LOTS GROUP

Collaborative Shipping Paving the Way to Net Zero Logistics

Navigating the Future of Logistics: Tackling Industry Challenges through Sustainability and Digital Innovation

Discover how the logistics sector can overcome today's hurdles with forward-thinking strategies, focusing on reducing carbon footprint and harnessing the power of cutting-edge digital tools.

Electrification * Collaborative shipping * Digital Transformation

EXECUTIVE SUMMARY

The crossroads of logistics: time for action

The logistics industry is at a critical turning point. Faced with the urgent need to reduce emissions and rapid digitalization, transportation—the engine of global commerce and one of the largest contributors to global emissions—must evolve fast. This transformation extends beyond cleaner trucks, it's about rethinking how goods are moved, leveraging digital solutions and collaboration to create a net zero logistics ecosystem.

This whitepaper highlights both the challenges and opportunities that lie ahead. However, systemic change cannot occur in silos. It demands a coordinated, system-wide approach that recognizes the interconnectedness of transport buyers, logistics operators, vehicle manufacturers, and infrastructure providers. Electrification is a crucial piece of the puzzle, but the barriers are real. Challenges such as large investments, infrastructure gaps, and technological uncertainty must be addressed with bold, decisive action.

To advance, the logistics sector must adopt system-level thinking, considering the cause-and-effect dynamics shaping the industry. Without demand, infrastructure won't be built and electric vehicles (EVs) produced; without infrastructure, EVs won't scale; and without scale, cost barriers remain too high. Beyond market dynamics, new digital tools will be critical catalysts for change. AI and machine learning will not only optimize operations and cut costs but also enable financial and environmental sustainability as companies navigate the complexities of a net-zero transition.

By 2030, we envision a logistics sector that is not just greener but radically more productive and resilient—one where sustainability becomes a core advantage. As we reimagine the flow of goods to drive economic growth decoupled from carbon footprint, we can transform logistics from a burden into a powerful part of the solution.

As always, progress will be gradual, and challenges will arise. But by leveraging technology, partnerships and rethinking how logistics systems are designed and operated, we can set the industry on a path towards lasting change. The time for bold leadership is now. As Mark Twain once said, "The secret of getting ahead is getting started."

Sincerely,

Johan Palmqvist
Managing Director Europe, LOTS Group

KEY INSIGHTS

- **Electrification for Emissions Reduction:**
  Battery electric vehicles (BEVs) and other sustainable technologies are fundamental to reducing carbon emissions and aligning with both regulatory and consumer expectations for environmental responsibility. However, without overcoming gridlock in infrastructure development and scaling efforts, the transition to electrification may stall, hindering progress in reducing CO2 emissions.

- **Collaboration Across Stakeholders is Critical:**
  Achieving large-scale electrification requires a transformative shift within the logistics ecosystem. It is imperative for manufacturers, suppliers, transport service providers, and end customers to collaborate and adapt to the evolving demands of electrification. Without this collective effort, the successful implementation of necessary changes and investments in the logistics sector will be unattainable.

- **The Role of a Central Orchestrator:**
  To facilitate the shift to large-scale electrification, a central orchestrator is crucial. The orchestrator is essential for overseeing the entire logistics network and balancing stakeholder needs. By managing the network, the orchestrator can identify inefficiencies, streamline processes, and maintain momentum in adapting to evolving sustainability demands.

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1. Introduction: The changing landscape of logistics

In the EU, the transport sector stands out as the only sector that hasn't decreased its emissions since 1990, instead they have increased, as seen in figure 1. Furthermore, the transportation sector represents a large chunk, 25%, of EU's total emissions[2], of which 27% stem from heavy-duty trucks & buses[3]. Meanwhile, road freight in EU is projected to rise 1.1% per year, 47% to 2050 from 2015[4]. To achieve the necessary C02 reductions from road freight and decouple it from the growth in transport demand, a new approach is needed. This is where companies' target setting for C02 emissions becomes crucial, as they play a pivotal role in driving the changes required to meet these ambitious goals.

TARGET SETTING FOR NET ZERO: THE URGENCY OF TACKLING SCOPE 3 EMISSIONS

Over 6,000 companies have now set Science based targets (SBTi) with more than 1,000 of those being net zero targets[5]. Achieving these targets require all companies to address their scope 3 emissions, which represent indirect upstream and downstream emissions embedded in the supply chain. These are often more challenging to mitigate compared to those from production, operation and energy use found in Scope 1 and 2.

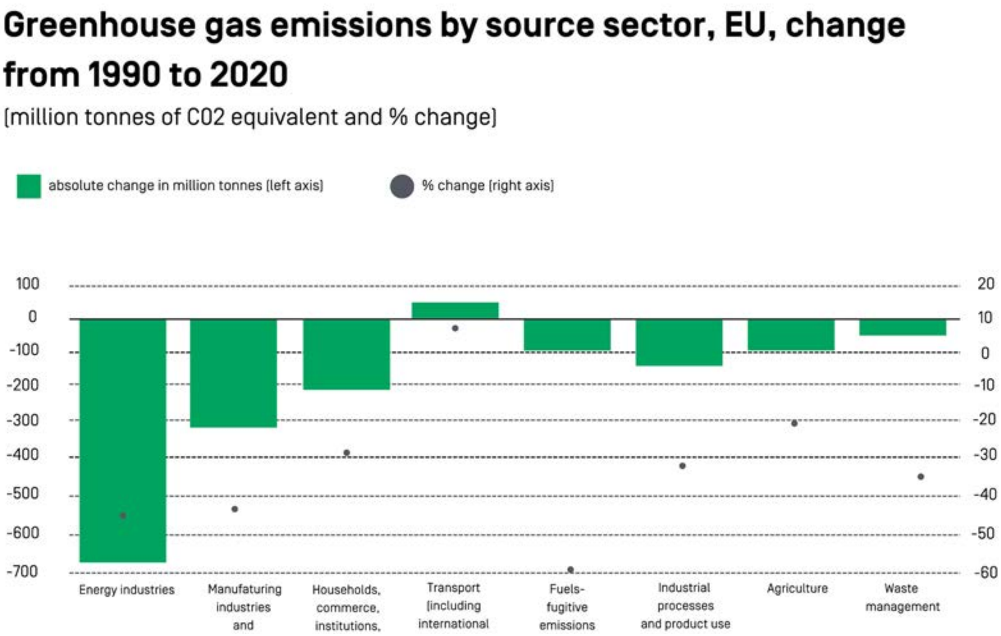


Figure 1. Source: World Economic Forum[1]

