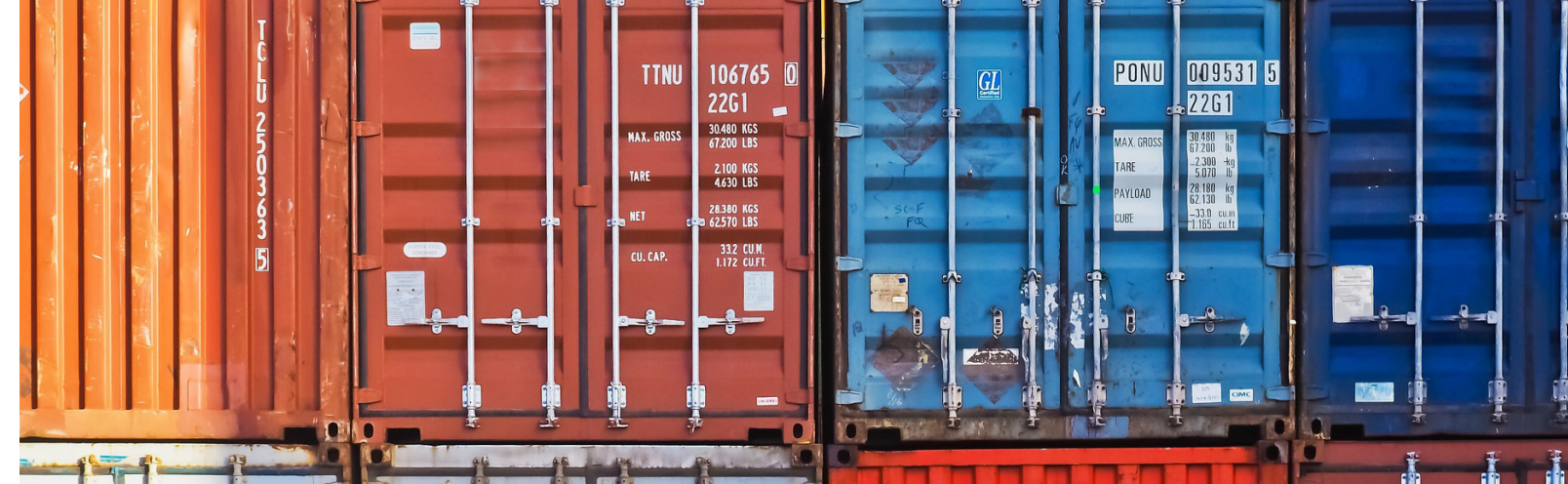
Market Drivers: These questions helped us to understand the core motivations behind enterprises that have integrated zero-emission trucks or freight services, giving us insights into the intrinsic drivers of market development.

Current Adoption Status: This series of questions allowed us to assess the current state of adoption among enterprises in implementing zero-emission freight solutions.

Existing Challenges: These questions helped to identify the major obstacles enterprises encounter in adopting zero-emission freight solutions and clarify the critical bottlenecks hindering market growth.

Policy Requirements: These questions were designed to understand what types of government support enterprises expect, reflecting their actual needs and wants under the current policy framework.

Sample Description



The survey collected 38 valid responses from 35 enterprises, comprised of: **13** shippers, **16** logistics service providers/carriers, **6** other enterprises (low-carbon logistics solution providers)

Geographical Market Distribution of Survey Samples

Geographical Markets



In terms of their regional scope of operations, participating enterprises were widely distributed across domestic markets, international markets, and hybrid markets:

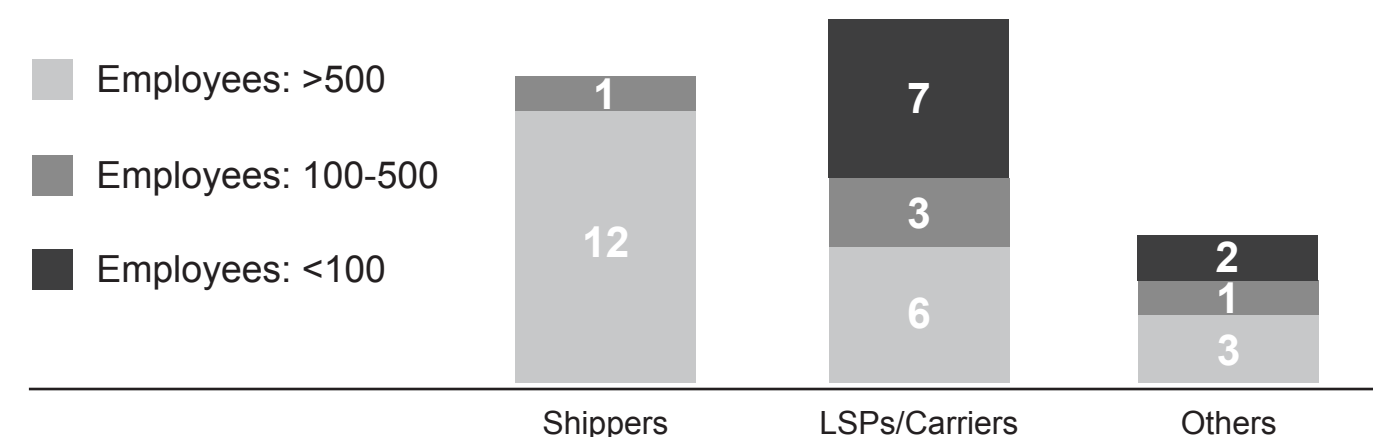
The 13 shippers surveyed primarily consisted of hybrid market operators (8 companies) serving both domestic and international markets, with the remaining 5 focused solely on domestic markets. This indicates that most surveyed shippers possess international supply chain backgrounds and are more likely to prioritize and promote the development of zero-emission freight solutions amid the global trend in green procurement.

Among the 16 logistics service providers/carriers surveyed, the vast majority (11 companies) mainly served domestic markets, with only 1 focusing on international markets and 4 operating in both domestic and international markets. This suggests that the surveyed logistics service providers/carriers are more actively exploring opportunities within China's domestic logistical services market.

The 6 enterprises of other types predominantly serve domestic markets (5 companies), with 1 company operating in both domestic and international markets.

Distribution of Sample Enterprises by Business Scale

Company Size



In terms of company size:

Among the surveyed shippers, those with more than 500 employees dominated the sample (12 companies), with 1 company having 100 to 500 employees, and no companies with fewer than 100 employees.

The surveyed logistics service providers/carriers showed a relatively balanced distribution in size: 6 companies had more than 500 employees, 3 companies had 100 to 500 employees, and 7 companies had fewer than 100 employees.

For other types of companies, half had more than 500 employees (3 companies), 1 company had 100 to 500 employees, while 2 companies had fewer than 100 employees.

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Results and Analyses



Market Drivers for Zero-Emission Freight Transportation

The promotion of zero-emission freight transportation requires a synergy of drivers from both the supply and demand sides of the market. This chapter systematically analyzes the motivations, levels of willingness, and procurement practices of shippers and logistics service providers/carriers (hereinafter referred to as LSPs/carriers) in their application of zero-emission freight solutions, while also exploring the intrinsic drivers that transform green transportation concepts into concrete actions.

