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EN TRANSITION

The greening of road haulage fleets in France

Current situation and conditions for success

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The decarbonization of freight transport in France and Europe entails a rethinking of the logistics sector: modal shifts and increased pooling, new rules for urban accessibility, availability of urban land and stricter constraints on e-commerce, are all levers to control the demand and to increase efficiency of flows. The choice of transport modes will also be decisive. Among other changes, there will need to be an increase in the modal share of rail freight (particularly for transit and international transport) to reach a target of 25% of tonne-kilometres (t.km) transported by 2050.[1] As a result and despite this ambition, road transport will remain the dominant mode, especially for regional transport. Given that context, addressing the shift to decarbonized fuels thus appears essential. This study focuses on the specific stakes of greening[2] heavy-duty vehicle (HDV) fleets.

For the transition to succeed, a set of conditions must be met simultaneously, involving all actors in a framework of fair competition and effort sharing. The State has a role to play in ensuring coherence, setting targets, providing financial support for the actors involved, and overseeing the development of infrastructure. The European framework requires manufacturers to develop a range of zero tailpipe emissions vehicles based on a defined trajectory.[3] Hauliers must be given incentives and be able to acquire/operate these low-carbon vehicles profitably. Finally, contractors must be encouraged to use these solutions. This study addresses, in the form of a "package of measures", the various aspects of public policy to facilitate the road haulage transition by involving all stakeholders in a coordinated and fair manner.

1 As defined by the national rail freight development strategy

2 Development of zero tailpipe emissions vehicle sales: electric and hydrogen

3 At present, CO_2 emissions of manufacturer registrations should be reduced by 45% in 2030, by 65% in 2035, and by 90% in 2040 compared with the average CO_2 emissions of the reporting period from mid-2019 to mid-2020.

KEY MESSAGES

The European CO_2 emission standards published in the Official Journal of the European Union on 6 June 2024 set tougher targets from 2030 onwards,* leading to a minimum greening of HDV sales of around 34% to 36% in 2030 (compared with 1.3% in 2023 in France). To achieve this target, the competitive gap with diesel transport must be reduced. Thus, the levers to be considered urgently are the comparative prices of energies/fuels and the continuation of at least three years of support for the purchase of zero-emission HDVs and related infrastructure. For their part, manufacturers will have to offer de-risked commercial packages based on resale value.

* Official Journal of the European Union, online: https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=OJ:L_202401610

The authors believe that the introduction of greening quotas for large fleet owners could secure demand for zero tailpipe emissions vehicles. This study proposes pathways along these lines. Dividing the objectives according to GVW seems essential, given the development trajectories of technological solutions for each segment and usage.

Finally, we recommend compulsory and more comprehensive reporting of road freight transport flows based on their environmental performance, as well as the introduction of an incentive mechanism to stimulate demand for low-carbon transport among hauliers.

IDDRI

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List of abbreviations

English	
AFIR	Alternative Fuels Infrastructure Regulation
B100	Biodiesel 100% FAME
BioNGV	Non-fossil Natural gas vehicle
CAFE	Corporate Average Fuel Economy
CNG	Compressed natural gas
CSRD	Corporate Sustainability Reporting Directive
ESRS	European Sustainability Reporting Standards
EVCI	Electric Vehicle Charging Infrastructure
FAME	Fatty Acid Methyl Esters
GVW	Gross Vehicle Weight
HDV	Heavy duty vehicle
HVO	Hydrotreated vegetable oils
ICE	Internal combustion engine
LEZ	Low emission zone
NGV	Natural gas vehicle
RFT	Road freight transport
SCR	Selective Catalyst Reduction – Depollution control system
TCO	Total Cost of Ownership
French	
SIV	Système d'immatriculation des véhicules (Vehicle registration system)
NAF	Nomenclature nationale d'Activité Française (French classification of activities)
HTT	Hors Toutes Taxes (Excluding all taxes)
TTC	Toutes Taxes Comprises (All taxes included)
AAP	Appel à Projet (Call for Proposals)
SDES	Services des Données et Études Statistiques (French Statistical Data and Studies Department)
LOM	Loi d'Orientation des Mobilités (Mobility orientation law)
SNBC	Stratégie Nationale Bas Carbone (French National Low Carbon Strategy)
CEE	Certificat d'Économie d'Énergie (Energy Saving Certificate)
ORT	Observatoire Régional des Transports (Regional Transport Observatory)
GART	Groupement des Autorités Responsable de Transport (Association of Transport Authorities)
DGITM	Direction Générale des Infrastructures, des Transports et des Mobilités (Directorate-General for Infrastructure, Transport and Mobility)
DGE	Direction Générale des Entreprises (French Directorate General for Enterprise)
SGPE	Secrétariat Général à la Planification Écologique (French General Secretariat for Ecological Planning)
TIRUERT	Taxe incitative relative à l'utilisation d'énergie renouvelable dans le transport (Tax to encourage the use of renewable energy in transport)
TICPE	Taxe Intérieure de Consommation sur les Produits Énergétiques (Domestic consumption tax on energy products)
SIREN	Système d'Identification du Répertoire des Entreprises (Business Directory Identification System)

Methodology

For the purposes of this study, which aims to gain a better understanding of the implications of greening road freight transport and more specifically HDV fleets, the Mobility in Transition Institute (*Institut Mobilités en Transition,* IMT) used data supplied by its technical partner C-Ways. The database used includes the HDV fleets and registrations in France according to various characteristics: energy, GVW, location, ownership type, professional activity sector, and fleet size. The database was compiled by consolidating data from the SIV,[1] cross-referenced with NAF codes,[2] enabling the linking of each company and its fleet with its professional activity sector. "Greening" refers to the development of battery-electric and hydrogen engines. By "contractors", we mean the party that concludes the transport contract. This may be the shipper or the buyer, whether a manufacturer, distributor, importer or exporter who needs to send products to their customers, suppliers or commercial partners.

1 *Système d'immatriculation des véhicules* (French vehicle registration system)

2 Nomenclature d'activités française (French classification of activities)

1. ENERGY MIX OF FRENCH HDV MARKET IN 2023: SALES, FLEET AND FUELS

The HDV market in France represented around 55,000 registrations in 2018 and 2019. In 2023, registrations fell to 48,853.[3] For 2024, a stabilization at around 48,000 units seems likely. Despite a clear drop in activity at the end of 2023, fleet renewal is set to continue under the impetus of new HDVs that offer significant fuel consumption reductions.

TABLE 1. HDV registrations over 16 t according to energy source in 2023

	[15.9 t; 18.9 t[	[18.9 t; 25.9 t[	[25.9 t; 31.9 t[	[31.9 t & +[	Tractor unit	Total
Diesel	1,513	3,796	4,611	3,903	27,046	40,869
B100	46	123	131	85	900	1,285
NGV/ bioNGV	88	303	537	78	434	1,440
Electric	243	99	154	2	54	552

In 2023, diesel fuel alternatives accounted for 7.4% of French vehicle registrations. NGV/bioNGV engines had started to level off, with a market share of 3.3%, slightly down on 2022 (4.1%).[4] B100 accounts for 3.2% of newly-registered tractor units, while electric tractor units are reaching a level similar to that of NGV/bioNGV registrations for two-axle rigid lorries (16 t + 19 t). It should be noted that around fifty electric tractor units were registered for the first time in 2023. Only 0.2% of the current fleet is electrified, and fleets of more than a hundred vehicles account for more than 80% of electric HDVs.

Given these factors, 2023 saw a change in the pace of registrations of alternative engines, even if their share of sales continued to lag behind that of private vehicles by six to ten years (electric vehicles in particular). This delay can be explained by (1) the historical dominance of diesel, which meets the specific technical and usage requirements of freight transport, (2) a longer development time for credible innovations that offer the ability to decarbonize more restrictive uses, based on the technological learning curve achieved in the passenger vehicle market, and finally (3) the delay of European Member States in defining regulatory CO_2 emission standards.

At present, 95.6% of the HDV fleet uses conventional B7 or B10 diesel fuel.[5] B100/HVO biodiesel (diesel fuel made from biomass: rapeseed, sunflower) is the leading alternative energy source in the vehicle fleet, and is being deployed at a significantly rapid rate. By early 2024, it was estimated that 15,000 HDVs were using this energy source. Finally, natural gas for vehicles, which first appeared more than ten years ago, is the second most popular alternative energy source, accounting for 1.7% of vehicles on the road. In 2023, the IMT carried out prospective work on the potential role of these alternative (first generation) liquid[6] and gaseous[7] fuels in heavy vehicles. These analyses were based on fuel availability, the prioritization of uses for non-road

3 CCFA, registrations of commercial vehicles over 5.1 t in 2023, online: https://ccfa.fr/wp-content/uploads/2024/01/2023_12_VU51t_france.pdf

4 Truck Editions, based on CSIAM, online: 2023 assessment of the industrial vehicle market by the CSIAM: growth and challenges

5 B7 and B10 correspond to the respective maximum percentages for the incorporation of biofuel as a substitute for petroleum-refined diesel, i.e. 7% and 10% respectively.

6 IMT, online: First-generation biofuels in road transport: a better understanding of the dynamics at work and the challenges ahead

7 IMT, online: What will be the role of bio- CNG/LNG in road transport by 2030 in France?

needs (particularly second-generation fuels for aviation and industry or biogas for heating), the availability of compatible vehicles, usage costs, and the support from government budgets. The main results in terms of the contribution to be expected from biofuels are summarized in section 2 below.

The potential use of hydrogen for road haulage will only happen later with large-scale developments after 2027 for HDVs, and marginally for certain light commercial vehicle uses, when battery electric power is not adequate. Given this different timeframe and the niche nature of these uses over the next decade, the challenges and potential of hydrogen engines are not discussed here. Indeed, the primary aim of this study is to demonstrate the need to create a framework of effort, organization and incentives that is essential to the successful transition of road freight transport, whatever the mix of low tailpipe emission solutions that emerges in the long term (batteries, hydrogen fuel cells or thermal hydrogen). The analysis in section 3 does, however, allow us to conclude that the potential for initiating zero-emission heavy goods transport is achievable in the short term, and to a significant extent, through the use of batteries.

2. DEVELOPMENT PROSPECTS OF ALTERNATIVE FUELS

2.1. BioNGV

If methane continues to be used as a fuel for road transport, there must be a 100% conversion to biomethane by 2030, as envisaged in the France Mobilité Biogaz (formerly AFGNV) sector plan. Recent developments in the integration of bioNGV into the TIRUERT (French tax to encourage the use of renewable energy in transport) give credibility to this development.

Biomethane has significant development potential as a replacement for fossil CNG and diesel for long-distance HDV transport, for uses where the conversion to electric or hydrogen would be difficult in the immediate future.

Manufacturers are faced with economic and strategic compromises, which reduce their ability to propose and maintain competitive products that comply with future regulatory requirements (EU CO_2 standard or EURO standard) over the medium to long term and, moreover, which must be industrially feasible at the European level. This factor limits the uptake of bioNGV and largely determines the extent of its long-term potential.[8]

The development potential of biomethane must also be assessed in light of its agroecological implications. The debate concerns the alignment of production conditions with the sustainable development of this resource from an agroecological perspective. Several controversies currently surround the issue, as identified by IDDRI (Bouacida et al., 2024),[9] particularly concerning the impacts on (i) maintaining, or even increasing, soil organic matter, which guarantees the long-term health of soils, (ii) reducing the use of synthetic inputs (fertilizers and pesticides) and (iii) diversifying agricultural systems, including crop diversity but also that of landscape structures.

The scenario developed by the IMT suggests that the market share of bioNGV-compatible HDVs newly registered in France will be around 2.5% in 2030, with consumption by the fleet of HDVs, buses and coaches levelling off at around 10 TWh in 2030 (i.e. around 25 times higher than bioNGV consumption in 2021).

2.2. Biofuels

Commodities that compete with human foodstuffs remain the primary resource for biodiesel production. While French and European regulations have successively banned palm and soya oils, and cooking oils are set to be used in the aviation industry, rapeseed oil has in recent years come to dominate the production of biodiesel.

With one million hectares of rapeseed cultivated in France (an area that has declined in recent years), a conservative yield of 30 hundredweight per hectare and a crushing process that yields oil from 45% of the harvested mass, France has 1.75 billion litres of rapeseed oil, or 5% of the total volume of diesel consumed in the country today. This is not even sufficient to meet the demand for resources to market conventional B7 diesel distributed at the pump (which by definition contains up to 7% FAME).[10] Consequently, the decision to develop a B100 engine for HDVs is tantamount to allocating to specific vehicles a resource that would have been consumed in any case. This first-order logic (1) reflects the limited availability of the resource, (2) leads to a high proportion of imports if this fuel continues to be promoted and (3) is, moreover, conservative in that it omits the need for oil in the food sector. Despite these limitations and the underlying political choices, the consumption of pure biofuels such as B100 or HVO is still encouraged in France as a result of a very attractive tax system (€0.118/litre for B100). The IMT has previously noted that this choice creates an interrelationship between the various biofuel distribution channels (from B7 to B100), generating tax revenue losses for the public authorities estimated at €45 million in 2023 in VAT and TICPE (French domestic consumption tax on energy products) revenues.