According to a study by Capgemini and CDP[7], 92% of all disclosed emissions from EU companies in 2022 were classified as Scope 3. However, only 37% of these emissions are currently being addressed through existing decarbonization measures. Whether the pressure comes from regulatory requirements, fiscal policies, changing customer demands, or concerns about brand image, not establishing a clear baseline and actionable targets can become a critical issue for businesses.

THE PATH TO REDUCING CO2 EMISSIONS

To summarize the current status of CO2 emissions within the transportation sector: The bad news is that there is a lot of them. The good news is that many companies are committing to reducing them. That begs the question, how will it be achieved? There is no silver bullet to reduce CO2 emissions from road transport; optimization, inter-modality, different fuels, and electrification are all essential tools that will play a significant role, as seen in figure 2. But, electrification stands out as a solution that delivers significant reductions and is projected to be the main technology in the long term[8]. However, electrification is not about replacing a conventional truck with an Electric one. To understand the challenges of transitioning to electric, it's crucial to first have a system-level understanding of the transportation system.

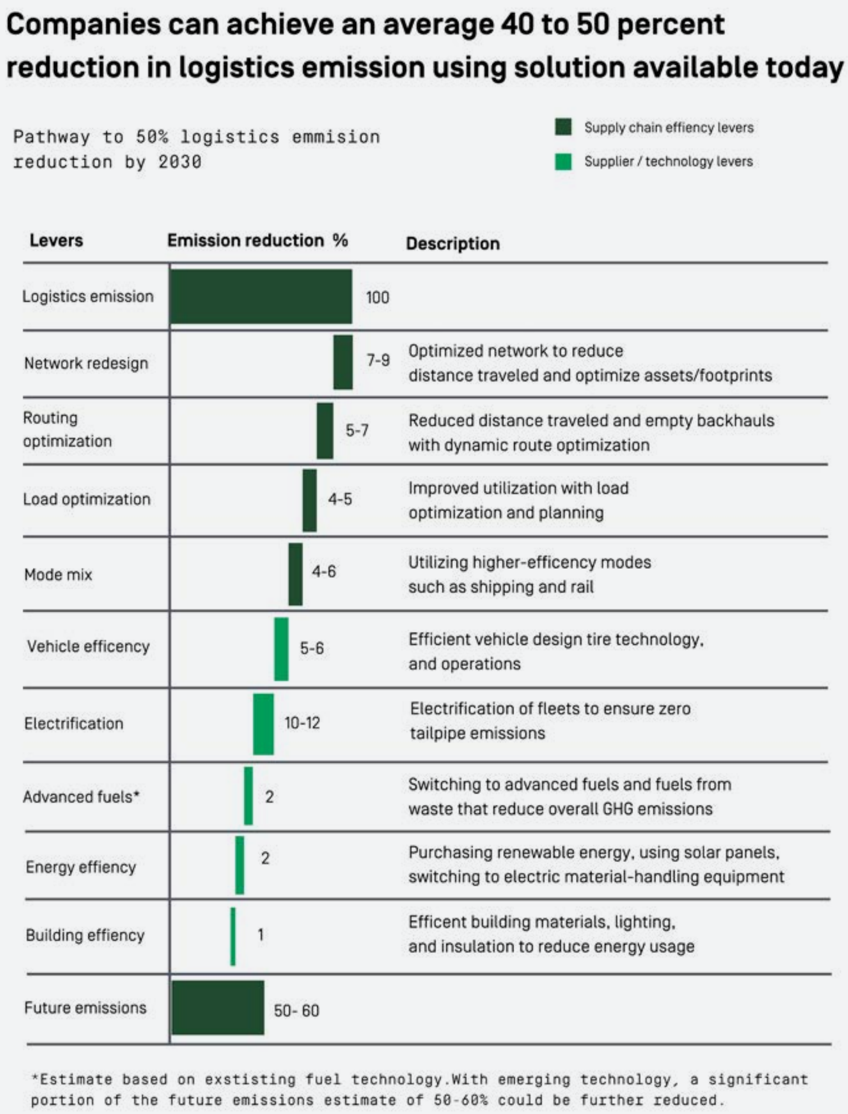


Figure 2.
Source: McKinsey, Decarbonizing logistics: Charting the path ahead[18]

AN ECOSYSTEM GRIDLOCK HINDERS ACCELERATION OF DECARBONISATION

The logistics system can be described as consisting of four different layers[9], each with distinct actors and markets. Each layer has its own set of needs, challenges, opportunities, and connections to other actors, visualized in figure 3