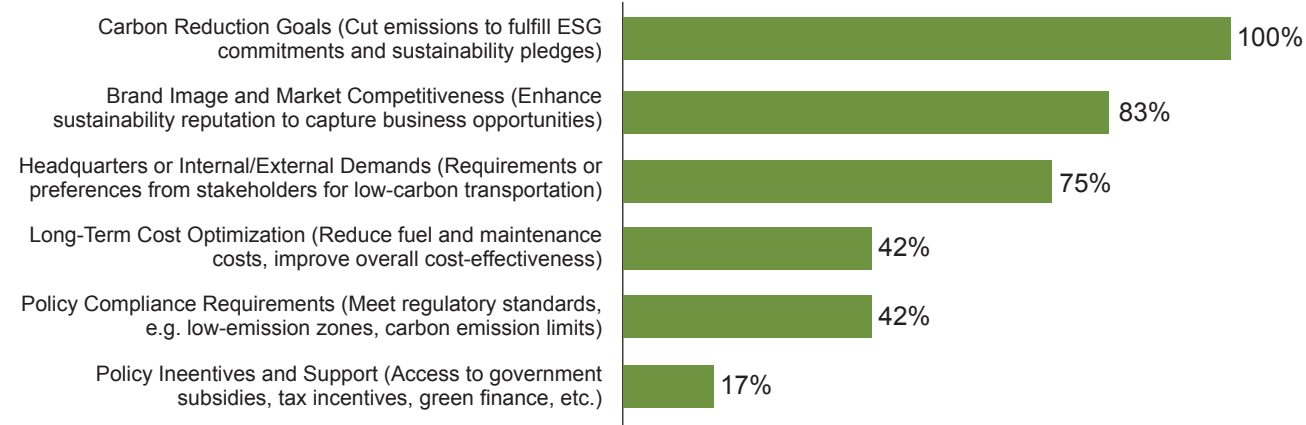


Core Drivers: Combined Motivation of Brand Image and Carbon Emission Reduction Goals

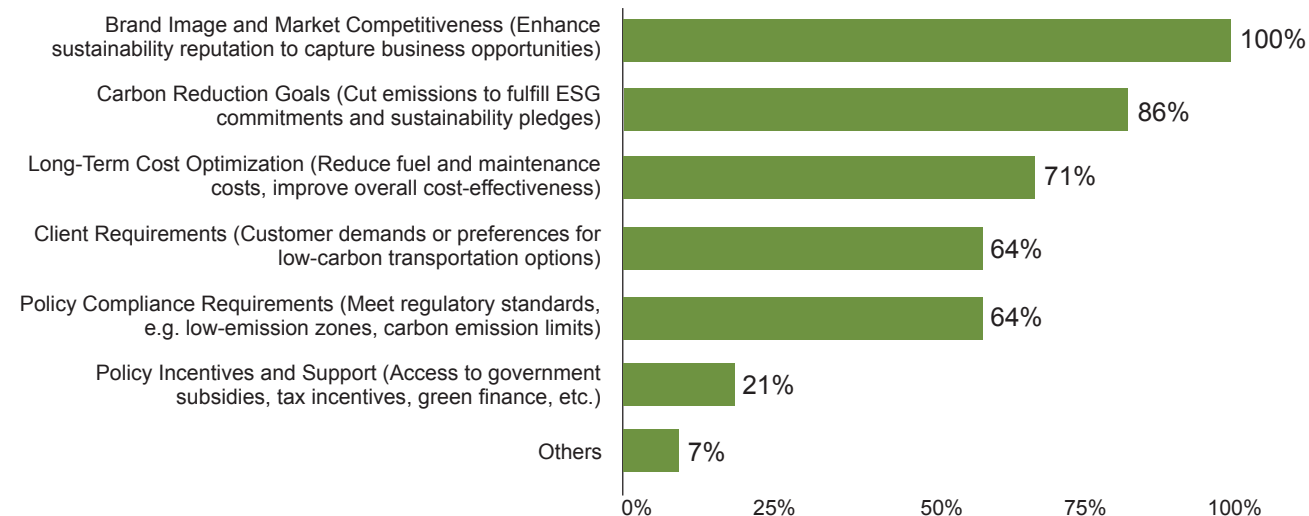
This section focuses on the driving factors behind the adoption of zero-emission trucks by shippers and LSPs/carriers, exploring their key considerations in transitioning to green transportation in response to policy pressure, market demand, and client requirements.

Core Drivers

Shippers



LSPs/Carriers

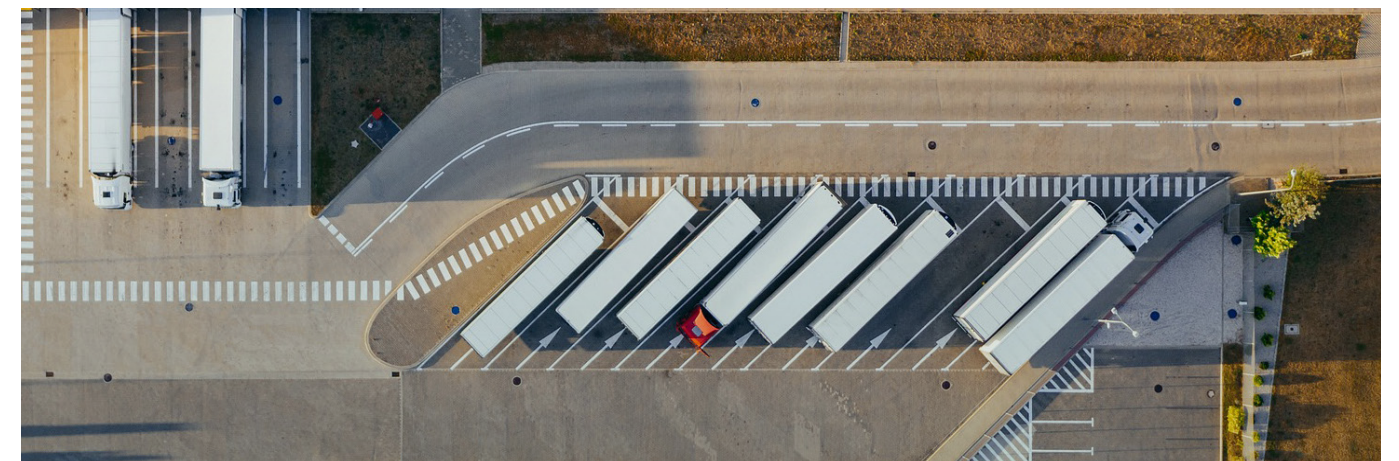


Research findings reveal that **while the priorities of the two groups differ slightly, brand value and carbon reduction goals are universally recognized as the "combined core motivations."** This indicates that both shippers (demand-side entities) and LSPs/carriers (supply-side providers) acknowledge the critical role of green transportation in external reputation management and long-term value creation.

A high proportion of shippers (75%) and LSPs/carriers (64%) cited customer or other internal/external demands, suggesting that green supply chain linkages are gradually taking shape.

Policy compliance exerts a significantly stronger influence on LSPs/carriers (64%) than on shippers (42%), reflecting that current regulations primarily target the operational end of transportation services. **These policies have yet to generate sufficient pressure or a compelling mechanism for shippers at the procurement decision-making level.** Meanwhile, policy incentives still play a limited role in actual corporate decision-making. Only 17% of shippers and 21% of LSPs/carriers identified policy incentives as primary motivators, indicating that the market appeal of subsidies, tax incentives, and green financial tools needs to be enhanced to strengthen their role in impacting corporate behavior.

