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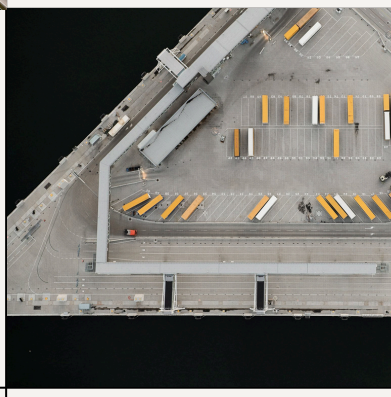

It’s Not the Truck, It’s the System:

A Blueprint for Sustainable Electric Freight

2025

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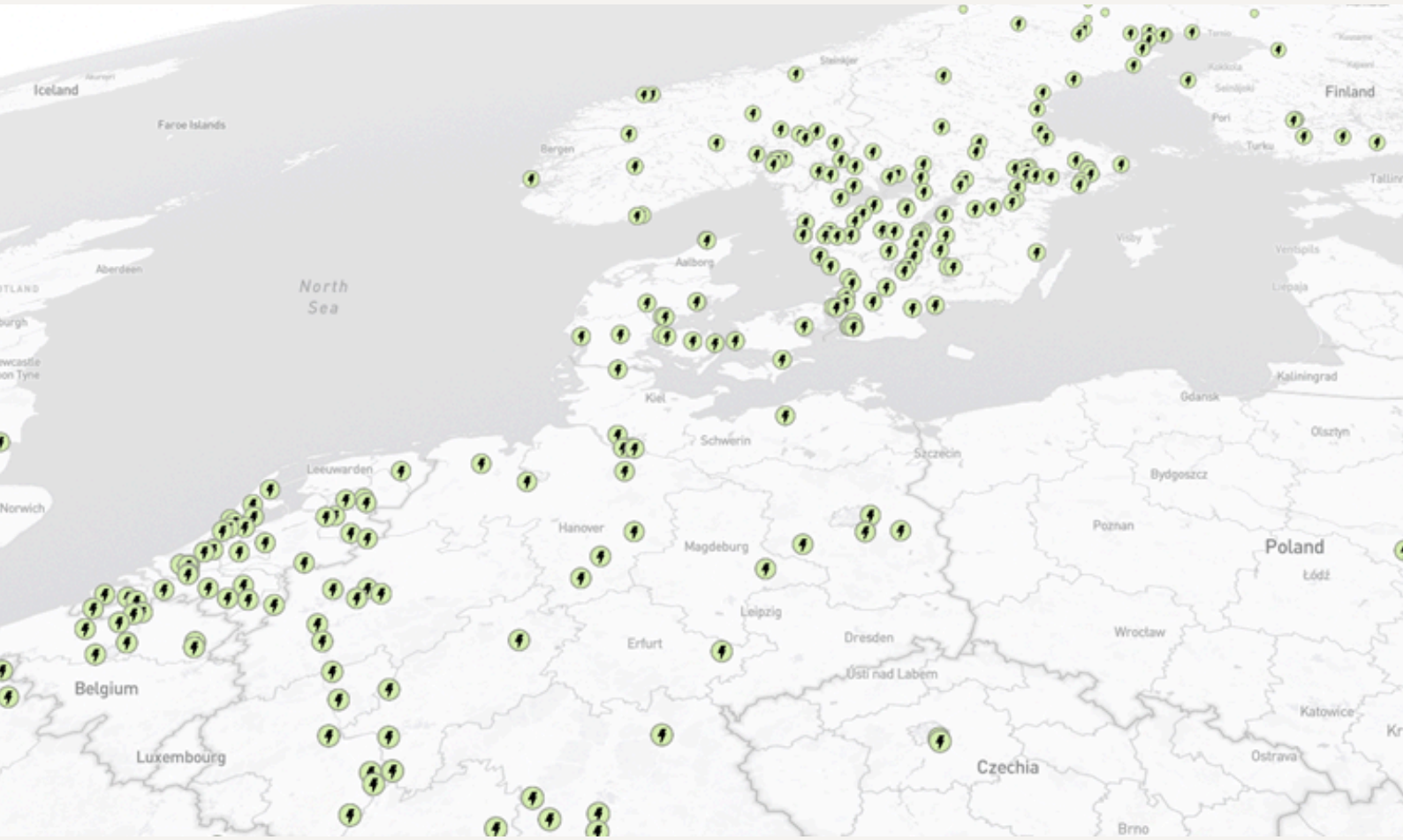
The imperative to decarbonize road freight is intensifying, driven by both climate targets and looming regulations like the EU's Emissions Trading System 2 (ETS2). This new carbon-pricing mechanism is set to fundamentally challenge the economic landscape of logistics. While biofuels like Hydrotreated Vegetable Oil (HVO) offer a popular transitional path, their long-term viability is constrained by fundamental supply limitations, shifting the focus to truly scalable, zero-emission solutions. To put this in perspective, even with optimistic projections for European HVO production is set to reach 10 million metric tons by 2025 – doubling from 2022 levels,[1] this would cover less than 5% of the 172.1 million metric tons of diesel consumed by the EU's road sector in 2023.[2]