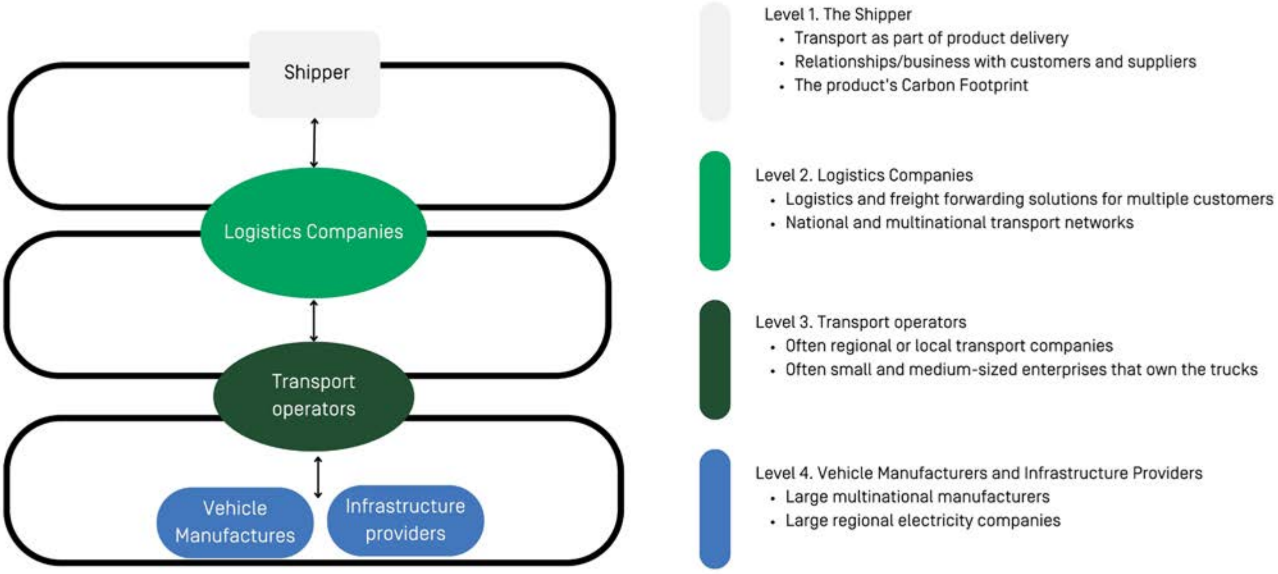


Figure 3. Logistics ecosystem overview. Source: Own, inspired by Abrahamsson et. al[9]

STAKEHOLDERS AND SYSTEM LEVELS

- **Level 1: Shipper** – Transport buyers, like manufacturers, are responsible for the carbon footprint of their products, including transportation emissions. They have a central role in influencing the supply chain through their demand for transport services but face challenges in supporting fossil-free options due to higher costs, technological uncertainty, and lack of infrastructure. The current system prioritizes flexibility with short, price-pressured contracts and no volume guarantees for logistics providers.
- **Level 2: Logistics Companies** - Third-party logistics firms and freight forwarders, such as DHL and Schenker, coordinate logistical solutions across networks and own CAPEX-intensive assets like warehouses and fleets. They need to improve asset utilization, which can conflict with overall system efficiency.
- **Level 3: Transport operators** - Typically regional or local, these companies own vehicles, employ drivers, and execute physical transportation. They face high costs for electric vehicles, uncertainty in residual values, and lack of charging infrastructure.
- **Level 4: Infrastructure Companies** - Companies like Volvo and Scania, and energy providers like Eon and Vattenfall, are crucial for developing vehicles, services and infrastructure. They must make significant R&D investments and face risks before market maturity. They are pressured to reduce emissions and accelerate sales of sustainable technology, which requires commercial viability of new vehicles and charging solutions.

There are two major gaps currently hindering the development of electric transport[9]:

1. **Demand Gap:** Between those who demand fossil-free transport services (shippers) and those who provide them (logistics companies). This includes a willingness to pay as well as un-adapted procurement processes.
2. **Commercial Gap:** While the technology for electric trucks and charging infrastructure exists, the required investments are considerably higher than those for operating diesel trucks. Given the current business models, this often means that is that despite the availability of the technology, it is challenging to justify from a business perspective.

To address these gaps, a clear understanding of how BEVs affect the main players in the ecosystem is needed.

> "There is no silver bullet to reduce CO2 emissions from road transport; optimization, inter-modality, different fuels, and electrification are all essential tools"

2. Electrification: The next frontier for decarbonization of transport

KEY INSIGHTS:

- **Technological Readiness:** Battery electric trucks are capable of meeting long-haul needs, but their market uptake remains low, with only 1.1% of new heavy-duty vehicle sales in Europe being electric in 2024.
- **High Upfront Investments:** Electric trucks, charging hardware and installation require significant upfront investment, making it difficult for smaller operators to transition to electric transport.
- **Infrastructure and Operational Challenges:** Large-scale electrification requires both efficient fleet utilization and cost-effective charging infrastructure, particularly for long-distance transport, where en-route charging adds complexity and cost.

As battery technology has advanced and the charging infrastructure buildout has started, Battery Electric Vehicles (BEVs) have emerged as a viable option for a wide range of applications. A pivotal milestone in this evolution is the ability of many Heavy Vehicle manufacturers to produce trucks that surpass the industry's "golden limit"—achieving sufficient range to drive for 4,5 hours without needing to recharge. This benchmark stems from European regulations mandating that drivers take a 45-minute break after 4.5 hours of driving[10].

Consider this example, based on technology that is available on the market: With 600+ kWh of installed battery capacity and a gross train weight of 40 tonnes, in good conditions, this vehicle can travel over 500 km on a single charge. At an average speed of 80 km/h, this translates to 6.25 hours of driving time, allowing for potential range reductions due to topography or weather conditions. Therefore, it's not an exaggeration to claim that the technology to electrify one of Europe's main source of CO2 emissions —road freight—is already here.

CURRENT STATE OF THE MARKET

Even though the technology to electrify many applications is available, the widespread adoption of electric transport has not yet taken off, with only 1.1% of new heavy-duty vehicle sales in Europe in Q1 2024 being electric[11].

Understanding this low market uptake requires a perspective beyond the technological aspect. One of the main reasons hindering the short-term deployment of BEVs is the current production ramp-up. This has led to a shortage of available trucks on the market, resulting in extended lead times. Additionally, the serial production of commercial vehicles demands high-quality standards. Integrating new technologies, such as state-of-the-art batteries and electric machines, further complicates the process. Multiple production lines must be simultaneously scaled up, contributing to potential delays. This will not hinder electrification in the long run, but it is essential to understand the current state of the market.