Finally, whether biodiesel is used in low (B7) or high (B100) blends, this energy resource will remain severely limited both for regulatory reasons (European regulations limit the use of first-generation biofuels in transport to 7%) and in terms of availability, in a context where these resources will be (1) impacted by a more difficult production context (adaptation to climate change, greater sensitivity to pests, local water

8 IMT, online: What will be the role of bio- CNG/LNG in road transport by 2030 in France?

9 IDDRI, online: Potentiel de biométhane en France : une cartographie des controverses pour reconfigurer le débat politique

10 See list of abbreviations

supply constraints) or (2) redirected to other uses that do not benefit from other proven technological alternatives for decarbonization (river and maritime transport).

3. ELECTRIC VEHICLES ARE EMERGING AS THE TECHNICAL SOLUTION WITH THE GREATEST POTENTIAL TO DECARBONIZE TRANSPORT BY 2030

3.1. Adoption of an ambitious European regulatory framework

Building on the technological successes achieved with light vehicles and specifically as a result of developments in battery technology, electrification is recognized by heavy vehicle manufacturers and European authorities as the main technological lever for the transition. Battery electric vehicles have indeed demonstrated their reliability, environmental performance (life cycle pollutant emissions and CO_2 emissions), as well as road performance and driver comfort. Unsurprisingly, European institutions have defined new CO_2 standards for HDVs, accounting for the potential development of the range offered by manufacturers. These do not specifically address electrification, since the targets and pathways are expressed in terms of gCO_2/tkm of exhaust emissions to be achieved. This definition therefore introduces a degree of flexibility that enables the improvement of the energy performance of internal combustion engine (ICE) vehicles (lower fuel consumption), the use of ICE vehicles that run on low-carbon fuels, and also to electrify powertrains. In the short term, however, it is this latter lever that will be the main factor in achieving the 2025 and 2030 targets. It should be noted that the range of HDVs offered by manufacturers (in terms of tonnage and architecture) is also likely to influence the performance achieved, due to certain exemptions in force. However, this variable is marginal in the overall calculations.

European standards have thus defined the target of reducing tailpipe CO_2 emissions by 15% over the period from mid-2025 to mid-2026, compared with the 2019-2020 baseline. This framework has already had an impact by bringing to market new ICE vehicles with improved performance, both in terms of aerodynamics and powertrains, making it possible to achieve exceptional real-life reductions in fuel consumption (and therefore emissions) of 8% to 10%. However, it will not be possible to significantly improve on these gains in future, given the technical limits that have been reached (50% efficiency for diesel engines) and the fact that investment in diesel ICE vehicles has now ceased. Therefore, to reach the European target (a 15% fall by mid-2025), manufacturers will also have to register between 3% and 5% of electric vehicles within 12 months, which represents a relatively significant step up from the current situation (1.3% in France and 1.5% in Europe).[11] This imminent deadline means that orders will have to be taken as early as 2024 to match this ambition.

In terms of the post-2025 decarbonization pathway, in early 2024 the European Parliament and Council agreed to strengthen the objectives, i.e. a CO_2 emissions reduction from HDV registrations of 45% in 2030, 65% in 2035, and 90% in 2040 compared with the 2019-2020 baseline.

The strengthening of the ambition to decarbonize HDVs within the framework of the Green Deal was carried out after manufacturers' announcements, while remaining more conservative than the latter. Indeed, IMT simulations based on the abovementioned emissions standards suggest that a minimum electrification of new HDV sales of around 34% to 36% by 2030 is required to comply with European regulations, whereas most manufacturers have committed to achieving a target of 50% by this date. The European framework should therefore secure industrial investment and provide a relatively level playing field for manufacturers. It is for this reason that most manufacturers are in favour of the Green Deal. While ultimately this may not result in the elimination of ICE vehicles, this framework remains decisive due to the scale of the technological change it represents.

Beyond the goal of 36% zero emission registrations by 2030, it is worth noting that manufacturers are at liberty to achieve different performance levels in different Member States. In this respect, disparities in progress have already been seen in the electrification of light vehicles (in response to a similar type of mechanism). Any ambitious support policies in France will therefore be likely to create a certain advancement that is potentially favourable to national manufacturers, in relation to the greening rate of European registrations.

3.2. Beyond regulatory objectives, the short-term economic and practical challenges of switching from diesel to electricity

Electrification of HDV fleet assumes that operational conditions (charging infrastructure, range, speed of charge), economic conditions (TCO and financing) and industrial conditions (availability, lower prices) are all brought together in the same agenda. This section provides a progress report on each of these issues and the obstacles that have already been overcome, and those that are currently being addressed or are still limiting the development of these alternative fuels. The combination of the factors analysed outlines the potential for freight transport electrification in the short term and the associated conditions to ensure success.

Firstly, TCOs were calculated in France for two types of electric HDVs that are already in operation: a 19 t rigid

11 ACEA, online: New commercial vehicle registrations in 2023

truck with trailer and a tractor unit for regional use. Favourable TCO ranges and conditions were first defined, before financing issues were examined, followed by an analysis of the feasible uses for electric HDVs on a national scale (for this purpose, a segmentation of distances travelled, vehicle types and activities was drawn up). Finally, based on the electrification trajectories defined by the regulations and the vehicle types corresponding to favourable uses, we were able to verify (confirmed by a series of audits) that the need for charging infrastructure could be met by the current EVCI deployment dynamic, at least for the market launch phase (regarding EVCI deployment requirements for HDVs on public roads, the European regulatory framework is discussed in section 3). In this regard, the challenges mainly involve managing network adaptation and connection times and costs. The costs of this infrastructure (in depots and on public roads) are included in the abovementioned TCO analysis.

TCO comparison according to electric vehicle type

The IMT keeps an up-to-date record of the competitiveness of low-carbon options for HDVs, incorporating both ownership costs (purchase, financing cost, investment grants) and the cost of use (energy costs, charging infrastructure, maintenance). **Table 2** shows the TCOs of battery-electric solutions compared with B7 diesel ICE vehicles.

ASSUMPTIONS MADE:

- The 19 t rigid truck body considered has a value at €25k included in the new price excluding VAT.
- The annual mileage figures are in line with SDES data and with the listed uses of the vehicles in question.
- Grants for purchases (now financed via a CEE programme) are included in the calculations at the level of the allocations by vehicle type published in mid-June 2024, i.e. €65k for a rigid truck and €90k for a tractor unit. The additional depreciation is also considered, even though it only benefits companies making a profit.
- The unit energy consumptions are representative of the utilization in large urban areas for the rigid truck, and of regional transport at an average rolling weight of 30 t for the tractor unit with its trailer (thus including empty running). The fuel consumption of diesel vehicles is representative of that observed on the latest generation of new vehicles.
- The price of energy is considered exclusive of VAT and smoothed over the period of vehicle use. In this respect, the end of the partial TICPE reimbursement in 2030 is considered, as well as an intermediate stage where this advantage is decreased in 2027. The introduction of ETS2 from 2027 is considered to have no impact on diesel prices, as the calculations are based

TABLE 2. Comparison of the TCO of internal combustion and electric vehicles in France in 2023 with purchase subsidies

	Rigid – B7	Rigid – EV	Tractor – B7	Tractor – EV
New 2024 Price excluding all taxes	€95k	€265k	€115k	€320k
Gross installed battery capacity	/	300 kWh	/	550 kWh
Financing rate	8%	8%	8%	8%
Resale value after 14 and 10 years	€10k	€10k	€20k	€20k
Call for projects | Grants FR	/	€65k	/	€90k
Additional investment costs	/	€110k	/	€115k
Depreciation *	/	€26.5k	/	€34.6k
Annual mileage	35,000 km	35,000 km	80,000 km	80,000 km
Duration of use	14 years	14 years	10 years	10 years
Energy consumption	24 l/100 km	90 kWh/100 km	27 l/100 km	130 kWh/100 km
Smoothed energy price	€1.40/l ex. VAT	€0.1146/kWh ex. VAT	€1.36/l ex. VAT	€0.1903/kWh ex. VAT
AdBlue SCR	€155/year	/	€400/year	/
Refuelling	€1k	€5.7k	€1k	€37k
Maintenance	€2,800/year	€2,400/year	€8,100/year	€5,100/year
Total annual cost	€21,671	€20,551	€49,145	€50,452
Of which is energy cost	€11,773	€4,246	€29,447	€22,278
Difference in TCO	**REF.**	**-5.2%**	**REF.**	**+2.7%**
Cost per kilometre	€0.619/km	€0.587/km	€0.614/km	€0.631/km

* On the total value of the vehicle (including bodywork equipment). Since the 2024 Finance Bill, the excess depreciation is capped at €300k over three sliding years per company.

on the geographical area of France where fuel taxes are higher than the European minimums. The price of diesel, excluding all taxes, is assumed to be on a slight upward trend. The price of electricity is also assumed to be trending upwards, mainly to take account of the cost of adapting the electricity network. The case modelled here considers the use of a subscription-based electricity supply to take advantage of the best pricing conditions for off-peak vehicle charging. The simulation does not take into account any self-consumption of electricity, which could reduce electricity costs.

— Electricity losses during charging are integrated at 15% AC and 8% DC. The 19 t rigid trucks are charged exclusively at a 22 kW AC charging point. 80% of the energy is charged during off-peak hours / 20% during peak hours. The tractor unit charges 65% of its energy during off-peak hours, 10% during peak hours and 25% by DC fast charging on public roads at a price of €0.44/kWh excluding VAT. This distribution of charging times is considered adequate for the driver's usual downtime, and therefore has no effect on transport productivity. Assuming that this charging plan is representative of daily practice, the proportion of energy recovered on public roads corresponds to a stop of around twenty minutes. On-site charging also includes a proportion of DC fast charging during the day, so an infrastructure cost of €37k is considered. This cost is understood to be the cost of sharing a 250 kW rapid charging point between three tractor units. This choice is justified insofar as it allows greater intensity of use of the tractor units at a relatively low marginal cost. This practice has already been observed in real-life situations. ADVENIR grants for the installation of charging equipment are considered and reach their respective ceilings of €2,200 and €15,000 for the capacities considered. Any additional costs for connection to electricity source substations are not considered, given the lack of data on the proportion of connections concerned.

— The residual values of internal combustion and electric vehicles are considered to be identical at the end of their useful life. This choice is considered to be very conservative since it means assuming a much higher rate of depreciation for electric vehicles. Electric vehicles are also more likely to be reconditioned at the end of their life (the possibility of replacing batteries at the end of their first life, made possible by much lower prices over the next ten years, will result in a higher residual value and therefore an improved TCO for electric vehicles than those considered in this simulation).

— AdBlue is purchased excluding VAT at a price of €0.24/litre. This is a conservative assumption and the price is available for large quantities only.

— The uses modelled do not require electric vehicle batteries to be replaced. For the cases analysed (19 t and tractor units), the batteries complete 1,400 and 2,075 cycles respectively. These results were supported by discussions with battery manufacturers and initial feedback from tests carried out in Nordic countries.

Rigid trucks

Based on the information presented and simulated, the TCO of a 19 t electric 300 kWh HDV is considered competitive if the purchase subsidies (€65k) available in France are taken into account, and despite a conservative assumption regarding the residual value of the electric powertrain. Considering the additional added value of low-carbon transport, this type of engine makes economic sense in these conditions and for this vehicle type.

A sensitivity analysis shows an identical result (competitive TCO) for a 400 kWh truck while the fuel consumption

