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The electrification of the heavy-duty road transport

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Spis treści

Key numbers

486,000 people

were employed in the road freight transport sector in Poland in 2020, 15% of the EU total

1.15 million HDVs

with a GVW above 3.5 tonnes made up the Polish vehicle fleet in 2021, the largest number in the entire EU

380 billion tkm (tonne-kilometres)

were transported by the Polish road transport sector in 2021, the most in the EU and 24% more than Germany, which came second

21,000 additional jobs

in Poland could be created by the accelerated electrification of the heavy-duty road transport sector by 2035, compared to slow electrification in the status quo scenario

by 9.9 billion tkm

potential increase in Polish road transport sector's transport activity by 2035 thanks to accelerated electrification, compared to the status quo scenario

by EUR 1.1 billion

potential increase in value added from the road transport sector in 2021-2035 thanks to accelerated electrification, compared to the status quo scenario

Key findings

- **Poland is one of the leaders in road transport in the European Union.** Since 2017, Polish companies have been transporting the most goods in the EU. In 2021, the number of tonne-kilometres reached nearly 380 billion, 24% more than transported by Germany, the second country in terms of transport activity.

- **Poland has the largest number of employees in road transport sector in the entire EU.** In 2020, over 486,000 people were working in it. This is 74,000, or 18%, more than Germany, which came second. Employees employed in Poland make up 15% of all employees in the goods transport sector in the EU. Poland has been in the lead since 2018, when the increase in the number of employees reached 19% y/y.

- **Poland has the largest fleet of vehicles with a GVW above 3.5 tonnes in the entire EU.** In 2021, this fleet consisted of nearly 1.15 million HDVs, an increase of 33,000 y/y. In 2021, the average age of a truck was 13.2 years, slightly below the EU average of 13.9 years, and significantly higher than in the competitive markets of Germany and France; 9.6 and 9 years respectively. Lack of investment in expanding the fleet of electric vehicles will prevent Polish companies from operating on certain transport routes within the EU and expose transport, shipping and logistics (TSL) companies to additional costs linked to their failure to comply with EU regulations.

- **Accelerated electrification will boost employment by 21,000 jobs and value added by EUR 1.1 billion by 2035, compared to the status quo scenario.** Support for electrification by subsidising the purchase of electric vehicles and investments in charging infrastructure, as well as regulatory facilitations for the eHDV sector, will not only help the Polish industry adapt to market trends and EU emission reduction requirements, but also bring tangible economic benefits.

- **In 2040, at least seven major manufacturers plan to sell only electric vehicles.** After 2030, approximately half the models sold by Scania, MAN and Volvo will be powered by electric engines. Industry representatives

note that the increase in the range of models available in the coming years could accelerate the electrification of heavy transport.

Infographic 1. Impact of the electrification of the HDV road transport sector on employment, transport activity and value added

	Scenario 2. "Gradual electrification"	Scenario 3. "Accelerated electrification"
Employment (thousands)	10.09	20.89
Transport activity (billion tkm)	4.78	9.90
Value added (million)	542.0	1120.0

Source: prepared by PEI.

Introduction

The heavy-duty road transport sector in the European Union is changing. The fight against the effects of global warming as part of the EU climate packages includes reducing emissions in most sectors of the economy. In 2019, 71.7% of transport emissions in the EU came from road transport. Although **HDVs** account for less than 3% of the total car fleet on European roads, they are **responsible for as much as 19.4% of the CO_2 emissions from road transport.** For this reason, EU regulations are introducing limits on emissions by HDVs, which is accelerating the sector's electrification.

The number of light and passenger electric vehicles on European roads is increasing significantly at the moment. Electric cars accounted for 13% of new registrations of passenger cars in March 2023. By 2035, there will be a ban on registering new passenger cars with combustion engines in the EU. The discussion on reducing emissions in the EU transport sector also concerns the introduction of regulations that cover HDVs.

According to European Commission forecasts, the electrification of the heavy-duty road transport sector will increase the number of jobs in the EU economy (EC, 2023). In particular, employment will increase in the energy sector and in the production of mechanical and electronic parts. Spending on fossil fuels will fall: in 2020-2040, savings in oil consumption will reach 170 million tonnes and, according to simulations, consumer spending will increase. This will also translate into higher GDP growth. This raises the question: which countries could be the special beneficiaries of these changes?

Following global trends and EU requirements, the electrification of the heavy transport sector will advance in Poland, too. It is therefore worth examining the impact on the country's economy. In cooperation with the Polish Alternative Fuels Association (PSPA), we have prepared this analysis of the potential impact of electrification of the heavy-duty road transport sector on employment and value added by 2035. The conclusions should help Poland prepare optimal solutions for the upcoming changes linked to reducing emissions in the sector.

In the first chapter, we present a diagnosis of the challenge for Poland presented by the electrification of heavy transport, taking into account national

and EU regulatory requirements, as well as sectoral restrictions regarding charging infrastructure and the shortage of employees. We also consider the impact of external factors, including Russia's invasion of Ukraine and its economic consequences. We compared national policies in the EU that support the electrification of the heavy transport sector. In the second chapter, we discuss the results of our analysis of the main indicators of the heavy transport sector in Poland and Europe. In the third chapter, we present three scenarios for the electrification of HDVs in Poland by 2035, taking into account changes in transport activity, employment and value added. In this chapter, we also included the PSPA's recommendations, which could help implement the most favourable scenario of the accelerated electrification of the heavy-duty road transport sector.

Diagnosis

National and EU regulations regarding the heavy-duty road transport sector

CO_2 emissions standards

The first ever CO_2 emission standards for heavy-duty vehicles in the EU were introduced on 14 August 2019, as part of the Regulation (EU) 2019/1242 of the European Parliament and of the Council of 20 June 2019 (EP, 2019). The regulations encourage the promotion of low- and zero-emission vehicles, as an element of the EU strategy for reducing greenhouse gas emissions in 2021-2030 and the implementation of the obligations arising from the Paris Agreement.

The regulation sets binding CO_2 emission reduction targets for new heavy-duty vehicles.[1] Manufacturers are obliged to reduce the emission intensity of newly-registered HDVs by 15% in 2025 and by 30% in 2030, compared to emissions by HDVs first registered between 1 July 2019 and 30 June 2020.

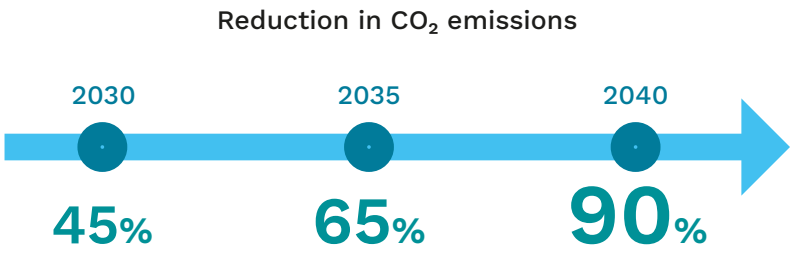
The regulation is also meant to ensure a smooth transition to zero-emission mobility. It therefore introduces a system of incentives: the average individual CO_2 emission levels of the manufacturer that introduces so-called super-units – zero- and low-emission HDVs – will be calculated in a preferential way. Super-units allow manufacturers to apply a double multiplier for zero-emission vehicles and a smaller multiplier for low-emission vehicles with a gross vehicle weight (GVW) above 16 tonnes (the value of the multiplier is determined based on a given vehicle's emission level).

[1] In this report, we understand heavy-duty vehicles (HDVs) as trucks with a GVW of over 3.5 tonnes used to transport goods.

If manufacturers do not achieve the expected CO_2 reduction, the Commission can fine them, depending on the extent to which the limits have been exceeded. The fine is calculated using the following formula:

- in 2025-2029: fine for exceeding CO_2 emissions level = excess CO_2 emissions x 4250 EUR/g CO_2/tkm;
- from 2030: fine for exceeding CO_2 emissions level = excess CO_2 emissions x 6800 EUR/g CO_2/tkm.

On 14 February 2023, the Commission proposed new CO_2 emission targets for new HDVs for after 2030, arguing that current standards are not consistent with the EU's climate targets. The Commission is calling for the gradual introduction of stricter CO_2 emission standards, compared to 2019 levels:



Exhaust emission standards

The new European exhaust emission standards that have been announced, Euro 7, will also accelerate the reduction of emissions from heavy-duty vehicles. These standards will have a much greater impact on reducing exhaust gases from trucks and buses in real driving conditions. According to the Commission's forecasts, the new emission standard will contribute to a 56% reduction in NOx gases and a 39% reduction in particulate emissions in the truck and bus segment, compared to the Euro 6 standard adopted in 2006 and updated in 2012, while helping make electric drives more widespread in the manufacturers' offer (EC, 2022).

The new standards will not only apply to pollution from exhaust systems, but also to that from brakes and tires, **so they will apply regardless of whether a given vehicle is powered by petrol, diesel, electricity or other types of alternative fuels.** Passenger cars' and delivery vans' compliance with the new regulations will be verified up to 200,000 km and for ten years of operation. This makes the regulations twice as strict as the Euro 6 ones. The new regulations also impose requirements concerning battery degradation, limiting the maximum loss of battery capacity after 100,000 km to 20% of capacity and to 30% after 160,000 km.

AFIR

On 28 March 2023, members of the European Parliament and the Swedish Presidency of the EU Council reached a preliminary agreement on the AFIR project, a regulation that will replace the directive of 22 October 2014 on the development of alternative fuel infrastructure. This is a legal act originally proposed as part of the "Fit for 55" package. As a regulation, it will apply directly in each member state, without having to be incorporated into national law.

The new regulations will impose requirements on member states when it comes to expanding the network of charging stations, including those intended for zero-emission HDVs. In the form agreed on, the AFIR project assumes three stages in the development of charging infrastructure for electric heavy-duty vehicles (eHDVs) (Table 1). Member states will also be obliged to expand hydrogen refueling infrastructure. Along the Trans-European Transport Network (TEN-T), the charging zones will have to operate every 200 km in one direction.

Table 1. AFIR's compromise proposal assumes the availability of charging hubs every 60 km throughout the TEN-T core network by 2030
Stages in the development of charging infrastructure for eHDVs in 2025-2030

Network	2025		2027		2030	
Core	Charging zones with a power of at least 1400 kW located at least every 120 km	15% of the length of the entire TEN-T network	Charging zones with a power of at least 2800 kW located at least every 120 km	50% of the length of the entire TEN-T network	Charging zones with a power of at least 3600 kW located at least every 60 km	100% of the length of the entire TEN-T network
Comprehensive			Charging zones with a power of at least 1400 kW located at least every 120 km		Charging zones with a power of at least 1500 kW located at least every 100 km	

Source: prepared by PEI and PSPA.

Alongside EU climate policy, more and more countries and regions are deciding to introduce their own regulations regarding combustion vehicles. One example are the zero emission zones implemented by city authorities. Their main goal is to solve the problem of transport-related air pollution and traffic congestion in cities. Reducing greenhouse gas emissions is supposed to be another direct effect. A ban on combustion cars in certain areas may encourage walking, cycling and the use of public transport (ICCT, 2022) and transport companies will have to use cars with electric engines on routes that include zones covered by the ban.

Box 1. In other places, cars powered by combustion engines are prohibited

More cities and regions are banning vehicles with combustion engines from entering: Munich, Berlin, Stuttgart, Hamburg and Darmstadt are regulating the entry of diesel cars. In France, the number of Low Emission Zones will increase from a dozen in 2022 to over forty in 2025. Similar restrictions will also affect HDVs. A zero-emission zone has been introduced in Rotterdam, in the Netherlands; trucks with a gross weight of over 3.5 tonnes can only enter it if they are zero-emission (Transport & Environment, 2019; ICCT, 2022).