In terms of economic considerations, only 42% of shippers view long-term cost optimization as a driving factor, significantly lower than the 71% of LSPs/carriers. This disparity highlights shippers' relatively cautious expectations regarding the economic viability of zero-emission freight and suggests that, compared to LSPs/carriers, transportation costs have a relatively limited impact on the decision by shippers whether to adopt such solutions.



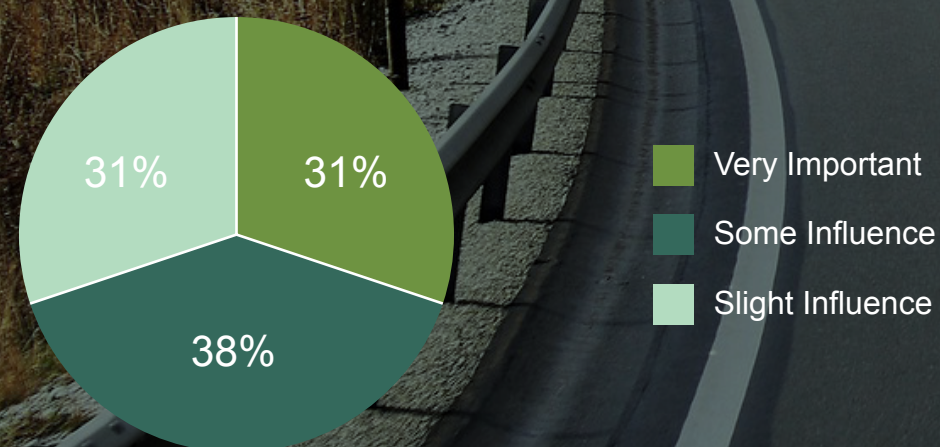
Shippers: Positive Attitude Not Yet Reflected in Procurement Decisions

This section further examines whether shippers have translated these drivers into an intent to actually adopt these solutions. Survey results reveal that 92% of shippers maintain a positive attitude toward adopting zero-emission freight services in their logistics supply chains (54% have already planned or are actively implementing such initiatives, while 38% express a willingness to do so but have no concrete plans yet). Only 8% of shipper enterprises indicated no intention to adopt zero-emission freight solutions.

Adoption Readiness for Zero-emission Freight



Procurement Decision for Zero-emission Freight

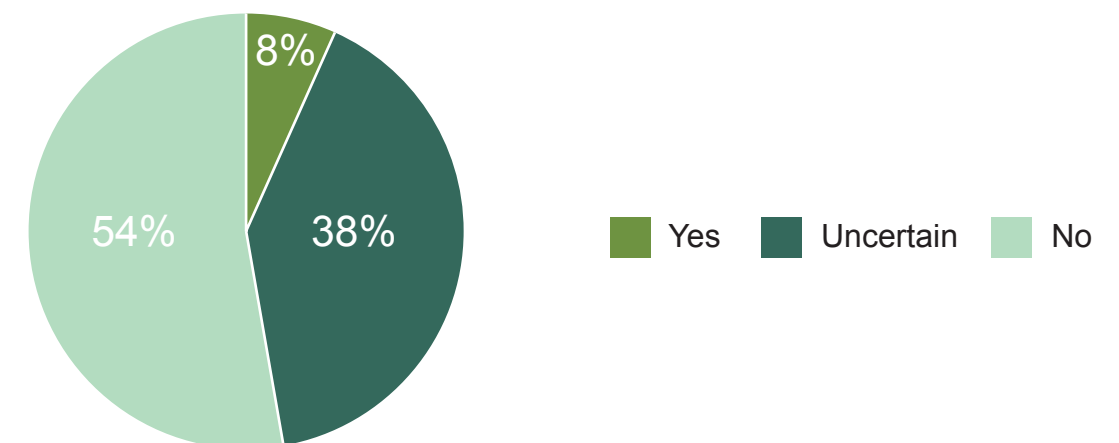


In terms of procurement, zero-emission freight has not yet become an explicit criterion for shipper enterprises in selecting suppliers. Among the surveyed shippers, 31% consider zero-emission freight to be an important factor in their supplier screening process, while 38% treat it as a bonus point rather than a decisive factor during tendering. The remaining 31% believe zero-emission freight has a limited impact on their procurement decisions. This indicates that zero-emission freight currently exerts only a marginal impact on shippers in the procurement decision-making process.

Shippers: Few Willing to Pay Green Premiums

Regarding the willingness to pay green cost premiums, only 8% of shippers said they were willing to pay higher freight rates for zero-emission freight services, while 38% remain undecided and 54% refused to pay any premiums. This finding shows significant divergence from both McKinsey's 2022 interviews and BCG's 2024 global survey results^{5,6}. In McKinsey's interviews, multiple large-scale shippers indicated a willingness to pay 5%-10% in premiums for green logistics services⁵. BCG's global survey further revealed that over 80% of enterprises would pay premiums for carbon-neutral freight services⁶. The higher premium willingness observed in McKinsey and BCG studies predominantly reflects European and North American markets, where corporations—facing stringent emission regulations alongside demands from clients and investors—showed a stronger recognition of the value of green transportation and a greater readiness to invest in supply chain decarbonization. In contrast, **the Chinese market remains dominated by conservative views on the added value of zero-emission freight, with most enterprises exhibiting a heightened sensitivity to freight cost increases.**

Willingness to Pay for Zero-emission Freight



Summary

It is our conclusion that the promotion of zero-emission freight is undergoing a critical transition from concept to action. Both shippers and LSPs/carriers generally regard brand value enhancement and carbon reduction responsibilities as core drivers behind their decisions to adopt zero-emission freight solutions. However, less than one-third of shippers consider zero-emission freight a key factor in their procurement decision making process, and fewer than one in ten were willing to pay premiums for green transportation services. Therefore, we believe that further efforts are still needed to make policy measures more targeted, optimize economic incentives, and enhance value communication to ensure that the market transitions smoothly from conceptual acceptance to practical implementation.

⁵ McKinsey & Company. Dual Approach: Accelerating the Decarbonization of the Transport Sector. McKinsey Greater China, 2022. www.mckinsey.com.cn/%e5%8f%8c%e7%ae%a1%e9%bd%90%e4%b8%8b%ef%bc%9a%e5%8a%a0%e9%80%9f%e8%bf%90%e8%be%93%e4%b8%9a%e8%84%b1%e7%a2%b3%e8%bf%9b%e7%a8%8b/. (Original work published in Chinese).

⁶ Boston Consulting Group. The Real Cost of Shipping Decarbonization. BCG, 2024, www.bcg.com/publications/2024/real-cost-of-shipping-decarbonization.