> "Electrification is not an isolated issue that can be managed solely between transport buyers and operators; it necessitates a holistic, system-level perspective."

OPERATOR PERSPECTIVE

Another crucial perspective to consider in order to understand the deployment of electric trucks, is that of those who will use the trucks, the transport operators. In Europe, the average carrier manages a fleet of 12 trucks[12], while some regions average 2-3. Purchasing an electric vehicle, which costs 2-3 times more than a diesel truck, significantly impacts their business. Given that their fleets often consist of trucks of varying ages, the book value of their assets is typically lower than the price of a new diesel truck. Consequently, the cost of a single electric truck could represent a substantial portion of their fleet's capital.

Moreover, within the transport industry, shippers rarely commit to specific volumes over time, placing the entire risk on the transport operator to ensure the truck remains operational. This uncertainty further complicates the operators decision to invest in electric vehicles.

INCREASED CAPEX

The cost structure for electric trucks differs significantly from that of diesel trucks, as illustrated in Figure 4. The higher initial cost of Battery Electric Vehicles (BEVs) is primarily due to the significant upfront investment, where batteries can account for more than 50% of the total cost[13]. Another critical difference lies in the residual value (RV) of BEVs, which is highly dependent on the condition of the batteries. This condition is influenced by how the truck is operated, making the determination of the RV for a specific BEV highly situational and uncertain, as it depends on the truck's future usage.

Adding complexity to this issue is the fact that the technology is relatively new, meaning the market lacks experience in estimating the value of second-hand BEVs. This challenge is further compounded by the rapid pace of development within the electric truck sector, with many OEMs investing heavily. As a result, the market anticipates better-performing products in just a few years, which might outperform today's technology. This uncertainty regarding the future market value of a BEV further complicates the RV estimation of BEVs purchased today. Consequently, the RV of BEVs is often set conservatively, leading to a shorter depreciation period and thus making electric transport more costly.

However, as the market becomes more adept at estimating the RV, this issue is expected to diminish, potentially becoming more of a concern for conventional trucks.

MITIGATE INCREASED CAPEX WITH OPERATIONAL EFFICIENCY AND LOW FUEL COST

To manage the higher capital expenditure (CAPEX), two key conditions must be met. First, it's crucial to on a fleet level increase utilization and thus distribute the fixed costs over more billable kilometers. One way of achieving this is to ensure that the trucks carry full loads on both the outbound and return trips.

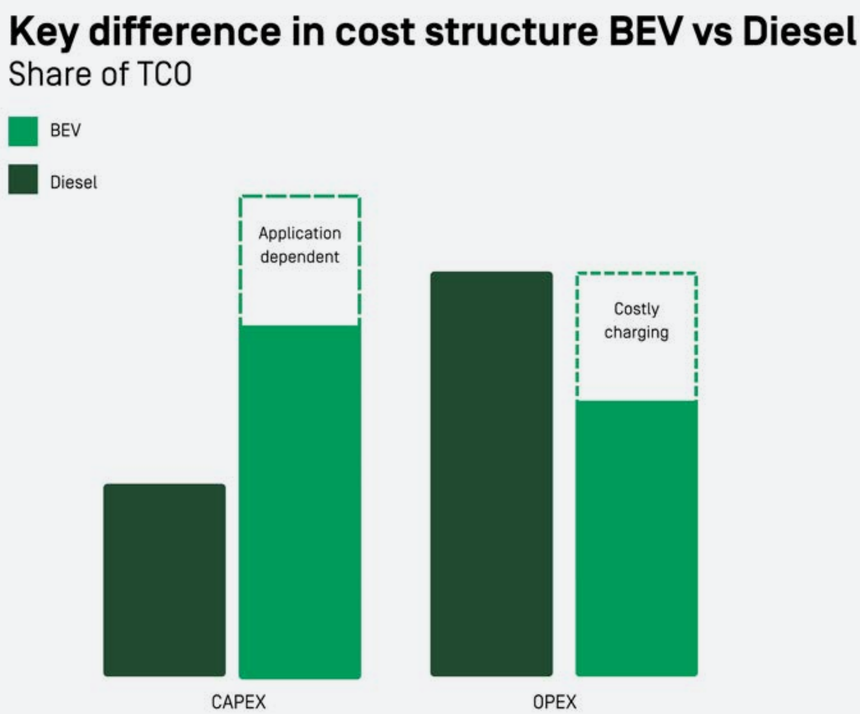


Figure 4. Schematic difference in cost structure for heavy duty long-haulage application, with a mix of public charging. Source: Own

While achieving full round-trips is possible with clever supply chain design, it remains challenging for the transport industry as a whole. In 2023, the average fill rate in EU was 57%[14], considering that a full truck can carry 25 tonnes, while the EU average was 14,3 tonnes[14]. This can be attributed to imbalances in freight demand, specialized transport needs, and logistical constraints.

A more insightful explanation can be derived from understanding the role of transport within supply chains. From the perspective of transport buyers, transport costs often constitute a relatively small portion of many industries' overall expenses. For instance, the Establish Davis Database[15] reports that transport cost for all of the analyzed industries is below 5% as share of sales, see figure 5 below.

