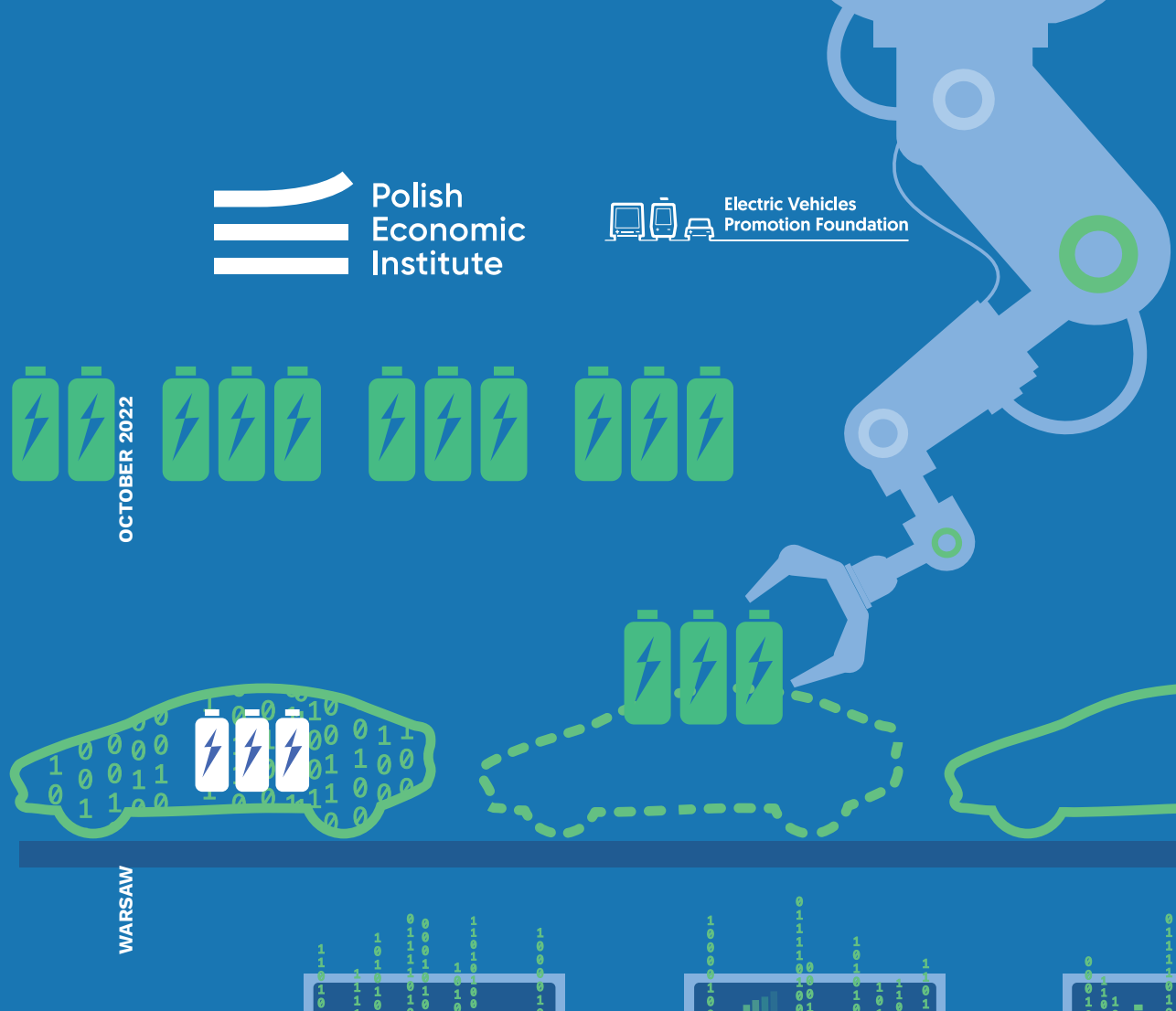
Polish Economic Institute

Electric Vehicles Promotion Foundation



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WARSAW

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The impact of the Fit for 55 package on the automotive industry in the Visegrad Group

Budgetary effects of more restrictive emission performance standards

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Key numbers

EUR 45 billion

was the value of Poland's manufacturing of automotive products in 2019; in the Visegrad Group, it exceeded a total of EUR 160 billion

35 per cent

is the share in the Polish industry of the production of Internal Combustion Engine Vehicles (ICEV) parts that will become unnecessary after the entry into force of a ban on the registration of ICEV* in the EU by 2035

EUR -22.8 billion

will be the loss of added value of production in the traditional automotive sector in the V4 countries by 2035 after the entry into force of a ban on the registration of Internal Combustion Engine Vehicles* in the EU; the respective figure for Poland will be EUR -7.2 billion

EUR +58.5 billion

could reach the net balance of manufacturing of automotive products and battery production in the V4 countries by 2035, after the entry into force of a ban on the registration of Internal Combustion Engine Vehicles* in the EU; the respective figure for Poland could be EUR 16.9 billion

5.3 per cent

higher could be GDP in the V4 countries by 2035 if the region developed battery production investments; the respective figure for Poland would be 2.6 per cent

EUR 13.3 billion

could be an increase in public revenues in the V4 countries by 2035 as a result of rising battery production for the automotive sector, of which EUR 7.4 billion would be generated in Poland

EUR 6.6 billion

was the value of Lithium-ion battery exports in Poland in 2021

4 million

new jobs could be generated by the battery sector in the EU after 2025, as estimated by the EC

* passenger cars and light commercial vehicles

Key findings

The implementation of the Fit for 55 package and its proposal for amending Regulation (EU) 2019/631 of the European Parliament and of the Council setting CO_2 emission performance standards for new passenger cars and for new light commercial vehicles, intended for sale in the EU market will bring about major changes on the map of the automotive industry in Poland. Total average emissions from such vehicles newly registered in the EU are supposed to be cut from the current level of approx. 100 g CO_2/km to 0 g CO_2/km by 2035.

The expected loss of value added of production in the traditional automotive sector in the V4 countries by 2035 as a result of the introduction of the Fit for 55 package could be nearly EUR 23 billion, of which EUR 7.2 billion would be lost in Poland. However, the expected budgetary gains considerably exceed potential financial losses. **The net balance of automotive and battery production in the V4 countries by 2035 – i.e. the year from which it will be impossible to buy and register within the Community a new vehicle running on petrol, diesel, LPG or CNG – could be around EUR 60 billion,** of which EUR 16.9 would be generated in Poland. It means a rise in GDP in the V4 countries by an average of 5.3 per cent by 2035 and an increase in public revenues by over EUR 13 billion.

The value of automotive products in Poland is nearly PLN 200 billion, which is 13 per cent of Polish manufacturing. The industry employs approx. 315,000 people and every zloty earned by the sector contributes to generating value-added of PLN 1.7 in other sectors of the Polish economy; every 1,000 jobs in the automotive sector translate into 1,300 additional jobs in the economy as a whole.

With banning the registration of internal combustion engine vehicles and as electromobility develops, around 35 per cent of the current production of automotive parts in Poland will become unnecessary. The percentage encompasses factories manufacturing parts not used in electrically chargeable vehicles, such as internal combustion engines and their components, fuel and exhaust systems, gearboxes and clutches. Among the V4 countries, the share of such parts in production is even higher in Hungary and Slovakia, at about 50 per cent.

22 per cent of the Polish production of subassemblies can be adapted for use in electric vehicles, e.g. steering and braking systems, suspensions, wiring or interior equipment. The remaining production (43 per cent) includes parts fully compatible with electric vehicles, such as body components, wheels and rims, safety seat belts and airbags or lighting components.

There will also emerge a new segment intended for electric vehicles production, which development, owing to the involvement of foreign investors, could offer new investment opportunities in Poland. The value added of the EV battery market in Europe could be EUR 625 billion by 2030. The respective figures for the Visegrad Group and Poland could then be EUR 73.2 billion and EUR 24.1 billion. At present, Poland's Li-ion battery exports exceed EUR 6.5 billion and account for more than 2 per cent of total Polish exports.

To meet the growing demand for electric battery-powered vehicles, manufacturers need to create a new ecosystem of partners delivering parts and accessories required in the production and operation of such alternative vehicles. The whole powertrain supply chain will transform; the component types, logistic processes, sourcing and destination markets and the multi-tier nature of supply chains in the automotive industry will change. The recent sudden shocks – the coronavirus pandemic and the war in Ukraine – have stimulated corporations to shorten their supply chains and to increase the manufacturer's control of the process (e.g. through shareholdings in supplying companies). It has major implications for structuring the automotive supply chain and offers new investment opportunities in the EU.

Digitalisation is both a challenge to the automotive sector and a chance to develop new business lines connected with servicing vehicles through their useful lives. In addition to the energy transition and digitalisation, another trend to cope with is production automation which could undermine the attractiveness of the Polish labour market, previously competitive with lower salaries and wages. Everything in the automotive sector, from vehicles to whole factories, is becoming increasingly compatible and complicated, being supported by technologies such as AI, the IoT, 5G and robotics.

Time will tell whether the automotive industry will maintain its production level and invest in new facilities as it will also largely depend on the carbon footprint of the whole production chain. Regardless of the EU requirements, manufacturers have been following the recent trends in striving for neutrality at their factories. Therefore, electromobility will entail having access to low-emission energy sources not only for the operation but also for the production of vehicles. Reducing the emission intensity should concern systemically available electricity, heating and cooling energy. Another solution for the industry is the development and modernisation of companies' own low-emission energy sources and energy storage facilities.

Introduction

Russia's invasion of Ukraine has been forcing the European Union to revise its energy and climate policy. As the Kremlin has been increasingly using energy as a tool of political influence, it is justified to deprive it of this instrument of pressure, by radically reducing our dependence on imports of fossil fuels from Russia. The geopolitical rationale behind such measures is consistent with the imperative of combating climate change. The most recent report of the Intergovernmental Panel on Climate Change (IPCC, 2022) on the mitigation of climate change emphasises the urgency of the task. Total greenhouse gas emissions must reach their peak by 2025 if we are to avoid a catastrophic increase in global temperatures. Furthermore, the transition to clean energy in the whole economy should be managed with caution, taking into consideration the unavoidable social and economic consequences; it must be a 'fair transition'. The EU and the European Investment Bank have to play a key role in this transformation. Investment in renewable energy sources, energy efficiency, electrification and innovative technologies are significant tools in opposing the Russian aggression, while simultaneously helping save the planet from dependence on fossil fuels. Every euro spent on the country's energy transition is a euro taken from the authoritarian power engaged in an aggressive war. Every euro spent on clean energy increases our decision-making freedom.