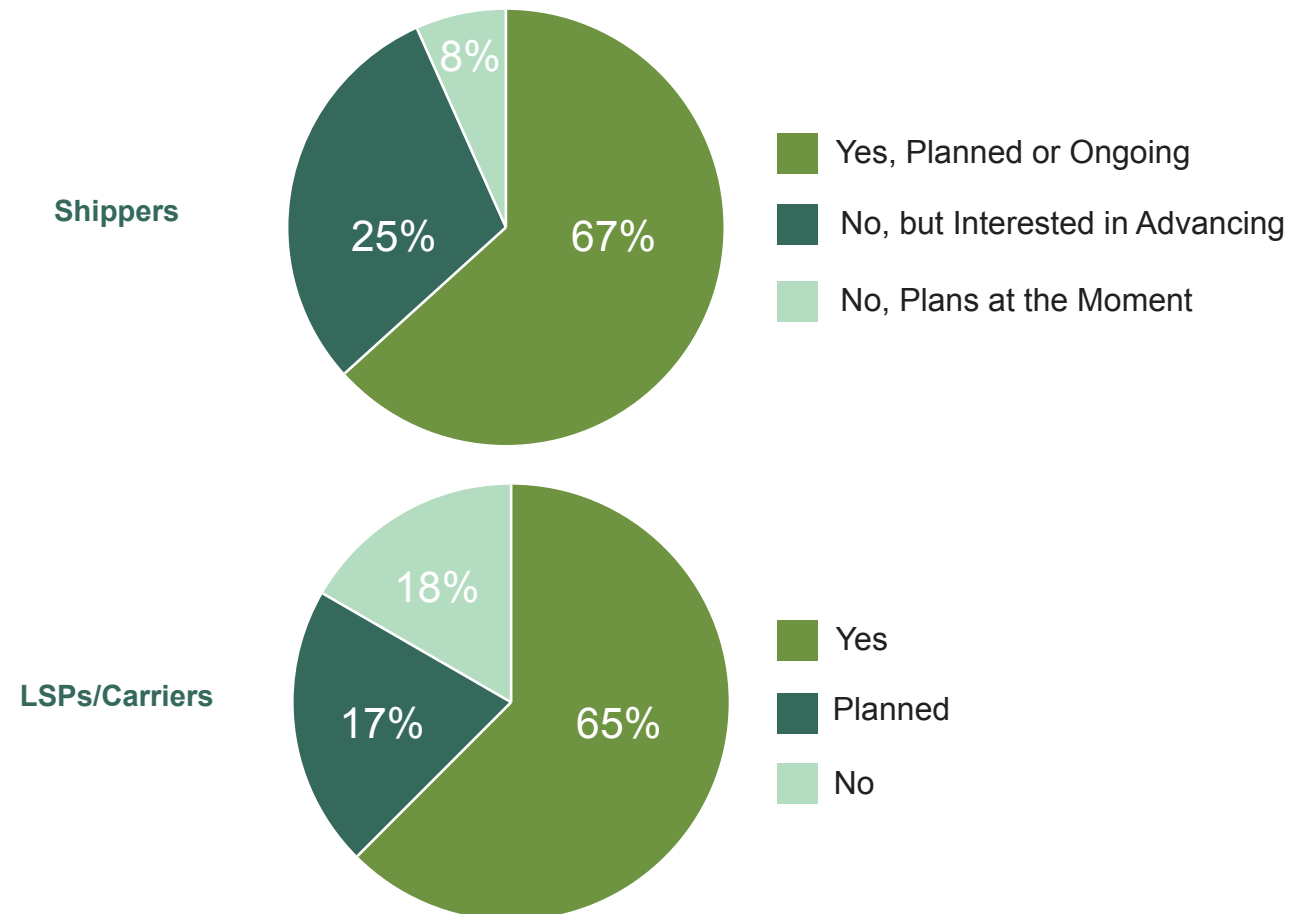
The Adoption and Application of Zero-Emission Trucks

This section focuses on the current state of adoption of zero-emission trucks among shippers and LSPs/carriers, while further analyzing the key barriers between "willingness" and "action" in the process of actually putting zero-emission trucks on the road.

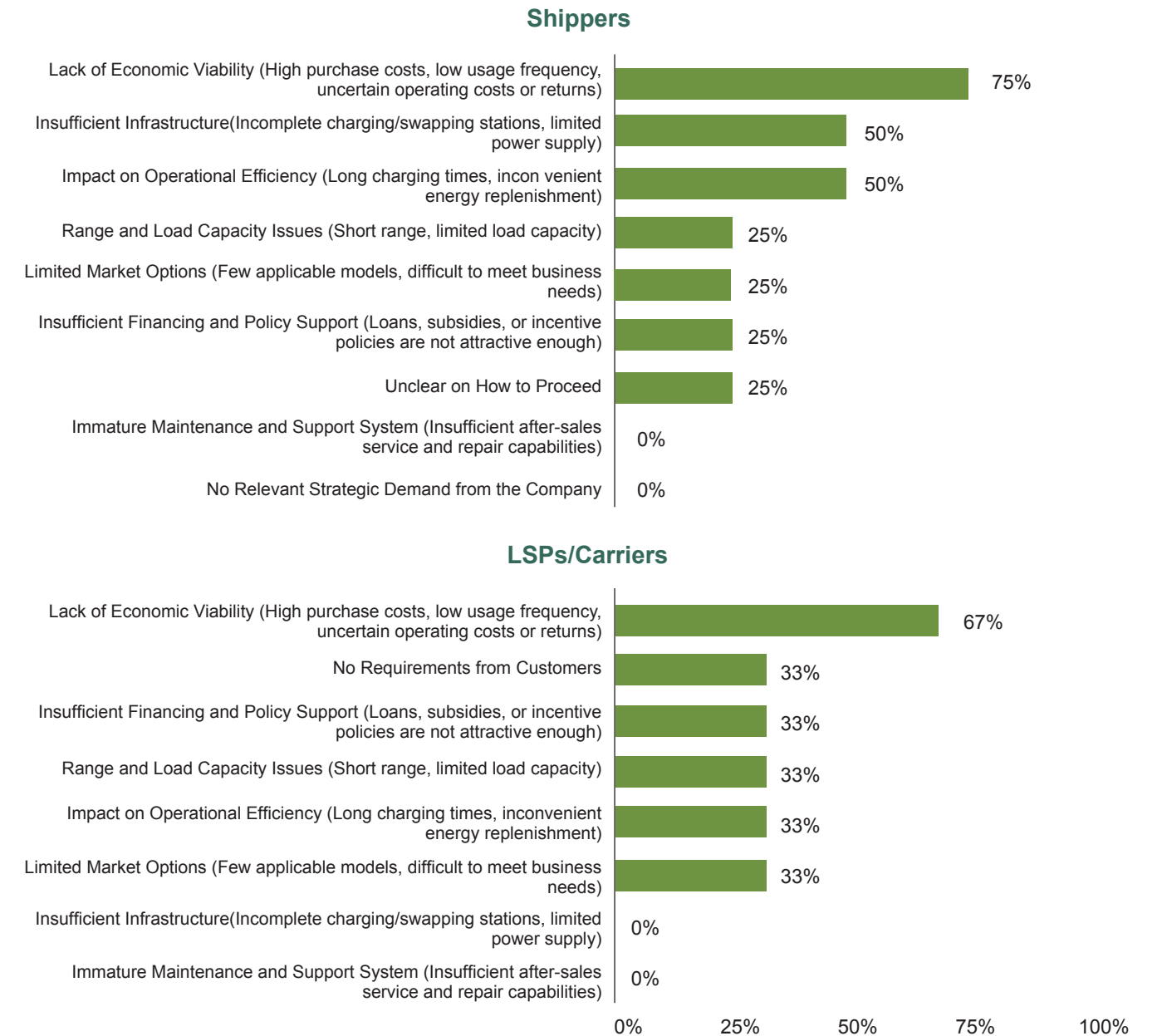
Current Status of Adoption: Most Enterprises Already Taking Action