FIGURE 1. Total cost of a 19 t rigid diesel truck over 14 years

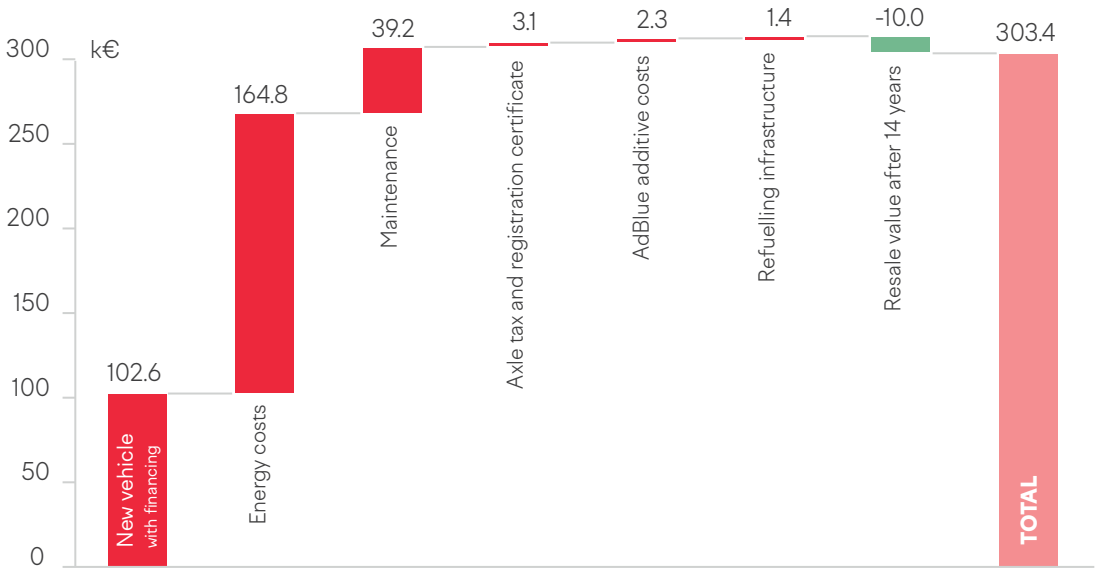
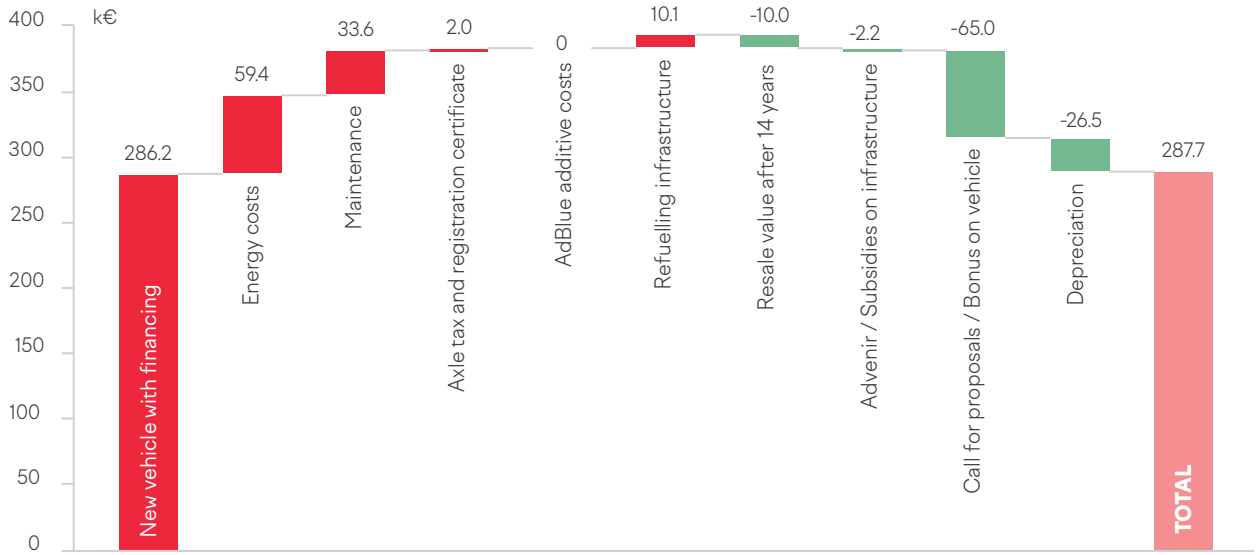


FIGURE 2. Total cost of a 19 t rigid electric truck over 14 years



of an equivalent diesel truck increases. In this specific case, a fuel consumption of 29 l/100 km translates into a TCO difference of only 0.9%. This use case is perfectly suited to many applications such as rigid trucks with cranes, tippers, etc., where fuel consumption when stationary is not negligible. In this context, refuse collection vehicles are very good candidates for electrification: they operate in urban areas, with frequent braking, with very high fuel consumption levels (70 l/100 km for diesel refuse collection vehicles) and cover relatively low daily distances (around 120 km).

Figures 1 and 2 show the differences in terms of TCO structure between diesel and electric powertrains

Tractor units

Tractor units, on the other hand, face greater constraints in terms of use, with significantly higher mileage and total rolling weight, as shown by the data in Table 2.[12] For these vehicles, the models available and in operation in 2023 only have a range of 250 km on a single charge in real-life usage. Their unit purchase cost remains high because of the very low initial production volumes, which is reflected in the purchase costs of batteries. The durability of these batteries, faced with a greater number of cycles, requires specific design choices that differ from those used in passenger cars. In addition, the charging infrastructure (higher power) requires greater investment than for rigid trucks. All these constraints, combined with lower production volumes, mean that the TCO is still slightly higher than for diesel over the ownership period at the time of the study. This additional cost is estimated at 2.7%, taking into account a purchase subsidy of €90k. The development of electric engines for tractor units in the coming years will therefore require (even more than for rigids): (1) greater development of vehicle autonomy (a factor on which industry signals are reassuring), (2) continued support for purchases, (3) firm commitment or incentives from shippers[13] to justify a higher cost of carbon-free transport net of tax, and (4) a greater commitment from manufacturers on residual values (trade-in values), which has a major impact on the calculations.

The factors analysed above therefore justify the need to maintain funds in the short term, with much greater visibility, for the greening of the HDV fleet. The change in the 2024 call for projects to a format now funded through energy saving certificates (CEE), which demonstrates a certain disengagement by the State, will hopefully ensure that the necessary resources are available to maintain a high level of support for early adopters (€130 million for 2024 for the greening of HDVs). At the same time, for both electric rigid trucks and tractor units, the scale-up of production volumes over the next few years will result in a potential significant drop in the price of vehicles and batteries; a reassuring factor that could see a gradual reduction in purchase subsidies in the medium term.

Thus, in view of the technological advances and the availability of biomass energy discussed in section 2, the authors believe that support for other alternative energies that no longer need subsidization for certain use types should be reconsidered as a matter of priority (e.g. B100 and bioNGV grants for vehicles with a low GVW or city buses).

12 It should be noted that these values are representative of regional transport. There are examples of tractor units travelling 150,000 km per year with average tonnages of 40 t.

13 A shipper is any natural or legal person who uses a logistics service provided by a haulier. It is the entity that owns the goods when they are transported.

Lastly, there seems to be three major and essential elements to secure the investments underway, ensuring visibility on the decreasing trajectory of the partial TICPE reduction, and on the implementation of the European carbon market quotas extended to the transport sector (ETS2 from 2027), as well as the initiation of discussions at the European level on fuel tax differentials. The aim is to provide clear signals that will (1) enable decarbonized solutions to take off, (2) support efforts to reduce the fuel consumption of ICE vehicles, including in the fleet, and (3) develop complementary and additional solutions such as wind deflectors or hybridization on semi-trailers. IMT will be developing a full analysis of this last option in the coming months.

Other mechanisms can also be envisaged to increase the TCO competitiveness of low-emission vehicles. In the European Union, since June 2022, the Eurovignette Directive has made it possible for Member States to vary the cost of tolls according to the pollutant and carbon dioxide emissions of HDVs.[14] The reduction in toll charges for zero-emission vehicles can be as much as 50% or 75%. Unfortunately, the French transposition of this directive[15] into French law is hampered by the renewal of motorway concessions, and is not expected to happen until post-2030.

Financing issues

While a favourable TCO is a necessity for the electrification of HDVs, the cost structure of these vehicles is very different to that of their diesel equivalents. Thus, this means that the energy transition has major implications for the ability of hauliers to finance their vehicles, whatever the method of financing used. In this respect, it should be noted that in 2024, independently of electrification, the majority of HDVs in France are financed by leasing. Leasing is defined as a long-term financial hire agreement with a purchase option. When the contract is signed, it stipulates the residual value of the vehicle at the end of the lease term (as a percentage of the vehicle's new value) as well as its resale value. Alternatively, companies can take out a financial lease. This is more marginal, as it does not include a purchase option for the lessee at the end of the contract. This option accounts for less than 10% of registrations, and the trend is downwards. It should be noted that whatever the formula, the duration of the contract taken out has no impact on the nature of the financing product. **Table 3** shows the market share of these two leasing options within French vehicle registrations, by vehicle type and fleet size. We can also see that these leasing formulas are more represented in the smallest fleets. Other vehicles (around 40% of the French market) are still financed by loans with or without guarantees, and more rarely by cash purchase.

TABLE 3. Rate of leasing for the financing of new HDVs by fleet size and GVW

Share of leasing: 2022	]7.5 t – 19 t]	]19 t – 26 t]	]26 t – 32 t]	Over 32 t	Tractor unit	Total
1 to 5 vehicles	55.8%	59.1%	62.3%	68.7%	76.8%	68.3%
6 to 10 vehicles	62.0%	60.4%	61.7%	66.2%	74.3%	68.7%
11 to 20 vehicles	62.2%	62.0%	53.4%	65.0%	71.8%	66.9%
21 to 50 vehicles	50.3%	50.6%	45.2%	62.9%	65.9%	60.9%
51 to 100 vehicles	45.6%	40.7%	46.4%	52.5%	50.0%	48.7%
More than 100 vehicles	55.7%	53.8%	49.0%	47.8%	55.0%	54.2%
Total	55.1%	54.1%	51.2%	60.0%	60.1%	57.9%

Note: the leasing rates observed correspond to long-term hire purchase and financial leasing.

There are three main reasons for the increasing use of leasing in recent years: (1) greater visibility over monthly payments, including maintenance and servicing costs; (2) greater agility in managing the size of fleets and their renewal (making it possible to benefit from the latest innovations, particularly in terms of reducing diesel vehicle fuel consumption); and finally (3) under French accounting rules, the monthly payments are treated as expenses that are deductible from profits and not as debts. This last factor allows companies in good financial health to optimize their taxation (lower corporation tax) and reduce their debt ratio.

The electrification of vehicles is leading to a number of changes in this operating model. With additional purchase costs 2.5 times higher for identical margins (which are relatively low in the road transport sector), electrification increases the need for capital, an obstacle that is much greater for small and medium-sized actors. Two trends emerge from this initial observation. The electrification of HDVs will further increase the use of leasing solutions. This trend has already been established, since in 2023, 67% of electric HDVs were financed by leasing, compared with 58% for the average of all vehicle types. Finally, the increase in initial investment means that it takes longer to generate margins. This is a sensitive point, as the transport business usually generates real margins only once the asset held is free of debt. For diesel vehicles, this turning point is effective after only a few years of operation. For electric engines, this point will necessarily be delayed. Regarding this issue, it is worth noting that the contractual leasing period for electric trucks is usually longer than that for diesel vehicles, often based on the battery warranty period (8 years).

For these reasons, it seems relatively desirable for electrification to be supported during a start-up phase (of a few years) by very large actors with greater financial capacity.

14 Publication in the French Official Journal, online: Segmentation par classe d'émission et tarification

15 Eur-Lex, European Eurovignette Directive Transcription into French law in the Official Journal LOI n°2023-171 of 9 March (articles 31 to 38).

This is fully in line with the proposal for greening quotas set out in section 4 of the study. This dynamic can be illustrated by the commitments made by these actors, who are already grouping together in joint initiatives advocating electrification (such as the EV100+ approach).[16] Due to the contribution of these large fleets, the volumes of vehicles ordered will make it possible to trigger the price cuts that are essential for the spread of electric motorization among smaller actors. However, it will be important to ensure that these smaller actors are still able to make the transition. The use of state-guaranteed and/or reduced-rate loans, longer financing periods, purchase subsidies,[17] and better feedback on residual values will all help to make this transition accessible to a greater number of actors. The use of land to provide access to low-cost electricity will also be a competitive factor, which could lead to inequalities between the sizes of transport companies (particularly for independent operators). This point is likely to justify, in the long term, the existence of a common price index for electric charging based on parameters that have yet to be defined. The CNR (*Comité National Routier*) has initiated discussions on this subject.

Table 4 shows that the proportion of vehicles registered by small and medium-sized fleets (fewer than 20 vehicles) is relatively low – less than 25% of sales. In this sense, the targets for greening sales by 2030 can be achieved without strongly involving the smallest operators.

TABLE 4. HDV registrations in 2022 according to size of user fleet

Fleet size	Registrations of all HDVs[18] in France	Registrations of 19 t and 26 t rigid trucks in France
1 to 5 vehicles	8.1%	9.5%
6 to 10 vehicles	6.8%	6.2%
11 to 20 vehicles	10.0%	7.8%
21 to 50 vehicles	15.9%	11.5%
51 to 100 vehicles	11.9%	9.4%
More than 100 vehicles	47.4%	55.6%

Usage and typology: analysis of fleets by vehicle type, size, and activity sector

Given that battery electric technology clearly does not yet have the intrinsic operating range characteristics of diesel engines, an analysis of fleet usage is essential to assess the potential and pace of electrification. While the functional unit generally used to measure freight transport flows and emissions is the "tonne-kilometre", a study of the tonnages transported by category of distance travelled provides a more detailed understanding of the nature of the difficulties (technical or organizational) involved in making the transition. A cross-analysis of SDES data is therefore proposed (categorizing the movement of goods transported according to vehicle class and distance)[19] with the activity of newly-registered HDVs (NAF codes) and the performance offered by the range of electric vehicles available on the market in 2024. Within the triple criteria of use/range/activity category, the aim is therefore to identify the factors limiting the feasibility of transitioning the rolling stock to electricity, and thus to conclude on the potential for electrification at that date.

Rigid trucks

On average between 2014 and 2021, the rigid truck fleet accounted for 14% of tkm and 31% of veh/km of domestic road transport (excluding transit)[20] and around 18% of HDV CO_2 emissions. These vehicles accounted for 35.5%[21] of registrations in France in 2023.

TABLE 5. Weight of goods transported (in millions of tonnes) by rigid trucks (including trailers) according to distance category on French domestic routes from 2019 to 2021

	Up to 205 km	More 205 to 425 km	Up to 425 km	Total
Less 18 tons	**881.3**	96.0	26.3	1
	70.0%	7.6%	2.1%	79.7%
From 18 to 28 tons	190.4	13.8	7.3	211
	15.1%	1.1%	0.6%	16.8%
More 28 tons	36.6	5.6	2.1	44
	2.9%	0.4%	0.2%	3.5%
Total	1	115.5	35.7	1
	87.9%	9.2%	2.8%	100%

Note: the green box corresponds to the proportion of flows considered electrifiable to date.