Battery electric vehicles (BEVs) represent a technically mature pathway to eliminating tailpipe emissions. While heavy-duty vehicles constitute just 2% of the vehicles on European roads, they are responsible for over a quarter of all road transport emissions.[3] This impact is further concentrated, with a disproportionate share of these emissions generated along a few key freight corridors. The strategic imperative, therefore, is not a scattered rollout but the large-scale deployment of electric fleets on these high-volume lanes, where the greatest climate impact can be achieved.
So why isn't this happening at scale? The necessary long-range electric trucks are entering the market, and key public charging infrastructure is already built along major European corridors as shown below.



The reason, to borrow a phrase from politics, is simple:
"It's the economy, stupid."

The business case hinges on offsetting significant truck, charger and grid investments with savings from an energy source that can fluctuate 100-fold in a single day—a level of volatility unheard of in the predictable world of diesel. This raises a critical question: must we wait for autonomous driving to offset the increased costs electrifying Europe's main freight lanes, or can BEV TCO parity be achieved within today's paradigm?

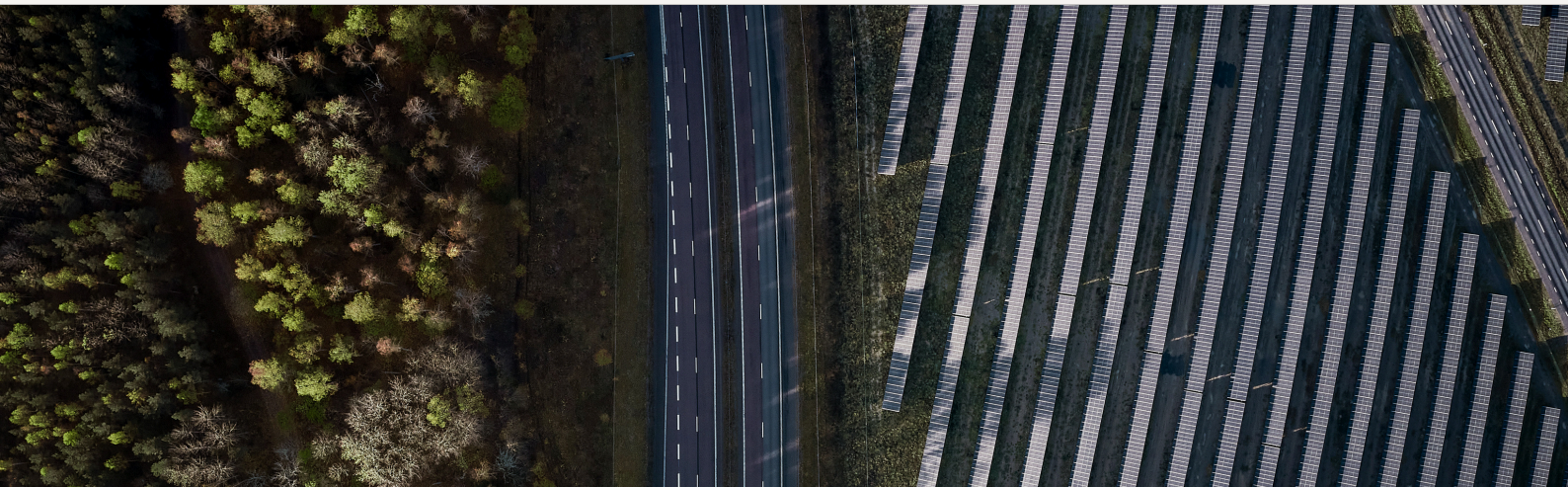
This paper argues that TCO parity is not a distant prospect but an achievable reality now. Unlocking it, however, is a sequential process that starts with design and ends with execution.

First, the very design of a high-volume Green Lane requires a system-level approach rooted in classic supply chain management. This means designing the lane not as a series of independent trips, but as a single, integrated production system that synchronizes committed volumes with the precise scheduling of trucks, drivers, and charging.