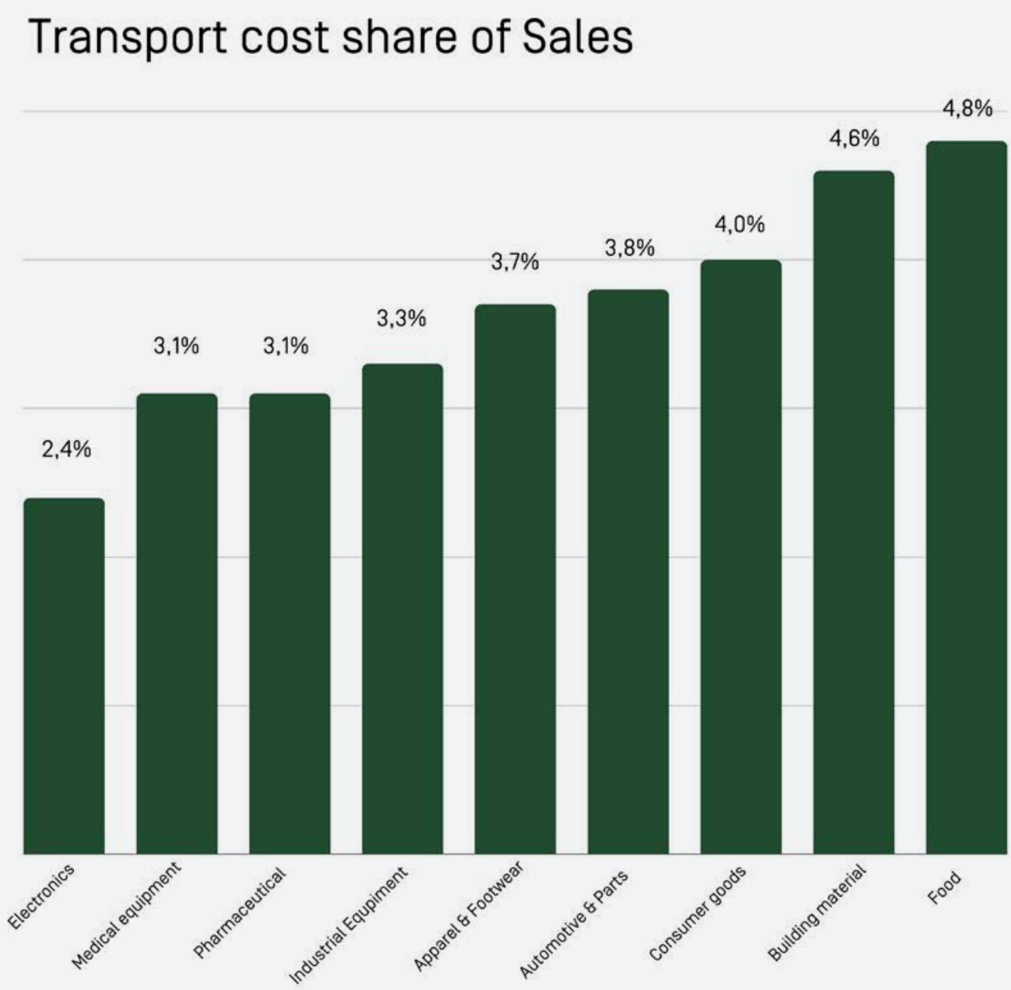


Figure 5. The Establish Davis Database[15]

This implies that transport cost is rarely a top cost category for businesses and, therefore, is rarely the primary focus for supply chain optimization. Consequently, transport often has to adapt to other supply chain needs, leading to instances of waiting times and empty mileage. This issue is already a hinder for large-scale electrification and will become even more pronounced with the advent of autonomous transport, which will require even more adaptations to how the trucks are operated and how the supply chains are designed.

The second condition that has to be met, is that the fuel cost has to be as low as possible in order to make up for the increased CAPEX. This can in some cases be achieved by charging the truck overnight in regions with competitive energy prices. Since overnight charging does not require significant investment, as there is ample time to charge, there is no need for costly high power. Additionally, low power requirements mean that the effect of peak power tariffs, which depending on region, are a major cost for high-power EV chargers, is limited. Furthermore, the existing grid can often accommodate the charger without additional costs or lead time for grid adaptation.

However, large-scale electrification for longer distances in Europe necessitates en-route charging. Notably, 60% of road freight in Europe involves distances exceeding 300 km[16], implying that a substantial portion of the energy must be charged en-route. En-route charging typically requires fast, high-power EV chargers exceeding 300 kW. From an energy cost perspective, this type of charging is significantly different from overnight charging. Firstly, investing in this kind of charging hardware requires a substantial financial commitment. On top of that, installation costs, which often include extensive ground works, add to the expense. Additionally, connecting to the grid and installing an additional transformation station can be quite costly, all in all leading to potential doubling of the initial hardware investment. Consequently, the total cost for a 300+kW charger can range from €150,000 to €300,000 as seen in figure 6.

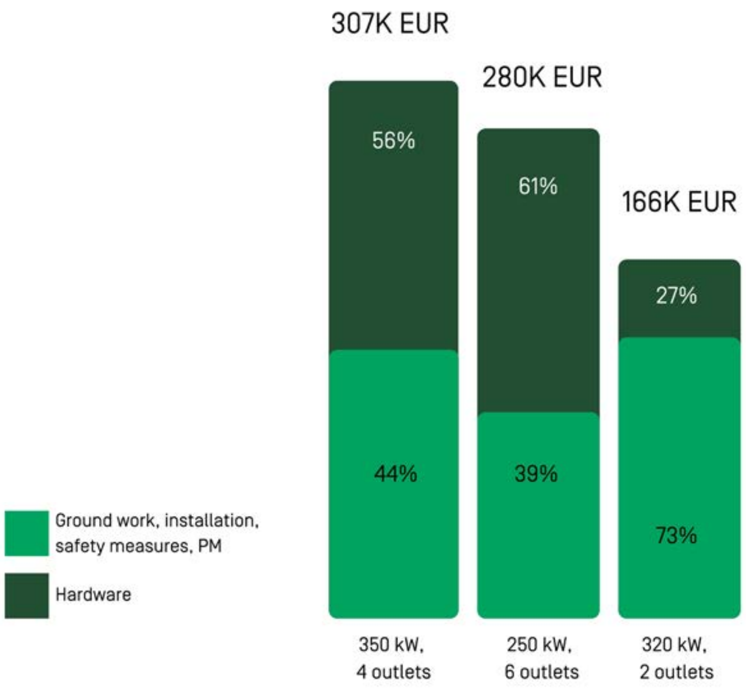


Figure 6

Moreover, obtaining permission to install high-power chargers can be challenging if the grid cannot support the additional load, potentially delaying installation for years. From an cost perspective, higher costs for energy transmission must also be considered, as the often substantial fixed fees are based on the peak power utilized at the site.