The survey results indicate that over 60% of shippers and LSPs/carriers have either implemented or plan to implement zero-emission truck programs. Around one-quarter of shippers have not yet adopted such programs but expressed clear intentions to implement them, with only 8% currently having no plans for adoption. Meanwhile, the proportion of LSPs/carriers with no immediate plans was slightly higher at 18%. Overall, among the surveyed enterprises, **there is already a practical foundation for the application of zero-emission trucks on both the supply and demand sides.**

Current Status of Adoption



Barriers to Adoption: Economic Concerns Hindering Zero-Emission Heavy-Duty Truck Deployment

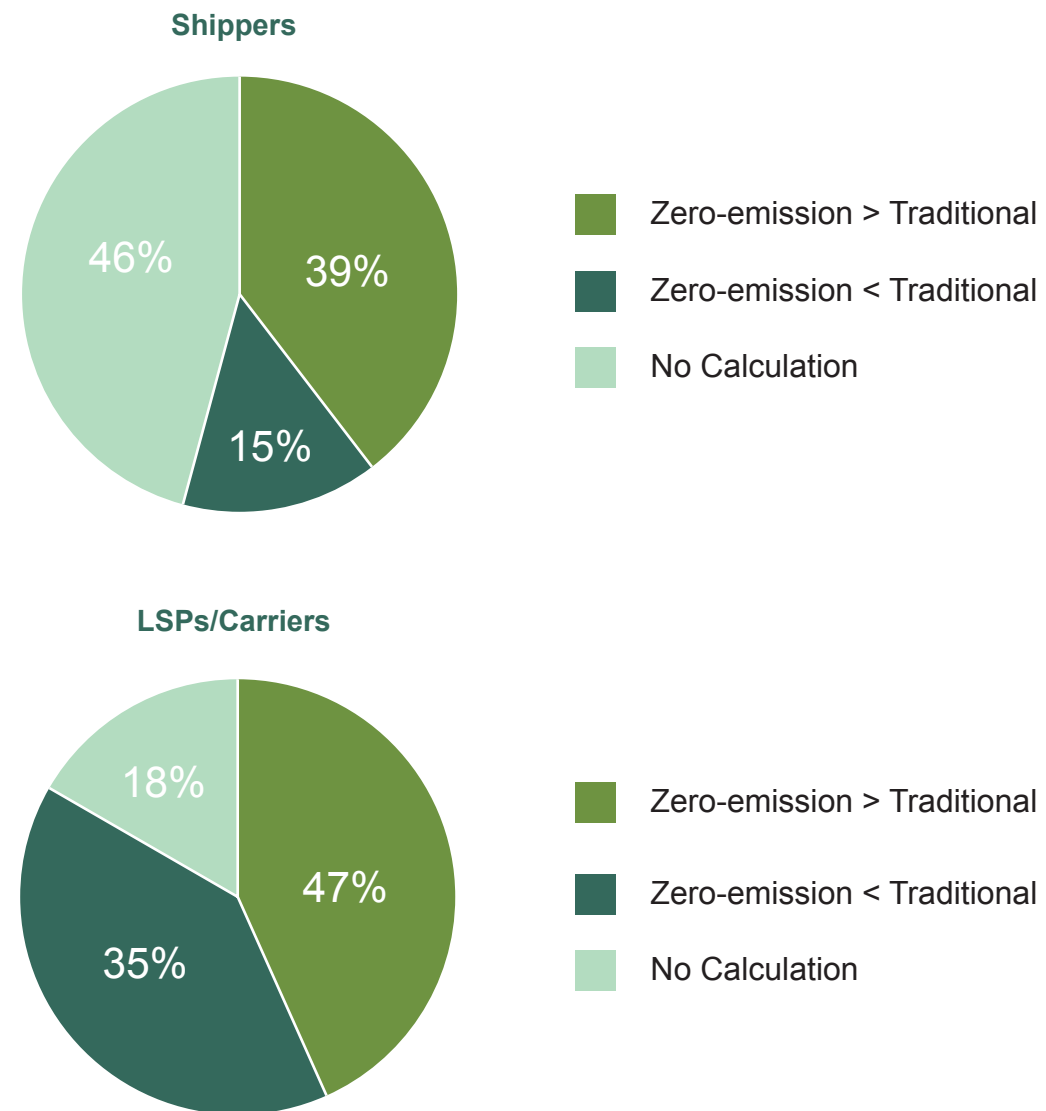


Despite a generally positive attitude among enterprises, this survey revealed those that have yet to introduce zero-emission heavy-duty trucks face clear practical obstacles. **For both shippers and LSPs/carriers, the primary reason for not planning to adopt such projects at the current time is the lack of clear economic benefit due to factors including high purchase costs, low use rates, unknown operational costs, and uncertain rates of return.** Responses indicate that return on investment remains the most critical factor influencing the decision of shippers to implement green transition measures. Additionally, shippers cite a lack of support infrastructure (e.g. charging stations, power supply) and operational efficiency limitations (e.g. long charging times, refueling difficulties, etc.), highlighting multidimensional bottlenecks that need to be addressed ranging from project feasibility to practical implementation. For the LSPs/carriers, the main constraint is the fact that their "clients have not yet presented clear demands," showing that market demand has not been sufficiently conveyed to them in terms of real-world operations.

Cost Perception: Majority View Zero-emission Trucks as Lacking Operational Cost Advantages

Delving deeper into the underlying reasons for these economic concerns, **46%** of shippers and **18%** of LSPs/ carriers have yet to conduct operational cost assessments for zero-emission trucks. Among those that have performed such calculations, the majority have found that the operational costs of zero-emission trucks are higher than those of conventional trucks. This aligns with the finding that enterprises are opting not to adopt zero-emission truck programs due to a perceived lack of economic viability.

Cost Perception



Summary

Overall, both shippers and LSPs/carriers show active engagement in the adoption and practical application of zero-emission trucks, indicating growing market recognition of zero-emission freight solutions. However, enterprises that have not yet deployed these trucks mainly cite a lack of economic viability and inadequate infrastructure as the most practical barriers. Currently, most companies feel that zero-emission trucks lack a clear cost advantage over conventional diesel trucks.