Second, this integrated design introduces immense complexity, where digitalization and AI become indispensable tools for modeling and optimizing the lane's architecture itself.

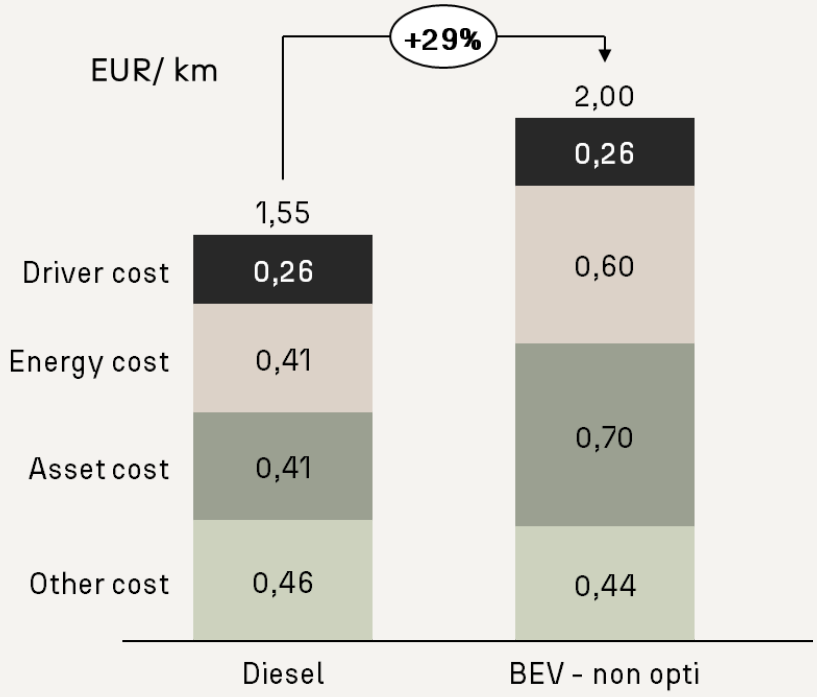
Finally, daily operations require a new level of digital orchestration. The challenge is to manage the dynamic interplay between truck routes, vehicle state-of-charge, driver availability, and volatile energy prices—variables that live in separate, disconnected systems. The solution is a central digital platform that acts as the operational brain, connecting these systems to transform complex, fragmented data into clear, actionable insights. By using AI to continuously analyze and simulate outcomes, it can provide the optimal, data-driven decisions needed to run the lane efficiently.

The opportunity this presents is massive: because it is so difficult, the few who succeed will gain a powerful competitive advantage as rising CO2 tolls and ETS2 make diesel increasingly expensive. Ultimately, mastering this new ecosystem will make optimized BEV transport not just comparable to, but significantly cheaper than, its diesel counterpart.



Case study example

To make the theoretical tangible, let's examine a real-world freight lane: Rotterdam to Stockholm. In a conventional setup, this is a three-day journey. A standard diesel operation, optimized for cost through established industry practices like cabotage and international driver deployment, costs approximately 1.55 EUR/km. If we simply replace the diesel truck with a battery-electric one but change nothing else about the operating model—relying on non-optimized expensive charging at around 0.50 EUR/kWh—the cost balloons to 2.00 EUR/km.



This 30% cost increase, as illustrated in the graph above, is not viable in the highly cost-pressured logistics industry. Faced with this gap, the obvious strategy is to wait. This is a reasonable position, as the main cost drivers—high public charging prices and future CO2 tolls—are largely beyond the control of any single actor.

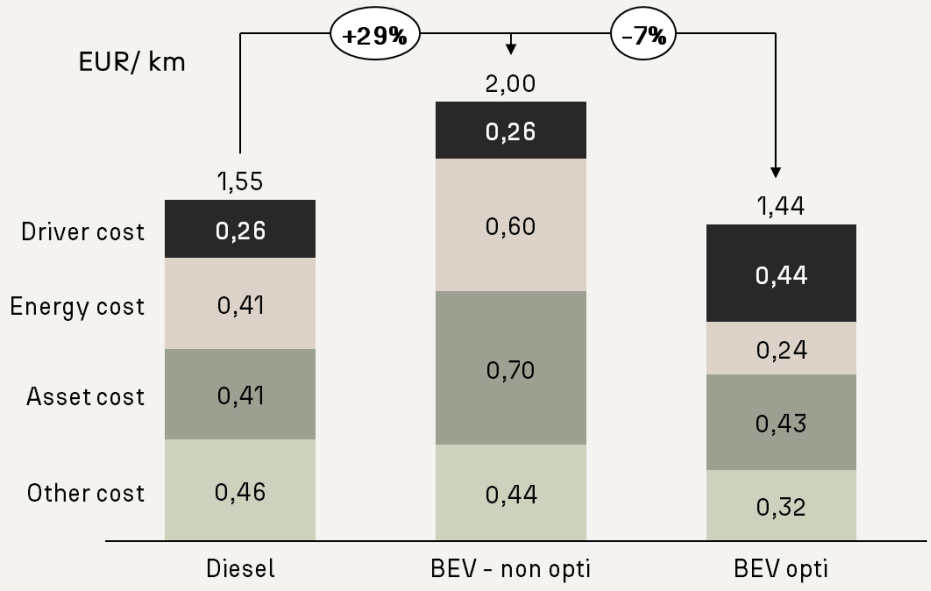
The alternative, however, is to reject this passive stance and proactively redesign the system around the parameters that can be controlled today: asset utilization and charging costs.