On the positive side, mobile high-power Battery Integrated Chargers are emerging on the market to address these challenges. These chargers can deliver high-power charging without requiring a robust grid connection. Additionally, they offer the capability to optimize energy costs by using the battery as a buffer.

CONCLUSION

Electrification is not an isolated issue that can be managed solely between transport buyers and operators; it requires a holistic, system-level perspective. The need for increased utilization and performance in the logistics ecosystem, such as reducing empty mileage, has been a long-standing discussion in the industry but remains unresolved. A comprehensive approach is essential to solve this, ensuring that all stakeholders, work together to address the challenges and opportunities of electrification, ultimately leading to a more sustainable and efficient logistics network.

3. Collaborative shipping: Decarbonization won’t happen in silos

KEY INSIGHTS:

- **Complex System:** The logistics ecosystem is highly interconnected, requiring coordination across various stakeholders to succeed with adapting it for electrification.
- **Fragmentation Hinders Electrification:** Lack of collaboration and leadership leads to inefficiencies and hinders the transition to electric vehicles and infrastructure.
- **Orchestrator Role:** A central "Orchestrator" is needed to align stakeholders, streamline efforts, and drive sustainability in the logistics system.

THE LOGISTICS ECOSYSTEM

The logistics ecosystem is a highly intricate and interconnected network involving various stakeholders, including manufacturers, suppliers, transport service providers, warehousing companies, and end customers[17]. Each of these actors plays a critical role in ensuring the smooth flow of goods from production to consumption. The system relies on precise coordination and communication to manage the movement of goods, inventory levels, and delivery schedules. Additionally, it must adapt to dynamic factors such as fluctuating demand, regulatory changes, and technological advancements. The integration of digital technologies, such as IoT and AI, which are there to reduce the complexity and increase efficiency, on the contrary adds additional layers of complexity to the system.

The transition to electrification requires substantial modifications in energy provision, vehicle operation, infrastructure development, and digital services. These changes necessitate coordinated efforts among various stakeholders, including vehicle manufacturers, transport service providers, transport buyers, electricity and infrastructure providers, and software developers.

COLLABORATIVE SHIPPING

The current system's fragmented nature means that each actor optimize their own part of the supply chain, which can have conflicting interests and priorities for the ecosystem as a whole. This fragmentation leads to inefficiencies and a lack of cohesive strategy, further impeding the transition to electrification. The absence of a unified approach results in duplicated efforts, wasted resources, and slower progress. The need for a coordinated effort is evident, but the current system's structure does not support such collaboration effectively.

> Moreover, the system lacks centralized leadership or governance, making strategic decision-making and effective management of required changes challenging.

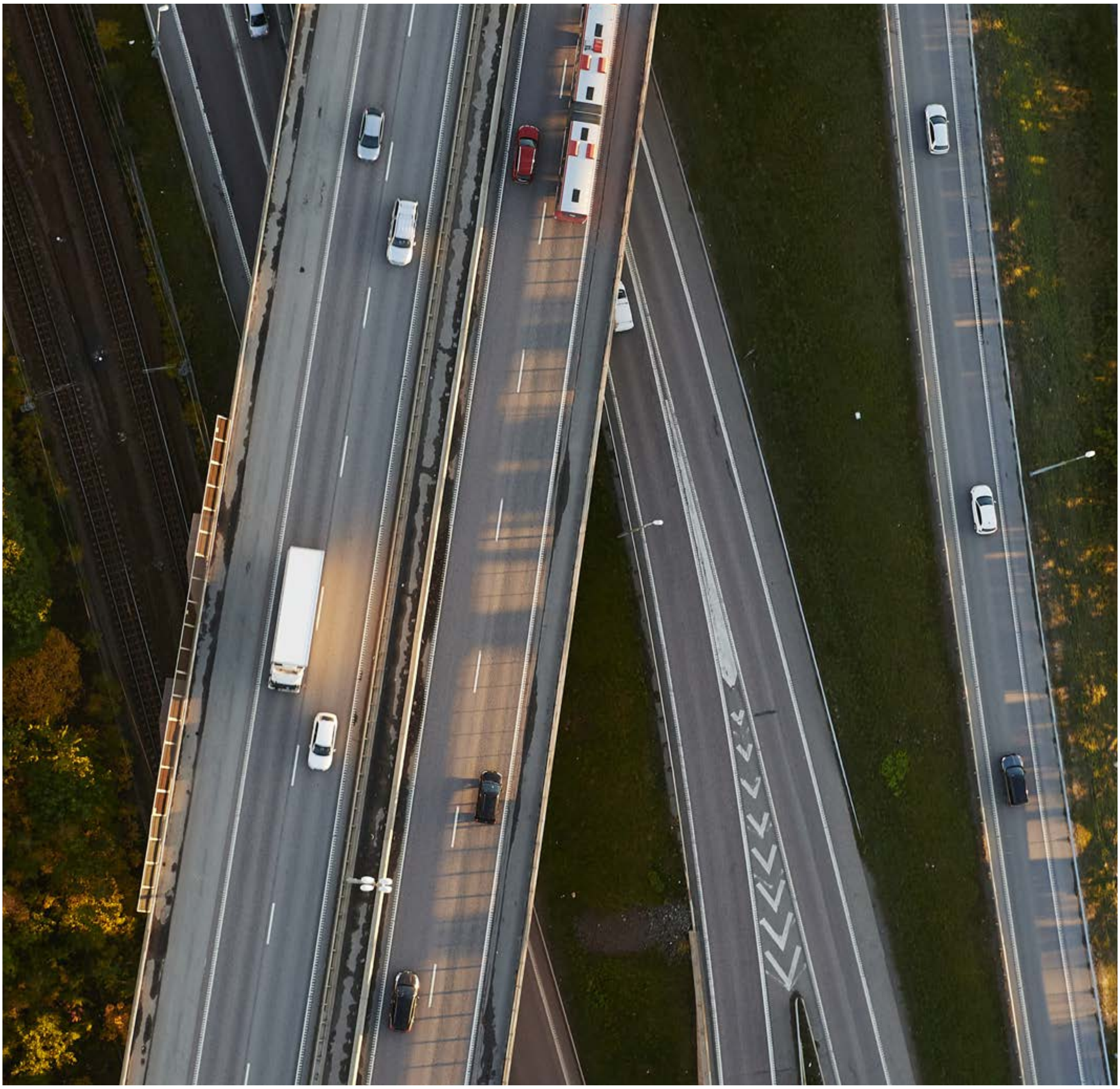
Moreover, the system lacks centralized leadership or governance, making strategic decision-making and effective management of required changes challenging. The "chicken-and-egg" problem between the market adoption of electric trucks and the expansion of charging infrastructure exemplifies the coordination difficulties. Without a sufficient network of charging stations, the adoption of electric trucks is hindered, and vice versa. This interdependence highlights the need for a system-level understanding to align the agendas of different actors and manage the transition effectively.