The survey carried out by the SDES shows that rigid trucks carried 26% of the tonnes of domestic road freight transport under the French flag between 2019 and 2021, and that 70% of this activity was carried out over a distance of less than 205 km with a weight of goods on board of less than 18 t (including possible additional towed trailers). This analysis shows the massive use of rigid trucks for regional distribution activities. Table 7 supports the understanding of these data. It shows that 50% of 19 t and 26 t rigid trucks are purchased by third party logistics providers and B2C retail

16 The Climate Group, online: https://www.theclimategroup.org/our-work/press/climate-group-lancheus-ev100-tackle-worlds-most-polluting-road-vehicles

17 Discussed at greater length in the section on TCO.

18 With a GVW over 7.5 t.

19 SDES survey carried out on single-load journeys (a single origin and destination). The distance travelled is calculated between the loading and unloading locations.

20 SDES, RFT survey 2014-2021.

21 Including short-term registrations, garage demonstrators and administrations.

sectors, activities where daily mileages rarely exceed 350 km.

These factors are reassuring, and reinforce the potential for rapid electrification of rigid trucks, given that the real-life range of electric vehicles in this category is already between 250 km and 350 km. It should be noted, however, that the electrification of these vehicles results in a loss of payload that is not always fully covered by the exemptions to maximum weights. Indeed, vehicles must still comply with the general axle load limits, which can limit the payload on certain vehicle architectures. Some applications currently carried out with two-axle rigid trucks may therefore require the use of three-axle rigid trucks, which will cost slightly more to run (additional purchase and running costs; additional tyre wear).

The SDES data presented in Table 5 do not at this stage allow us to consider the sequences of the movement of goods for the same vehicle over time. In other words, it would be necessary to know the recurrence of any long-distance journeys for vehicles used for more localized daily use. It is reasonable to assume that this is an important issue for fleet electrification and that it could lead to vehicle specialization according to their engines. As things stand, the lack of knowledge about this data is a limitation that will need to be addressed in future. The SDES surveys could incorporate developments in this direction.

Table 6 shows the share of new registrations of the different types of rigid trucks according to GVW, the orders of magnitude of the maximum payloads that electric variants can carry (excluding trailers), and the potential for electrification of sales defined by the authors considering the factors highlighted above; established on the basis of the range of vehicles, usage trends and payload issues.

TABLE 6. Characteristics of rigid trucks and potential for electrification in 2024

PTAC	16t	19t	26t	32t	Total
Specifications	2 axles	2 axles	3 axles	4 axles ou +	–
Market share of HDV sales in France in 2023	4.3%	9.8%	12.3%	9.2%	35.5%
Electro-compatibility at date defined by authors	100%	70%	60%	30%	60%
Electro-compatibility market share	4.3%	6.8%	7.4%	2.8%	21.3%
Maximum payloads for electric vehicles	7t	8t	14t	17t	–

The electrification potential of trucks over 26 t is considered to be lower. Indeed, the construction and public works sector alone accounts for 60% of registrations in this category. These four or five-axle vehicles have a vehicle architecture that does not currently allow them to carry more than 360 kWh. As a result, the first examples delivered in Europe have a real-life range of just 170 km (after taking into account their consumption linked to their auxiliary equipment: tippers, cranes, mixers, etc.). For this reason, following a resolutely conservative rationale, a lower electrification potential is considered for this category.

Despite a few cases where bodywork is limiting (construction and public works) or where the vehicles used are evolving (potential shift from 19 t to 26 t), this analysis shows that the possibility of transitioning the French rigid truck vehicle fleet to electric is already around 60%. This compares with a 3.2% rate of electrification in this segment in 2023. Finally, the role of the public sector is not insignificant in the greening of rigid trucks, with 11.3% of the market share for public authorities in the 19 t category.

TABLE 7. Rigid truck registration market structure - 9 :2023 months

Professional sector	]7.5 t – 19 t]	]19 t – 26 t]	] >26 t]
Transport for hire or reward	19.2%	25.2%	25.3%
B2C Trade	16.1%	24.1%	14.2%
Garage and manufacturer demonstrations	12.4%	5.9%	6.2%
Admin	11.3%	7.6%	3.7%
Short-term rentals	12.1%	1.8%	1.3%
B2B Trade	9.3%	9.2%	9.0%
Agriculture and industry	5.7%	11.3%	14.0%
Services	4.9%	4.8%	3.4%
Construction	4.2%	7.4%	20.0%
Professional services	2.9%	1.4%	1.3%
Other activities	1.6%	1.3%	1.4%
Health	0.2%	0.0%	0.1%
Association	0.1%	0.1%	0.0%

Note: activity categories are based on the following NAF groupings[22]: Transport for hire or reward: 49, 52, 53; B2C trade: 45, 47; Construction: 41 to 43, 81; Agriculture and industry: 1, 2 ,3 ,8 ,10 ,11, 13 ,14, 16 to 18, 20 to 33, 35 to 39; B2B trade: 46; Services: 55, 56 ,58, 59, 61, 63, 68, 95, 96; Health : 75, 86, 87; Professional services: 62, 64, 65, 66, 69 to 74, 78, 79, 80, 82; Association: 88, 94; Administration: 84, 85.

It should also be noted that a significant proportion of registrations are carried out by manufacturers themselves. These registrations, commonly referred to as "garage demonstrations", account for 7.9% of new vehicles brought to market.

22 See corresponding NAF codes online: https://www.juripresse.fr/liste-des-codes-naf-ape/

It is customary for these vehicles to be used as demonstrators by companies (so that they can judge their qualities) or to be made available as short-term rental vehicles.

Tractor units

Tractor units are over-represented in new registrations compared with their proportion in the fleet (their renewal rate is higher - less than 8 years on average in France). When purchased new, the vast majority are used for transport for hire or reward (59%). Under the French flag, they alone account for 86%[23] of tkm in France, 69%[24] of veh/km and represent around 82%[25] of HDV CO_2 emissions. In 2023, tractor units accounted for 64.5% of HDV registrations in France. Historically, their growing use in terms of tkm transported in France and Europe, to the detriment of rigid trucks, is largely due to their flexibility in terms of the jobs they can carry out (these vehicles can easily change function by separating from their semi-trailer). This flexibility is also reflected in their day-to-day operation, due to their transport demand adaptability for both regional and international operations. Similarly, during their ownership, it is common to see intensive use during the first few years, followed by a change of owner for more diverse operations. After their initial life in France, these tractors are also frequently sold on the second-hand market in other geographical areas, particularly Eastern Europe (this trend is not as widespread for rigid trucks, which are used for much more specific purposes). As a result of these different uses, it is more difficult to accurately categorize the use of these vehicles over their lifetime. The emerging electrification of tractor units will very probably result in a reconsideration of their ownership pattern as seen today. Eventually, it is likely that they will be used more specifically for certain operations. Even if this is the main obstacle to change over the next decade, it does not appear to be insurmountable, since this type of vehicle specialization is common for rigid trucks.

The SDES data show that the tonnages transported by tractor units are very different from those transported by rigids (see Table 5). Unit loads of 28 t or more account for 43% of the weight transported. For this proportion of flows, it is considered that the maximum total rolling weight of semi-trailers is reached, i.e. 44 t. The transport of cereals, hydrocarbons and bulk food products are very good examples of this subset. At full load, electric tractor units can be expected to consume around 160 kWh/100 km, giving a range of only 180 km at present, given the available vehicles. Based on this observation and the data in Table 8, it can be assumed that by 2024 only 25% of the tractor unit fleet will be electric compatible (an estimate corresponding to a reduced share of the sum of the two green boxes in **Table 8**).

TABLE 8. Weight of goods transported (in millions of tonnes) by distance category by French tractor units on domestic routes from 2019 to 2021

	Up to 205 km	More 205 to 425 km	Up to 425 km	Total
Less 18 tons	**350.7**	145.1	94.2	590
	9.9%	4.1%	2.7%	16.7%
From 18 to 28 tons	**943.4**	284.9	186.9	1
	26.7%	8.1%	5.3%	40.1%
More 28 tons	1	137.5	49.6	1
	37.9%	3.9%	1.4%	43.2%
Total	2	567.7	330.7	3
	74.6%	16.1%	9.4%	100%

The ability of new 100% electric battery-powered models currently on the market to offer ranges of up to 450 km in real-life conditions, supported by a fast recharging infrastructure (equal to or greater than 400 kW), means that the electrification of tractor units is already possible, enabling the usage examples in the top four left-hand boxes of Table 8 to be met, i.e. to cover around 50% of the tonnage transported. It is reasonable to say that this potential could be achieved by 2030. It should be noted that this assessment is based on the fact that the vehicles will be on the market from 2026, and that the most limiting factor will be the level of development of the public charging infrastructure. The fact that these vehicles will be able to cover a majority of operations is established by two factors: (1) European manufacturers, who have telemetry data for their vehicles, state that "around 60% of long-distance journeys in Europe are less than 500 km"[26] (2) SDES data for 2022 also show that 46%[27] of national road transport tkm under the French flag is intra-regional (transport where loading and unloading take place in the same region). Within just a few years, therefore, all regional transport has the potential to be electrified. To achieve this, however, it will be necessary to develop a charging infrastructure and, above all, for owners to specify which vehicles suit their operations. This approach to transport therefore has implications for far-reaching operational change.

TABLE 9. Potential for electrification of new HDVs in France in 2024

	Market share France 2023	Electro-compatibility established by authors	Electro-compatibility market share in French sales
Rigid trucks	35.5%	60%	21.3%
Tractor units	64.5%	25%	16.1%
Total	100%	/	37.4%

23 SDES: Domestic road transport, excluding transit (Average 2014 to 2021)

24 SDES: Domestic road transport, excluding transit (Average 2014 to 2021)

25 Internal estimate by IMT

26 Press article, Transport routier, online: https://www.transportroutier.ca/nouvelles/mercedes-benz-presente-son-eactros-au-salon-iaa-de-retour-apres-quatre-ans/

27 SDES, RFT 2022 survey.

To summarize this analysis dedicated to the more detailed examination of HDV uses, Table 9 compares the respective market shares of the various HDV tonnages with their electro-compatibility, as estimated above. The state of the art in electric HDV technologies (at the time of writing) means that we can safely say that at least one third of domestic road haulage tonnages under the French flag has the potential to be electrified. As a reminder, domestic road transport under the French flag represents 57% of the total road transport observed in France in 2022 (the remainder being carried out according to the following analysis of the total activity in France: 4% cabotage,[28] 16% transit and 23% international).

FURTHER INFORMATION

In 2022, 73 billion tonne-kilometres were transported within a single region by HDVs registered in France, according to the SDES road haulage survey. 80% of these journeys were made by hauliers for hire or reward. Based on the distribution of the HDV fleet (rigids/tractors) according to the type of transport operation carried out (own activity/for-hire), it is possible to estimate that 18% of the tonne-kilometres transported were carried out with rigid trucks at the regional level (compared with a national average of 14%). Then, using assumptions about the tonnage and average distance travelled by each of these vehicle types (rigids/tractors), we estimate that intra-regional transport requires the use of 95,000 HDVs, including 53,000 rigid trucks. It is this pool that offers the greatest potential for electrification. The ecological planning objective of having 80,000 electric HDVs in the French fleet by 2030 therefore corresponds to the advanced electrification of regional transport.

The emergence of hydrogen-powered tractor units in a second phase will make it possible to decarbonize very long-distance transport (mainly international), which necessarily needs a range of over 700 km and, in addition, reduced refuelling time. This will complement biodiesel and bioNGV solutions and will also support a modal shift. As a result, the cost of very long-distance road transport is likely to remain structurally higher than the cost of regional/national transport (TCO H_2 > TCO battery).

2.3.4. EVCI deployment: AFIR and the issues linked to adapting the electricity network

For the transition to electric HDVs to be a success, there must be reliable charging networks in depots (to be developed as a priority) and on the road. To this end, Enedis is carrying out prospective work in these two areas, with the aim to define the power and energy needs of the grid in terms of the distribution substations. All this work, which has already been published[29] or is in the process of being published (by the end of 2024), will enable EVCI development plans to be drawn up to complement the resources already installed for light vehicles. It should be noted that (1) the orders of magnitude involved do not present any insurmountable technical difficulties at this stage, and (2) the nature of the demand for charging light and heavy vehicles on major roads will allow the overlapping of the power demand between these two vehicle categories on the electricity network (during the week and at weekends), reducing the overall need for reinforcement. **Table 10** sets out the requirements for the deployment of charging infrastructure for HDVs in Europe.[30]

TABLE 10. Minimum European requirements for the deployment of EVCI for HDVs

Compulsory cumulative and unitary power (depending on the road network) every 120 km for HDVs	End 2025	End 2027	End 2030
HDV; Core TEN-T	1400 kW[a] ; 350 kW[a]	2800 kW; 350 kW	3600 kW; 350 kW
HDV; Comprehensive TEN-T		1400 kW[b]; 350 kW[b]	1500 kW[c]; 350 kW[c]

a) on 15% of the network length ; b) over 50% of the network length ; c) every 100 km

These regulatory obligations will help kick-start the development of a charging network for HDVs. Some developments are already underway[31] but these steps must be secured and strengthened if we are to fully achieve the European targets. The availability of land is an issue to monitor. Technically, these sites will initially offer unit capacities of 400 kW, and in a few years' time 800 kW, so that they can be used for rapid charging during the statutory break for road users. For hydrogen, European regulations aim for a fuelling network offering at least one 700-bar pump every 200 km on the core European network by the end of 2030, with each station able to dispense 1 t of hydrogen per day.