Sectoral challenges

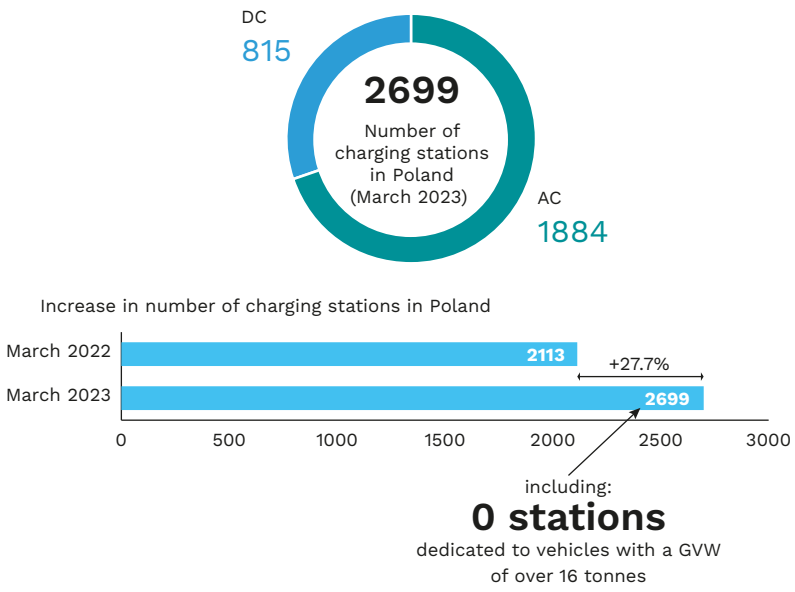
Not enough charging infrastructure

One of the biggest barriers to the development of electric road transport, both heavy and passenger, is currently the lack of developed charging infrastructure. Hall et al. (2021) identified five main recommendations for an accelerated transition to zero-emission HDVs: 1) specific targets for phasing out combustion vehicles, 2) regulations, 3) fiscal incentives, 4) building consumer awareness and, above all, 5) developing charging and refueling infrastructure. Similarly, this issue has been highlighted during public consultations in developing economies: in a study conducted by Khan and Yang (2022), increasing the number of charging places was one of the most frequently-presented proposals.

In March 2023, there were no charging stations for vehicles with a GVW above 16 tonnes in Poland, according to data from the PSPA/PZPM Electromobility Counter. Representatives of the TSL industry in Poland remain highly distrustful of the electrification of truck transport, pointing out that the infrastructure has not been prepared (Grzeszak, 2022). While the number

of publicly-available charging stations increased by 27.7% year on year, to 2,699, none of them are intended for trucks. This is accompanied by a low number of electric trucks; according to ACEA, just 11 had been registered in Poland by 2022.

Chart 1. In March 2023, the number of charging stations in Poland had risen by almost 30% y/y
Number of publicly-available charging stations in Poland (number and percentage)



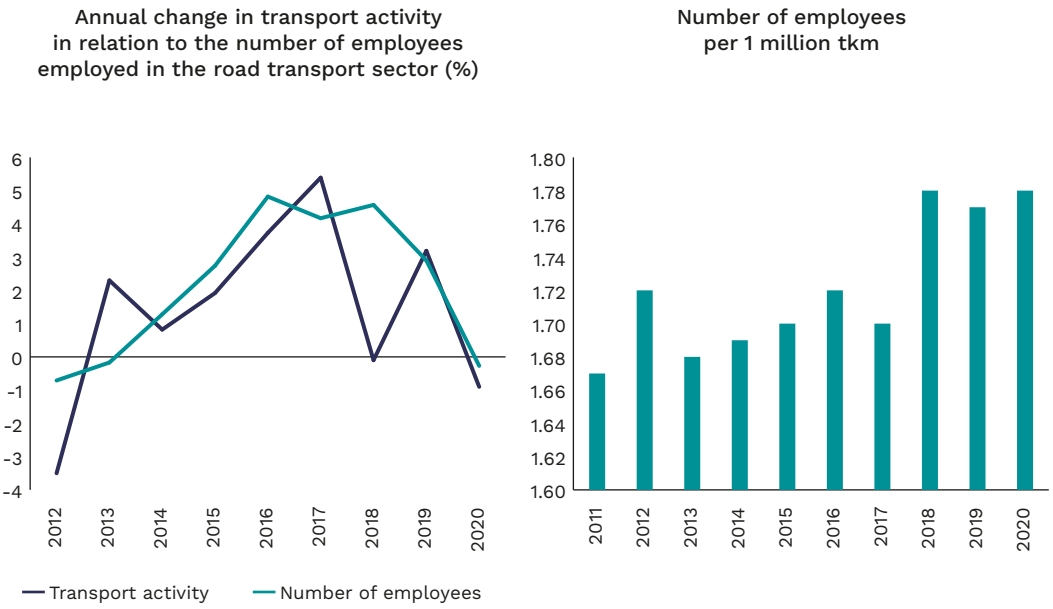
Source: prepared by PEI based on PSPA/PZPM E-mobility Meter.

Too few drivers

Over the past decade, the number of employees in Poland's road transport sector has gradually increased. According to Eurostat data, in 2011-2020 the number of employees per unit of transport activity, expressed in tonne-kilometres, increased from 1.67 to 1.78 employee per 1 million tonne-kilometres. However, these changes did not fully meet the demand. The insufficient number of drivers is one of the main barriers to the development of the TSL sector throughout Europe. The shortage of truck drivers could reach 10% of positions at the end of 2021; that is, 380,000-425,000 unfilled jobs (IRU, 2022). The effects of the shortage of drivers will increase as the workforce in transport ages. A higher percentage of professional drivers are over 50 years

of age (34.6%), compared to the entire labour force (27.8%) (TLP, 2022). In 2021, 34% of European drivers were over 55 years of age, and just 7% were under the age of 25. It will therefore be extremely difficult to replace drivers from 2026.

Chart 2. The increase in the number of employees is not fully meeting demand



Source: prepared by PEI based on Eurostat data.

The tense geopolitical situation in Eastern Europe has increased the outflow from Poland of some workers from Ukraine and Belarus, who returned to their home countries after Russia invaded Ukraine. Driver shortages are also affecting other European countries. In the UK, problems recruiting new drivers have forced regulators to change driving rules and reduce rest times for drivers. In France, work on increasing the attractiveness of the driving profession includes a ban on drivers participating in loading and unloading operations, following the example of Spain and Portugal (IRU, 2022).

Regulations

A study conducted by the industry at the beginning of 2022 (TLP, 2022) indicates that, apart from the lack of drivers, one of the biggest challenges in the next five years are regulations, including the **Mobility Package, a set**

of legal acts containing the provisions regulating road transport in the EU, primarily those of an inter-country nature. The final version of the regulations was adopted in August 2020. The justification for the introduction of the Mobility Package was the expected improvement and unification of regulations on the working conditions and social rights of drivers in the EU. It consists of:

1. A regulation regulating access to the road transport market, the profession of transporter of goods and transporter of passengers,
2. A regulation on drivers' maximum working time and minimum rest time and determining location using tachographs,
3. A directive amending the enforcement requirements and laying down the rules on the posting of drivers.

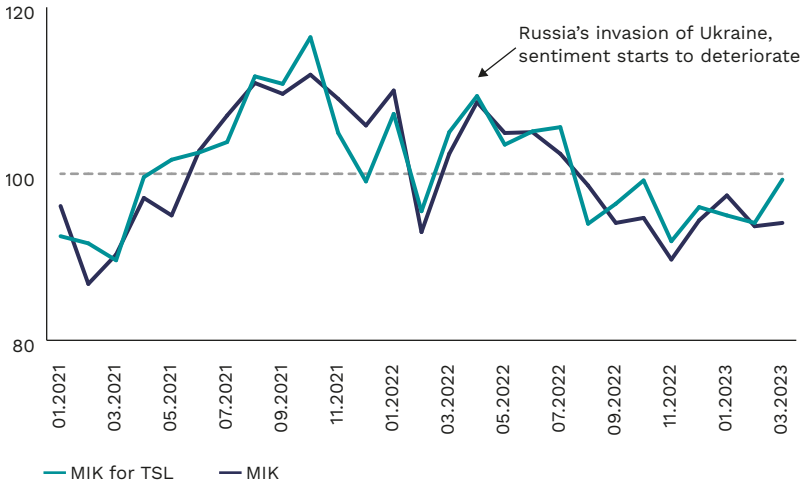
The EU regulations force companies in the transport industry to take steps to reduce their carbon footprint. In a PEI survey from last year, Polish companies said that they are purchasing purchase new combustion vehicles that meet the increasingly stringent emission standards (Euro 6). Entrepreneurs running logistics centres or owning warehouses cited the installation of photovoltaic panels or plans to do so. Selected companies are testing, or will test, the use of electric vehicles (Grzeszak, 2022).

The impact of external factors on the electrification of heavy road transport

The war and limited demand

Countries in the immediate vicinity of the hostilities, including Poland, are particularly exposed to the economic consequences of Russia's invasion of Ukraine (IRU, 2022). According to the National Bank of Poland (NBP), inflation in Poland will not fall below double-digit values in 2023. The Monthly Business Conditions Index in the TSL industry has remained below neutral values since September 2022 (PEI, BGK, 2023). Polish carriers are therefore struggling with both the difficult situation on the domestic market and limited international transport due to decreasing production in European factories.

Chart 3. Declining business sentiment has hit road transport
Monthly Business Conditions Index (MIK) (points)



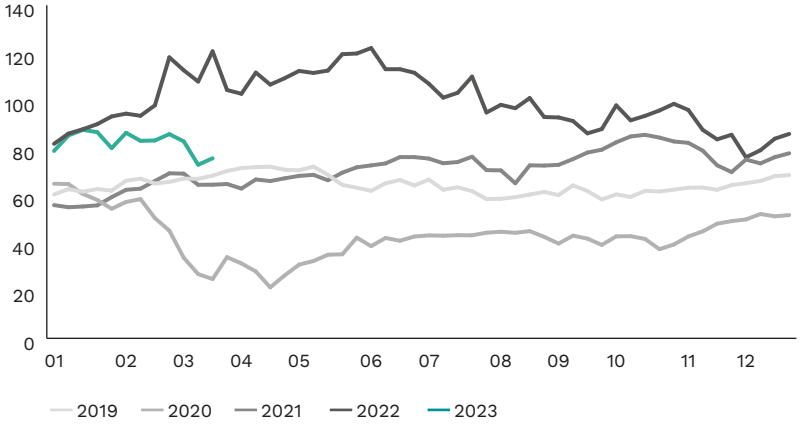
Source: prepared by PEI based on MIK data.

Fuel and electricity prices

In the fourth quarter of 2022, diesel prices in Europe were 21.5% higher than just before the war, in January 2022 (Ti, Upply, IRU, 2023). In Central Europe, fuel costs have increased from 40% to 50% of transport companies' total operating costs (Béguerie, 2023). Although oil prices fell in March 2023 to the lowest level since December 2021, fuel prices are expected to remain highly volatile due to forecasts of record demand for oil in 2023 and limited production by OPEC countries in the fourth quarter of 2023 (IEA, 2023).

High and volatile fuel prices have prompted businesses and consumers to become more interested in electric vehicles. According to Gao et al. (2017), electric trucks could offer savings of over 40%, compared to diesel-powered vehicles. More recent testing by the Volvo Group has show that the Volvo FH Electric uses 50% less energy than a Volvo FH with a comparable diesel engine (Volvo, 2022). Despite rising electricity prices, assuming that a truck consumes 1.1-1.24 kWh/km, the cost of electric drive is cost competitive compared to diesel (El Helou et al., 2022).

Chart 4. Oil and fuel prices are high and volatile
Price of Brent crude oil (USD per barrel)



Source: prepared by PEI based on ICE data.

Review of the support mechanisms for the electrification of heavy road transport

"Connecting Europe"

The EU is supporting the development of electrification in the heavy-duty road transport sector financially. Investment support in this area is provided for as part of the Connecting Europe Facility. The funds for the development of alternative fuel infrastructure in 2022-2023 amount to EUR 375 million. The subsidies cover:

- publicly-available charging stations with a minimum output power of 350 kW for heavy vehicles and network connections with a minimum power of 600 kVA (the infrastructure must be located on a part of the TEN-T network),
- publicly-available charging stations with an output power of at least 150 kW for heavy vehicles and network connections with a minimum power of 600 kVA (the infrastructure must be located in safe parking lots along the TEN-T road network),
- publicly-available charging stations with a minimum output power of 350 kW for heavy vehicles and network connections with a minimum power of 600 kVA (the infrastructure must be located in urban nodes of the TENT-T network).

Support is provided in the form of unit contributions:

- EUR 30,000 for a charging point with a minimum power of 150 kW,
- EUR 60,000 for a charging point with a minimum power of 350 kW,
- EUR 30,000 for a network connection (MFiPR, 2021).