To address these challenges, it is essential for shippers to collaborate more closely. This collaboration is vital for three reasons:

1. **Demand Clarification:** By having shippers share detailed information beyond their immediate transport needs, thus increasing demand visibility, a comprehensive understanding of the aggregated demands on the logistics ecosystem can be established. This enhanced visibility is the foundation to improve the ecosystem.
2. **Optimization:** With shippers' well-specified and pooled demand, coupled with a mandate to adjust supply chain parameters beyond just transportation, the logistics ecosystem can be optimized as a whole. This holistic approach minimizes inefficiencies and ensures better resource utilization, directly benefiting from the improved demand visibility.
3. **Investments:** An efficient ecosystem, built on the pooled demand of several shippers, justifies investments by demonstrating increased productivity. These investments, shared among various stakeholders, lower risks and enhance attractiveness for investors.

Finally, the coordination and orchestration of all the needed changes require a new role in the ecosystem: the Orchestrator. This role would be responsible for overseeing the entire network and balancing the needs of all stakeholders to ensure the overall success of the transition to sustainability. The Orchestrator would facilitate communication and collaboration between shippers, logistics providers, and energy providers, ensuring that all parties are aligned and working towards common goals.

By managing the network as a whole, the Orchestrator can identify and address any bottlenecks or inefficiencies, streamline processes, and ensure that resources are allocated effectively. This role is crucial for maintaining the momentum of the transition and ensuring that the logistics ecosystem can adapt to the evolving demands of sustainability.



4. Digital Transformation as a Catalyst for Sustainable Logistics

KEY INSIGHTS:

- **Digital Innovation is Key for Sustainable Logistics:** Electric trucks require new digital tools to manage dynamic vehicle range, charging, and energy costs.
- **Machine Learning Boosts Efficiency:** It optimizes routes and reduces emissions, making electric logistics more cost-effective.
- **Generative AI Drives Automation:** It automates planning, helping integrate electric trucks and optimize charging, speeding up the shift to sustainable transport.

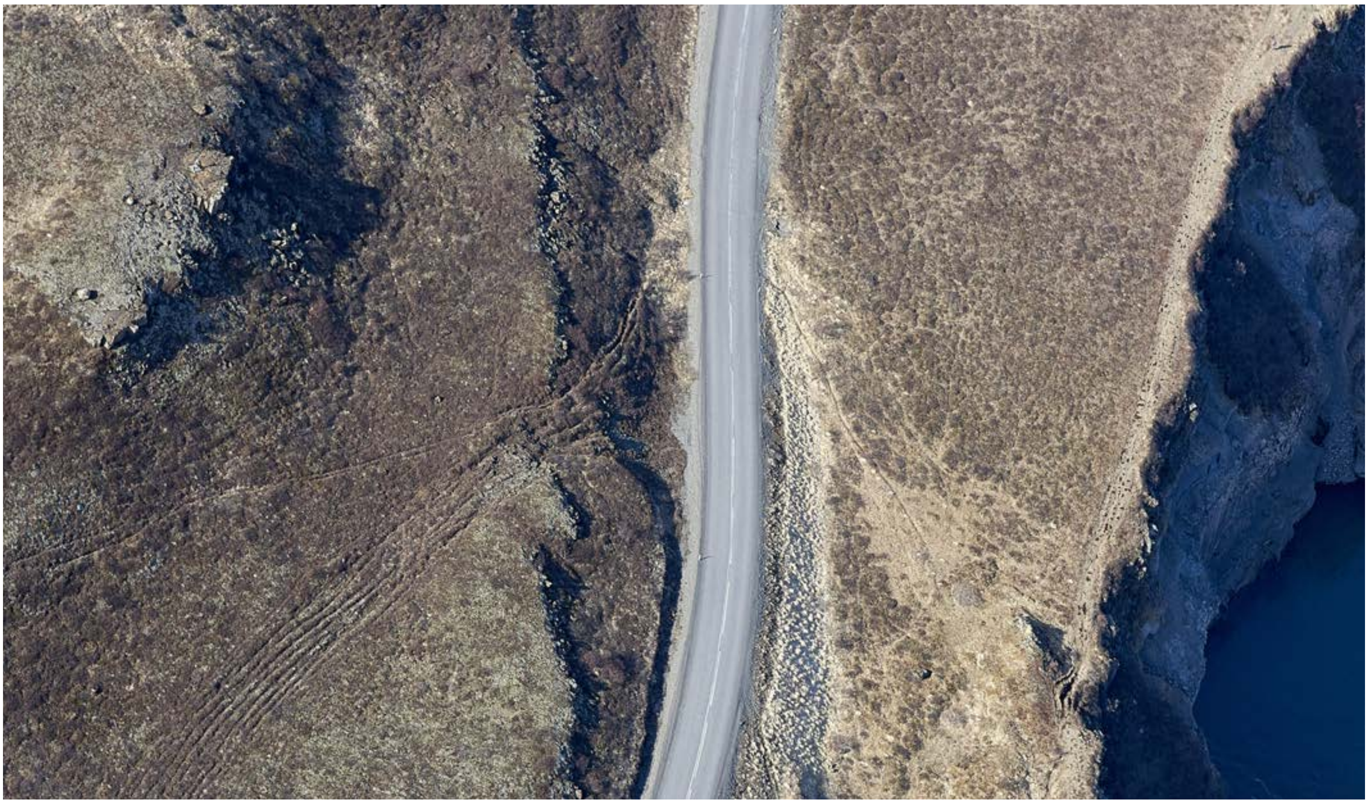
As today's technical landscape in freight management lacks the ability to efficiently manage tomorrow's electric logistics network, an increase in relevant digital and AI capabilities is needed to unlock the transformation to sustainable logistics networks at scale. In the world of diesel trucks, vehicle range is long and predictable, the refueling process is short, and energy prices are stable. For electric trucks, the situation is the opposite: vehicle range is often short and dynamic, the charging process is long and varies from case to case, and energy prices are volatile. As a result, there is more complexity to address when designing and operating logistics networks. Beyond the traditional logistics optimization of load factors and efficient routing, with electrification it is also necessary to consider energy supply, charging and vehicles as one system to optimize and reduce costs. Hence, strengthening digital capabilities becomes highly relevant to be in the forefront of sustainable logistics.