At present, the Fit for 55 package is the main tool to achieve climate neutrality by 2050, presenting details of the pathway to meeting the milestone of -55 per cent by 2035. If the Fit for 55 proposals are agreed upon and implemented, they would deepen and extend the decarbonisation of the European economy to make it climate neutral by 2050. Without the package, under the EU's current climate legislation, Europe will only reduce its emissions by 60 per cent by 2050. The extensive package, containing hundreds of pages of legislative proposals, includes the creation of a new EU emissions trading system (ETS) covering buildings and road transport, a major revision of energy taxation in Europe, stepping up renewable energy and energy efficiency targets, introducing a Carbon Border Adjustment Mechanism (CBAM) and changing CO_2 emission performance standards for new passenger cars and light commercial vehicles. The process of achieving climate neutrality in the EU can be accelerated by the REPowerEU package. It is the European

Commission's plan (aimed at saving energy, producing low-carbon energy and diversifying energy supplies) for decoupling Europe from fossil fuel imports from Russia by 2030, in the context of Russian invasion of Ukraine. Supported by funds, legislative and regulatory measures, it will serve to build new infrastructure and a new energy system that Europe needs.

The research context

Synergies between the decarbonisation and derussification strategies

In the longer term, energy security and competitiveness can coincide to strengthen endeavours towards net zero CO_2 emissions. It would be necessary to take courageous actions quickly to intensify measures for energy efficiency and alternative energy sources. Such actions, if taken, could push zero-emission technology cost curves downwards, thus creating a path to faster decarbonisation. At the same time, on the other hand, the competitiveness of alternative energy sources has been increased by higher fossil fuel prices, particularly from the beginning of the Russian aggression. Such results would not be surprising in the light of historic events; in past, conflicts have frequently accelerated many energy transitions. The naval wars of the 19th century accelerated the transition from wind- to coal-powered ships. World War I became a catalyst for the shift from coal to petroleum. After World War II, nuclear power spread as the main energy source. In each of those cases, wartime innovation solutions were implemented directly in the civil economy and started a new period. In contrast to other wars, the war in Ukraine has not been stimulating the same type of innovation in the energy sector, but it has accentuated the need for change. Nevertheless, its potential influence can be equally transformative (Samandari et al., 2022).

Consumer preferences ecourage decarbonisation

As demonstrated by various studies, growth in the share of electric vehicles in the automotive market of the European Union depends on a variety of factors. The available literature attempts to identify technical, economic, legal and organisational barriers directly affecting electromobility. At the same time, the authors point to the most significant areas of disagreement such as technological progress in batteries, battery production costs and life span, recycling, the density and availability of recharging points, efficiency and connection to the power grid, the influence on energy efficiency and greenhouse gas emissions, recharging station standardisation, infrastructure management, organisational readiness – business and industrial models, manufacturing capacity,

etc. Although interrelationships between the above-mentioned factors can play a vital role in the development of the electric vehicle market in the current conditions, customer attitudes will determine the popularity and market success of electric vehicles (Lewicki et al., 2021).

Consumer preferences vary between countries worldwide. Research has shown that almost 90 per cent of all respondents in China conceive of buying a hybrid vehicle or a battery electric vehicle, whereas 78 per cent would welcome such an option when buying the next car. The figures are significantly lower for the United States, at approx. 73 per cent and 30 per cent respectively. The Chinese are particularly enthusiastic about new technologies. European consumers emphasise the main advantages of electric vehicles: being environmentally friendly (73 per cent), energy efficiency (46 per cent) and access to low-traffic areas (30 per cent). But the high purchase price (50 per cent), a limited selection of vehicle models (39 per cent) and insufficient service infrastructure (38 per cent) are indicated as the most important obstacles to buying an electric vehicle. Although the high purchase price is perceived as the main disadvantage of electric vehicles in all regions, many people would be generally willing to pay the environmental friendliness premium. The consumer perception of electromobility has been evolving; in particular, ecological and social factors are perceived better than before (FEV, 2019). According to a survey by Transport & Environment, a surprisingly high percentage of the surveyed Europeans (60 per cent; 79 per cent in Poland) believe that the government should require car manufacturers to sell more electric cars in the country concerned (Transport & Environment, 2018). Studies have shown that, at the moment, the most typical group of buyers of electric vehicles are university-educated men, employed on a full-time basis, particularly with occupations in civil society or academia, below middle age (30–45). Analyses have also revealed other market segments where electric vehicles could take root, such as higher-income women and retirees/pensioners (Sovacool et al., 2018). Recipients of electromobility technologies seek financial savings for the future and/or care for the environment. Corporations making their fleets green are also guided by ambitious emission reduction plans, attractive subsidies, or both. As in the case of individual recipients, both environmental considerations and the overall cost seem to be important decision-making factors. Intermediaries, e.g. leasing companies, are also active in the electric vehicle (EV) space to meet increased demand from fleet customers (Amsterdam Roundtable Foundation, 2014). A mere 33 per cent of European buyers of cars declare that their next choice would be a vehicle running on petrol or diesel, whereas 67 per cent are willing to choose a hybrid or electric vehicle. 70 per cent of Europeans claim that they consider the issue of climate change when they vote. In the planning of political actions, it is worth taking into account the recognised type of technology recipients to be convinced as voters and public opinions shaping long-term economic preferences (EIB, 2022).

Decarbonisation, autonomy, retaliation

New players in the automotive market from the US and China (since 2019, due to efforts by the European Battery Alliance, Europe has attracted the most investment in batteries for electric vehicles worldwide) rely on innovative technologies, particularly concerning digitalisation and electrification. Those new technologies, responding to climate change, have an essential impact on the automotive sector. Due to fierce competition for innovation, EU car makers may find it difficult to survive in the market if they lag behind. This is a time of fundamental change. A broader political landscape has been developing; such a picture in such an important industry should guide decision-makers to carefully consider the policies being made.

Cumulative impact policies

If the EU policy plans are considered together. The cumulative impact of many individual packages and regulations is a demanding investment project, to bring measurable long-term benefits in comparison with the alternative scenario of maintaining the development of fossil fuels. Since the EU does not exist in a void, whether any climate, industrial or commercial plans are successful or not, depends on responses from the EU and world industries, primarily from both friendly and hostile trading partners and competitors, naturally inclined to take measures mitigating the effects of EU initiatives. It is within and between them that the appropriate balance must be found between regulatory costs and international competitiveness, State aid against international competitors, open or autonomous, at risk of retaliation, government guidance or private sector leadership. Striking such a balance will be challenging, considering the extensive programme presented below.

Retaliatory measures and countermeasures

The measures currently proposed for EU commercial policy involve a risk of retaliation. Due to the number of such initiatives and the role of the EU as a major commercial policy player, countermeasures should be expected from other economies in response to various EU actions. The measures currently considered and their retaliatory consequences are presented below.

There is a serious debate on whether the CBAM is legal according to the policy of WTO (Chase, Pinkert, 2021). Despite the EU's declarations, it seems almost certain that the dispute will involve similar economies characterised by lower carbon footprints than the EU but still affected by the CBAM rather than economies that pollute the environment to a large extent. There are particular concerns that the imposition of different tariffs on allegedly the

same product is inconsistent with the most-favoured-nation clause, whereas exceptions do not take sufficient account of the scenario.

Table 1. EU measures subject to significant retaliation risk

Measure	Potential consequences / retaliation
Carbon Border Adjustment Mechanism (CBAM)	WTO dispute and countermeasures, competitive carbon pricing systems increasing trade costs
Investment control	Increased difficulties for EU undertakings investing elsewhere, particularly in China
Sustainable supply chain	Regulatory obstacles to economic activities of EU undertakings in other countries
Anti-coercion instrument	Deterioration of disputes with third countries and measures taken against EU products
Instrument on foreign subsidies	Competitive subsidies and/or retaliatory measures against products made in the EU and seen as unfairly subsidised, e.g. cars using subsidised semi-finished products
Next Generation EU	Retaliatory measures against products supported by State aid

Source: prepared by the PEI.

There is no global consensus that the climate change emergency is sufficiently important to require a revision of the existing WTO rules. But the argument becomes weaker considering the existence of other measures such as subsidies (European Commission, 2021). As regards encouraging changes in behaviour, measures in the industries most affected by decarbonisation – heavy industry, extractive industries, transportation and agriculture – usually do not cover foreign competition.

The EU programme is similar to approaches adopted by comparable economies, whereby the United States, the United Kingdom and China also carry out government interventions to maintain or restore globally competitive production while reducing carbon dioxide emissions. **Such 'competitive interventionism' does not lead to reliable international cooperation and open markets.** In the time of increasing interventions, especially, it is very likely that such measures will be perceived by others as hostile, which may result in taking countermeasures adversely affecting the EU economy and the automotive sector in particular. The regulatory agenda can be a special programme for designing new global standards. The 'Brussels effect' is often referred to as proof that the EU's regulatory power was guided by global market transformation, making the mechanism difficult to resist. A better thought-out approach to gaining an advantage, thanks to regulations with extra-territorial impact, will probably be unacceptable to competitors. Simultaneously, the preferences of the wealthiest consumers have been changing as they become willing to pay more for products made with the least carbon and environmental footprints.

Although understandably, in the EU's opinion new instruments are necessary to maintain support for open markets, their design and application must be very carefully considered to avoid escalation into a destructive spiral of the opposite situation. **There is a certain level of tacit understanding of the new interventionism, at least between the US and the EU, but it may be insufficient to protect the most vulnerable sectors such as transportation.** It is a dangerous risk for the EU, relying heavily on the sector in question.