Challenges and Policy Demands in the Adoption of Zero-Emission Trucks

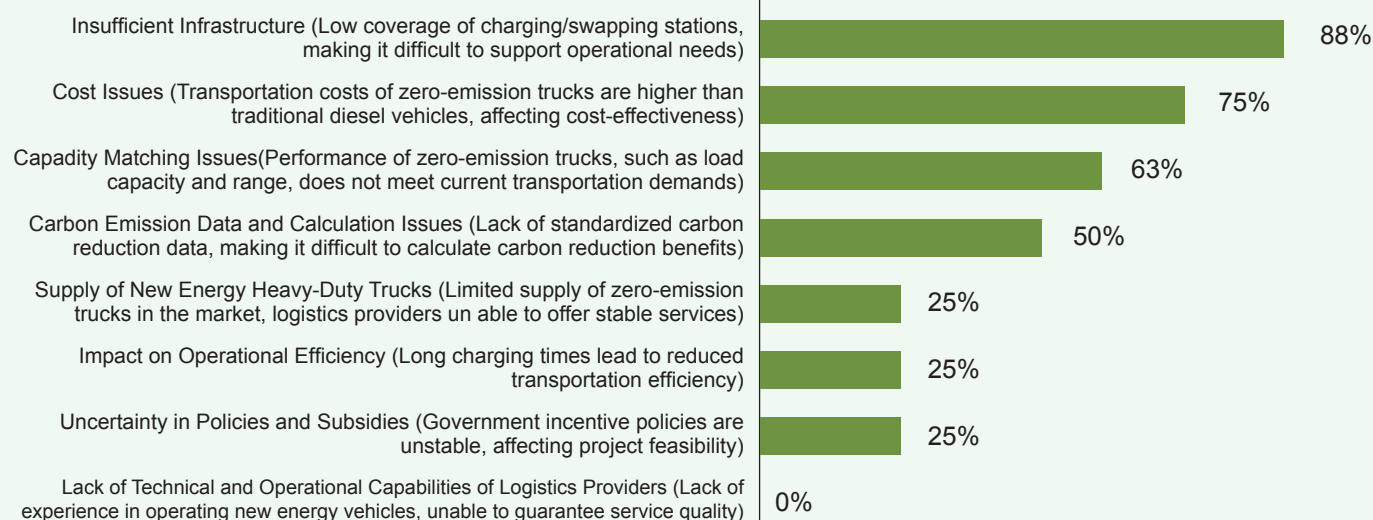
Despite a growing willingness among enterprises to adopt zero-emission trucks, there are several practical constraints that have prevented actual implementation. This section first analyzes the key obstacles encountered by shippers and LSPs/carriers in project deployment and operations, then explores their hopes in terms of potential policy supports, serving as a reference for government decisionmakers in creating more targeted public policies.



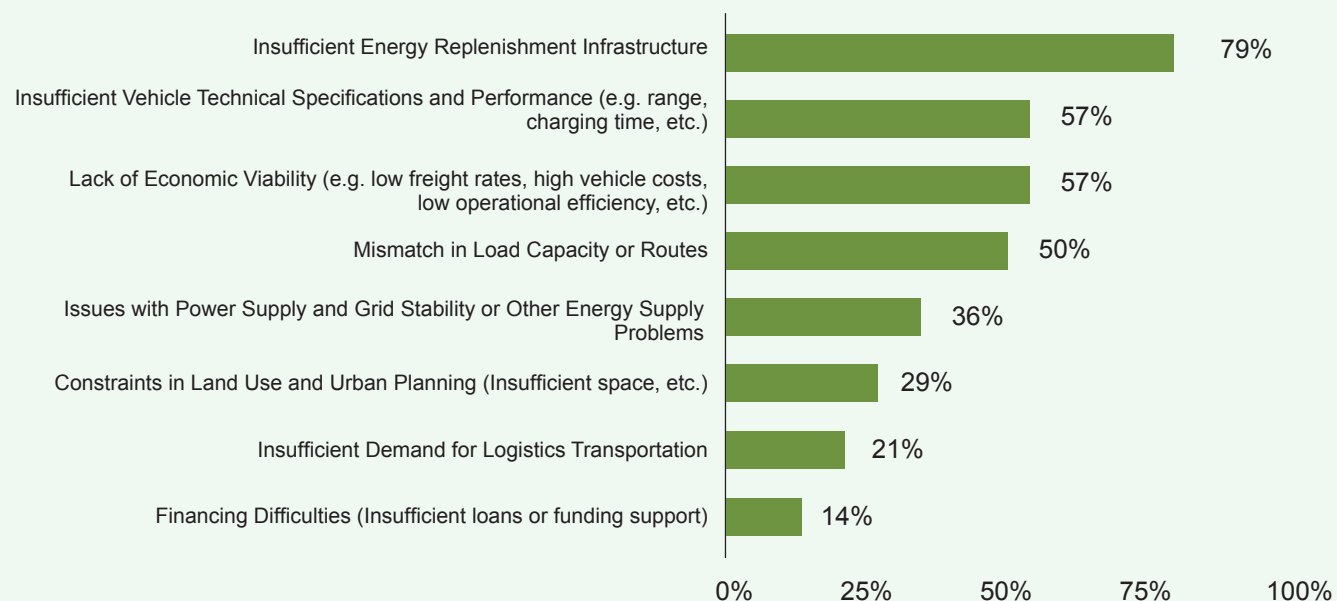
Implementation Challenges: Key Bottlenecks in Energy Supplies, Costs, and Capacity Matching

Implementation Challenges

Shippers



LSPs/Carriers



Survey results revealed that **both shippers (88%) and LSPs/carriers (79%) consider inadequate charging and refueling infrastructure to be the most significant challenge in adopting zero-emission trucks**. The infrastructural shortcomings mainly include insufficient charging/battery swap stations or hydrogen refueling stations along operational routes, which severely limits charging and refueling capabilities. For instance, there is currently an insufficient number of battery swap stations for pure electric trucks and existing stations are geographically unevenly distributed. This has resulted in frequent battery shortages during peak usage periods, which makes it difficult to ensure a stable supply of energy. For hydrogen fuel cell trucks, survey responses show that there is a lack of coordination in the construction of hydrogen stations, which often face shortages in hydrogen supplies. This has resulted in significantly longer queues than at traditional gas stations and substantially compromised efficiency. **This infrastructure lag directly limits the operational range and transportation efficiency of zero-emission trucks**, thereby hindering their scalability in standardized logistics scenarios. These uncertain infrastructural factors further amplify risk perceptions during early-stage deployment decisions, undermining industry confidence in capital and resource investments.

The second most prominent challenge is economic viability, with 75% of shippers and approximately 57% of LSPs/carriers reporting that new zero-emission trucks currently lack compelling cost-performance advantages. Further investigation reveals that for electric trucks, high upfront purchase costs and uncertain operational returns hinder market penetration. Hydrogen fuel cell trucks face even greater economic hurdles, with per-100-kilometer operating costs nearly 100 RMB higher than diesel trucks. This is compounded by elevated maintenance expenses, which further erode their cost competitiveness. These economic challenges equally apply to related infrastructure development. Charging and refueling facilities require substantial capital investment, but end-user demand remains volatile, which creates significant risks for investors looking for a return on their investment. Collectively, **these economic barriers weaken market momentum**. Whether in terms of vehicle purchase costs, operational expenses, or payback period for infrastructure projects, none of these currently meet the threshold for organic market expansion. Against a backdrop of sustained freight rate pressures, prevailing concerns about long-term profitability and cost recovery may perpetuate a reliance on subsidies and policy supports, hindering the development of self-sustaining market mechanisms.

Furthermore, **a significant proportion of shippers (63%) and LSPs/carriers (50%) have encountered capacity matching challenges during implementation**. Specifically, the payload limitations of zero-emission trucks lead to reduced actual freight capacity, while higher failure rates and dependence on manufacturer-specific maintenance systems further increase operational risks. These factors collectively undermine corporate confidence in the reliability of zero-emission trucks for long-haul scenarios. Many enterprises would rather delay their transition timeline than risk costly trial-and-error investments, thereby prolonging the market validation cycle.