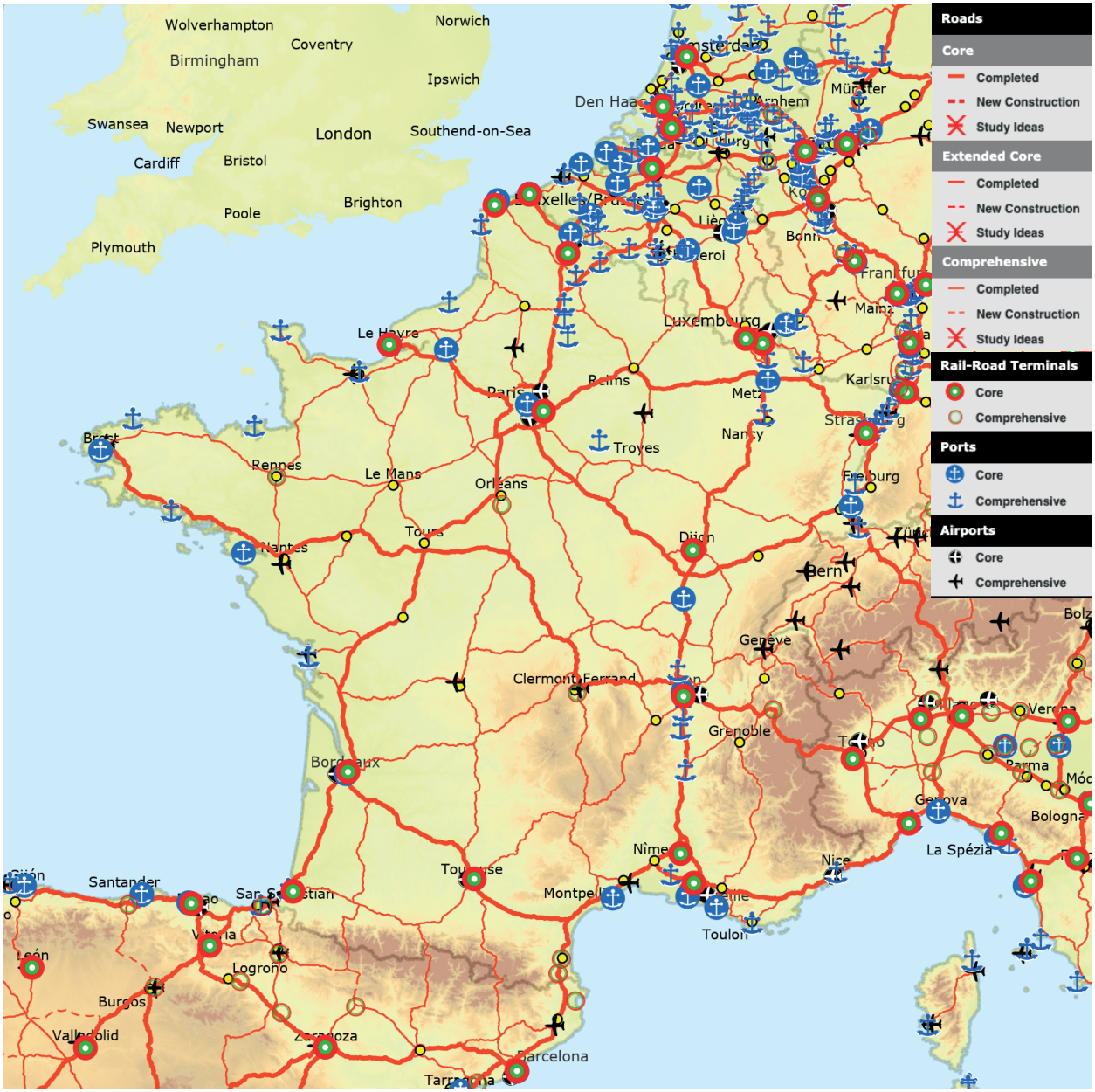
28 Cabotage: A road haulage cabotage operation is any transport of goods (loading, unloading) between two points on a national territory, carried out by a transport company from another country.

29 TotalEnergies, online: https://totalenergies.com/fr/medias/actualite/communiques-de-presse/electrification-des-poids-lourds-enedis-totalenergies-vinci

30 AFIR regulations, online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R1804

31 Milence, online, press release: Milence announces first electric charging hub for heavy duty vehicles in France near Rouen

FIGURE 3. **European core network meeting requirements shown in Table 10**



Source : TENTec, https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html#&ui-state=dialog

4. FOR THE TRANSITION TO SUCCEED IN THE SHORT/MEDIUM TERM, IT WILL HAVE TO BE A SHARED EFFORT BETWEEN ALL RFT ACTORS

In addition to the emergence of a supply of vehicles and charging infrastructure, a successful transition requires a balanced framework in terms of the efforts required by the various actors. The abovementioned factors relating to TCO, financing and supply must therefore be supplemented by measures to stimulate demand for low-carbon vehicles, particularly through (1) the introduction of incentives at the interface between hauliers and contractors, and (2) a framework for fair competition among hauliers according to their size and activity sector.

4.1. Investment strategy of European truck manufacturers

It is encouraging to see that HDV manufacturers have made a significant commitment to the extensive decarbonization of their vehicle ranges. Table 11 shows the commitments made by the main industrial groups to sell zero-emission HDVs in Europe, and the impact on the total market if these targets are met.

4.2. Hauliers: proposal to introduce HDV greening quotas

Objectives

Once a consensus has been reached on the acceleration of HDV decarbonization through battery technologies and, as a complement, hydrogen, during the fleet's transitional phase (a period when carbon-based and decarbonized energies will evolve in parallel), we must define the terms and conditions of a level playing field for the competition between users of these vehicles. The following section therefore develops the idea of greening quotas for HDVs, a complementary measure in a package that would help to achieve the following three objectives simultaneously: (1) to consolidate the environmental ambitions established as part of France's ecological planning, (2) to ensure that HDV manufacturers are able to meet their European regulatory obligations in relation to CO_2 standards (see section 3), and (3) to ensure that efforts are distributed between actors according to their size and activity classification, taking into account the current and expected level of maturity of the vehicle range, and according to needs and usage constraints.

TABLE 11. Commitments to sell zero-emission HDVs in Europe and market share

Manufacturers	Manufacturer targets for zero emission sales in Europe in 2030	France market share in 2023[a]	Europe market share in 2020[b]	Share of zero-emission registrations in 2030 by manufacturer in Europe (based on 2020 market share) if manufacturer targets are met
Mercedes-Benz[c]	60%	12.9%	18.1%	10.9%
Scania	50%	11.6%	16.7%	8.4%
Volvo Trucks	50%	13.5%	15.8%	7.9%
Renault Trucks	50%	27.0%	8.8%	4.4%
MAN	50%	9.3%	14.7%	7.4%
IVECO	33%	9.1%	8.6%	2.8%
DAF	/	13.8%	16.5%	/
Others	/	2.8%	0.8%	/
TOTAL		100%	100%	41.8%

(See manufacturer announcements[d])

a) Transport info, online: https://www.transportinfo.fr/immatriculations-de-camions-le-bilan-2023-marque-par-marque/
b) ICCT, online: https://theicct.org/wp-content/uploads/2023/07/hdv-co2-emissions-eu-2020-reporting-2-jul23.pdf
c) Reuters, online:https://www.reuters.com/business/autos-transportation/daimler-truck-premieres-new-eactros-600-step-towards-all-electric-shift-2023-10-10/
d) Renault Trucks, online: https://www.renault-trucks.com/fr/newsroom/press-releases/renault-trucks-affiche-ses-nouvelles-ambitions-en-matiere-de-mobilite • Man Truck and Bus, online: https://press.mantruckandbus.com/france/un-lancement-sur-le-marche-reussi-pour-la-nouvelle-gamme-de-camions-electriques-man/ | https://press.mantruckandbus.com/france/lavenir-se-dessine--man-construit-une-usine-de-batteries-a-nuremberg • Scania, online: https://www.scania.com/fr/fr/home/about-scania/newsroom/a-la-une/2021/scanias-commitment-to-battery-electric-vehicles.html | https://www.scania.com/fr/fr/home/about-scania/newsroom/alternatives/numeros/alternatives-49/mobilite-electrique-scania-redouble-energie.html • Actu transport logistique, online : https://www.actu-transport-logistique.fr/franceroutes/actualites/constructeur/2022-annee-electrique-pour-renault-trucks-771605.php • Iveco, online: https://www.iveco.com/france/-/media/IVECOdotcom/France/Press/PressReleases/PDF/01_Communique_de_presse_IVECO_-_Lancement_MY24.pdf • Volvo Trucks, online: https://www.volvotrucks.fr/fr-fr/news/press-releases/2024/jan/volvo-presente-son-tout-premier-camion-100---electrique--optimis.html

Since 2019, the *Loi sur l'Orientation des Mobilités* (LOM) has required companies with fleets of more than 100 light vehicles (GVW[32] <3.5 t, i.e. private or commercial vehicles) to meet greening quotas when renewing their fleets. Therefore, purchases of new and used vehicles must include a certain proportion of low-emission vehicles, according to a progressive scale, the ambition of which was reviewed for the first time by the Climate and Resilience Act of August 2021. As part of a bill tabled by MP D. Adam, a further increase in the ambition of this mechanism could emerge,[33] consistent with the trajectory of the ending of sales of tailpipe CO_2 emitting light vehicles in Europe in 2035.

Context

Transcription of the European CO_2 tailpipe emission standards for HDVs (the issues involved were outlined in section 3) leads us to estimate that around 3% to 5% of registrations will have to be zero-tailpipe emissions by 2025, and 34% to 36% by 2030. **Figure 4** shows the bend in the curve required to achieve this target (registrations are smoothed between the two targets). It is clear that the dynamics of the situation must change significantly over the next few years, and that the mid-2025 target represents a challenge in itself that cannot be guaranteed.

As mentioned in section 3, electric motors (which were the first zero-emission vehicles available on the market) will increasingly meet the diversity of uses for which rigid trucks are required. In this respect, the CAFE objectives will be met by a greater contribution from HDVs weighing less than 26 tonnes. The IMT's analyses have produced two different electrification curves, as shown in **Figure 5**.

With a view to achieving an electrification rate of 46% of vehicle registrations by 2030 (SNBC3 objective run 2), the following exercise aims to examine the implications of deferred mandatory greening quota trajectories according to activity sector/vehicle classification/fleet size for achieving this objective in France. In other words, the aim is to identify potential bottlenecks to achieving the target set by the SNBC and the SGPE, and to define how it is to be achieved.

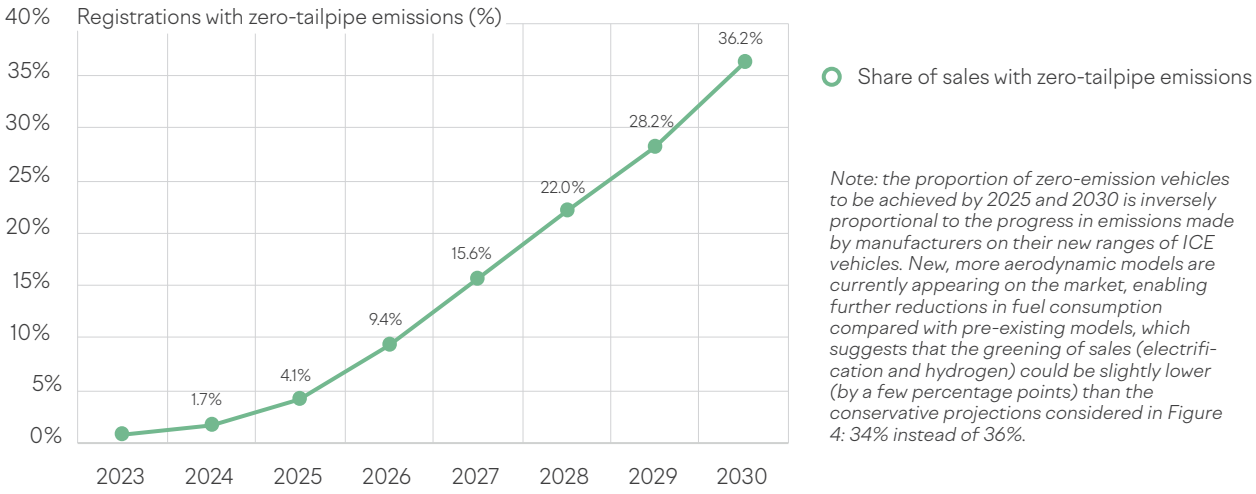
Methodology

A simulation model was built following the method illustrated in **Figure 6**. The model is based on registration and fleet data supplied by IMT's technical partner C-Ways.

FIRST SET OF ASSUMPTIONS:

- For simplification, the simulation assumes of a conservative and constant number of annual registrations of around 46,000 units (based on average registrations over the last 5 years, from 2019 to 2023) and a stable breakdown of registrations according to fleet size, activity sector and vehicle category.
- The nature of the fleet by 2030 has also been modelled. To this end, it was assumed that (1) the fleet remains constant compared with 2022 (excluding temporary transit registration – 565,900 vehicles), (2) the oldest ICE vehicles are removed from the fleet as a priority, and (3) no electric vehicles are removed from the fleet over the period considered.
- Long-term leasing, even those with fleets of more than 100 vehicles, would not be subject to the obligations

FIGURE 4. Greening scenario for new HDV registrations as a result of European regulatory requirements



Note: the proportion of zero-emission vehicles to be achieved by 2025 and 2030 is inversely proportional to the progress in emissions made by manufacturers on their new ranges of ICE vehicles. New, more aerodynamic models are currently appearing on the market, enabling further reductions in fuel consumption compared with pre-existing models, which suggests that the greening of sales (electrification and hydrogen) could be slightly lower (by a few percentage points) than the conservative projections considered in Figure 4: 34% instead of 36%.