The EU's endeavour to mitigate climate change is not necessarily a protectionist construct. **One of the three premises of the European Green Deal, i.e. 'decoupling economic growth from resource use', is only one way of understanding it, reasonable but still slightly utopian, considering the currently available technology.** The concept of climate neutrality does not necessarily involve limiting growth or reducing consumption; it can also imply emission compensation with the use of technology. The EU must transform into a new, low-carbon economy through leveraged public financing, direct subsidies and environmental regulations. However, some of the EU measures force costs in other markets on purpose, thus affecting future access to the EU market. Such a strategy can be a real path for basic commodities such as steel. But the situation can be different for undertakings with strongly fragmented supply chains, particularly where their domestic markets only allow to cover fixed costs.

The proposed regulatory package will add cumulative transitional and regulatory costs, considerably pushing up the EU's production costs relative to competing regions. Concerning various mechanisms not yet finalised (or still negotiated), it is important to consider cumulative effects. It is of particular importance where such policies change basic demand or take account of market conditions in such a manner that EU investments in green production could become less profitable.

However, bearing in mind the strong regional competition for investments, it should not be assumed that another major investment in a production factory or a research and development centre by a European (or Asian) supplier of subassemblies for vehicle production would be made in Europe. The EU also needs appropriate mechanisms for attracting foreign direct investment to production, retail trade and research and development as well as tax systems enabling the repatriation of foreign earnings by EU-based multinational enterprises back to our tax systems. Otherwise, the EU's industrial policy could only accelerate 'deindustrialisation', with national and global capital abandoning European shares to seek alternative markets abroad, offering higher dividends, profit margins or more effective environmental policies.

The research issue

The manufacturing of motor vehicles in the EU is concentrated in the several Member States. Western European car manufacturers, attracted by lower labour costs located part of their production facilities in the Central and Eastern European countries (CEECs). According to the European Centre for Vocational Training, it is still more cost-effective to outsource assembling and machine operation activities to Eastern Europe than fully automate processes (Brown et al., 2021). In 2019, the manufacture of motor vehicles, trailers and semi-trailers in the V4 countries employed 592,070 persons, representing 23 per cent of total employment in the sector across the EU, of which the respective figures were as follows: in Poland – 225,000, in the Czech Republic – 182,000, in Slovakia – 82,000 and in Hungary – 104,000. In the Visegrad Group, the automotive sector accounts for a major share of employment in industry (6–12 per cent) and in the labour market as a whole (1.5–3 per cent). In the V4 countries, in 2020, there were 4,031 undertakings in the automotive sector, representing approx. 23 per cent of automotive businesses in the EU (Eurostat, 2022).

In 2019, the value of Poland's automotive production was EUR 45 billion (Eurostat, 2020). Which constituted more than 13 per cent of the overall domestic industrial processing in Poland, whose automotive sector is the second largest division. The industry is part of an extensive ecosystem, mostly formed by manufacturers of motor vehicles and car parts, their subcontractors and suppliers as well as by car dealers, sellers or garages. It is a value chain directly employing around 315,000 persons. The automotive industry has major favourable effects on other sectors – every zloty earned by the sector contributes to generating value added of PLN 1.7 in other sectors of the Polish economy; every 1,000 jobs in the automotive industry translate into 1,300 additional jobs in the economy as a whole; and every zloty paid to employees generates PLN 1.5 in salaries and wages in other sectors (Dębkowska et al., 2019).

This state of play can indeed be tranformed by European climate law which is setting out aspects such as binding targets of the EU's climate neutrality by 2050 and reducing emissions by 55 per cent by 2030. In the Fit for 55 package, which is a tool for achieving the emission reduction target, the Commission presented a legislative proposal to revise Regulation (EU)

2019/631 of the European Parliament and of the Council on 17 April 2019 setting CO_2 emission performance standards for new passenger cars and new light commercial vehicles. To increase the contribution of the road transport sector to achieving climate targets, the proposal specifies more ambitious requirements by 2030 for new passenger cars and new light commercial vehicles and the zero-emission target for such vehicles by 2035. Those assumptions are consistent with the objectives of the European Climate Law, which sets out the conditions of achieving EU's climate neutrality by 2050 and emission reduction by 55 per cent by 2030 against the 1990 levels. Emissions from road transport account for approx. 25 per cent of the EU's total emissions. To achieve climate neutrality by 2050, the European Green Deal stipulates decreasing emissions from the sector by 90 per cent in 1990. Apart from the emission reduction targets for passenger cars and light commercial vehicles, the Fit for 55 package includes an extended set of emission reduction methods for road transport:

- Establishing a separate entitlements emissions trading system for the road transport sector and heating buildings.
- Adopting more stringent requirements than those contained in the Renewable Energy Directive.
- Amendment of the Energy Taxation Directive to eliminate any tax benefits for the use of fossil fuels.
- Strengthening activities under the Alternative Fuels Infrastructure Regulation on its development and increasing the number of zero- and low-emission vehicles.

Table 2. Emission reduction targets in the legislation currently in force and in the legislative proposals (in per cent)

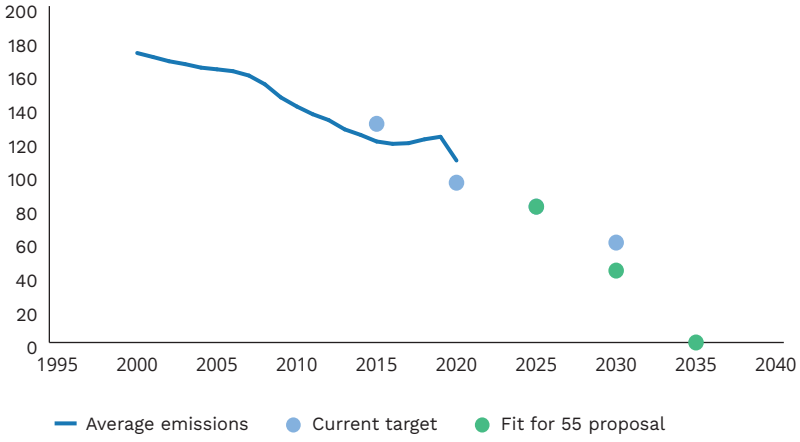
Specification	Passenger cars			Vans		
	2025 v 2021	2030 v 2021	2035	2025 v 2021	2030 v 2021	2035
Regulation 2019/631	-15	-37.5	None	-15	-31	None
Fit for 55	-15	-55	-100	-15	-50	-100

Source: prepared by the PEI based on: Erbach (2022).

The proposed revisions of Regulation 2019/631 assume more ambitious emission reduction targets for new cars and light commercial vehicles. Relative to the respective 2021 baseline, the emission targets of new vehicles registered in UE would be reduced to 55 per cent for passenger and to 50 per cent for light commercial vehicles. By 2035, emissions from the two vehicle types would be cut by 100 per cent, i.e. all newly registered vehicles would need to be zero-emission ones. The financing of zero- and low-emission fleets should end by 2030. Those requirements would not

apply to smaller manufacturers responsible for less than 1,000 new vehicle registrations. Manufacturers responsible for between 1,000 and 10,000 new passenger car registrations or 1,000 and 22,000 new van registrations would be granted a derogation until 2029. Individual target values would depend on the average mass of a manufacturer's new passenger car and van fleet, with higher absolute emission levels granted for heavier vehicles (ICCT, 2021).

Chart 1. Average carbon dioxide emissions from new passenger cars in the EU (in g CO_2/km)



Source: prepared by the PEI based on: Erbach (2022).

After a steady fall until 2016, average CO_2 emissions from passenger cars newly registered in the EU showed a rise in 2017–2019. It was mainly due to the increased popularity of sport utility vehicles (SUVs). Although the emissions were below the overall level of 130 g CO_2/km set for 2015–2019, it was clear in 2020 that the target of 95 g CO_2/km for 90 per cent of vehicles was not achieved. Most car manufacturers met their requirements for newly registered passenger cars in 2019 (EEA, 2021). The share of electric vehicles in new registrations went up from 3.5 per cent in 2019 to 11 per cent in 2020, reaching the first million. In 2020, the level of emissions from newly registered vans was 157.7 g CO_2/km, i.e. 1.5 per cent less than in 2019. The 2020 target for the vehicle type was 147 g CO_2/km. The share of electric vans in new registrations then increased from 1.4 per cent to 2.3 per cent. Under Regulation (EU) 2019/631 of the European Parliament and the Council, emission limits for the following years are set as percentages relative to 2021. The excess emissions premium for a manufacturer is EUR 95 for each gram per kilometre by which the manufacturer exceeded its average specific emissions of CO_2.

On the other hand, manufacturers are rewarded for their performance with less restrictive targets in the future and emission credits for using in their vehicles eco-innovations having emissions reduction effects.

The Commission prepared an impact assessment of updated emission requirements for vehicles, containing conclusions from the relevant public consultations. The consultations covered more than 1,000 persons, of whom private individuals represented 82 per cent, whereas other respondents were business representatives, mostly from Germany. The vast majority of industry respondents and public authorities supported the emission reduction target for new cars, in line with the EU's climate objectives. In contrast, citizens expressed mixed opinions in that regard, indicating critical factors such as the vehicle price, driving range, the availability of infrastructure and, partly, the purchase incentive mechanism and the vehicle types to be supported.

In response, the proposed revision of Regulation 2019/631 primarily stipulates the following:

- Contributing to the EU's climate targets for 2030 and 2050 by reducing emissions from passenger cars and vans; early action is important, considering the materialisation of effects in time and the dynamics of the fleet renewal.
- Providing benefits to societies from wider deployment of zero-emission vehicles, in terms of better air quality, energy savings and decreasing the total cost of ownership (TCO) of such vehicles.
- Stimulating innovation in zero-emission technologies vehicles, thus strengthening the technological leadership of EU manufacturers and suppliers and boosting the labour market.

The main issues identified in the impact assessment concern the possibility of a limited contribution of light commercial vehicles to reducing greenhouse gas emissions and the risk of losing the benefits of zero-emission cars for consumers in the event of insufficient market measures. The third indicated problem is the risk of losing the technological advantage in the automotive value chain at the EU level.

Although the regulation proposed is supposed to be technologically neutral, the objectives for 2030 and 2035 can only be achieved with a high share of battery electric vehicles (BEVs) or fuel cell electric vehicles (FCEVs) in new registrations. As estimated by the Commission, the result of introducing the regulatory proposals for the whole passenger car and van fleet will be average emission reductions of 33 per cent, 51 per cent and 86 per cent in 2030, 2035 and 2040 respectively (Erbach, 2022).