Support system for the eHDV sector in selected countries

Germany

The Federal Ministry of Digital Affairs and Transport in Germany (Bundesministerium für Digitales und Verkehr, BMDV) supports the purchase of vehicles with climate-friendly drives, the expansion of refueling and charging infrastructure, and feasibility studies focused on its development. By 2024, BMDV will provide a total of approximately EUR 1.6 billion to support the purchase of climate-friendly commercial vehicles and approximately EUR 5 billion to develop refueling and charging infrastructure for passenger cars and trucks. As part of the programme, beneficiaries can apply for a subsidy amounting to up to 80% of the additional investment expenditure for the purchase of a low- or zero-emission vehicle and the construction of charging or refueling infrastructure for it. The support for feasibility studies amounts to 50% of eligible project expenses.

Spain

As part of the EU's NextGenerationEU recovery fund, the Spanish Ministry of Transport, Mobility and Urban Agenda (Ministerio de Transportes, Movilidad y Agenda Urbana, Mitma) has awarded the "Programme for the transformation of the truck fleet for professional road transport" a grant of EUR 400 million. The programme aims to promote decarbonisation in the heavy transport sector and its supporting infrastructure. Support of up to EUR 190,000 is available for the purchase of a new low- or zero-emission vehicle in the N2 and N3 categories (that is, with a GVW above 3.5 tonnes) or up to EUR 20,000 for the conversion of a conventional truck into an electric vehicle (BEV or FCEV) or gas (CNG or LNG). It is also possible to obtain up a subsidy of up to EUR 70,000 for building charging infrastructure.

Italy

The Ministry of Infrastructure and Transport (Ministero Delle Infrastrutture e Dei Trasporti, MIT) in Italy has allocated EUR 50 million for 2021-2026 for a programme to encourage the replacement and scrapping of polluting heavy

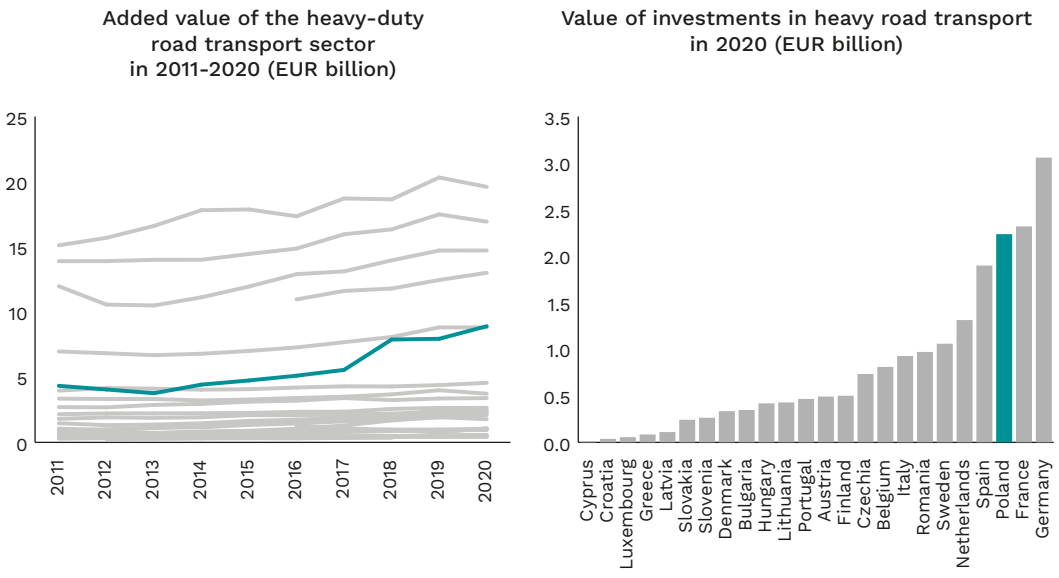
transport vehicles. Road freight transport companies can apply for support for the purchase of electrified vehicles (BEV and PHEV) and trucks powered by LNG or CNG in the N2 and N3 categories. The value of the subsidy is EUR 4000-24,000 and depends on the type of drive and the vehicle's GVW. It is possible to receive an additional EUR 1000 if a diesel vehicle that does not meet the Euro 6 standard is scrapped at the same time.

Overview of the heavy transport sector in Poland and Europe

The Polish transport sector compared to the rest of the EU and companies' condition

The added value of the Polish heavy-duty road transport sector is the fifth highest in the EU. In 2020, it amounted to EUR 9 billion, less than in Germany (EUR 20 billion), France (EUR 17 billion), Italy (EUR 15 billion) and Spain (EUR 13 billion). In 2020, up to 25% of the sector's value added, approximately EUR 2.2 billion, was allocated to investments in Poland (such as new trucks or logistics centres). In other EU countries, this fluctuated around 15-17%. Only more was invested in Germany and France than in Poland in nominal terms: EUR 3.1 billion and EUR 2.3 billion, respectively.

Chart 5. High investment costs are not translating into high value added in the heavy-duty road transport sector in every country

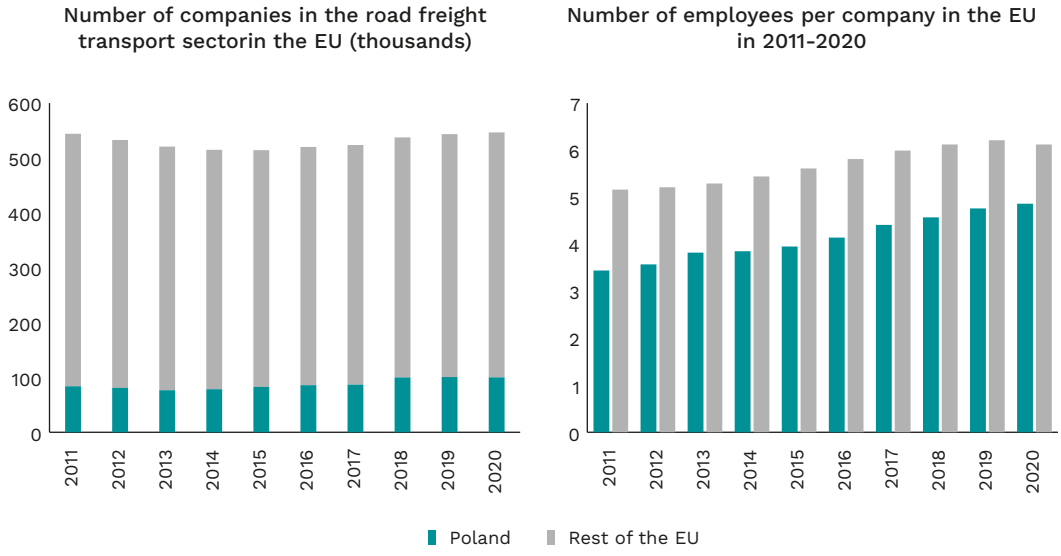


Note: in the chart on the left, Poland is marked in green and the grey lines represent individual EU countries, without Malta and Cyprus.

Source: prepared by PEI based on Eurostat data.

In 2020, there were over 100,000 enterprises in the road freight transport industry in Poland. This represented as many as 18% of all companies in the sector in the EU (547,000). In Poland, the number of employees per company was 4.9 people in 2020 (in other EU countries, it was 6.1). This may point to greater fragmentation in the Polish sector. However, this difference is gradually decreasing: in 2011, there were 3.4 people working at each Polish company on average, and 5.2 in other EU countries.

Chart 6. Polish companies make up 18% of companies in the EU road transport market



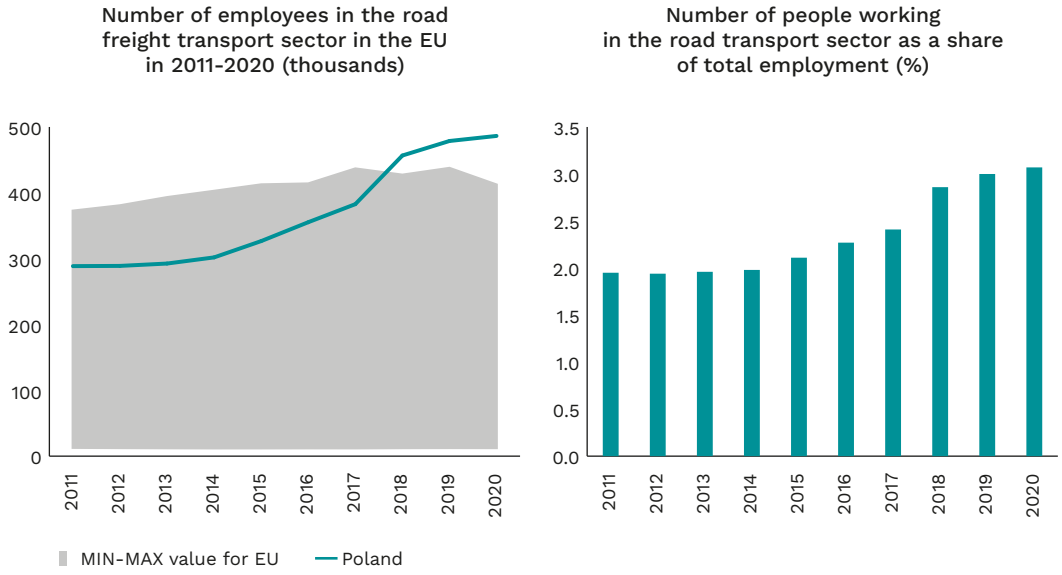
Source: prepared by PEI based on Eurostat data.

The road freight transport sector in Poland employs the largest number of employees of this type of industry in the entire EU. In 2020, over 486,000 people worked there, 74,000 (or 18%) more than in Germany, which was in second place. People employed in Poland account for 15% of all employment in the goods transport sector in the EU. Poland became the leader in 2018, after a sharp increase in the number of employees – by 19% year on year.

The freight transport sector is becoming increasingly important in the Polish employment structure. The share of people working in the sector increased from less than 2% in 2011 to over 3% in 2020. The growing number of employees is associated with the high demand for them, including professional drivers. According to estimates by analysts and representatives of

the sector, there may still be a shortage of 100,000-150,000 truck drivers in Poland (www1; www2; www3).

Chart 7. The Polish road transport sector employs 486,000 people

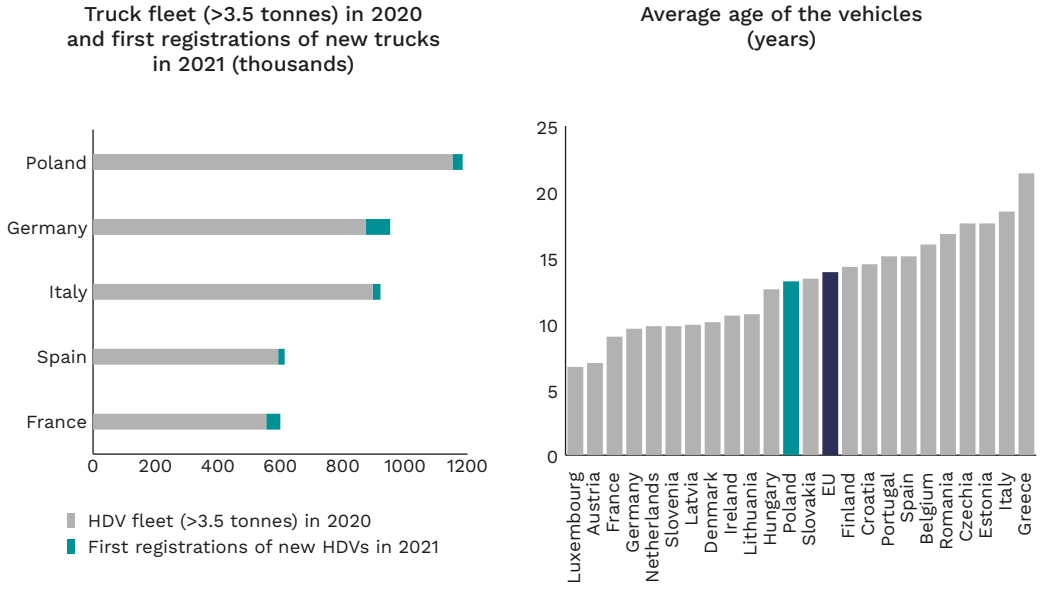


Note: the grey area shows the range of minimum and maximum values for EU countries, excluding Malta and Cyprus.

Source: prepared by PEI based on Eurostat data.

Poland has the largest fleet of trucks with a GVW above 3.5 tonnes in the entire EU. In 2021, it consisted of nearly 1.15 million trucks, an increase of 33,000 year on year. The average age of this type of vehicle in Poland is slightly below the EU average: 13.2 compared to 13.9 years, but more than in the rival markets of Germany (9.6 years) and France (9 years). For example, in Germany, the second country in terms of the size of its fleet, the number of new trucks registered in 2021 (79,000) was the highest in the EU, nearly 2.4 times higher than in Poland.