32 Gross Vehicle Weight Rating

33 Adam bill, online: https://www.assemblee-nationale.fr/dyn/16/textes/l16b2126_proposition-loi

FIGURE 5. Greening scenario for new HDV registrations established by IMT according to GVW and resulting from European regulatory obligations

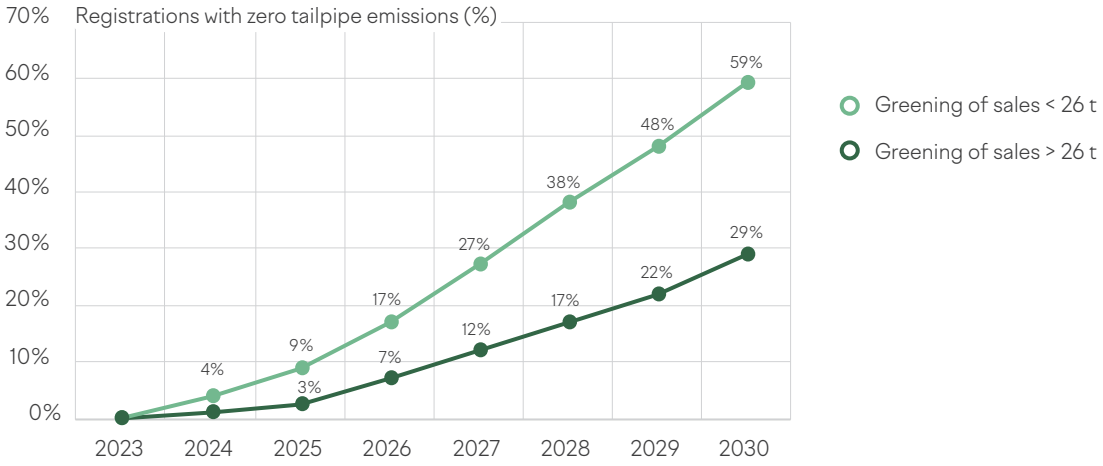
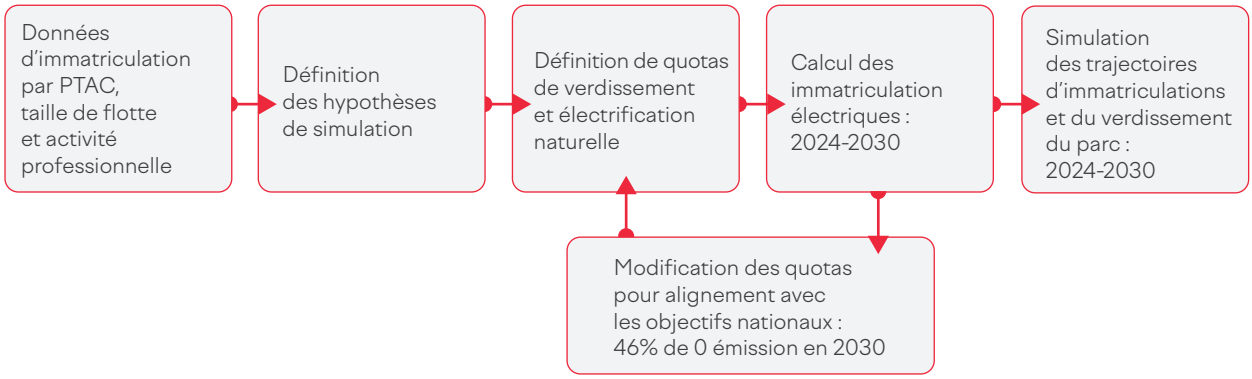


FIGURE 6. Schéma méthodologique de la simulation développée par les auteurs



modelled here, so as to maintain a supply of ICE vehicles for leasing to small companies that do not have the means to go electric. In this respect, it should be noted that companies with large fleets, which are subject to the proposed quotas, will account for only 45% of the market share of HDV leasing companies in 2023.

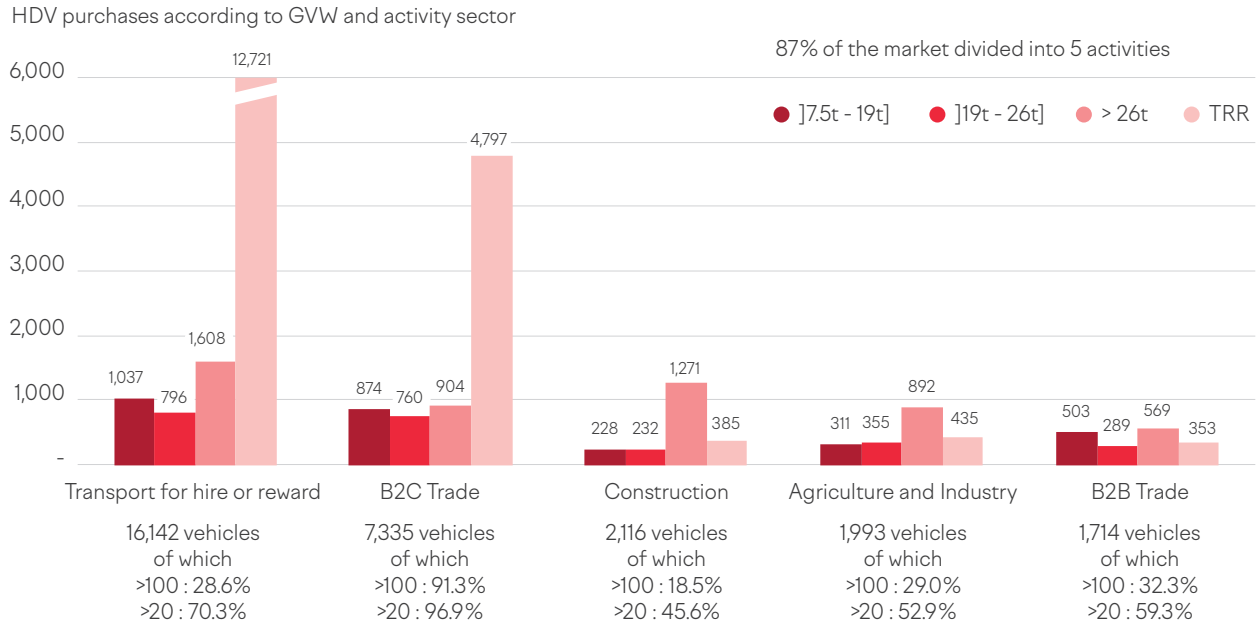
— To keep the greening effort focused on the largest actors and to ensure that the effort is progressive, only fleets with more than 100 vehicles (i.e. 47.4% of the market share, excluding long-term leasing) would be subject to greening obligations until 2029. This approach takes the view that large companies have a greater capacity to amortize the cost of these new vehicles, while at the same time being able to allocate their vehicles more easily to dedicated functions that are compatible with electric driving. It is thought that greening quotas could be extended to fleets of more than 20 vehicles by 2029. The industrial development of very low-emission vehicles and the emergence of mobile electric vehicle charging network (see section 3) will make electric vehicles more accessible to a wider range of transport operators.

— At present, companies that use short-term leasing, most of which own more than 100 vehicles, are subject to the HDV greening quota mechanism. A differentiated trajectory could be envisaged if a quota mechanism was introduced.

In addition to these assumptions, an analysis of the structure of registrations according to activity sector and GVW was conducted, as shown in **Figure 7**. This should make it possible to establish whether other variables need to be taken into account to guarantee the desired objective of fair competition via the proposed mechanism.

Logistics and transport for hire or reward activities account for half of all HDV registrations. "Logistics", as defined in Figure 7, includes activities such as transport, storage, inter-city and local freight transport, handling,

FIGURE 7. HDV registrations by activity sector and GVW - 9 months 2023



Note: Every new registration (used or new vehicles) is recorded in the SIV database for companies and private individuals. By combining this data with NAF codes grouping companies by activity sector, it is possible to obtain a detailed view of the HDV market according to fleet size, GVW and activity sector.

express freight, courier and freight forwarding, as well as removal services. Of these registrations, almost 80% are tractor units. The second largest sector in terms of registrations is B2C (retail), corresponding mainly to food and consumer goods distribution activities, where very large actors predominate. Indeed, this category, which accounts for 22% of HDV registrations, is more than 90% made up of companies with more than 100 vehicles, and makes greater use of rigid trucks (35% of registrations). This is followed by the construction and public works sector, which includes civil engineering, construction and landscaping activities, with over 80% using rigid trucks, 73% of which are of high tonnage (over 26 t). It is worth noting that 55% of registrations in the construction sector come from companies with fleets of less than 20 vehicles.

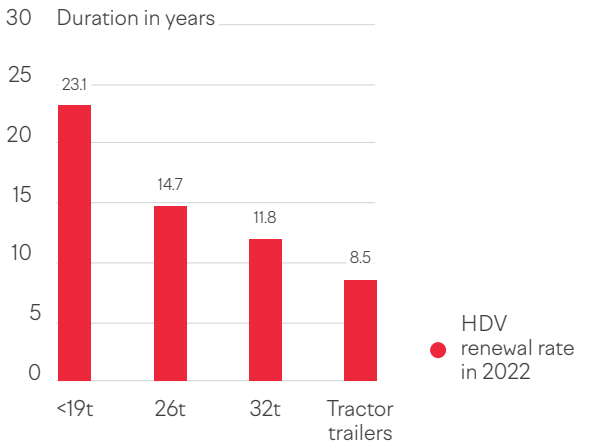
This distribution of new vehicle registrations reveals the relatively concentrated and specialized nature of HDV purchases in France. In summary, rigid trucks weighing less than 26 t are purchased by large companies operating in urban logistics relating to distribution and food. Tractor units still account for the vast majority, and are used for transport for hire or reward. The construction and agriculture sectors rely heavily on relatively specific HDVs: rigid trucks over 26 t.

These elements of market interpretation reflect the pressing need to segment the greening of vehicles (and potential greening quotas) in a differentiated way according to the GVW of vehicles. Two greening pathways are therefore proposed, depending on whether the vehicles have a GVW of less than or more than 26 t. This division, which concerns registered equipment, is both consistent with the range of vehicles on offer and, above all, enables the introduction of fairness into the efforts required by actors. Indeed, under these conditions, the greening effort for certain activities such as construction and agriculture is deemed acceptable and would not require a specific exemption for these activities. An analysis of the electrification of the fleet in 2030, presented with the results of the simulation in the rest of the analysis, confirms this assumption.

This division of greening quotas according to GVWs that are above or below 26 tonnes is also justified in view of the renewal rates observed for these categories, as shown in **Figure 8.**

The low renewal rate for rigid trucks on the market for new vehicles with a GVW of less than 19 tonnes justifies the need for additional measures to accelerate the electrification of these vehicles as a priority (as we have seen, such vehicles are more compatible with the transition). This prioritization of rigid trucks for electrification (which is a public policy choice) could run counter to reasoning based solely on the cost of carbon abatement. Indeed, for rigid trucks this cost seems to be 15% to 25% higher than for tractor units (due to lower annual mileage). However, the IMT believes that, in view of air quality and noise pollution issues, rigid trucks should be allocated at least half of the greening support available, since most are used for local services in large urban areas, i.e. in areas that are already subject to or are in the process of becoming subject to LEZs. In this respect, it should be noted that the European regulatory framework for

FIGURE 8. Renewal rate of the French HDV fleet according GVW, based on new registrations



Note: To obtain the results in Figure 8, the 2022 data for the fleet according to GVW are compared with the average annual sales over five reference years from 2019 to 2023.

LEZs will soon develop to include a strengthening of regulatory thresholds,[34] an element adopted on 20 February 2024 at the European level.[35]

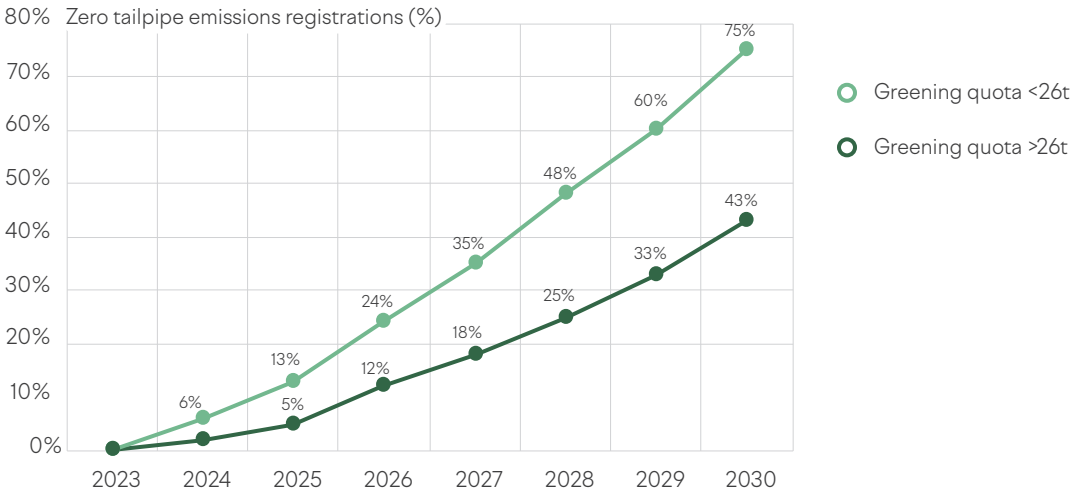
Results

Based on the assumptions and elements of analysis set out above, **Figure 9** shows a greening quota scenario for the French market that meets the target (SNBC and SGPE) of 46% zero-emission sales by 2030. It should be noted that to obtain this result, vehicle fleets not subject to quotas have been considered as following the pathways presented in Figure 5, i.e. the European obligations set for manufacturers according to CO_2 standards. The reasoning behind this assumption is that the manufacturer offer and its attractiveness for their customers is designed and calibrated to obtain this result on a European scale and therefore to follow the service requirements of actors not covered by these greening quotas in France (those with fleets of less than 100 vehicles or with GVWs that are excluded).