Although it is difficult to accurately predict future BEV sales, one thing is certain: a combination of rising demand for greener cars and the average fleet-wide emission reduction targets imposed by governments on newly registered vehicles will force manufacturers to increase their proportion of BEV production, at least to some degree. But the enthusiasm and expectations for BEVs frequently overshadow the potentially important impact of the product shift on the operations of car manufacturers and suppliers, thus on global automotive employment patterns. Without a full understanding of the repercussions related to the transformation from internal combustion engine vehicles (ICEVs) to BEVs, automakers will not be able to prepare coherent plans for handling the shift.

What are the differences between ICEVs and BEVs?

Construction differences between BEVs and ICEVs will ultimately determine production requirements. The differences can be divided into two categories: powertrain and electronic circuits (Infographic 1).

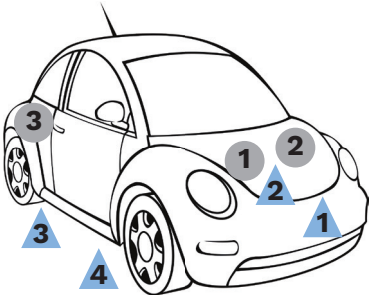
Powertrain. The main components of the powertrain of an internal combustion engine (ICE) vehicle – the engine and auxiliary systems such as the alternator, starter, fuel and exhaust systems – are unnecessary in a BEV. Instead, those are replaced by a battery pack and an electric motor. The battery pack consists of modules containing battery cells, a battery management system that monitors performance, a thermal management system to cool the battery, interconnects and housing. Additionally, the multi-speed gear boxes used in ICEVs are virtually always swapped out for a single-speed transmission in BEVs (naturally, with the reverse mode) as the power output of electric motors is efficient and consistent across a much broader range of RPMs than conventional internal combustion engines (Kuhlmann et al., 2020).

Power electronics. It includes all the equipment that is necessary for running BEVs and electric hybrids but does not exist in ICEVs, such as DC/DC and DC/AC converters and power electronics controllers (Kuhlmann et al., 2020).

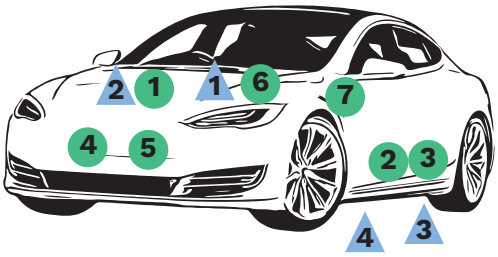
Primarily due to their more complex powertrains, ICEVs have many more components than electric cars. The powertrain of an ICE may include over 1,000 components, whereas a BEV powertrain tends to have only a few dozen (not counting each battery cell separately). However, in terms of content per vehicle, a BEV is approx. 30 per cent more expensive than an ICEV, mostly because of the costs of batteries (Kuhlmann et al., 2020).

Infographic 1. Comparison between an internal combustion engine vehicle and a battery electric vehicle

Internal combustion engine vehicle (ICEV)



Battery electric vehicle (BEV)



Powertrain

1. Internal combustion engine
2. Alternator and starter
3. Fuel and exhaust system

1. Electric motor
2. Battery thermal management
3. Battery pack

1. Cooling system
2. Gear box

Power electronics

4. Converters and inverters
5. Power electronics controller
6. Power electronics thermal management
7. High-voltage wiring

Vehicle platform

3. Vehicle architecture
4. Lightweight materials

Legend:

- X Omitted component/system in BEV v ICEV
- X New component/system in BEV v ICEV
- X Changed component/system

Source: prepared by the PEI based on: Kuhlmann et al. (2020).

The transition from internal combustion engine vehicles to electric cars – thus a shift in key powertrain technologies – will establish completely different playing rules in the automotive industry. An increasing number of corporations have been focusing on the development of new powertrains – 14 of the 15 largest manufacturers offer at least one fully electric vehicle model, whereas new market players have been gaining ground, limiting the influence of traditional leaders. The transformation concerns the whole value chain and its consequences may be even more significant to suppliers of parts. First and foremost, the composition of a BEV is simpler than that of an ICEV in terms of the number of components used. **For producers of parts intended for internal combustion engines, e.g. powertrains, exhaust systems, fuel systems, or gear boxes, the forthcoming revolution will bring major challenges related to shrinking markets. On the other hand, however, new powertrains offer opportunities – the emergence of a new market in parts for electric powertrains,** whereas the role of suppliers for automotive corporations will probably be greater in the new ecosystems. This growing slice of the 'pie' will be tempting to the existing Tier-1 suppliers investing in new areas as well as to electronic and technological companies (Zduniuk, 2019).

Today, the automotive production is almost entirely adapted to the needs of ICEV vehicles – Poland is no exception. As the role of electric powertrains increases, the nature of production will need to change. Nevertheless, different areas will be affected in varying ways and the process will proceed in stage (Zduniuk, 2019).

As regards vehicle production, the ongoing changes may result in a 'new deal'. On the one hand, electric car factories are often built 'from scratch' due to their dissimilar nature. On the other hand, leaders in new technology range – thus potential investors – can be very different companies than before. This is where an opportunity arises for Poland. Although Poland has not attracted the largest investments in car manufacturing in recent years, **a new wave of electromobility investment projects involves quite new development possibilities** – it may allow to reverse the unfavourable downward trend of vehicle production in Poland and facilitate a certain development leap in this area. **Particular opportunities may arise from growing Asian concerns for which Poland may be a gateway to development in Europe.** In addition, it is possible that corporations already present in Poland will also decide to develop their activities in that direction, under the pressure of the changing environment (Zduniuk, 2019).

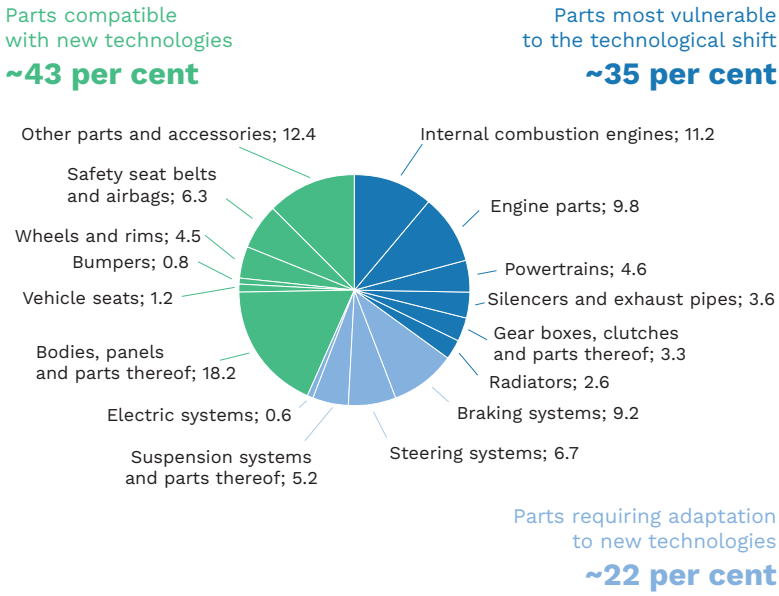
A separate issue is the future of the existing manufacture of automotive parts in Poland. As already mentioned, the different composition of electric powertrains gives rise to challenges in many subsegments of parts production. During the shift to alternative powertrains (Zduniuk, 2019):

- **certain parts will become unnecessary** – those include internal combustion engines and parts thereof, fuel and exhaust systems, gear boxes, and clutches. That group of manufactures is facing the most serious challenges, whereas the prerequisite for surviving in the market will be a fundamental change in the production profile. **Their respective shares can be estimated at approx. 35 per cent in Poland,** 30 per cent in the Czech Republic, 49 per cent in Slovakia and 52 per cent in Hungary;
- **some components can be adapted relatively quickly,** e.g. steering and braking systems, and suspensions; their design will be somewhat different, but it is easier to adapt them to the new technical requirements. **Those account for approx. 22 per cent of parts production in Poland,** 16 per cent in the Czech Republic and Slovakia each, and 14 per cent in Hungary;
- **fully compatible parts represent a significant share,** e.g. body components, wheels and rims, safety seat belts and airbags, and lighting components, forming part of every vehicle, irrespective of technologies used. That group of manufacturers is relatively the least vulnerable in the face of ongoing changes. **Such undertakings account for approx. 43 per cent of parts production in Poland,** 54 per cent in the Czech Republic, 35 per cent in Slovakia, and 34 per cent in Hungary;
- **an entirely new subsegment of the market in automotive parts has been emerging, intended for vehicles with new powertrains.** These primarily include batteries and whole electric motors and a wide range of new electric and electronic components. It should be expected that 'new' entrants, not necessarily associated with the automotive industry today, will play a vital role here. For the time being, they may represent an insignificant share of the market in Poland, but the area could offer the best development prospects;
- **another new and very dynamic market segment is software,** in particular, vehicle connectivity services but also battery management systems (BMS).

Therefore, **a significant share of the domestic automotive parts industry will need to prepare for major changes in operating conditions in connection with ongoing vehicle electrification. Although it is not an immediate challenge to face, it will require appropriate adjustments over time.** In addition, a completely new area is waiting for development and new investment projects: parts for new generation vehicles (Zduniuk, 2019).

New industry development areas will require new qualifications. In the Visegrad Group, there are battery production plants, the main employers in electromobility. But training programmes for lower- and higher-level personnel are not adapted to the relevant curricula in this direction.