Chart 8. The Polish truck fleet is the largest in the EU



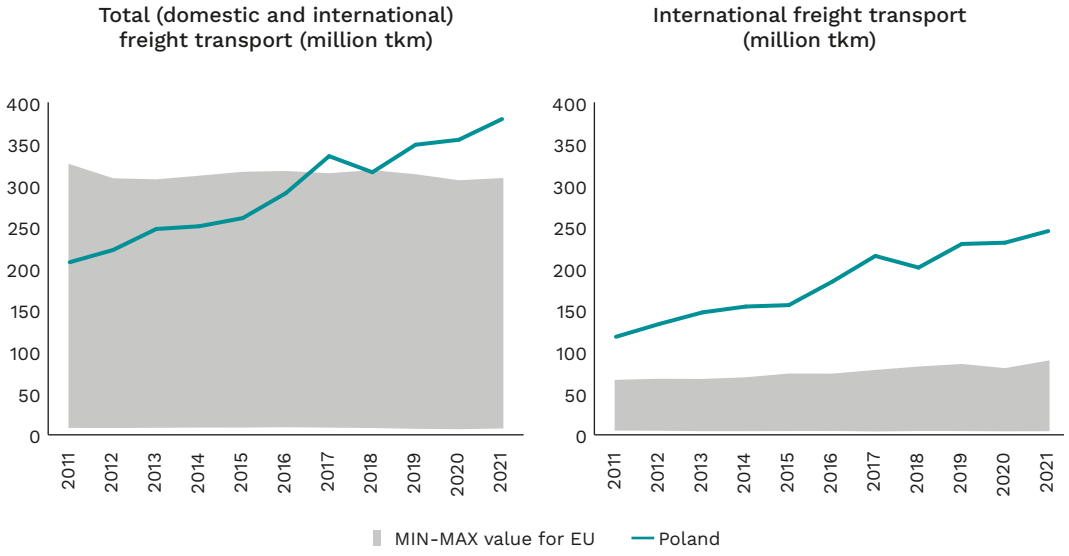
Source: prepared by PEI based on ACEA data.

Transit of goods within the EU and international trade

Since 2017, Polish companies have had the highest transport activity in the EU. In 2021, the number of tonne-kilometres amounted to nearly 380 billion, 24% more than the runner-up, German transport. While approximately 135 billion tkm less than the EU average are transported within the country, Polish transport clearly dominates in foreign transport. According to Eurostat data, in 2021, Polish trucks covered 245 billion tkm, almost 2.8 times more than Spanish ones, which came second.

International transport accounts for almost 65% of the Polish road freight market. Foreign contractors are eager to use Polish services. The structure of Polish international transport differs from that in Spain or Germany. In these countries, the transport of goods loaded and unloaded in the reporting country accounted for approximately 90% of transport. In Poland, it was approximately 60%; the remaining transport was carried out as part of operations within neighbouring countries (cabotage) and between them (cross-trade).

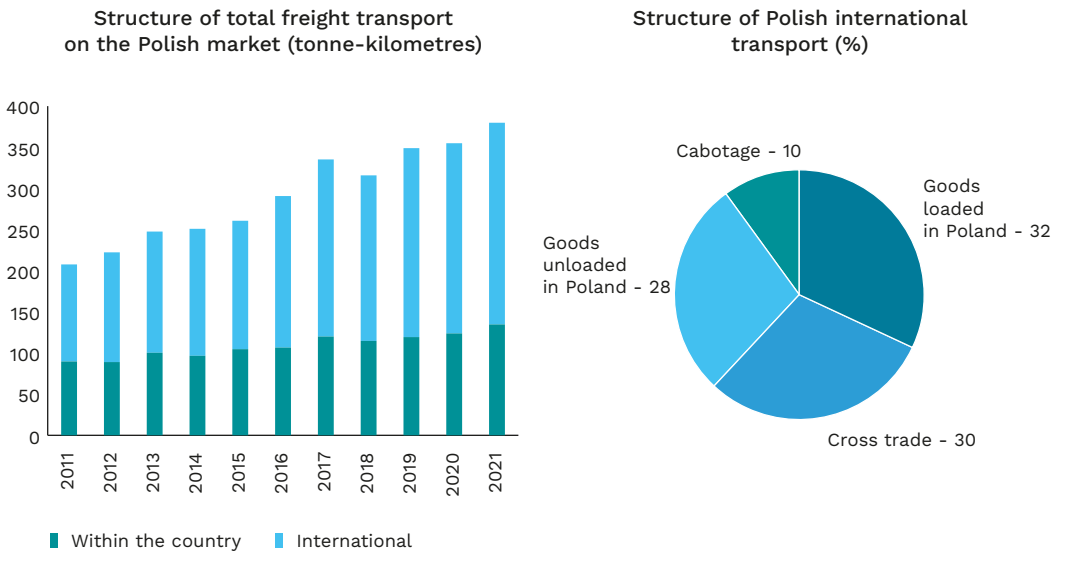
Chart 9. Poland is the leader in international transport



Note: the grey area shows the range of minimum and maximum values for EU countries, excluding Malta and Cyprus.

Source: prepared by PEI based on Eurostat data.

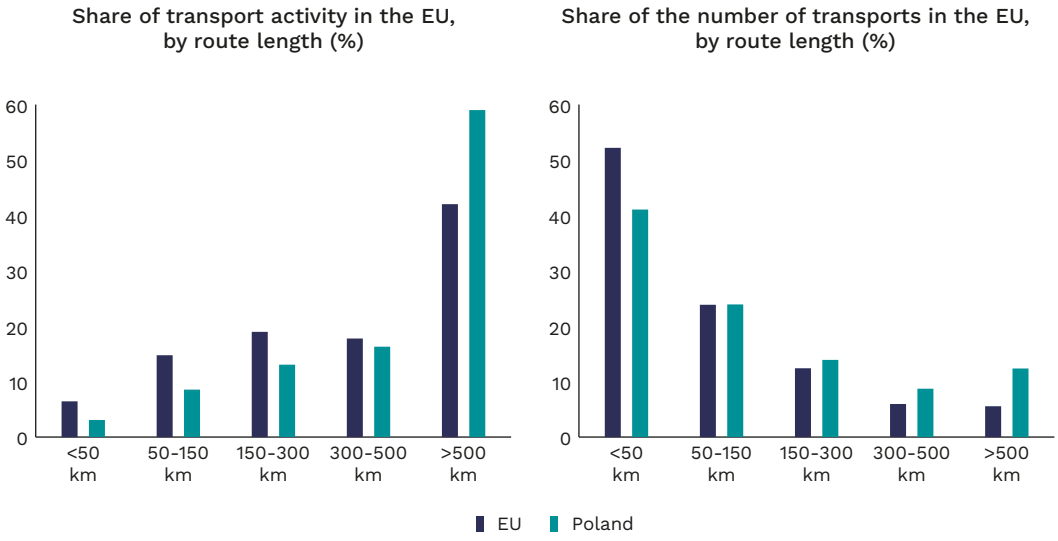
Chart 10. Nearly 1/3 of the goods transported abroad are loaded in Poland



Source: prepared by PEI based on Eurostat data.

Polish carriers make more long journeys than carriers in other European countries. According to Eurostat data, in the Polish sector, routes over 500 km account for over 12% of transport and 60% of the total activity expressed in tonne-kilometres. In the EU, this is less than 6% and around 42%, respectively. Short-distance deliveries play a smaller role in the Polish transport structure. The structure of transport activity and the number of deliveries are the result of the large tonnage of goods transported on long routes (over 500 km), which increases the impact of long-distance routes on transport activity.

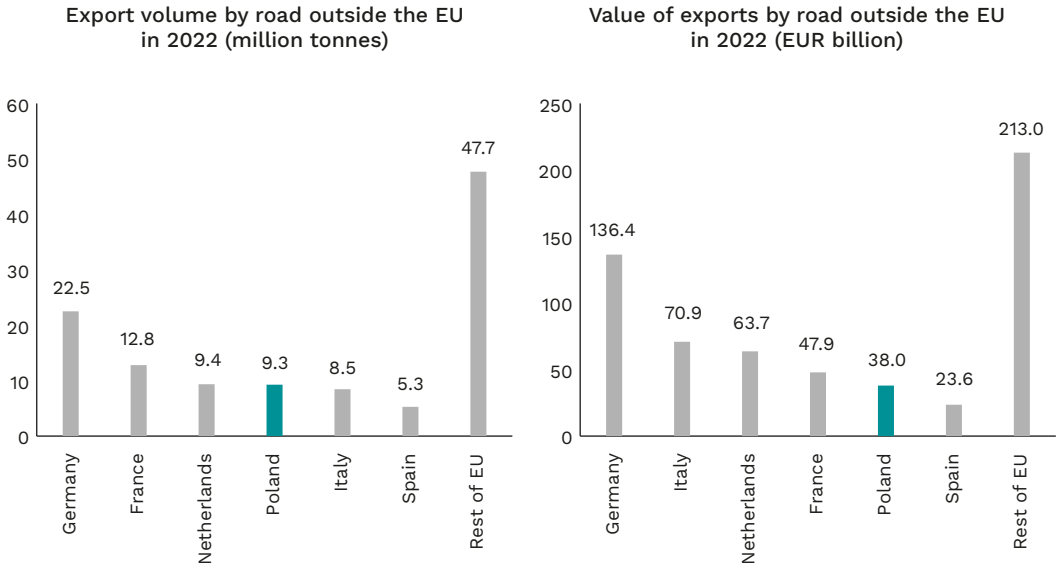
Chart 11. The routes operated by Polish carriers are longer than the EU average



Source: prepared by PEI based on Eurostat data.

In 2022, Poland was among the five largest countries exporting outside the EU, both in terms of volume and value. A total of 9.3 million tonnes of goods worth EUR 38 billion were transported by road. Germany dominated in both rankings. In Italy, the high value of exports can be justified by citing the high share of luxury goods. Polish exports were characterised by dominance in industrial categories: Poland sent the largest volume of vehicles (with parts and accessories), ships and boats, as well as weapons and ammunition outside the EU. In addition, Poland was the leader in the supply of meat and meat products. Apart from supplies of ships, boats, weapons and ammunition, Poland delivered the most trains and trams outside the EU, in terms of export value.

Chart 12. Poland exported goods worth EUR 38 billion outside the EU in 2022



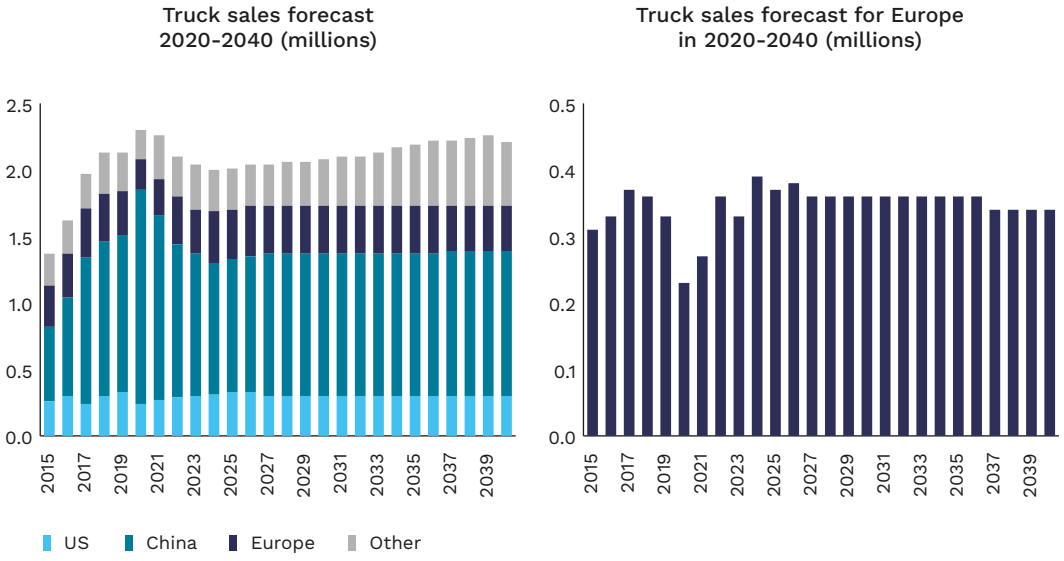
Source: prepared by PEI based on Eurostat data.