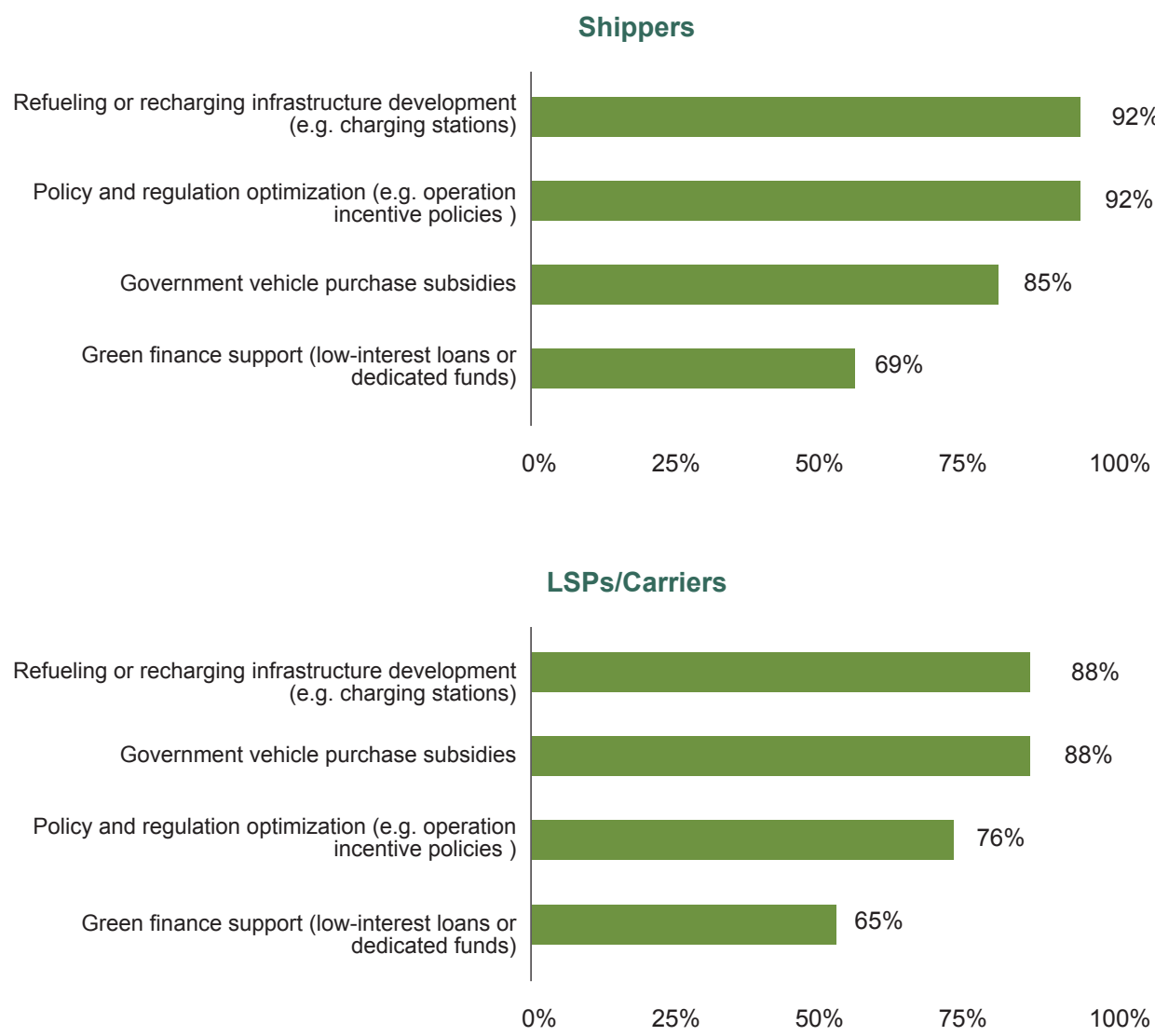
Moreover, **technical adaptability issues in operating zero-emission trucks have emerged as a significant barrier faced by LSPs/carriers, hindering the broader adoption of green transportation**. 57% of LSPs/carriers identified inadequate technical specifications and performance as key challenges in deploying electric trucks. Field research and interviews revealed that zero-emission trucks currently on the market struggle to meet the range requirements of major transport scenarios. For example, for trips exceeding 100 kilometers, pure-electric trucks typically required mid-route recharging, with reduced range capabilities becoming even more pronounced during the winter months in northern regions. Additionally, compared to conventional diesel trucks that generally only need to be refueled once per day, hydrogen fuel cell trucks often require two refueling stops daily, which are significantly longer, adversely impacting operational efficiency and scheduling flexibility.

The quantifiability and traceability of carbon reduction benefits are crucial for green transportation to be effectively integrated into corporate green strategies, sustainable supply chains, and policy incentive mechanisms. Half of the surveyed shippers (50%) reported encountering **challenges such as missing carbon data, unclear calculation methodologies, or a lack of standardized tools during project implementation, making it difficult to accurately assess the actual reduction in emissions from zero-emission trucks**.

Policy Demands: Strong Focus on Infrastructure Development and Operational Incentives

Against a backdrop of multiple interconnected challenges, enterprises have demonstrated a strong desire for policy support. This survey shows that current policy demands from enterprises regarding zero-emission truck adoption closely align with the obstacles they face, reflecting the industry's practical need for more robust and targeted policy interventions.

Policy Demands



The survey results indicate that the demand for **policies accelerating the development of charging and refueling infrastructure is universal among the vast majority of shippers (92%) and LSPs/carriers (88%)**, aligning perfectly with the foremost challenge identified in previous findings. Simultaneously, an overwhelming majority of both shippers and LSPs/carriers are calling for incentive policies targeting zero-emission transportation—such as vehicle purchase subsidies and operational incentives—to enhance the market competitiveness of zero-emission freight solutions.

On the policy supply side, the Chinese government has introduced numerous policies in recent years to support the development of zero-emission freight, covering strategic planning, fiscal support, infrastructure construction, road access rights, and implementation initiatives. Provincial and municipal governments have also actively responded by proposing corresponding local incentive policies.

For example, in February 2024, the Ministry of Transport issued a *Notice on Accelerating the Construction of Charging Infrastructure in Highway Service Areas in 2024*, focusing on improving charging and refueling facilities.

In June 2024, 13 departments, including the Ministry of Transport released an *Action Plan for a Large-Scale Upgrade in Transportation and Shipping Infrastructure*, supporting the construction of new hydrogen refueling stations, battery swap stations, and ultra-fast charging infrastructure.

In November 2024, the Ministry of Transport and NDRC jointly issued the *Action Plan for Reducing Cost and Improving Quality in the Transportation and Logistics Sectors*, proposing to optimize transport structures and enhance organizational efficient in the freight sector and foster the development of green logistics and zero-emission freight.

While these policies broadly align with corporate demands at the strategic level—indicating **preliminary policy responses to key market concerns**—survey feedback reveals persistent gaps between policy formulation and on-the-ground implementation. **Enterprises continue to experience a "lack of policy effectiveness" in the course of project execution and daily operations, suggesting challenges in policy enforcement and tangible impact.**

Summary

The compounding effects of these challenges have kept zero-emission trucks in a transitional phase—"available but not yet essential, testable but difficult to mainstream." Without systemic breakthroughs, the industry risks being trapped in a negative cycle of "strong willingness—weak action—unproven value—increasingly cautious investment." While current policies have laid a directional foundation for a transition to zero-emission freight, continued reinforcement is needed to create a comprehensive support system that balances willingness to deploy new technologies with concerns regarding operational efficiency and investment returns. It is only by establishing this balance that we can bridge the gap between corporate willingness ("wanting to act") and operational resolve ("daring to act").