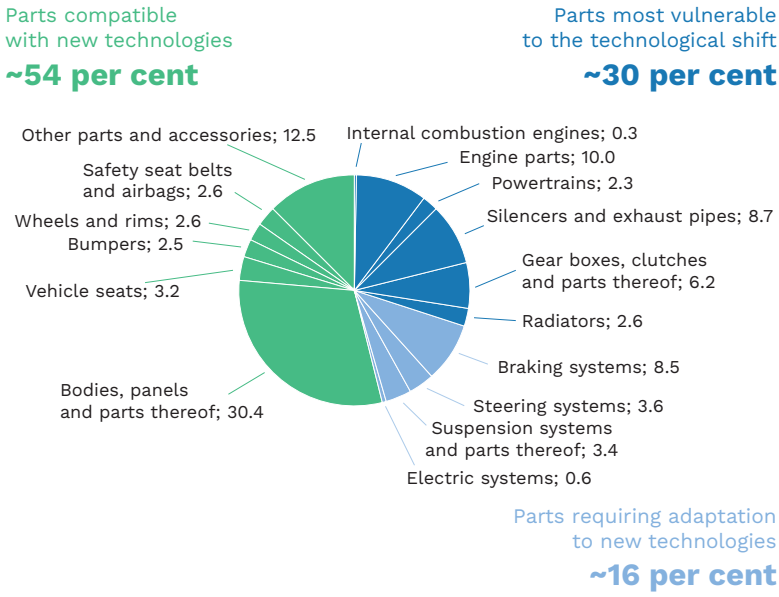
Chart 2. Structure of the Polish automotive parts industry and the influence of electromobility on the industry*



* Estimates based on the 2020 export database.

Source: prepared by the PEI based on Eurostat data.

Chart 3. Structure of the Czech automotive parts industry and the influence of electromobility on the industry*



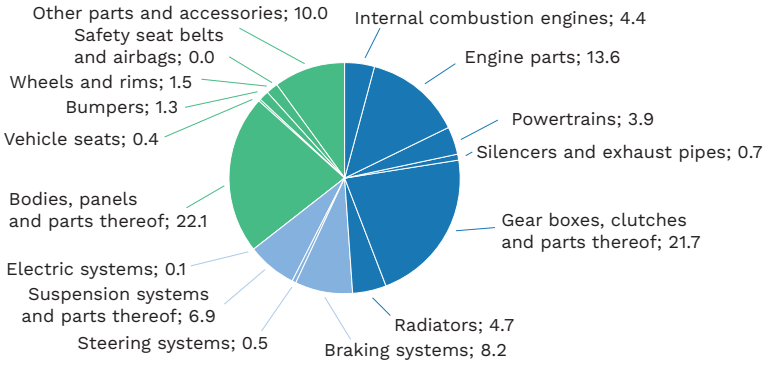
* Estimates based on the 2020 export database.

Source: prepared by the PEI based on Eurostat data.

Chart 4. Structure of the Slovak automotive parts industry and the influence of electromobility on the industry*

Parts compatible with new technologies
~35 per cent

Parts most vulnerable to the technological shift
~49 per cent



Parts requiring adaptation to new technologies
~16 per cent

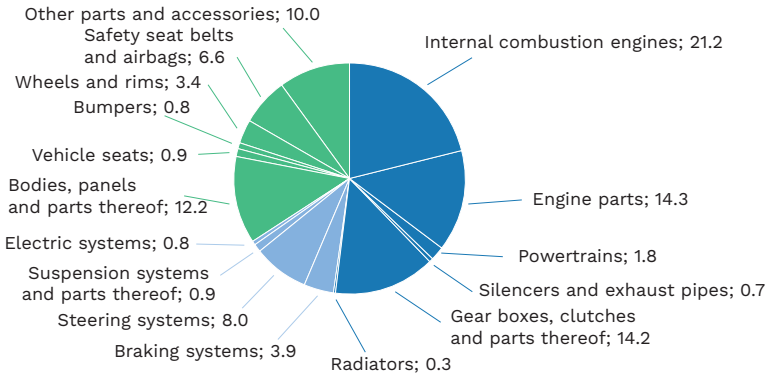
* Estimates based on the 2020 export database.

Source: prepared by the PEI based on Eurostat data.

Chart 5. Structure of the Hungarian automotive parts industry and the influence of electromobility on the industry*

Parts compatible with new technologies
~34 per cent

Parts most vulnerable to the technological shift
~52 per cent



Parts requiring adaptation to new technologies
~14 per cent

* Estimates based on the 2020 export database.

Source: prepared by the PEI based on Eurostat data.

Box 1. Electromobility education and training in the Visegrad Group

Poland

Professional education, vocational training:

- No electromobility, electrochemistry, battery education
- Available professional qualifications:
  - Operation of renewable energy equipment and systems
  - Operation of electricity transmission installations and equipment
  - Installation of renewable energy equipment and systems.

Higher education:

- Electromobility – Faculty of Automatic Control, Robotics and Electrical Engineering, Poznan University of Technology
- Electromobility – Kielce University of Technology
- Electromobility – Rzeszow University of Technology
- Electromobility – Faculty of Electrical Engineering, Warsaw University of Technology, bachelor's and master's programmes
- Hydrogen Technologies and Electromobility – Faculty of Electrical and Control Engineering, Gdańsk University of Technology
- Electromobility and Renewable Energy, with the following education profiles: Electric Vehicles and Electrical Engineering in Renewable Energy Sources – Faculty of Electrical Engineering, Czestochowa University of Technology
- Electromobility and Electricity Systems in Transport – engineer programme, Helena Chodkowska University of Technology and Economics,
- Electrical Engineering in Motor Vehicles – AGH University of Science and Technology in Krakow, master programme.

Slovakia

- Chemical Engineering – the Slovak University of Technology in Bratislava, bachelor, master and doctoral programmes
- Vehicles and Engines – the University of Žilina, bachelor programme.

Czech Republic

The Czech initiative regarding education includes the introduction to school curricula of elements relating to the importance of environmentally friendly forms of transport and mobility in 2018. It aims to build social awareness and acceptance of zero-emission transport already in school-age children (Forum Energii, 2021).

The electromobility sector

In 2021, sales of electric vehicles was rising faster in the CEECs (+71 per cent) than in the EU-14 (+67 per cent). The largest markets for BEVs continue to be Germany (356,000), France (162,000) and Italy (67,000); however, in terms of share in sales of new electric vehicles, the top performer is the Netherlands (20 per cent), followed by Sweden (19 per cent) and Austria (14 per cent) (ACEA, 2021b; Transport & Environment, 2022). At the same time, this CEECs are characterised by high production potential. Despite limited demand, partly due to lower GDP *per capita*, the CEECs, particularly Poland, may become leaders in the manufacture of electric vehicle components on account of their favourable infrastructure, logistics and lower employment costs than in Western Europe (ACEA, 2021c).

Poland ranks among Europe's leading producers of batteries and electric buses. Our country became the destination for factories of corporations such as German BMZ, UK Johnson Matthey or Korean LG. In recent years, as a result of investments by LG, some subsuppliers have appeared in Poland, creating thousands of jobs. These include Korean businesses: SK Hi-tech Battery Materials Poland, KET Poland, Foosung, Enchem, and LG Electronics (Energetyka24, 2021). Battery factories are located in Jawor (Mercedes-Benz Group) and Biskupice Podgórne (LG) (ACEA, 2021a; Williams, 2022). Northvolt is building a production plant and an engineering research and development centre for battery modules and energy storage systems (PAIH, 2021). The construction of the world's largest battery factory may imply further development of the sector (Kutlu, 2022).

Poland is the EU's largest exporter of electric buses. The main representatives of plants producing e-buses to foreign markets include Solaris, Volvo and Man. The share of Polish exports of electric buses in the EU strengthened from 10 per cent in 2017 to 46 per cent in 2020. Poland outperformed Belgium, accounting for 36 per cent of EU exports, and the Czech Republic, Germany and the Netherlands, representing 7 per cent, 4 per cent and 2 per cent respectively (Kubera, 2021).

Apart from Poland, other V4 markets are also considered attractive by electric vehicle manufacturers. The Korean firm SK Innovation is planning to spend USD 2.3 billion USD on the construction of a plant with a capacity

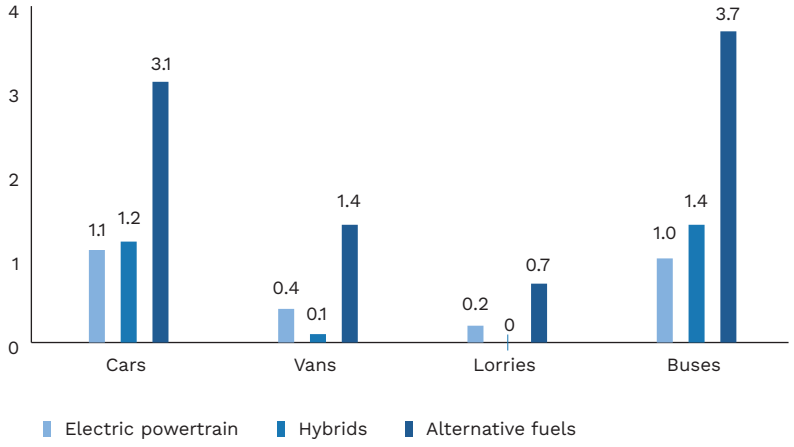
of 30 GWh in Hungary. At present, the company already has two EV battery factories, with annual production capacities of 7.5 GWh and 10 GWh. Another Korean manufacturer – Samsung – invested in a plant of 30 GWh in Hungary (Brown et al., 2021). SK On is developing an investment project to construct a Li-ion battery factory with a capacity of 30 GWh. The Korean manufacturer's rationale behind the selection of Hungary as the investment destination concentrates on the country's good location, optimal in terms of entering the global battery market, with easy access to Central Europe, the Balkan Peninsula and Central Asia. It also offers favourable conditions for supplying products to vehicle factories in Hungary and neighbouring Slovakia. In addition, Hungary's labour force and corporate income tax rate are competitive in the global battery market (SKinno News, 2021).

The Slovak company InoBat Auto intends to build a plant with a capacity of 10 GWh in collaboration with the US firm Wildcat Discovery Technologies (Hampel, 2020). The Volkswagen Group has announced that the fourth of its planned six European battery factories will be located in Hungary, Poland, Slovakia or the Czech Republic (Anderson, 2022). Together with Cez, the Czech government is planning to build a gigafactory with an annual capacity of up to 40 GWh by 2025 (CzechTrade, 2021). Considering that the Czech Republic has a deposit accounting for about 3 per cent of the global reserves of lithium, necessary to manufacture EV batteries, it is the perfect destination for such a gigafactory. The production factory is to be located in Prunéřov, near the lithium deposit.