This proactive approach is the foundation of the "**Green Lane**" concept, which centers on two principles:

1. Asset Utilization: The goal is to keep the expensive BEV assets in constant motion, much like a production line. This is achieved by establishing driver-swap hubs along the route. Instead of one driver completing the entire multi-day journey, multiple drivers work in shorter shifts. They drive for 3-4 hours to a hub, swap trucks with a colleague, charge their vehicle, and drive back towards their starting point, allowing them to return home at the end of their shift. By operating the lane in three shifts, asset utilization can be tripled during a standard 5-day work week, effectively spreading the high investment cost over far more kilometers and cutting the lead time from three days to just one. So why isn't this done today? With a diesel truck, the economics are different: the asset is not the main cost. The savings from keeping a relatively inexpensive truck running 24/7 simply don't justify the high expense of adding more drivers working odd hours.

2. Optimize Charging Costs: A distributed network of trucks along the lane eliminates the need for massive, high-power charging stations. This reduces hardware investment and avoids costly peak power tariffs. Combined with smart charging during off-peak hours when electricity is cheapest, the cost per kWh can be drastically reduced, depending on region, ultimately reaching 0.20 EUR/kWh.[4]

When these two principles are combined, the cost of the optimized BEV Green Lane drops to 1.44 EUR/km, beating the current diesel cost with technology and infrastructure available today.



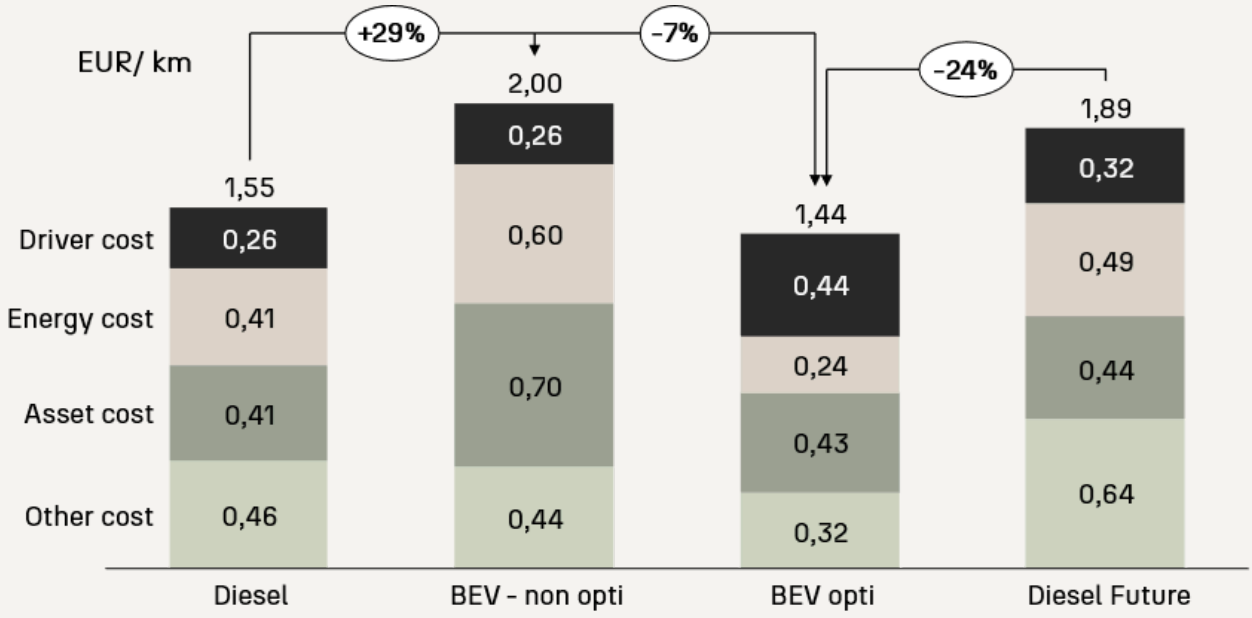
Of course, this operational model is not a simple 'plug-and-play' solution. Its success rests on three key foundational pillars that must be built in unison:

1. Commercial Design: securing committed, high-volume freight to ensure the system operates like a stable production line. Since individual shippers rarely have balanced flows, this necessitates deep shipper collaboration to create consistent, two-way volumes.