The results of the simulations show that the quotas would create a fairly significant demand shock on sales of smaller tonnage HDVs, which is a prerequisite for achieving the greenhouse gas emission reduction targets set out in French ecological planning. Thus, by 2030, i.e. within six years, all large fleets would need to ensure that at least three-quarters of their two-axle and three-axle rigid trucks were zero-emission vehicles. The greening of tractor units would take longer, reaching an average of 39% by 2030. This objective implies rapid progress on the range of battery-powered vehicles compared with the current possible ranges, or the development of competitive hydrogen-powered tractor units.

Figure 10 shows the effect of the introduction of the greening quota mechanism applied to HDV fleets compared with a registration scenario based solely on European CO_2 emission standards.

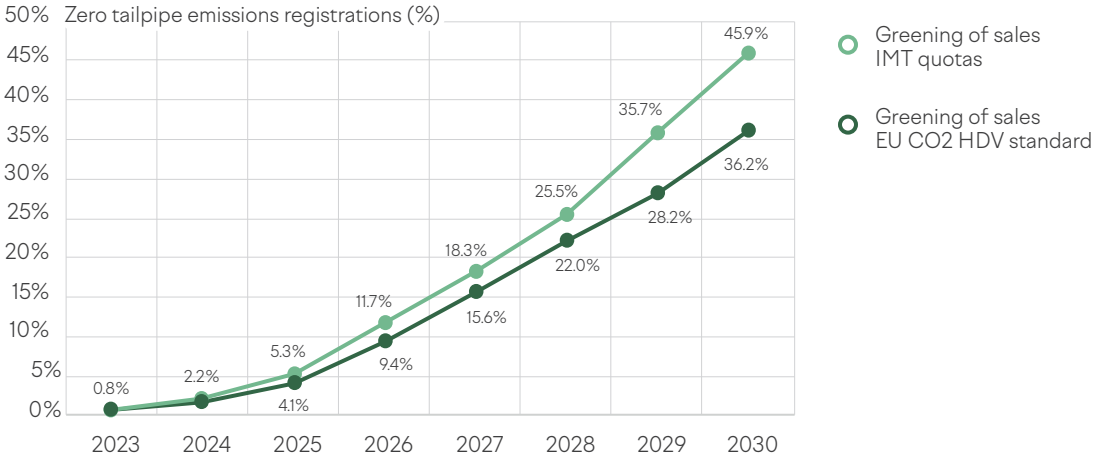
FIGURE 9. Results: Proposal for delayed greening quotas according to GVW to meet the defined targets



34 Annual averages. Nitrogen dioxide: 20 microgram/m3, PM10: 20 microgram/m3, PM2.5: 20 microgram/m3

35 Council of the European Union, online: https://www.consilium.europa.eu/en/press/press-releases/2024/02/20/air-quality-council-and-parliament-strike-deal-to-strengthen-standards-in-the-eu/

FIGURE 10. Greening trajectories for HDV registrations in France according to European provisions or with greening quotas for France as proposed by the IMT



In terms of the fleet, the introduction of quotas as defined above would make it possible by the end of 2030 to have a fleet of zero-emission HDVs in France of more than 60,000 units (11.1% of the fleet compared with 0.2% at the end of 2023).

TABLE 12. Evolution of the fleet of zero-emission HDVs from 2023 to 2030, at 31 December of each year with the introduction of greening quotas as proposed by the IMT

Year	2023	2025	2027	2030
Fleet electrification	0.2%	0.8%	3.0%	11.1%
No. of vehicles	1,167	4,364	17,077	62,654

To assess the distribution of efforts according to RFT activity category, particular attention has been paid to the results of the simulations for certain sectors, notably those for which electrification is considered to be more difficult. As mentioned above, the aim is to assess the relevance of any exemptions to the legislative framework tested here (see methodology above). **Figure 11** shows that the proposed measures do not run counter to the greater difficulty that some sectors have in obtaining vehicles for their specific requirements. Indeed, it can be seen that the greening quotas have a limited impact on the construction and public works sector, previously identified as being more sensitive to certain HDV architectures, since the simulations carried out show that it would be one of the activity sectors with the least electrified fleet in 2030. This is mainly due to the structure of its purchases: a large proportion of vehicles over 26 tonnes and a rather low renewal rate. Finally, these results confirm the fact that the proposed greening quotas, and in particular the significant cut-off at 26 tonnes, do not justify the addition of further derogation measures according to activity sectors.

FIGURE 11. Nature of the vehicle fleet with zero tailpipe emissions generated in 2030 according to activity sector, resulting from simulations based on IMT assumptions and proposals

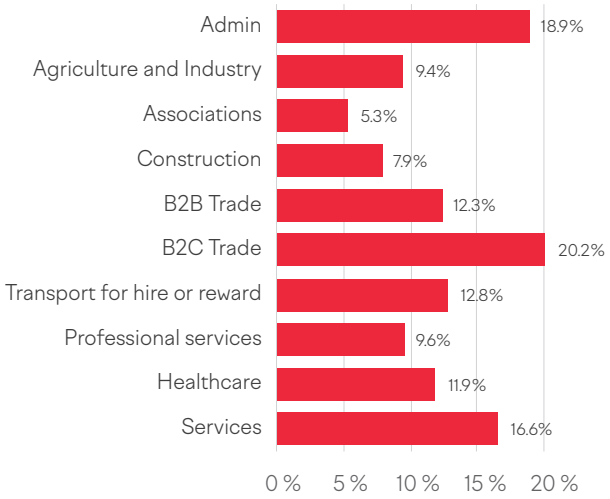
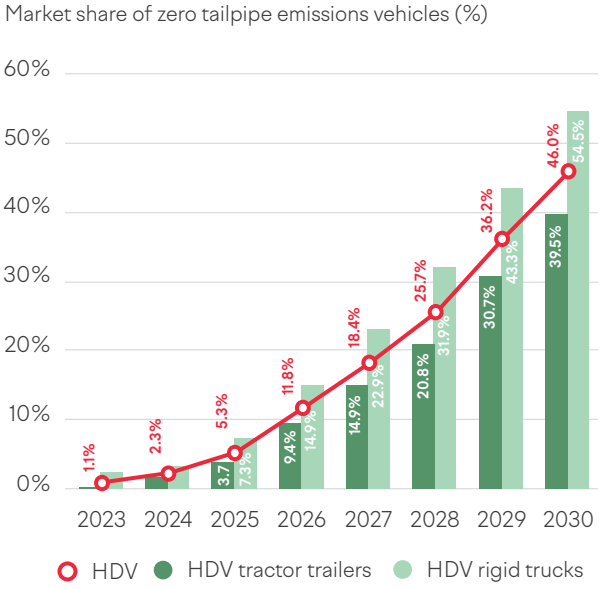


Figure 12, which complements the previous results, shows the electrification achieved by rigid trucks (19 t, 26 t, 32 t and over) and tractor units.

4.3. Achieving a balance of effort: stimulating demand for decarbonized transport from shippers

The consultations conducted for this study converge on the need to spread the effort across all economic actors in the road haulage sector. To this end, to complement the European regulatory system (CO_2 standard) and the French incentive system (APP/CEE), we also need to involve contractors in the greening of fleets, first and

FIGURE 12. Results: greening curve for sales according to vehicle type based on IMT proposals



foremost the shippers and freight forwarders (intermediaries who can be utilized by shippers). Indeed, their role, through the specifications they draw up, coupled in some cases with a 'premium' for the use of decarbonized vehicles, is a relatively unavoidable condition for initiating the greening of the fleets of major haulier companies. All too often the widespread use of short-term contracts, competitive tendering and the resulting low margins for hauliers do not provide sufficient visibility for long-term investment in more expensive, lower-emission vehicles. State intervention would therefore seem necessary to encourage contractors and to shift the economic equation according to the energy they specify in the services they require. The IMT's recommendations are aimed at stimulating and supplementing the voluntary commitments made by shippers through the development of a sustainable and enforceable reporting framework, conducive to the introduction of an economic incentive.

Such implementation requires knowledge of the proportion of zero tailpipe emission transport contracted, or alternatively (but with greater complexity) the CO_2 balance per tkm of goods transported. However, as we shall see, the reporting obligations to date have suffered from methodological shortcomings or a degree of cumbersomeness/complexity that makes comparative reporting difficult. The following section examines these shortcomings and risks. (**box 1**)

In this situation, and in the interests of simplification, it is proposed that existing transport documents should be marginally amended to incorporate environmental performance data, without creating an additional administrative burden, since all the information to be compiled already exists. The proposed changes are set out below ((**box 2**).

Recommendations

IMT is proposing to introduce by decree the obligation to report the energy code of the vehicle used and the duration of the transport contract for each shipment of goods. The following information would therefore be added to Article 4 of the Order of 9 November 1999:

- h) The energy code(s) of the motor vehicle(s) in box P3 of the registration certificate.
- i) The duration of the contract of carriage between the shipper and the haulier.

Coupled with an obligation to transmit the flows generated by large contractors to government departments, these elements would make it possible to consolidate national road transport according to the energy vector used. Government departments would then be able to carry out checks via the vehicle registration system. The desire to introduce an obligation to communicate the duration of the contract stems from the trend towards increased competition, which is pushing the system towards ever shorter contractual periods. This dynamic is considered to be a brake on the transition, whereas the opposite dynamic needs to be created to enable hauliers to benefit from sufficient visibility to agree to initial investments, which, as we have seen, remain more important.

PRACTICAL DETAILS:

- Today, a large majority of hauliers digitize their consignment notes using TMS (Transport Management System) software to limit data entry errors and monitor their performance. What's more, France and 15 other EU countries have ratified the E-CMR protocol, which authorises the carriage of goods using only digital documents. Making the digitization of these documents compulsory - initially for the biggest actors - would simplify their monitoring by the inspection services, and allow them to be easily aggregated, making more data available at the national level.
- The development of a digital platform, which could be run by the public authorities (SDES/CGDD/ DGITM) or by a trusted third party (ORT and GART have been identified as such in the LUD mission report[36] published in 2021 by the DGE and the DGITM), could be envisaged to facilitate the management and sharing of this information. This platform would enable the administration to monitor the performance of shippers (rate or tonnage/kilometre carried out in electric vehicles

36 Report, Logistique Urbaine Durable, 2021, online: https://www.economie.gouv.fr/files/files/2021/20211021_rapport_Logistique_urbaine_durable.pdf

BOX 1. EXISTING LEGISLATIVE FRAMEWORK IN FRANCE AND THE EUROPEAN UNION FOR REPORTING GREENHOUSE GAS EMISSIONS FROM ROAD FREIGHT TRANSPORT

Article 138 of the Climate and Resilience Act
The direct application of the Non-Financial Reporting Directive (NFRD, at the European level) makes it compulsory for shippers exceeding certain turnover thresholds* to include "direct and indirect emissions linked to transport activities upstream and downstream of the activity" in their extra-financial performance declaration.

However, this reporting is not standardized, and no calculation methodology is imposed. The results are made public by the companies concerned, but the aggregation and use of this data does not provide an accurate picture of national freight transport emissions (not all shippers are involved, depending on their size or nationality, and the proportion of transport within France is not necessarily identifiable).

Article L1431-3 of the Transport Code
This article requires hauliers to provide "information relating to the quantity of greenhouse gases emitted" at the request of the service beneficiary, or risk a fine of up to €3,000 from 1 January 2025.

The calculation methodology, defined in articles D1431-6 to D1431-19 of the same code and based on ADEME's *Base Empreinte* database, nevertheless leaves some freedom in the calculation for hauliers, particularly regarding (1) the energy consumption of the means of transport used, and (2) fuel consumption outside the delivery phase (empty running, repositioning, stationary, etc.). While these elements make it possible to consider the efforts made, the field of application studied remains broad and insufficiently constrained to enable a comparative method. *Do we base our reasoning on the unit consumption of the HDV involved in the transport, or on the haulier's fleet average? How should breaks be considered to provide comparative information? Should standards be defined for different applications and professions?* These are all open questions.

Article 138 of the Climate and Resilience Act
This article establishes that the government must carry out a national review of action plans aimed at reducing greenhouse gas emissions from transport activities. This assessment should be used to analyse the expected overall effectiveness of the action plans implemented with regard to the objectives of the national low-carbon strategy. At present, it is not possible to carry out this assessment satisfactorily on the basis of data produced by shippers or hauliers.