Today, OEMs see Central and Eastern Europe as attractive place for research and development activities. According to McKinsey & Company (McKinsey & Company, 2021), the CEE region is an appropriate location for strengthening the segment due to significantly less intensive R&D than in Western European countries relative to the sector size in the country concerned. The automotive sector was a fast-growing industry in the CEECs, in some countries exceeding 4 per cent of gross value added in 2005–2017. At the same time, in most countries of the region, gross value added in R&D remained below 1.5 per cent, suggesting that the growth potential of this segment may be further exploited. Therefore, new technical engineering centres have been emerging, e.g. the Budapest office of Jaguar Land Rover.

In 2020, buses represented the EU transport segment characterised by the lowest emissions and the most electrified. Nearly 4 per cent of the fleet ran on alternative fuels. Further development of the segment offers growth opportunities for Polish production potential, currently composed of five bus factories. It is the second best result in the EU, only behind France, with six production plants.

Chart 6. The share of alternatively-powered vehicles in the EU fleet (in per cent)



Source: prepared by the PEI based on: ACEA (2021b).

Battery production

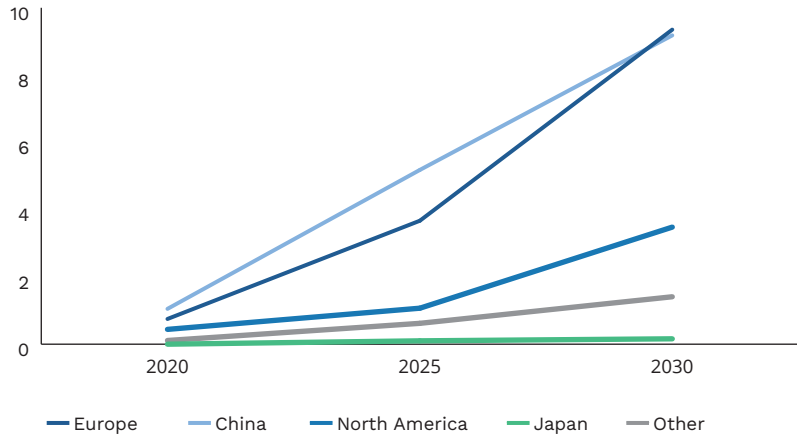
In 2021, exports of Li-ion batteries in Poland exceeded a value of EUR 6.5 billion, accounting for more than 2 per cent of total Polish exports. In 2020, Poland satisfied nearly a third of the European demand for EV batteries (Wi, 2021). Poland is the world's fifth largest and Europe's largest supplier of Li-ion batteries or components thereof for motor vehicles. Before 2016, Poland was a net importer of lithium batteries, in 2017 value of exports and imports were similar, whereas in 2018 Poland became a net exporter (Dobrowolski, Kochman, Kolasa, 2019).

The largest share in the battery production market is that of Asia and the Pacific. There has been a growing uptake of electromobility technologies in the region, a rising number of start-ups offering various solutions for the battery industry and an increased concentration of lithium in China. But the main reasons are China's leadership in the market battery production capacities and a boost in investments made by major battery manufacturers in the emerging economies of the region, such as Thailand, Indonesia and India (Bloomberg, 2022).

Growing production of electric vehicles implies the establishment of new battery factories. In 2020, sales of battery electric vehicles represented 5.4 per cent of sales in the EU. If the current trend should continue, that proportion will rise to 21 per cent in 2025 and to 54 per cent in 2030 (Transport

& Environment, 2021). According to GlobalData projections, by 2030 Europe will overtake China in terms of volume of electric vehicle production (Whiteaker, 2021).

Chart 7. Projected annual production of electric passenger cars (in million)



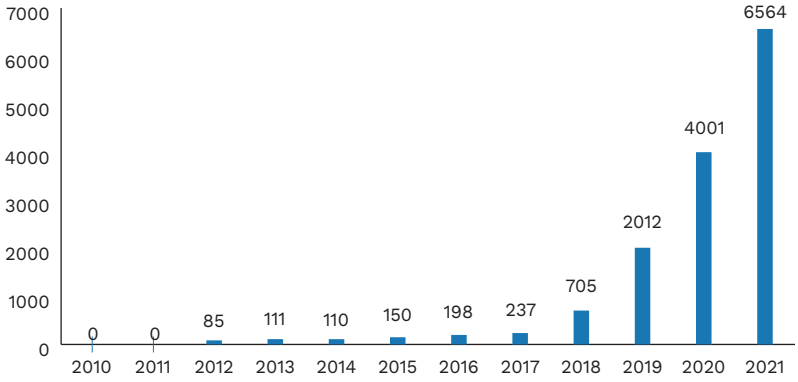
Source: prepared by the PEI based on GlobalData.

The EU Member States have been developing 111 major battery projects in the industry. Until 2021, the value of investments totalled EUR 127 billion. Further investment projects are expected, adding EUR 382 billion by 2030; considering the pace of investments, the annual value added created by the battery industry is estimated at EUR 625 billion by 2030 (European Commission, 2022b).

Exports of Li-ion batteries are characterised by the highest growth rate in Polish exports. According to the NBP, their exports from Poland rank high in deliveries to Germany, France, Belgium, Austria and Sweden (Ciepiela, 2021). This is mostly due to the operation of the Korean LG Energy Solution plants, located in Biskupice Podgórne in south-western Poland. LG Energy Solution started its first investment in a battery factory in Poland in 2016. Another phase began as early as 2017, whereas the third stage commenced in the spring of 2019. LG's plans include exceeding a production capacity of 100 GWh in Poland (Gramwzielone, 2022), which suggests the construction of the world's largest battery factory, according to the Polish Industrial Development Agency (ARP). It is supposed to satisfy 60 per cent of Europe's current demand. LG is not the only manufacturer to choose Poland as an investment destination for making Li-ion batteries for vehicles or related products. The Belgian company Umicore, collaborating with the German Volkswagen Group,

is planning to build a battery component factory in central Poland and another in Radzikowice in the south-west of the country (Wi, 2021). At the same time, the firm has been investing heavily in the development of recycling technologies (Danino-Perraud, 2020; Taylor, 2022).

Chart 8. Polish exports of Li-ion batteries (in EUR million)



Source: prepared by the PEI based on: GUS (2022).

Europe's demand for batteries will be growing rapidly in the years to come. According to the T&E report, it will be around 300 GWh in 2025, 700 GWh in 2030 and more than 1,300 GWh in 2035. Despite the CEECs' advantages, most of the new production capacities are to be located in Germany, as suggested by various declarations (Transport & Environment, 2021). Therefore, by 2024, Germany may overtake Poland in terms of battery production capacity. **The location of investments in battery cell factories in Germany is determined by the proximity of vehicle production plants, low electricity prices and the low carbon footprint of production.** Those are the reasons why the CEECs, without changing their energy mixes, will lose opportunities to host new investments at the expense of Western European countries, characterised by energy mixes generating fewer emissions.

Battery recycling

Irrespective of the market share to be gained by electric vehicles, the recycling of key materials will be a crucial element of supply chain solutions. Recycling has many advantages – from the lack of necessity of metal imports from Asia or Africa to avoiding extraction or other production activities to limiting waste flows. At present, the most frequent form of recycling is the manufacturing process itself. During battery production, significant quantities of the material

remain unused, due to insufficient purity or problems arising at various production stages. At present, Asian firms operating in Europe collect the material and ship it to Asia for reprocessing. It represents a significant value flowing back to Asia. The recycling of batteries with decreasing efficiency is another area in Europe to create electromobility-related value added. In December 2020, the EC published a draft regulation amending the Battery Directive about mandatory levels of recycled content in new batteries, proposing the following recovery targets for waste batteries: from 2030, 95 per cent of copper, nickel and cobalt and 70 per cent of lithium should be recycled (Transport & Environment, 2021). The proposal has been through a public review and is being discussed by the European Parliament. It could be finalised this year and phased in through 2030. Certain provisions have given rise to objections from industry representatives, concerned about losing competitiveness to batteries imported from non-EU countries without such restrictions in place. Nevertheless, battery producers have been awaiting relevant regulations. Northvolt has announced an objective of achieving 50 per cent of its raw material requirements to be sourced from recycled batteries by 2030. Volkswagen and Tesla are also engaged in major recycling programmes; according to Tesla, it can recover 92 per cent of the battery cell material (Adler, 2022).

Poland is already a major producer of electric vehicle batteries and it can become a significant battery disposal location. It belongs to the European Battery Alliance, aimed to create Europe's own competitive and sustainable value chain for battery cell production. That is why the domestic companies Eneris and Elemental Holding obtain support in the development of battery recycling technology (Energetyka24, 2021). Elemental Holding submitted a project for the construction of a recycling centre within the EU's IPCEI (Important Projects of Common European Interest) competition and acquired EU funds of EUR 73 million for the execution of the project worth EUR 100 million. The first factory for battery recycling on an industrial scale is to be launched in 2023 (Reiserer, 2021).

At present, Poland is characterised by a limited level of advancement in waste management. It concerns not only municipal waste but primarily industrial waste, representing as much as 90 per cent of all waste produced in Poland. On the other hand, Poland has a distinctly higher battery collection rate for recycling purposes compared to other EU Member States (Eurostat, 2020). But the EU market needs specialist sites for battery renewing and storage, which offers investment opportunities for developing a new sector in Poland.

The labour market

The European Commission expects 4 million jobs to be created in the EU in connection with battery production industry investments by 2025 (Deutsche

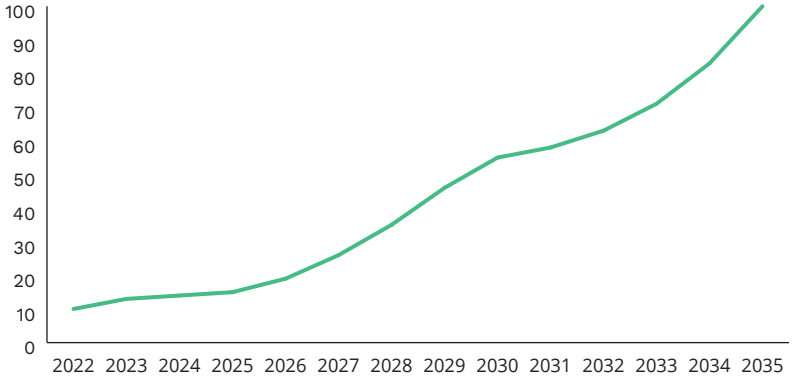
Welle, 2021). Despite their many advantages, the CEECs must compete with more advanced Western European countries, also willing to benefit from the electrification process.