Market forecasts for the transport sector

In 2023, we will see a reduction in the growth in demand for road freight transport in Europe, both among consumers and producers. According to the Ti, Upply, IRU (2023) forecast, the demand for road freight transport increase by 1.1% in 2023, compared to 3.4% in 2022. However, the EC (2023) indicates that the demand for heavy transport activity will increase by 29% by 2030, and by nearly 50% by 2050.

According to BloombergNEF data, the number of heavy commercial vehicles sold in the US and Europe has fluctuated around 0.35 million per year since 2015, with a significant decline in 2020-2021 linked to the pandemic. In China, truck sales increased as much as threefold between 2015 and 2020. This was the result of the rapidly growing economy, high industrial and production rates, and public incentives to purchase modern trucks. According to BNEF, by 2040, every fifth truck in the world will be sold in Europe (BNEF, 2022a).

Chart 13. By 2040, every fifth truck will be sold in Europe



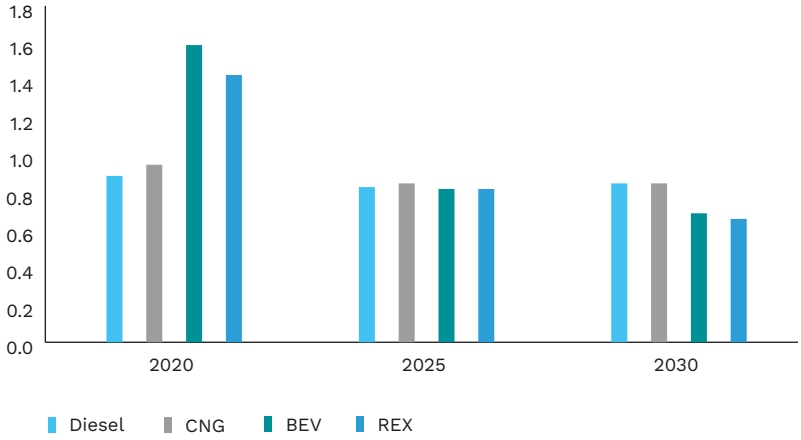
Note: The "Other" category includes South Korea, Japan, Australia and India. The data in the chart does not include other countries.

Source: prepared by PEI based on BNEF data.

Electric HDVs will be cheaper to operate than conventional ones. BloombergNEF assumes a decline in the total cost of ownership of electric trucks with a GVW above 15 tonnes of up to 57% by 2030. By 2025, electric delivery vehicles, regardless of size, will be more competitive than combustion vehicles due to the development of technology. **During intermittent driving, electric vehicles are more efficient.** This particularly applies to deliveries made during urban work cycles, which are characterised by frequent stops and starts. These factors have a significant influence on fuel consumption in conventional cars; in contrast, they increase the energy consumption of electric vehicles to a lesser extent. Charging a battery that has already been warmed up appropriately can also increase a zero-emission vehicle's range on long routes. For suburban routes, electric vehicles will be cheaper to run by 2030. BNEF's total cost of ownership (TOC) includes the money spent on purchasing and operating a vehicle, including fuel and tire replacement costs. The result is divided by the distance travelled by the vehicle during its use (BNEF, 2022a).

Chart 14. Electric trucks are becoming cheaper to operate

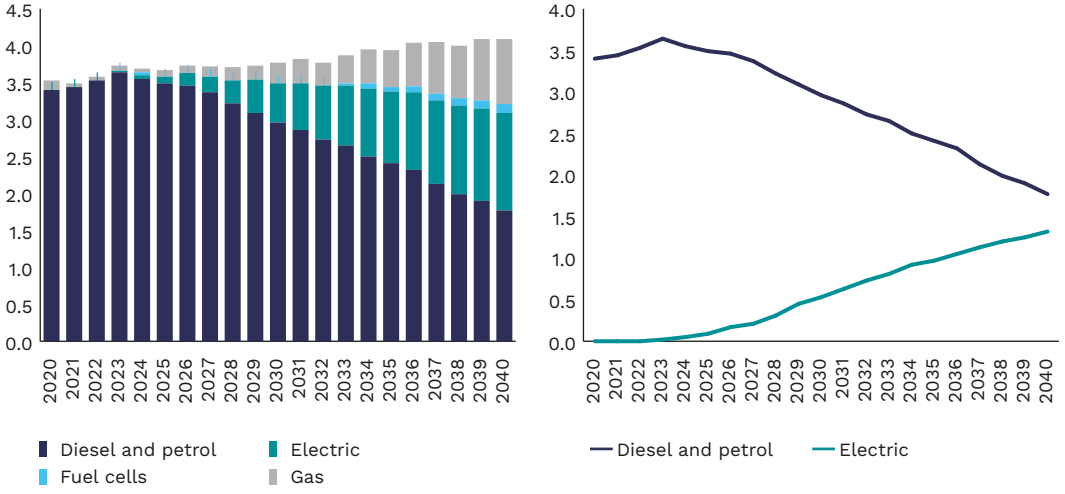
TCO of a commercial HDV in China (USD/km)



Source: prepared by PEI based on BNEF data.

Chart 15. By 2040, every third truck sold will be electric

Global heavy commercial vehicle sales forecast for 2020-2040 (millions)



Source: prepared by PEI based on BNEF data.

The development of technology and decreasing battery prices are helping lower the costs of using electric trucks, compared to conventional ones. At the same time, the total cost of maintaining conventional cars is gradually increasing due to climate rules, including regulations that seek to reduce emissions. We are currently observing these trends in the passenger car market. In heavy transport, the changes will follow a similar – but less predictable – path due to the development of battery and hydrogen technologies and, as a result, declining charging costs (MAE, 2023b).

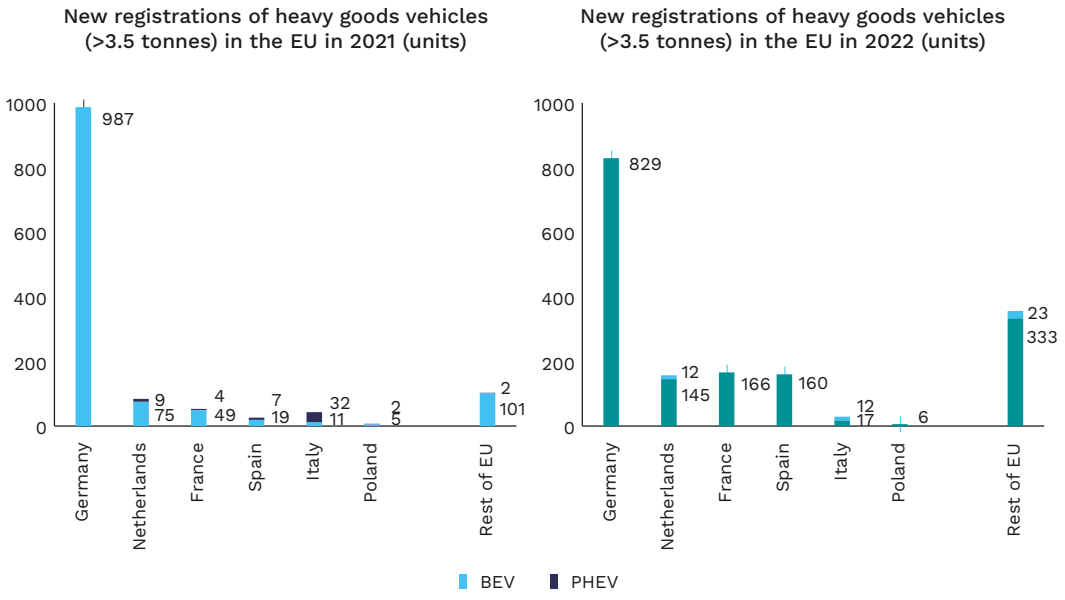
According to BloombergNEF projections, by 2040, more than 12.5 million electric trucks will be sold worldwide. In 2040, they will account for 35% of sales (BNEF, 2022a). At the same time, sales of conventional vehicles will continue to decline. Forecasts by international institutions show a similar trend in the transformation of the transport sector, including the transport of goods by trucks.

The future of heavy road transport in Poland

Development of fleet and charging infrastructure for heavy road transport vehicles

According to ACEA data, in 2021-2022, 2903 electric and 103 hybrid trucks were registered in the EU. In the electrification of the heavy transport fleet, Germany dominates, accounting for 63% of EU registrations (1816 registrations of electric trucks in 2021-2022), followed by Sweden (226), the Netherlands (220), France (215), Spain (179). This amounts to 2656 electric vehicles, 91% of all registrations in the EU. According to the ACEA, six electric trucks were purchased in Poland in 2022, and five the previous year.

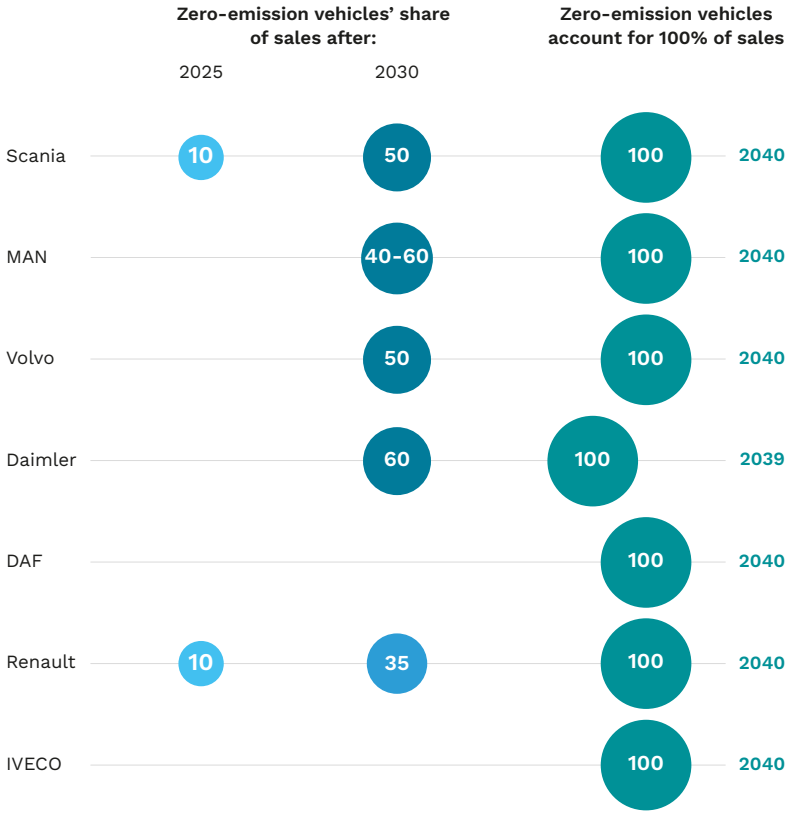
Chart 16. Germany purchased over 1800 electric trucks in 2021-2022



Source: prepared by PEI based on ACEA.

According to IHS Markit data, 346 electric trucks (with a GVW of at least 16 tonnes) were registered in Europe in 2021, an increase of 193% compared to 2020. However, zero-emission vehicles' share in the truck segment still remains very low. In 2021, it amounted to just 0.5% of the total number of registrations. In the passenger car segment, it is incomparably higher: it was 9.1% in 2021 and increased to 9.9% in the first half of 2022.

Infographic 2. Truck manufacturers plan for zero-emission vehicles to account for 100% of sales by 2040
Leading HDV manufacturers' electromobility plans (%)

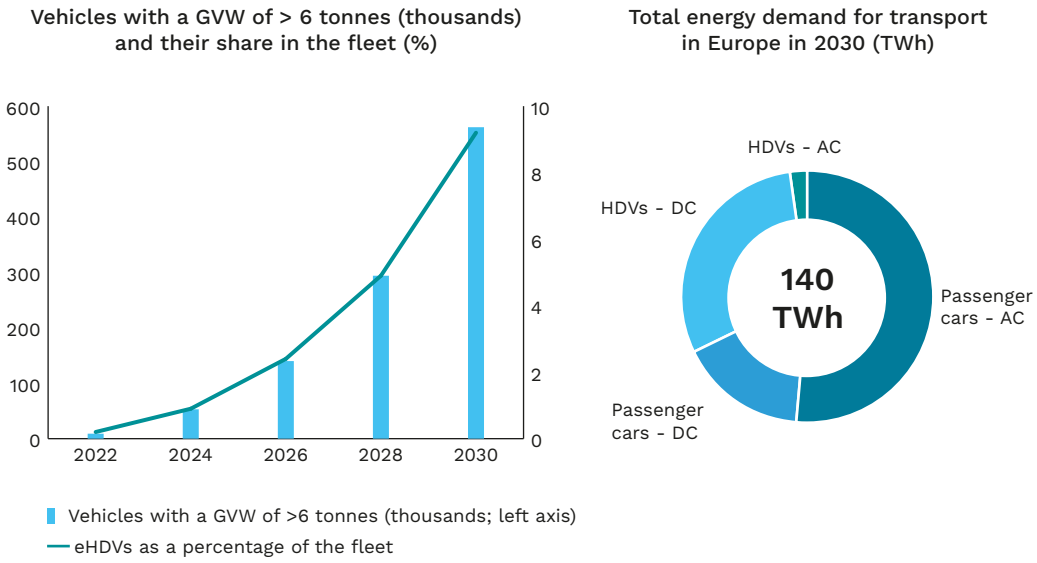


Source: prepared by PEI based on information from the companies.