Machine learning is transforming logistics by for example enabling smarter, data-driven decision-making[18]. These technologies can be developed to analyze vast amounts of data from various sources—such as traffic patterns, weather forecasts, and vehicle performance—to dynamically optimize routes, reduce fuel/energy consumption, and minimize delays[18]. This enables the creation of more powerful tools for both logistics network design and transport execution.

An improved ability to predict range and emissions means that logistics networks can be designed and operated with lower safety margins, which is especially important in electric transport where the range can be dynamic and strongly dependent on both environmental and operational conditions. The result of this is better utilization and a more cost-effective solution, which in turn accelerates the transition to electric transport by making more transport needs economically viable to electrify. However, challenges in building tools like this include accessing large amounts of high-quality data and designing systems that address both long-term optimization in the logistics network design process and short-term optimization in day-to-day transport execution.

> "Generative AI can significantly enhance productivity, making the design and operation of electric transport systems possible with far fewer resources, thereby moving logistics faster toward a more sustainable future."

Emerging generative AI technologies will also play an important role in logistics, as they already are in many other industries. This technology is particularly useful for automating workflows that have been difficult to automate with traditional software methods. It can also improve work quality by enabling the inclusion of much more information, context, and multi-scenario analysis in the design and planning process of logistics networks. Automation with generative AI can be applied to everything from organizing and analyzing customer demand data to handling daily transport bookings and managing deviations.



With electric trucks, there are many new factors to consider, such as charging infrastructure, dynamic energy prices, battery wear, and energy consumption. Generative AI can help analyze how different choices affect the logistics network, enabling companies to make better decisions. It can suggest the best ways to integrate electric trucks into existing fleets and plan for charging needs based on simulation results and relevant information from customers or other sources. By offering these advanced features, generative AI can significantly enhance productivity, making the design and operation of electric transport systems possible with far fewer resources, thereby moving logistics faster toward a more sustainable future.

Even in this AI-powered era, traditional simulation models and algorithms will continue to play an important role. For example, in load management and smart charging where the energy flow in vehicle depots and charge points is optimized to reduce expensive power peaks. The real advantage comes from combining the benefits of both traditional software and machine learning with new generative AI technology. This means utilizing a combination of powerful tools for both narrow and broader tasks across the organization while automating repetitive and time-consuming workflows. As a result, humans in logistics design and transport execution teams can focus on more strategic and important problems, thereby pushing the limits on how fast and efficient sustainable transport can be rolled out.

5. Conclusion: Orchestration as the Key to Change

- While optimization, different fuels and multiple modalities will play an important role in reducing CO2 emissions, the shift to BEVs is inevitable to decuple CO2 emissions from the rising demand for transport. This shift not only mitigates environmental impacts but also positions logistics companies to comply with increasingly stringent regulations and meet the growing consumer demand for sustainable practices.
- However, this transformation goes beyond simply adopting new technologies. The entire logistics ecosystem must evolve to meet the needs of BEVs. This requires a coordinated effort from all stakeholders, including vehicle manufacturers, transport operators, logistic companies, service providers, and shippers. These parties must collaborate to reshape the ecosystem into a highly efficient logistics network. With such a system in place, the deployment the technology will naturally follow, ensuring a seamless transition to a net zero logistics ecosystem.
- Furthermore, the use of digital tools and platforms is critical to support and enhance this electrification journey. AI-powered tools can optimize operations, manage energy consumption, and ensure the efficient use of electric vehicles. But, for this transition to succeed, an orchestrator is needed—an entity that can guide, coordinate, and align the various stakeholders involved. This orchestrator would balance the needs of vehicle manufacturers, transport operators, logistic companies, service providers, and shippers while also acting as a liaison with regulators to ensure compliance with evolving environmental policies. By uniting these efforts under a common umbrella, the industry can create an efficient and sustainable net-zero logistics ecosystem.

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