LG's plant located near Wrocław, specialised in battery production, already employs over 4,300 people and anticipates a rise in employment by nearly 2,000 as a result of expanding the production capacity. Although Poland has the second highest number of persons employed in the automotive industry, it is only ranked eighth in the EU in terms of labour costs. In the European market, Poland competes based on its low labour costs. According to PSPA (Polish Alternative Fuels Association) and the BCG, in an optimistic scenario, electromobility development in Poland will create 6,000 jobs across the sector by 2030 (PSPA, 2021).

Analysis assumptions and results

The impact of the Fit for 55 package on the automotive market in the Visegrad Group was estimated in six main steps, taking into consideration both potential financial losses and expected budgetary gains. The analysis is based on two possible development scenarios – a baseline scenario and one related to the impact of the Fit for 55 package provisions on the automotive industry.

Chart 9. Projected changes in the share of new electric vehicles in EU sales in 2022–2035 (in per cent)



Source: prepared by the PEI based on revision of Regulation (EU) 2019/631 of 17 April 2019 setting CO_2 emission performance standards for new passenger cars and new light commercial vehicles.

STEP 1. The comparative (baseline) scenario assumes the extrapolation of the current growth trends of particular segments of the automotive industry by 2035, without the Fit for 55 package. The prediction was based on an econometric model using data for 2000–2020 in each of the V4 countries. Specific segments were classified within one of the three groups of vulnerability to the technological shift.

STEP 2. In the group of the parts most vulnerable to the technological shift, in addition to the direct effects of the Fit for 55 package on the output of

the traditional automotive sector, the examination took into account of the estimated level of export of the industry to non-EU countries and the production of spare parts used in vehicle servicing. The comparison of the calculation results with the values adopted in the comparative scenario served to estimate the projected value of losses arising from the implementation of the Fit for 55 package.

STEP 3. Step three estimated the change in the production of parts requiring adaptation to new technologies. To that end, the forecast the change in its value, assuming that not all production in the group of parts would be adapted to new technologies. At the same time, as in the case of the first group of parts (the subassemblies most vulnerable to the technological shift), the account was taken of the behaviour of some export-oriented production intended for non-EU countries and the production of spare parts for ICE vehicles already in use.

STEP 4. Another assumption concerned the third group of subassemblies – compatible parts, such as vehicle seats, bumpers, safety seat belts and airbags, wheels and rims. According to the analysis presented in *The research issue* section, it was assumed that the production of such subassemblies would be adapted to new models of electric vehicles and maintained at the baseline scenario levels.

STEP 5. The projected impact of the Fit for 55 package on the automotive industry in the V4 countries was based on the European Commission's forecast of the EU battery market value (European Commission, 2022a; EIT InnoEnergy, 2022). The assumption was that there was a collinear relationship between the V4 share in the battery market and the share in the overall traditional automotive market. Based on the current and planned battery production and corporate announcements, the market shares of particular V4 countries were calculated. The projected results were compared to the baseline scenario, where battery production should develop without the introduction of the Fit for 55 package. The package regulations reducing the emission intensity of registered vehicles were considered a factor stimulating the development of the EU battery production market.

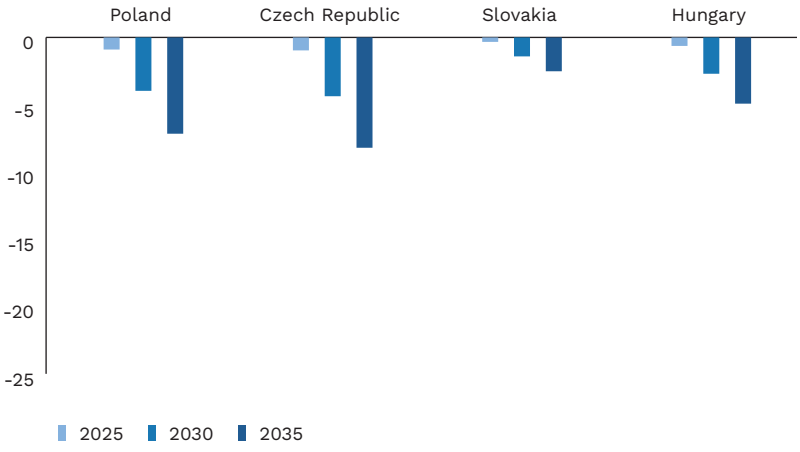
STEP 6. The final step estimated the balance of advantages and disadvantages, losses and gains. To that end, was compared with the expected value of production most likely to be generated by the traditional automotive sector was compared with the battery market, without (the baseline scenario) and with the implementation of the regulations included in the Fit for 55 package. Those differences allowed us to determine the impact of the Fit for 55 package on the automotive market of the Visegrad Group, i.e. the balance of advantages gains (mainly the battery market) and disadvantages

(mostly the traditional automotive market). It was followed by an estimation of the effect of the balance on GDP and the public sector, using respective economic growth projections for each of the V4 countries published by the International Monetary Fund and the effective tax rates in particular countries.

Banning the registration of ICE vehicles in the EU in 2035 will involve a risk of shrinking automotive production related to the manufacture of ICEVs. In the Visegrad Group, the decline is estimated at nearly EUR 22.8 billion by 2035. In nominal terms, the Czech Republic will lose the most – EUR 8.2 billion. The Polish and Hungarian automotive industries may contract by almost EUR 7.2 billion and EUR 4.9 billion respectively. Slovakia will be the least affected – losing over EUR 2.5 billion.

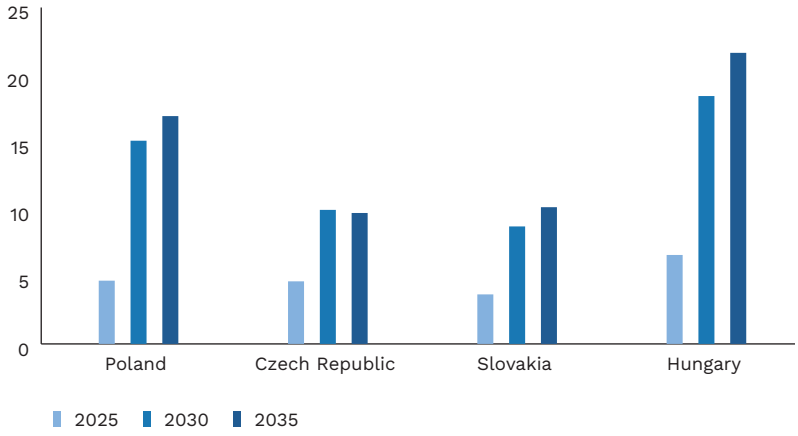
Considering the previously discussed development projections for the battery market in the EU and the V4 countries, the overall net balance for that segment and the automotive industry related to ICEVs is very different. In 2035, the best performer will be Hungary, closely followed by Poland. The respective balances for the Czech Republic and Slovakia are 2.5 times less advantageous. A significant rise in the Czech balance between 2025 and 2030 results from the expected launch of production in new battery factories in the period in question, including the gigafactory investment planned by the government in collaboration with Cez.

Chart 10. Value of endangered production of automotive parts in the V4 countries (in EUR billion)



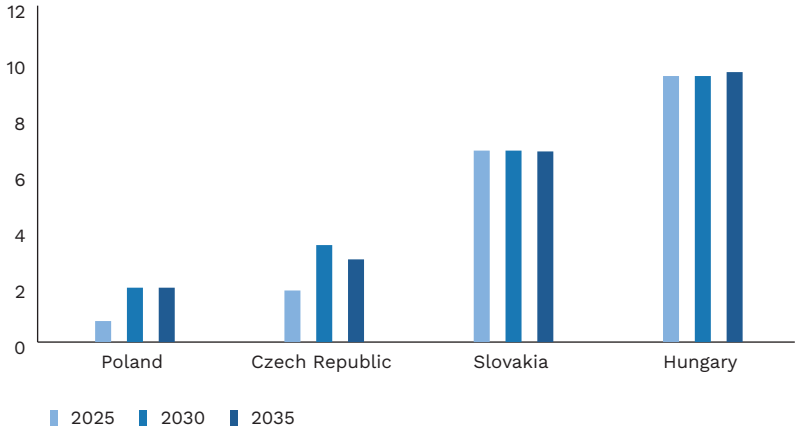
Source: prepared by the PEI.

Chart 11. The net balance of production losses in the manufacture of ICEV parts and battery production increases in the V4 countries (in EUR billion)



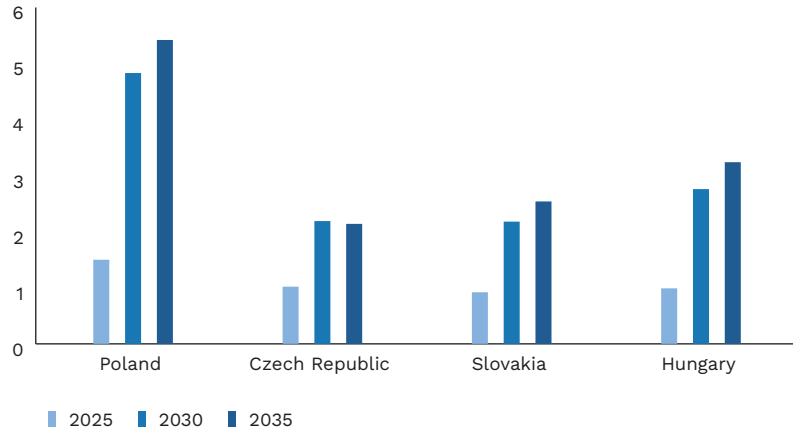
Source: prepared by the PEI.

Chart 12. The net balance of production losses in the manufacture of ICEV parts and increase of battery production in the V4 countries (in per cent of GDP)



Source: prepared by the PEI.