2. Physical Network: a strategically designed infrastructure of hubs for efficient driver swaps and intelligent charging.

3. Digital Orchestration Layer. This is the 'brain' required to manage the immense new complexity—from real-time truck and driver scheduling to dynamic energy purchasing and managing vehicle state-of-charge.

Furthermore, the current cost of operating operating a diesel truck is not static; it faces upward pressure from multiple directions. As the EU ETS2 phases in, the cost of carbon will be passed on to fuel suppliers and, ultimately, to consumers.
This carbon price is expected to be substantial, with some forecasts predicting it could reach €200 per ton by 2030, leading to a diesel cost increase in the range of 20%.[5]
Simultaneously, as BEV adoption grows, diesel trucks will be perceived as a riskier investment, depressing their residual value. A conservative model factoring in lower diesel RV and a 20% fuel cost increase, roll out of CO2 tolls in countries and a driver cost increase due to the driver shortage, this would push the diesel transport cost for this route to 1.89 EUR/km. Against this near-future reality, the optimized BEV lane at 1.44 EUR/km is not just competitive—it's nearly 24% cheaper.



The Bottom Line

Battery-electric transport can achieve Total Cost of Ownership parity with diesel today. This is not a technological problem to be solved by the next generation of batteries, but an operational and commercial one. Reaching this milestone is not about swapping one truck for another; it demands a full systems redesign built on shipper collaboration, committed volumes, and intelligent management of both logistics and energy.

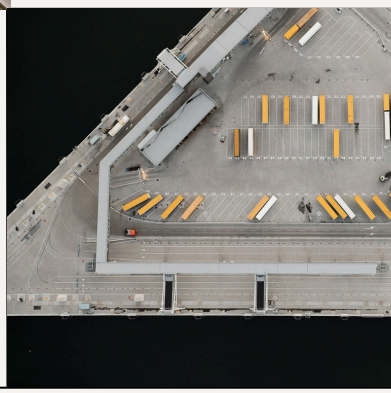
Those who master this complexity will gain more than just cost savings. They will build a significant competitive advantage as rising carbon prices from ETS2 and other CO2 tolls inevitably widen the cost gap between optimized electric transport and diesel. Furthermore, by mastering the domains of data integration, network optimization, and systems-level management, these companies will have built the foundational capabilities essential for the next disruptive wave in logistics: autonomy.

Autonomy is yet another new technology to be deployed into the logistics ecosystem, but its rollout will be fundamentally different from electrification. Driven by unparalleled economic advantages—with some estimates suggesting a potential 42% reduction in cost per km[7]– its deployment will not start with scattered, small-scale pilots. The economic rationale is simply too compelling. Instead, the rollout will likely be the inverse of electrifications' current path: autonomous technology will be targeted at the continent's most valuable, high-volume freight lanes first, where the returns are greatest.

This will compel shippers to adapt their supply chains to these autonomous corridors, not the other way around. It mirrors historical technology shifts where infrastructure dictated industry—like sawmills clustering around hydropower sources, or factories and communities aligning themselves along newly built railway lines. The autonomous network will become the new, hyper-efficient backbone of logistics, forcing everyone else to connect to it. This is precisely why the work of establishing Green Lanes today is so strategic. By learning how to take control of a transport network, build the required digital and operational capabilities, and adapt freight flows to the specific needs of a high-performance lane, companies are not just solving for electrification—they are future-proofing their operations and positioning themselves to lead in the autonomous era.

Beyond the balance sheet: A New Deal for Drivers

Perhaps the most transformative impact of this model lies beyond the balance sheet. This operational model offers a compelling alternative to the traditional long-haul structure, which evidently struggles to attract a sufficiently large and diverse talent pool. The combination of operating a quiet, modern electric truck with a driver-swap system that allows drivers to return home daily creates a vastly different career proposition. This shift could be a powerful tool to address the industry's stark gender imbalance. While only 4% of truck drivers in Europe are female,[6] that figure quadruples to 16% in the bus and coach sector[8] - whose daily-return structure this model emulates.



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