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Insights and Recommendations

Based on our analysis of the survey results, zero-emission trucks remain in a phase promotional phase characterized by strong willingness but weak implementation. While enterprises generally maintain an open attitude toward a transition to green transportation, their actual progress continues to be constrained by multiple factors including costs, supporting infrastructure, standards, and market mechanisms, as well as a lack of systemic enabling conditions.



Policy

To accelerate the transition from policy advocacy to practical implementation, policymakers should strengthen guidance for corporate actions, enhance coordination between supply and demand sides, and establish robust market mechanisms. This requires building an executable, verifiable, and incentive-driven policy framework to propel zero-emission freight transportation beyond the "pilot project" phase and onward to sustainable expansion. The following are specific recommendations to drive this transition.

Strengthen demand-side guidance to stimulate the willingness of shippers to purchase zero-emission vehicles. Although shippers have demonstrated some willingness to adopt zero-emission freight solutions, this attitude has not yet fully translated into actual procurement and market growth. One key reason is the lack of clear market-oriented mechanisms and institutionalized transmission pathways. Currently, green transportation relies more on voluntary corporate initiatives rather than forming a systemic cycle where procurement results in stable demand and service providers respond with capacity building.

We recommend establishing a coordinated policy mechanism that covers standard-setting, procurement application, and incentive supports. On one hand, clear reference indicators for zero-emission freight capacity (such as the proportion of clean energy transport as a part of total capacity) should be defined as criteria for shippers to evaluate and select logistics service providers. On the other hand, leading enterprises in manufacturing, fast moving consumer goods, e-commerce, energy sectors and other areas should be encouraged to incorporate clean energy transport capacity requirements into their bidding conditions for logistics services, thereby directing demand for green transportation to service providers through market mechanisms. Additionally, incentive policies that support programs like "Green Procurement Demonstration Projects" should be introduced for shippers or platform companies actively promoting procurement policies in green transportation, including special fund rewards and preferential financing costs. This will help create a closed-loop system that addresses standards, procurement, and incentives, creating a draw from the demand side and stimulating proactive investment from the supply side.

Promote the construction of a carbon data system to facilitate the valuation of green performance. Currently, enterprises generally have weak carbon accounting systems, which makes it difficult to evaluate efficacy when advancing zero-emission freight programs. On one hand, the lack of unified calculation methods and standardized reporting formats leads to carbon data that is inconsistent and less credible across different enterprises or platforms, making it difficult to serve as a valid basis for policy support, client review, or capital recognition. On the other hand, it is still difficult for carbon calculation results to be "monetized" or directly linked to incentive mechanisms. Even if enterprises quantify emission reduction benefits, they often fail to receive corresponding incentives or financial support, which dampens their enthusiasm for further developing zero-emission freight.

To address these issues, we recommend establishing a logistics carbon data system based on "unified methodology + result verification + incentive linkage" on a policy level. The following are detailed steps of how this may be implemented.

First, develop a unified and authoritative logistics carbon emission accounting framework. Key parameters, including transport modes, fuel types, measurement boundaries, and data quality, can be clarified by drawing on international guidelines and standards such as the GLEC Framework and ISO 14083, as well as the actual scenarios in China's road freight transport sector. This will help to establish a comparable, practical algorithmic logic and boundary framework that is applicable industry wide.

Second, promote the creation of an authoritative certification and verification mechanism for calculating carbon reductions. Qualified enterprises should be encouraged to disclose emission reduction data based on the GLEC Framework or ISO 14083 and develop a carbon performance verification scheme suitable for domestic enterprises. This will ensure that accounting results meet the basic requirements for government incentives, client review, and financial institution acceptance.

Third, create a linkage between carbon performance and incentive mechanisms by incorporating carbon reduction results calculated and certified using standardized methods into incentive systems such as green finance, tiered operational subsidies, and carbon credit management. Additionally, pilot projects should also be encouraged to explore Markets Based Measures (MBM) for converting emissions reductions into value. Allow transport service providers to earn revenue by trading emission reduction certificates across different geographic regions or corridors, thereby decoupling physical routes from carbon reduction commitments. This approach can provide shippers with carbon-neutral compliance pathways while offering LSPs/ carriers additional funding sources for green transition.



Industry



Enterprises are gaining a deeper understanding of zero-emission freight, yet they still face bottlenecks in practical implementation, such as unclear transition pathways, difficulties in verifying benefits, and a lack of incentive mechanisms. To help the industry better navigate the direction of their zero-emission transformation, we recommend focusing on the following three aspects to transition zero-emission freight from the pilot project phase to a systematic development phase.

Integrate zero-emission freight into corporate development strategies to foster deep alignment between green objectives and business operations. Zero-emission freight should not be treated as an isolated "environmental project" but rather as an integral component of overall corporate strategy. We recommend that enterprises conduct systematic assessments of application scenarios and the synergistic potential for zero-emission freight in line with their business development goals. By adopting an approach in which "green strategy supports business development, and business operations reinforce green implementation," companies can chart pathways, define phased goals, and cultivate a competitive sustainability profile.

Make the benefits of a green transition quantifiable and valuable. Enterprises should go beyond just incorporating zero-emission trucks into their fleets; they should proactively calculate the benefits of green transition efforts and carbon performance management to improve data quality, calculation, and disclosure capabilities. They should actively explore methods like product-level carbon emission accounting, carbon footprint disclosure, and third-party verifications of emission reductions to demonstrate their achievements in decarbonization in their client communications, financial support applications, and brand building. At the same time, they should also closely monitor Markets Based Measures (MBM) opportunities to monetize the benefits from emission reductions, turning green investments into positive returns.

Engage in pilot projects to validate approaches and gain first-mover advantages. As relevant regulations and standards are still under development, early participation in pilot programs allows enterprises to better assess the suitability of application scenarios and business models in practice, while identifying key challenges and focus areas on fleet capacity, data management, charging and refueling infrastructure, and client collaboration. Pilot projects will also serve as critical points of reference for future policy implementation, incentive allocation, and standard setting. Based on the findings and conclusions in this report, enterprises are encouraged to express their willingness to participate and jointly develop replicable green logistics demonstration pathways.

Q4

Outlook

Driven by China's "Dual Carbon" goals, the transport sector is accelerating its transition toward a development model that is safer, more efficient, cleaner, and more sustainable. As the vital backbone of domestic economic circulation, road freight plays a foundational role in ensuring and improving people's livelihoods. Achieving zero-emission freight not only demands strong policy support, but requires shippers, logistics services providers/carriers and other related companies to balance safety, compliance, and efficiency with increased attention to the adoption and promotion of green energy, low-carbon technologies, zero-emission trucks, and sustainable transport models.

As a key pathway for decarbonizing road transport, zero-emission trucks have begun to gain initial traction in the market. With the continued strengthening of policy incentives, the accelerated rollout of basic infrastructure, and the growing awareness of green competitiveness among enterprises, zero-emission trucks are expected to move from pilot deployment toward large-scale commercial operations across a wider range of application scenarios.

This report has focused on zero-emission trucks, viewing them as a critical technological entry point and practical solution for the transition to zero-emission road freight. This study has singled out zero-emission trucks as a focal point for exploring sector-wide dynamics of decarbonization, drawing on field interviews and survey insights to identify the key opportunities and challenges along the transition pathway. While the sample size for this study is limited, we hope the findings can offer valuable references and foundational insights for policymakers, industry practitioners, and future researchers, ultimately contributing to a more stable and forward-moving green transition in China's freight and logistics sector.