Leading heavy vehicle manufacturers have announced their electromobility plans. In 2040, at least seven major manufacturers plan to sell only electric vehicles. After 2030, approximately half of Scania, MAN and Volvo models sold will be powered by electric engines. The increase in the range of models available in the coming years could increase electric trucks' share of the market.

With the development of the eHDV fleet, the charging infrastructure for trucks is forecast to expand. According to a projection by Arthur D. Little (2021), by 2030 the fleet of electric HDVs in Europe will increase more than 60-fold, compared to the current level; by then, charging electric trucks will become the most important area for fast charging (DC), with a demand of 42 TWh per year. Heavy road transport will consume 65% of the energy for constant voltage charging, while demand from passenger vehicles will account for 35% (23 TWh). The regulations in the AFIR document will impose specific requirements on each member state regarding the expansion of the network of charging stations for zero-emission heavy transport; meanwhile, no publicly-available charging stations for trucks have been put into operation in Poland.

Chart 17. In 2030, heavy transport will account for 32% of vehicles' energy demand in Europe



Source: prepared by PEI based on Arthur. D. Little (2021).

Impact of the electrification of heavy road transport on the economy

European Commission simulation

The European Commission simulated the impact of the electrification of heavy transport on employment and GDP in the whole EU. The overall targets of the three EC scenarios presented apply to the average CO_2 emissions of new HDVs (trucks and buses, excluding the impact of energy efficiency standards on trailers).

Table 2. In the most extreme scenario, the EC assumes an emission reduction of 100% in the heavy transport sector in 2040, compared to 2019-2020

Reduction in emission intensity compared to the reference period, 2019-2020 (%)

Emission reduction scenarios	2025	2030	2035	2040
Baseline scenario	15	30	30	30
TL_Low	15	35	50	70
TL_Med	15	40	60	80
TL_High	15	50	70	100

Note: The names TL_Low, TL_Med, TL_High are taken from the simulation and represent three scenarios for the electrification of heavy transport. They differ in their emission reduction targets for 2025, 2030, 2035 and 2040.

Source: prepared by PEI based on EC (2023).

All three scenarios show the positive impact of the electrification of heavy transport on the EU's GDP. The European Commission expects that this move will be accelerated by stricter CO_2 reduction targets for heavy-duty trucks than in the baseline scenario. According to the Commission, thanks to the lower fuel costs, consumer spending in other segments will increase, which will change the structure of their shopping basket. The costs of importing oil and fuels will fall, and investments in network infrastructure, charging and refueling stations, and the technological development of vehicles will increase. This will drive GDP growth, and the electrification will also ensure growth in employment, despite the decreasing number of jobs in the refining sectors.

In the Commission's scenarios, GDP increases slightly, by between +0.01% and +0.02% in 2030, between +0.06% and +0.11% in 2040, and between +0.09% and +0.10% in 2050, compared to the assumed emission reduction in the baseline scenario. A natural consequence of reduced fuel consumption is a decline in the oil refining sector's performance in all the scenarios. It will lose 2.2-3.7% of its production by 2040. However, production in the energy and hydrogen supply sector (by 0.4-11% by 2040) – and, more moderately, in the metal and electrical equipment sector (by 0.1-0.4% by 2040) – will be growing.

The Commission has also calculated that the electrification of the HDV fleet could increase total employment in the EU by 9000-13,000 jobs in 2030, 38,000-83,000 in 2040 and 81,000-121,000 in 2050. Employment will primarily increase in the energy and electronics sectors, which will offset the decline in the number of jobs in the refining and automotive sectors.

The positive impact of investing in zero-emission trucks is clear, but the question of the extent to which individual European countries will benefit remains to be resolved.

Literature review and baseline scenarios

Poland's role in the future of the electrification of heavy transport in Europe is ambiguous. On the one hand, the Polish sector is dominant, in terms of employment growth and the expansion of the fleet of conventional vehicles. On the other hand, the sector's value added in Poland remains lower than in more developed EU countries, and delays in the electrification of the fleet could weaken the Polish TSL sector in the coming years. For this reason, we decided to assess the impact of investing in a zero-emission fleet on employment, transport activity and value added in the sector.

The impact of the development of the heavy vehicle fleet on employment and value added is widely described in the literature. The European Commission's (2023) calculations indicate that the impact on employment results from the development of the supply chain, especially in the area of mechanical and electrical equipment, as well as the battery industry. The EC has also shown the relationship between the sector's development and increasing consumer spending, which affects GDP growth. Kampman et al. (2011) noted that a growing fleet of electric vehicles is associated with higher investment potential in this sector, which translates into increasing value added and higher tax revenue for the state treasury. De Bruyn et al. (2012) described the indirect impact of a growing fleet of electric vehicles on the increase in consumer spending, employment, and growing investments and spending on R&D, which increases the sector's value added.

In this report, we assume that a growing truck fleet directly affects transport activity, employment and value added. Activity is expressed in tonne-kilometres; that is, the product of the volume of goods and the distance traveled by vehicles. A higher number of trucks increases the potential tonnage transported and naturally affects the number of jobs. An increase or decrease in transport activity is accompanied by an increase or decrease in new registrations. The relationship is intuitive, and the correlation is also confirmed by Eurostat data for 2011-2020. Growing transport activity also has a positive impact on added value – by increasing the number of services provided.

We performed calculations for the countries with the largest heavy-duty road transport sector in Europe in terms of value added, transport activity and employment, according to Eurostat data for 2020, and the registration of new vehicles, according to ACEA data. Ultimately, we analysed six countries: Germany, France, Italy, Spain, the Netherlands and Poland, which account for over 70% of the EU market. For simplicity, in the rest of this report, we refer to these countries as the EU market.

In accordance with the literature, we described the degree of electrification as new registrations of electric HDVs and their share in total truck purchases. We assumed the registration volume in Europe in 2021-2035 based on BNEF forecasts. We also checked the share of electric vehicles in the entire fleet using the EC simulation (2023). In accordance with the EU regulations introduced, we assume that the share of zero-emission trucks in the growing freight transport market will increase gradually, replacing combustion vehicles whenever possible.

We used estimates from the European Centre for the Development of Vocational Education (CEDEFOP) based on the *Future employment needs* study as the base forecast for employment levels until 2035. The project presents projections of future employment needs in EU member states in 2022-2035, broken down by individual professions. For the purposes of this report, we took into account the "Drivers and vehicle operators" category. According to CEDEFOP estimates, there may be nearly 1.5 million new jobs across the EU by 2035, an increase of 50% compared to 2022.

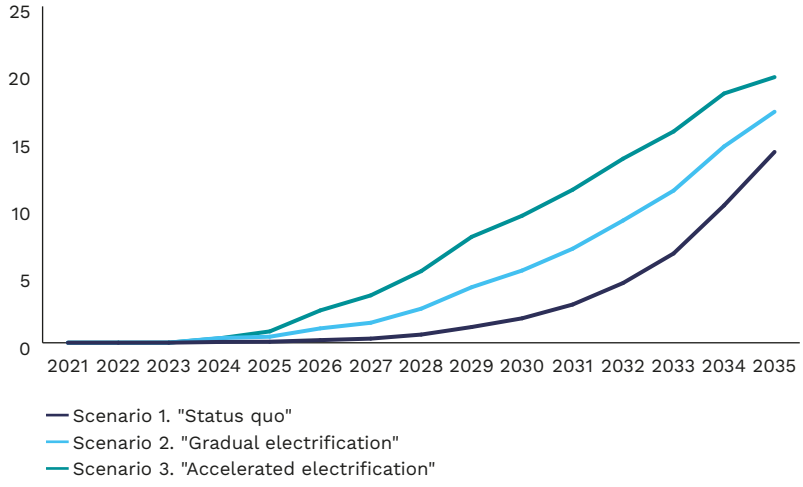
We developed the baseline scenario for transport activity based on the increase in demand for heavy road transport forecast by the Commission, which indicates that it could increase by 29% by 2030 and by 50% by 2050, compared to 2015 (EC, 2023). Assuming linear growth, we assumed growth in demand of 34.25% for 2035. The analysed countries' share in transport activity in the EU as a whole is based on the available Eurostat data from 2021.

We based the baseline scenario for value added on the relationship between the growth in value added and transport activity in 2011-2020, based on Eurostat data.

Scenarios for the electrification of the heavy transport fleet

We prepared three scenarios for the development of the electric truck fleet in Poland. The baseline scenario for the registration of electric vehicles in the countries analysed in 2023-2035 changes linearly, in line with the trends in 2021-2022, according to ACEA data. We assumed that, in the run-up to 2035, the structure of the registration of electric trucks will be the same as that of general registrations today (according to Eurostat data). The variable is the share of electric vehicles in new registrations in Poland. Depending on the scenario, we assumed that, by 2035, the registration of electric lorries in Poland will reach 10%, 20% and 30% in 2035. The different levels of electrification result in the registration of 42,600, 74,500 or 108,800 zero-emission trucks in Poland in 2023-2035.

Chart 18. In the most optimistic scenario, truck registration will reach nearly 20,000 in 2035
Registration of new electric trucks in Poland in the three scenarios (thousands)



Source: prepared by PEI.

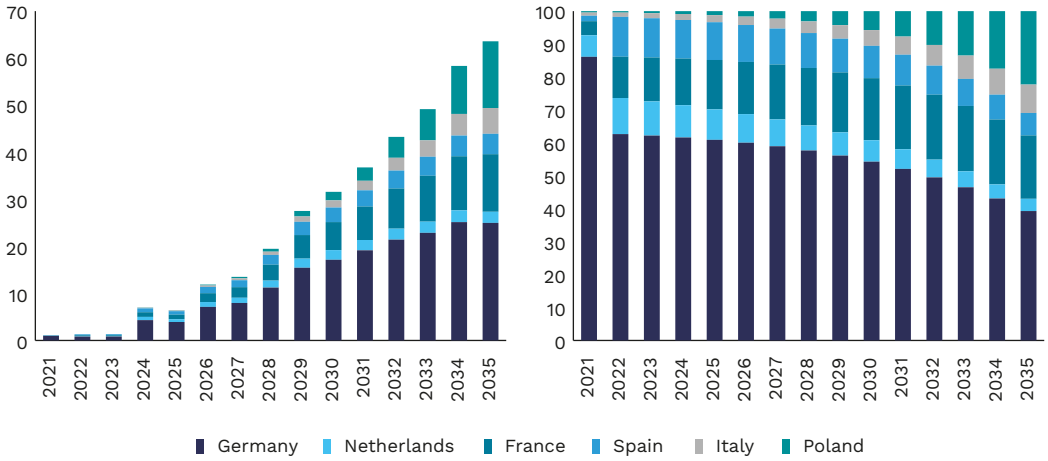
We calculated the relationship between new registrations and selected macroeconomic indicators based on Eurostat data for 2011-2020 and forecasts until 2035, based on CEDEFOP and the EC. For each country analysed, the share of electric vehicles in total vehicles registered allowed us to calculate the extent to which macroeconomic indicators will change relative to the slow electrification scenario: Scenario 1. "Status quo". This enabled us to conclude how many jobs Poland could lose or gain, how transport activity would change, and its impact on the sector's value added.

Scenario 1. "Status quo"

In Scenario 1. "Status quo", we assumed that the fleet of electric vehicles in the Polish heavy-duty road transport sector would gradually increase from less than 0.5% of EU registrations in 2021-2022 to approximately 15% in 2035. In this scenario, the changes are brought about by EU regulations on the reduction of emissions by the heavy transport fleet, while the lack of additional support in the country for the purchase of new vehicles and the construction of publicly-available charging network infrastructure delays the electrification process.