* Thresholds to be subject to the obligations: for companies listed on the stock exchange, a turnover in excess of €40m or a number of employees in excess of 500; for unlisted companies, a turnover in excess of €100m or a number of employees in excess of 500. (A total of 3,800 companies were affected in 2021).

or average carbon footprint of tkm). This database could be used as the basis for a tax system, a financial incentive or a regulatory obligation in comparison with desirable transition trajectories aligned with national objectives (SNBC, SGPE), or with European regulations on CO_2 standards or even with possible quota obligations for the greening of fleets (see previous section).

— Finally, the reporting obligation would enable systematic monitoring of cabotage activities, whose excesses, which impact on fair competition between the actors concerned, will be even more deleterious for the transition of the HDV fleet. This element should be reassuring for French actors. As a reminder, the restrictive conditions for cabotage should make it possible to limit this practice in the interests of reducing empty running (the main objective of this system). However, several excessive practices have been identified that offer low-cost freight transport (with wages accounting for almost 45% of the cost of *freight transport), thereby driving prices down.*

Figure 13 illustrates the reporting proposal based on the existing framework. It should be noted that, at the European level, longer-term initiatives are being launched with a view to standardize the data made public by companies. The CSRD and the ESRS play an important role in terms of ambition and communication requirements, without however presenting the operational level and speed of implementation required by the recommendations formulated above.

Therefore, while the deployment of a complete reporting mechanism, for emissions and flows, will not be operational for several years, it is essential to initiate a gradual build-up of an incremental system, which is the philosophy behind the approach formulated in this study.

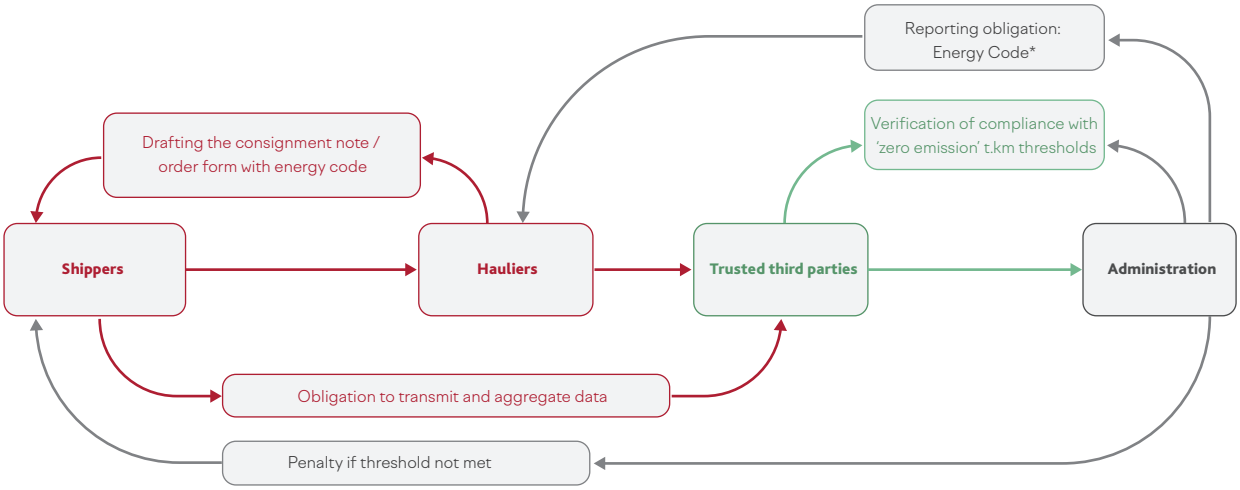
BOX 2. REPORTING RFT TRANSPORT FLOWS FOR ELECTRIC AND HYDROGEN ENGINES

Transport documents

At present, a large amount of data is systematically recorded for each movement of goods by hauliers. According to current regulations, each consignment transported by road must be accompanied by official documents known as "consignment notes" for transport for hire or reward, or "an invoice, collection note or delivery note" for transport on own account. In accordance with Article 4 of the Order of 9 November 1999, these documents must contain:
a) Date of dispatch or collection;
b) Name and address of the company carrying out the transport;
c) Name and address of the consignor if different from the company carrying out the transport;
d) Name and address of the consignee if different from the company carrying out the transport;
e) Place of loading;
f) Place of unloading;
g) Nature and quantity or weight or volume of goods.

The special case of delivery for several consignors or consignees - a frequent occurrence in the courier sector - is dealt with in article 5 of this order and provides for the possibility of carrying out the journey using several waybills, or a single waybill if it is accompanied by a summary statement containing the information d), e), f), g) and h) mentioned above for each operation.

FIGURE 13. Illustration of the reporting interactions between actors, as formulated by IMT



* Energy code = Box P3 on registration certificate

4.4. Proposals for incentive mechanisms based on suggested reporting

VAT lever

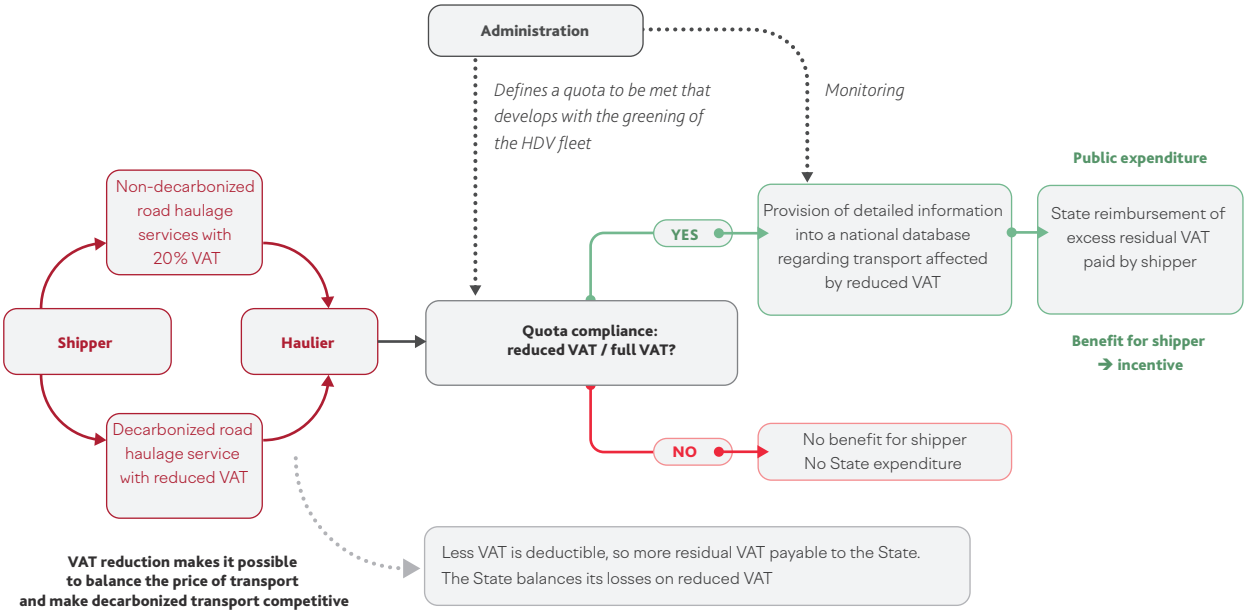
VAT returns for transport services could be a good tool for devising an incentive framework for the transition in the short term. The IMT has put forward the idea of a reduced intermediate VAT rate for freight transport services provided by a zero tailpipe emissions vehicle. The proposed mechanism could operate as follows:

(1) A haulier using a zero tailpipe emissions vehicle would be allowed to invoice the service provided at a reduced VAT rate.

(2) As a result, the shipper would have a lower amount of deductible VAT. The residual VAT that the shipper would need to pay to the State each month would therefore be higher. There would be no direct gain for the shipper (balance between reduced cost of low-emission transport and higher residual VAT payable); and no loss for the State at this stage (simple transfer of VAT paid by the haulier to the shipper).

(3) When completing VAT returns, shippers would be authorized to retain a standard deductible rate (20% instead of 10%, for example), subject only to (1) providing detailed information for a national database on the transport subject to reduced VAT and (2) complying with minimum "shipper

FIGURE 14. Reduced VAT incentive scheme for zero tailpipe emissions services



quotas" for the use of zero tailpipe emissions vehicles. The proposed mechanism would therefore create a financial incentive to achieve a greening objective. It would then be a matter of adjusting the target thresholds for shippers so that they at least meet the targets for greening the HDV fleet in France.

(4) A national platform would serve as a registration base for obtaining VAT refunds, based on: the haulier's SIREN number; the shipper's SIREN number; the registration number and energy code of the vehicle that carried out the transport; the journey made and the number of kilometres travelled;[37] and the payload transported.

This mechanism would make it possible to secure demand - due to the creation of quotas for shippers - and thus support the growing zero-emission supply. The threshold below which the shipper would not be able to claim reimbursement would act as an additional incentive, enabling the demand to be at the level of the efforts required by the haulier. In particular, the dynamics created could be such that:

- For hauliers, selling transport services at a reduced VAT rate would either enable them to increase prices before tax (and therefore margins) or to become more competitive. However, as the road transport sector is highly competitive, this mechanism would be more likely to bring about a reduction in the price of decarbonized transport.
- For shippers, the purchase of a reduced VAT transport service would mean the reimbursement of higher residual VAT at the end of the month. However, this would not affect the profits generated. If quotas for the use of zero-emission transport are met, the reimbursement of the additional VAT paid over the year for decarbonized transport would appear as a net benefit.
- For the State, the cost of the scheme, which is intended to be short-term and effective over four years, should be compared with the additional VAT revenue obtained from the registration of more expensive electric vehicles in greater numbers due to greening quotas, which are driving sales towards the SNBC targets. The mechanism could be designed with this in mind, and be relatively neutral, or even favourable, for public finances.
- Technical implementation issues need to be refined at this stage, in particular to ensure the effectiveness of the mechanism at the heart of subcontracting relationships.

Figure 14 illustrates this proposal.

Eco-contribution lever

With a view to fuelling demand for zero tailpipe emissions transport, other organizations or federations of stakeholders have suggested the creation of an eco-tax for all shippers, based on the level of emissions or the nature of the energy linked to the transport services purchased or provided by their own fleets. The aim is both to provide a net financial incentive for low-emission transport and to set up a fund to finance the purchase of electric trucks by company-owned fleets or haulage contractors, as well as the installation of charging infrastructure. This mechanism

37 The annual mileage of each HDV in the database will enable an effective check to be made on the consistency of the information. Pending more comprehensive reporting, this information will make it possible to aggregate initial data at the national level on zero-emission RFT.

would be introduced as part of ongoing efforts to reduce CO_2 emissions, with the involvement of shippers and freight forwarders.

Initially, based on the pre-existing legislative framework described above, all companies subject to the obligations of the transport code would be required to report their environmental performance from 2025 onwards. In a second phase, this data, monitored by the State, would be used as the basis for introducing a bonus/penalty system depending on the results achieved, with potential penalties being paid into the above-mentioned fund. This proposal is a way of anticipating, in terms of method and impact, the extension of the European carbon quota system to freight transport in 2027, which would also see the creation of a reallocation fund dedicated to the transition.

4. CONCLUSION

While the greening of road freight transport is well and truly underway from a technological and regulatory perspective, the efforts already made through the development of alternative fuels and more efficient ICE vehicles will reach a ceiling in terms of the emissions reductions they can generate, and will need to be supplemented by a strengthened decarbonization strategy.

Based on an analysis of TCOs, financing resources and the state of progress regarding charging infrastructure, coupled with an in-depth study of vehicle use and categories according to activity sector, this study evaluates the current potential for electrification of sales in France at 37.4%. This rate will make a significant contribution to the objective imposed on manufacturers of meeting European CO_2 standards.

The aim of the study is to identify the issues and conditions conducive to the technological acceleration needed to achieve the national decarbonization targets for RFT, particularly the emergence of an electric and hydrogen fleet. To meet this challenge successfully, the IMT believes that the efforts to be made must be equally shared between the various stakeholders involved: public authorities, manufacturers, hauliers, freight forwarders and contractors.

These actors (aware of the urgency and industrial complexity of the transition underway) must be able to find, within a package of relevant public policies, a framework conducive to greater confidence, visibility, and security in a transitional phase where uncertainties remain. Indeed, there are many issues at stake, some of which generate uncertainty, doubt and even opposition. The IMT is proposing a series of measures and recommendations, which all flow from one another, to help define a favourable framework for this transition.

The involvement of shippers in the decarbonization effort must include reporting CO_2 flows and emissions, and they must respond to economic incentives (VAT lever or eco-tax) or a market system based on mandatory targetable and tradable quotas. Hauliers, for their part, could be subject to a mechanism of greening quotas for HDVs, consistent with the emission standards defined at the European level for manufacturers and/or the specific objectives of France.

Finally, the role of the State is to address these new dynamics by tackling the issues specific to each actor in such a way as to ensure that the effort is evenly distributed. These issues include financing the additional investment costs of electric vehicles, supporting changes in vehicle operating practices, ensuring that charging infrastructure is deployed at the right level, addressing uncertainties over energy prices, etc. Many of these issues can be defined, but they all require monitoring, detailed analysis and consistent timeframes. It is only under these conditions that the effective deployment of electric and hydrogen vehicles (in a complementary way) will be achieved within HDV fleets.

The greening of road haulage fleets in France

Current situation and conditions for success

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