Chart 19. In 2035, 43,000 electric trucks will be registered in Poland in the "Status quo" scenario

Registration of electric trucks in the countries surveyed and forecast until 2035 in Scenario 1. "Status quo" (thousands and %)



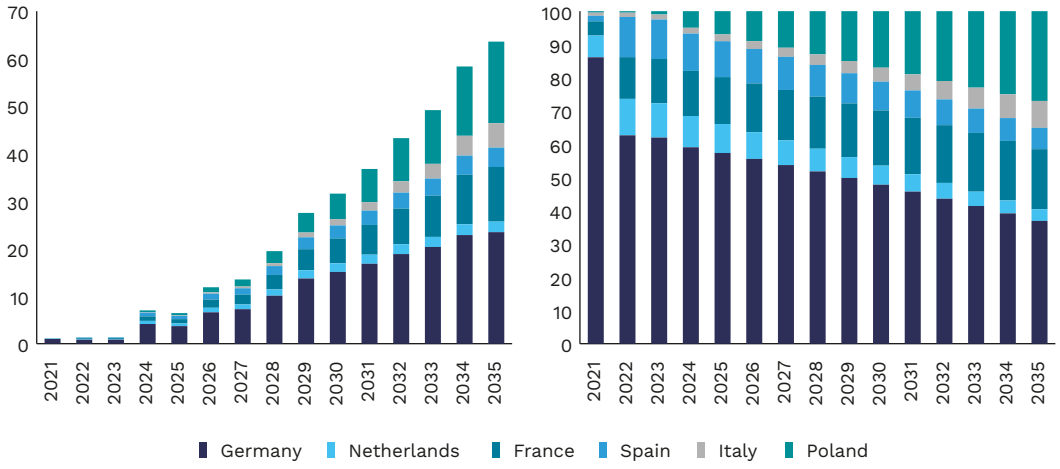
Source: prepared by PEI.

According to the BNEF forecast, there will be almost 580,000 electric trucks registered in Europe by 2035, most of them in Germany (183,000) and France (70,000). In 2035, Poland will advance to second place when it comes to eHDV registrations, registering more electric trucks that year than France (14,200 vs. 12,200). The total volume of eHDVs registered in 2023-2035 will reach over 10% of EU registrations.

Scenario 2. "Gradual electrification"

In Scenario 2. "Gradual electrification", after the registration of 11 electric trucks in Poland in 2021-2022, the electrification rate increases linearly, with Poland's share in new eHDV registrations in the EU rising from 5% in 2023 to 27% in 2035 Although, like in the first scenario, the main driver of the changes are EU regulations, additional support from the state in the form of a subsidy system for the purchase of eHDV may be responsible for the higher growth, the development of charging infrastructure, and subsidies depending on the level of the reduction in CO_2 emissions. This reduces the investment costs of electrifying the truck fleet and enables more entities to purchase electric trucks.

Chart 20. In 2035, there will be 75,000 electric trucks in Poland in the "Gradual electrification" scenario
Registration of electric trucks in the countries surveyed and forecast until 2035 in Scenario 2. "Gradual electrification" (thousands and %)



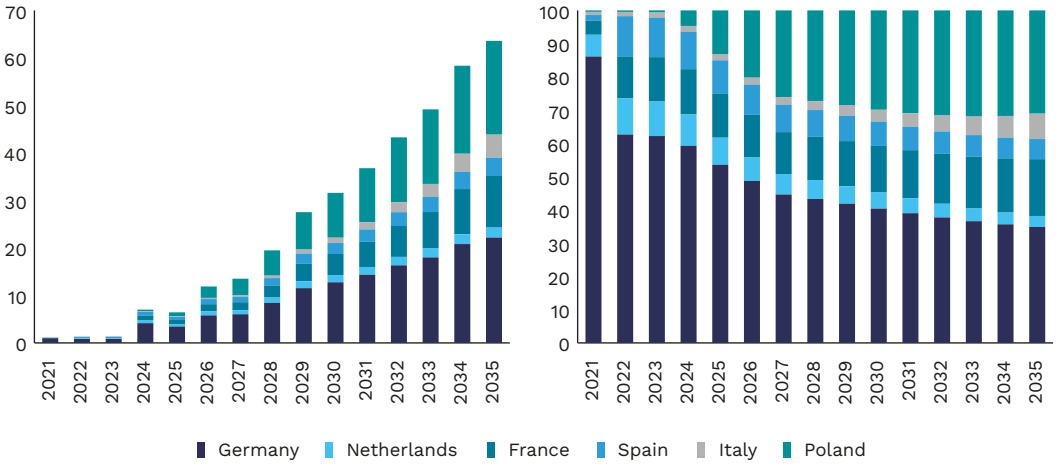
Source: prepared by PEI.

Of the 580,000 new registrations of electric trucks in the EU between 2023 and 2035, nearly 166,000 eHDVs will go to Germany. The introduction of subsidies, combined with the strong road transport market in Poland, will contribute to investment in approximately 75,000 electric trucks in 2023-2035. In the Netherlands, Spain, Italy and France, registrations of new eHDVs will fluctuate around 20,000-30,000. The total volume of eHDVs registered in Poland in 2023-2035 will reach over 20% of EU registrations.

Scenario 3. "Accelerated electrification"

In Scenario 3. "Accelerated electrification", the Polish heavy transport sector is rapidly increasing eHDV registrations as early as 2023-2024, thanks to government subsidies for the purchase of electric trucks and investments in publicly-available charging stations. The growth is modelled on the rate of electrification in the economies of Germany and France in Scenario 1. "Status quo". Scenario 3 shows the electrification potential in Poland, thanks to the introduction of regulations modelled on effective solutions in the largest European countries. The electrification is a direct response to EU regulations, but the sector's high level of development is initially due to government

Chart 21. In 2035, there will be 109,000 electric trucks in Poland in the "Accelerated electrification" scenario
Registration of electric trucks in the countries surveyed and forecast until 2035 in Scenario 3. "Accelerated electrification" (thousands and %)



Source: prepared by PEI.

subsidies, which increase companies' investment potential. The continued electrification in the long term is the result of facilitations for representatives of the sector, in the form of the abolition of road tolls for eHDVs, access to restricted traffic zones, tax relief, and the introduction of regulations making it easier to connect charging stations for eHDVs to the power grid.

By 2035, nearly 109,000 electric trucks will be registered in Poland, more than twice as many as in France and approximately 15,000 fewer than in Germany. In Spain, the number of new eHDV registrations in 2021-2035 will amount to up to 22,000. In the Netherlands and Italy, this will be approximately 14,000-15,000 each. In the accelerated electrification scenario, the total volume of eHDVs registered in Poland in 2023-2035 will reach over 30% of EU registrations.

The impact of electrification of heavy road transport on employment, activity and value added in the sector

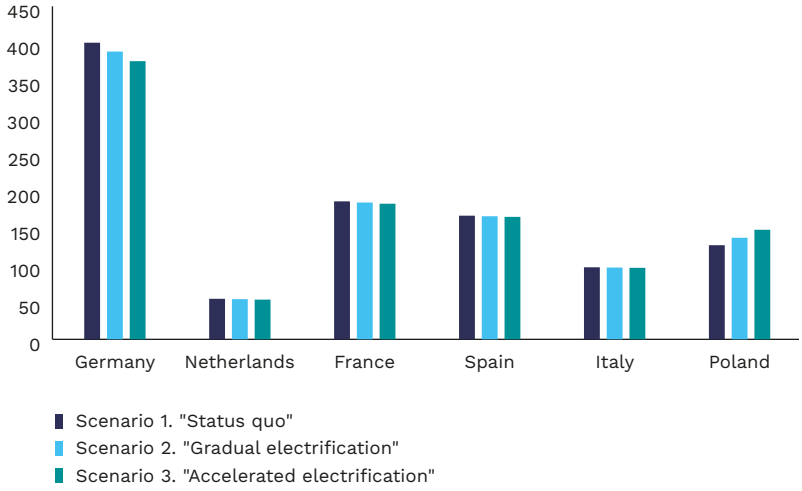
Employment

Poland can increase employment in the heavy transport sector by electrifying its fleet. The country's growing share in the EU transport market and larger fleet require an increase in the number of jobs; above all, truck driver jobs. Gradual and accelerated electrification could increase employment in Poland by 10,100 and 20,900 respectively by 2035, compared to the "Status quo" scenario. According to the CEDEFOP study, the increase in the number of jobs in the Polish road freight transport sector will be the fourth-largest in the EU, after Germany, France and Spain. Electrification will reduce the difference in the number of employees between Poland and competing economies.

Electrification affects the development of national labour markets. We assume that the high level of investment in the fleet of eHDVs in Germany will result from support programmes, including subsidies for the purchase of the vehicles. Thanks to these actions – already undertaken in 2021-2022, before other EU countries – employment in Germany will increase by 52,000-88,000 jobs in the scenarios, compared to CEDEFOP assumptions. A lower degree of electrification results in this process having a smaller impact on the development of the heavy transport sector; the greater the share of electric vehicles, the disproportionately greater role electrification plays in the sector. For this reason, in the other countries surveyed, the effect of electrification is smaller than in Germany or Poland.

Chart 22. Poland could gain an additional 21,000 jobs in the "Accelerated electrification" scenario

Change in the number of new jobs created in 2021-2035 (thousands)



Source: prepared by PEI.

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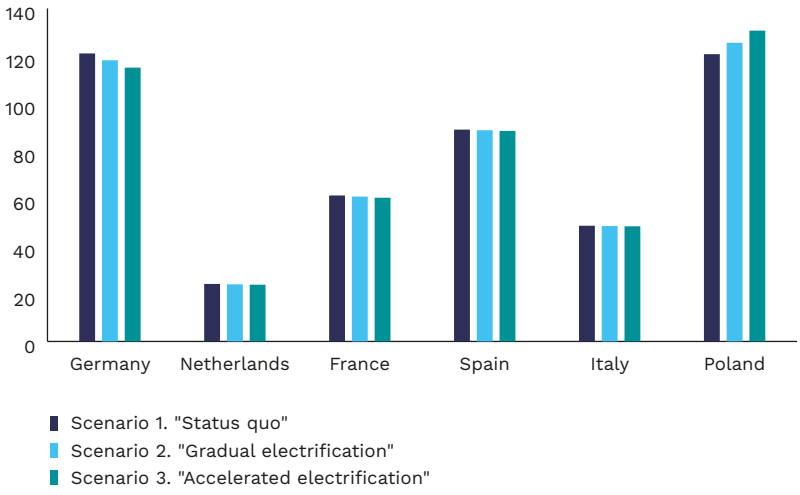
Transport activity

The slow electrification of the truck fleet in Poland could have a negative impact on the sector's development. The lack of electric trucks reduces the possibility of making some deliveries on certain routes. Conventional HDVs' limited access to cities and EU regulations on emission reductions will reduce the number of potential transport routes, which will reduce the activity of a fleet based solely on combustion vehicles.

According to forecasts based on EC data, by 2035, the Polish sector could increase transport activity by 130 billion tkm, the most among the countries surveyed. Accelerated electrification will enable Poland to improve this result. Transport activity will increase by 9.9 billion tkm, compared to Scenario 1. "Status quo", and by 4.8 billion tkm compared to Scenario 2. "Gradual electrification".

Chart 23. Transport activity in Poland could increase by an additional 9 billion tkm in the "Accelerated electrification" scenario
Change in transport activity in 2021-2035 (million tkm)



Source: prepared by PEI.

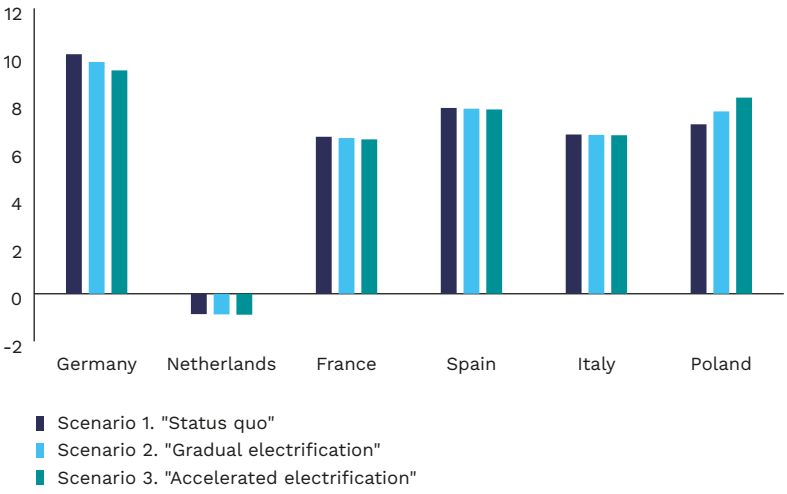
Electrification is an opportunity for Poland to remain the European leader in the heavy transport sector. New electric vehicles will be preferred over combustion vehicles due to their higher competitiveness and ability to serve segments that are strict in terms of EU emission reduction requirements. The impact of "gradual electrification" on the heavy transport sector in the other countries surveyed is limited. Poland, Germany and Spain dominate the projections for the increase in transport activity in 2035. The lower degree of electrification in the countries of the Iberian Peninsula than in the other countries surveyed, including Germany, results in this process having less of an impact on the sector's development. Since Poland is primarily competing against Germany, which already has a high degree of electrification, it also needs to accelerate electrification to maintain its market position. This race results from the above-mentioned possibility of introducing zones that conventional vehicles cannot enter. Countries with a significant electric vehicle fleet can create these kinds of zones without harming their own market and

thereby limit competition from other countries with high-emission trucks. Depending on the speed of the changes in France and Germany, these two countries will take over increasingly large segments of the EU market – regardless of the scenario, they benefit from electrification, compared to the projection based on the EC guidelines.

Value added

The value added of the Polish road transport sector has been lower than in Germany, France, Spain and Italy in recent years. Maintaining the speed of the changes in the previous decade would increase the Polish sector's value added by EUR 7.7 billion in 2023-2035, which may be the third-highest result among the countries analysed. According to the literature, a higher level of electrification increases R&D investments and the efficiency of the zero-emission fleet, which increases the sector's value added in subsequent years. In addition, higher transport activity related to the displacement of combustion vehicles by electric trucks in the case of the adoption of zero-emission zones increases the volume of orders and deliveries, resulting in higher value added.

Chart 24. The increase in the value added of the heavy-duty road transport sector in Poland will reach over EUR 8 billion by 2035 in the "Accelerated electrification" scenario
Change in the sector's value added in 2021-2035 (billion EUR)



Source: prepared by PEI.

Through the accelerated electrification of its fleet, the Polish heavy-duty road transport sector could grow by EUR 1.1 billion by 2035, compared to the "Status quo" scenario. Subsidies and regulations supporting the purchase of electric trucks and the development of publicly-available charging stations would enable Poland to maintain a high share in the transport market. Road transport is one of the key sectors of the Polish economy and only accelerated electrification can help increase the potential increase in value added in the run-up to 2035.

Compared to maintaining the current pace, the "Accelerated electrification" scenario would increase the road transport sector's value added by 16% by 2035. In the "Status quo" scenario, the increase in the value added of the sector in Poland would amount to EUR 7.1 billion by 2035. This would mean a slowdown for the sector, compared to the expected values. Gradual electrification would increase the increase in value added by 2035 by an additional EUR 0.5 billion, and accelerated electrification by over EUR 1.1 billion (approximately PLN 5 billion). At the same time, profits will be observed in Germany and the Netherlands, the beneficiaries of each of the scenarios, compared to the projected increase in value added based on historical data. Italy and Spain will have to prepare for the greatest losses.

Impact of electrification of heavy road transport on the energy sector

Increase in demand for electricity

The development of the fleet of electric vehicles will drive demand for electricity, which requires securing generation capacity, as well as electricity transmission and distribution throughout the country. Electric HDV charging will become the key area for fast charging (DC), with a demand of 42 TWh per year in Europe by 2030. Heavy road transport will consume 65% of the energy intended for constant voltage charging (Arthur D. Little, 2021).

Electric trucks may account for approximately 2-4% of total electricity demand in Poland in 2030-2035. Our assumptions are based on the forecast increase in electricity demand in Poland in the PEP2040 (The Energy Policy of Poland until 2040), the projected increase in electricity demand in the eHDV sector in Europe according to Arthur D. Little (2021), and the scenarios for the registration of electric vehicles in Poland. If the status quo is maintained, electricity demand will increase by around 3.1 TWh, or approximately 1.6% of total demand. Gradual electrification, which would result in a greater increase in new electric vehicles registrations, would result in consumption of 5.4 TWh (2.8%) and, in the case of accelerated electrification, 7.9 TWh (around 4% of the total consumption).

The development of publicly-available charging infrastructure should take into account the business profile of companies in the TSL industry. Correlating charging station locations with carriers' plans for the use of electric vehicles on given routes will ensure that the charging infrastructure is used to the appropriate degree. This will also strengthen the synergy effect of the all entities involved in the electrification of heavy road transport (PSPA, 2022). Electric trucks' charging profile must also be taken into account, which means that the vehicle charging time and hours, as well as the technical parameters, must be determined. Above all, this information is important for distribution and transmission network operators, who may find it challenging to manage the demand for electricity during peaks in demand.

Colle et al. (2022) have noted that power grids can cope with the increased demand that will accompany the transition to electric vehicles. However, the challenge is the unpredictable fluctuations in consumption that will result from fleets of electric vehicles charging at the same time, which could potentially destabilise and disrupt the power grid. Electric trucks charging on their route during peak consumption times could constitute a problem. The system will therefore need to provide sufficient, optimal generation, storage and network capacities.

According to data from Polskie Sieci Elektroenergetyczne (PSE), the high-voltage transmission network consisted of 303 lines with a total length of 15,964 km at the end of 2022. 400 kV lines (131 lines with a total length of 8,562 km) and 220 kV (171 lines with a total length of 7,288 km) account for the largest share of the network. The entire system is complemented by 110 high-voltage stations. Based on information from the Polish Electricity Transmission and Distribution Association, Poland's transmission networks are largely outdated (PSE, 2022).

According to data from 2017, 42% of the high-voltage network was over 40 years old, while 34% was 25-40 years old. 31% of medium-voltage network was over 40 years old, while 39% were 25-40 years old. The low-voltage network was the newest, but as much as 66% of it was over 25 years old (31% over 40 years old, and 35% 25-40 years old). Increased investment in the development of Poland's electricity networks is included in the PEP2040 update (PSPA, 2022).

The role of RES in the electrification of transport

Energy production in Poland is mostly based on fossil fuels, dominated by hard coal and lignite, which account for 71.1% (data for 2022). The development of electromobility requires a transition towards renewable energy sources (RES). Although electric cars have zero tailpipe emissions, by being

powered by the electricity grid, with the current electricity generation structure, they contribute to indirect emissions, which should be minimised in the coming years.

In January 2023, the installed capacity of energy from RES amounted to 24,472 MW, or 40.3% of the total installed capacity, according to ARE. Solar energy accounted for the largest share: 51%. Energy production from RES amounted to 37,472 TWh in 2022, which represented 21.1% of the country's energy production. As the share of RES increases, the use of electric vehicles will offer increasing environmental benefits in Poland.

Experts at Transport & Environment estimated in 2022 that, with Poland's electricity mix, using an electric vehicle reduced emissions in Poland by 40% over the course of its life cycle, compared to conventional vehicles, while the EU average was -69% (PSPA, 2022). Increasing the share of RES in Poland's electricity mix therefore remains one of the key challenges when it comes to developing electromobility and maximising its positive environmental impact.

Recommendations resulting from PSPA's research

The development of the electric heavy transport sector requires the creation of a favourable regulatory environment that encourages investment in zero-emission trucks. The negative effects of the lack of electrification – resulting in the loss of Poland's position on the freight transport market and, as a consequence, economic losses – can be limited. There are currently a number of barriers delaying the development of zero-emission heavy transport in Poland and no appropriate systems supporting the sector's decarbonisation.

As part of the eHDV Infrastructure Lab project, a unique case study building know-how in the field of applying best practices on the eHDV market, the construction and operation of charging infrastructure, and the electrification of the fleet and road network, PSPA has prepared proposals for legislative changes, which would increase in the number of trucks that run on alternative sources of energy in Poland more rapidly.

The proposals, based on an analysis of the support systems used in Europe, include the following assumptions:

1) **Introducing a subsidy system for purchasing eHDVs**
   - extending of the list of vehicles supported by the "My Electric Car" programme of the National Fund for Environmental Protection and Water Management (NFOŚiGW) to include zero-emission vans in the N2 category with a GVW of up to 4.25 tonnes,

- introducing a financial support system for buyers of zero-emission trucks.

2) Abolishing road tolls for eHDVs

- exempting electric vehicles with a GVW above 3.5 tonnes from tolls on national roads until 2025,
- after 2025, limiting fees for electric vehicles with a GVW above 3.5 tonnes travelling on national roads to 25% of the fees for conventional vehicles.

3) Allowing eHDVs to enter restricted traffic zones

- exempting electric vehicles with a GVW above 12 tonnes from periodic restrictions and road traffic bans.

4) Increasing eHDVs' maximum permissible weight

- amending the Minister of Infrastructure's regulation on vehicles' technical conditions and the scope of their necessary equipment when it comes to the maximum permissible weight of individual categories of eHDVs, both with and without a trailer.

5) Introducing a subsidy system based on the CO_2 emission reduction

- developing a subsidy at the operational stage or implementing solutions that meet the assumptions linked to the emissions trading system in road transport.

6) Introducing a support system for the development of charging infrastructure intended for eHDVs

- including funding for publicly-available charging stations for zero-emission trucks in the NFOŚiGW's "Support for infrastructure for charging electric vehicles and hydrogen refuelling infrastructure" programme.

7) Introducing tax relief for entities that invest in environmentally-friendly means of transport

- exemption from the tax on means of transport referred to in the law on local taxes and fees for zero-emission vehicles with a GVW of less than 12 tonnes.

8) Introducing regulations making it easier to connect charging stations intended for eHDVs to the power grid

- adopting a special law containing demands for regulatory solutions abolishing the greatest barriers that are delaying the expansion of the network of publicly-available charging stations. The aim of the new regulations would be to implement:
  a) facilitations and incentives for DSOs in the implementation of investments in the field of electromobility,

b) regulations streamlining the procedures for connecting publicly-available charging infrastructure devices to the power grid,
c) regulations making it easier to locate publicly-available charging infrastructure at passenger service points.

Summary

The electrification of the heavy-duty road transport sector is an opportunity for Poland to maintain its leading position in this sector of the EU economy. Simulations by the European Commission point to the positive impact of the electrification of the truck fleet on employment and GDP in the entire EU. At the same time, failure to accelerate efforts to electrify the heavy fleet could contribute to the weakening of the Polish TSL sector's position on the EU market, including measurable economic losses in the face of the EU regulations on emission reduction being introduced or national regulations. The first countries and regions are restricting the entry of vehicles, including trucks with combustion engines, making it impossible to use them on selected routes and reducing potential transport activity.

Poland currently stands out in the EU road transport sector. In 2021, it had 1.15 million trucks with a GVW above 3.5 tonnes, the largest fleet in the EU. In 2020, over 486,000 people worked in the Polish road transport sector, the highest number in the EU. Since 2017, Polish transport has had the highest transport activity; 380 billion tkm in 2021. The Polish heavy-duty road transport sector's value added was the fifth highest in the EU (EUR 9 billion).

Calculations for Poland indicate that electrification could have a positive impact on the country's economy. Investing in new electric trucks will help Poland maintain its leading position in the road transport sector and add up to 21,000 jobs and EUR 1.1 billion in value added (over PLN 5 billion). In contrast, slow electrification could contribute to job loss or a decline in value added by 2035, even compared to the baseline scenarios based on CEDEFOP and European Commission projections.

The electrification of the heavy-duty road transport sector should be accompanied by optimal infrastructure investments. New registrations of electric trucks could increase the demand for electricity in Poland by approximately 2-4% in 2030-2035. The charging profile or the use of fast chargers during peak hours will require investments in generation, storage and network systems. At the same time, the share of renewable energy sources in Poland's electricity mix should be increased, which will allow emissions to be reduced to a greater extent.

In this report, we have shown that the electrification of heavy road transport is not only beneficial from an environmental perspective, but also from an economic perspective. To implement the accelerated electrification scenario, we recommend solutions based on the analysis of the support systems in Europe prepared by PSPA. They include direct subsidies the purchase of electric vehicles, investment in charging infrastructure, and suggestions focused on regulatory changes that make it easier to connect charging stations intended for eHDVs to the power grid or for electric trucks to enter limited traffic zones.

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The Polish Economic Institute

The Polish Economic Institute is a public economic think tank dating back to 1928. Its research primarily spans macroeconomics, energy and climate, foreign trade, economic foresight, the digital economy and behavioural economics. The Institute provides reports, analyses and recommendations for key areas of the economy and social life in Poland, taking into account the international situation.

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