Chart 13. Impact on the public sector of the net balance of production losses in the manufacture of ICEV parts and increase of battery production in the V4 countries (in EUR billion)



Source: prepared by the PEI.

Summary and recommendations for Poland

Decarbonisation is a strategic imperative of the European Union. Whereas greenhouse gas emission reduction was a pressing need related to climate protection before, now, in response to the Russian military aggression and use of energy resources as a blackmail instrument, the issue is twice as important. Achieving climate neutrality should become the main defence and security policy objective. It would only be possible to speed up the transition with sufficient involvement by the general government, private sector and social leaders, recognising that investments in renewable energy sources, energy efficiency and decarbonisation are solutions to the energy price increases and the lack of security rather than the causes of those problems.

Although supply shortages and the price rise can also affect the transformation in the nearest future, supply chain bottlenecks, such as lithium production in battery components, have long been considered factors hampering the transition. **The current supply shock emphasises the genuine need for and the possibility of investing in the diversification and security of supplies of critical raw materials,** which will be beneficial not only for the future pace of transformation but also for pushing down the costs of other common consumer goods, particularly electronics, requiring the same investment. As fossil fuel prices are on the increase and renewable energy prices continue to fall, new solutions for decarbonisation through the marginal abatement cost curve become economically justified. Financial institutions could build larger-scale capacities to identify and finance such opportunities as they arise.

In connection with the transformation related to the implementation of the Fit for 55 package and the development of low-emission vehicles, primarily EVs, it is possible to distinguish three groups of production plants in the automotive industry. The first group includes parts which production will remain unchanged, such as body components, wheels and rims, safety seat belts and airbags or lighting components, accounting for approx. 43 per cent of the parts market in Poland. The second group comprises plants that will relatively easily adapt to the manufacture of vehicles with new powertrains. In Poland, those represent about 22 per cent of the parts market, producing steering, braking or suspension systems. The third group of factories encompasses the manufacture of parts no longer necessary in electric vehicles, e.g. internal combustion engines and their parts, fuel and exhaust systems, gear boxes and clutches,

accounting for 35 per cent of the parts market in Poland. That market segment is the most vulnerable to the transformation of the sector.

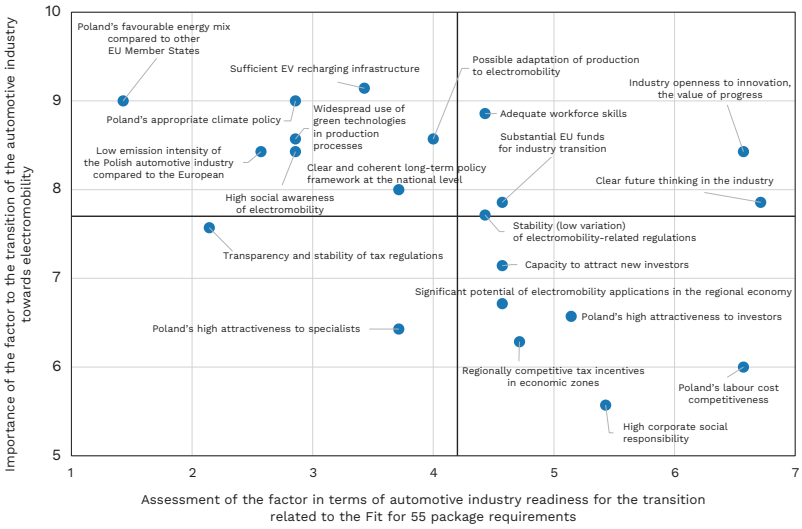
Part of the production of ICEV subassemblies will be maintained on account of exports to non-EU countries and deliveries for the aftermarket. Unless emission performance restrictions also apply to already registered vehicles, it may turn out that the service lifetime of ICEVs will be extended until electric vehicles become attractively priced.

The analysis covers a new production segment related to electrically chargeable vehicles. Electromobility development could pose a risk to small subcontractors with narrow automotive specialisations. Simultaneously, factories present in Poland may serve as a safety cushion for possible market changes. Poland ranks among Europe's leading battery producers and competes with other Visegrad countries. Foreign investors' willingness to develop the automotive industry will be largely determined by investment-friendly conditions, e.g. a stable regulatory environment.

CEE will be an important region in the European automotive industry's shift towards electrification, whereby some countries – especially those having close relations with Germany – will become key centres for the manufacture of electric vehicles and batteries. In addition to traditional automotive firms – on whose foreign head offices the Central and Eastern European countries are largely dependent – one may expect that the automotive market will see new entrants from other regions (particularly from China) and regional businesses starting operations. At the same time, the shift towards electromobility will be less dynamic than in advanced Western European countries, due to relatively lower innovation capacities, the pitfalls of functional specialisation and the persisting, albeit declining, labour cost advantage.

The process common to all automotive plants concerns the environmental and climatic requirements for production. Irrespective of the EU requirements, trends have shown that automakers intend to achieve a zero emission production objective for the whole chain in the years to come. Apart from the production itself, it also concerns the energy sources of plants. In the event of slow decarbonisation of the national energy sector, the solution for a plant would be to install its low-carbon energy sources. In parallel to the development of the market in electric vehicles, the automotive industry needs to decarbonise the production cycle in line with the overall aim of achieving the climate neutrality of the economy as a whole. As demonstrated by the International Council on Clean Transportation (ICCT) analysis, the replacement of ICEVs with BEVs would reduce total lifecycle emissions by 65 per cent, on the assumption of the current average energy mix in Europe, and by 83 per cent with electricity production entirely from renewable sources (McKinsey & Company, 2021).

Chart 14. The importance and assessment of factors in terms of preparedness of the automotive industry for the transition related to the implementation of the Fit for 55 package (on a scale of 1 to 10)



Source: prepared by the PEI based on expert survey results[1].

The EU can maintain its position in the global automotive market with the current greening and digitalisation innovation trends if it retains its basic technology advantage. The digital revolution is closely related to modern cars and provides an opportunity to create new business models with services offered throughout a product's lifecycle. Therefore, the automotive industry in Poland needs to prepare for a new reality where profits are earned not only from selling a vehicle but also from developing digital ecosystems.

According to 58 per cent of representatives of automotive plants, university graduates are not adequately prepared for jobs in Industry 4.0. Workforce skills are one of the two main barriers to implementing Industry 4.0 (KPMG, 2016). **It takes too much time for universities to adjust their curricula to the development of necessary skills and expertise,** which is the other obstacle. The development of the transport sector based on modern production technologies also involves the need to raise workforce competence requirements. Creating upskilling opportunities throughout a person's working life is the responsibility of the state and industry-related institutions. To this end, it is necessary to recognise the skills missing in the market, now and

[1] Based on the results of a survey regarding the quantitative determination of the impact of the Fit for 55 on the automotive industry in Poland and its preparedness for changes, with questionnaires distributed to 30 automotive experts from corporations, research institutes and non-governmental organisations.

in the future, and then to adapt the education and training systems to market requirements. A skilled labour force could give Poland an advantage in attracting foreign investors connected with new segments of low- and zero-emission transport.

The state should create an environment encouraging the formation of independent and efficient organisations of employers and employees from the automotive industry for social dialogue concerning the transition-related challenges and opportunities. It would support the process of job abolition, transformation or creation, based on human capital investments.

As they are characterised by relative market immaturity and significant electromobility development potential, Europe and North Africa are the most likely to develop their battery markets. For comparison, the battery industry value chain is already well developed in China – the largest EV market – and South Korea. The biggest 'slice of the pie' – electric battery cells – is yet to be distributed and this is where the fiercest competition will be. The Visegrad Group governments could play an enormous role in facilitating the process of battery industry development, especially through direct financial incentives, but also by encouraging the creation of favourable local conditions. A double-track strategy should be adopted: maximising value creation for a strong ecosystem and taking measures for attracting individual battery cell manufacturers. The former approach should identify the potential of available resources (lithium, nickel, cobalt) and manufacturing capacities (refining, the manufacture of materials), facilitate cooperation within the value chain at industry forums and support talks between EV makers and battery cell producers. Battery cell manufacturers can be attracted by fast-track processes of granting permits, authorisations and land leases as well as lending, providing grants and guarantees for covering capital shortages. A significant factor could be cooperation and trade within the Visegrad Group and with the neighbouring countries, other suppliers and partners along the supply chain.

Batteries pose different challenges to automotive suppliers. As the heaviest components of electric vehicles, they are difficult to transport, which means that battery suppliers with geographic locations closer to the final vehicle production point will have a competitive advantage in executing contracts. At present, most batteries are made in Asia; therefore, other regions may need to invest in battery factories to keep their current automotive production levels.

Although the share of the domestic fleet of electric vehicles is no explicit measure of attractiveness to electromobility related investors, it is of unquantifiable and sentimental value. Initially, the production of technologically advanced subassemblies is primarily located in the home country of the corporation concerned. As the degree of robotisation increases, pay conditions

will be less relevant to the CEECs' investor attractiveness. At present, the unstable geopolitical situation at Poland's eastern border is also of significance, while its influence remains limited. The most important determinants of the maintenance and development of automotive production, thus keeping hundreds of thousands of jobs, including a low-carbon economy and a friendly regulatory environment. Those are the factors on which policy-makers and stakeholders have the greatest influence. The non-protection of the industry could involve an annual fall in Poland's GDP by an average of 2.05 per cent.

Although public recharging infrastructure is currently no barrier to the demand for BEVs, its development should keep up with sales. However, if the development of recharging points lags behind the increasing popularity of electric vehicles, it could undermine the shift to electromobility, whereas EVs will only be used by those with access to recharging facilities at home, to the detriment of EV expansion and inclusivity.

The Fit for 55 package will pose no threat to the Polish automotive industry – it could even offer a unique opportunity – if appropriate measures are taken soon to maintain the production of the parts described, to adapt another group and attract investments related to the manufacture of new subassemblies for electric vehicles. One necessary condition is a cooperation between policy-makers and industry representatives as well as between the energy sector and Industry 4.0. In addition to batteries, the software is a new area where the highest value added can be created in the changing automotive sector, concerning vehicle connectivity, including services for autonomous vehicles, and EV battery management. But it requires new skills and expertise in education and training as well.

Bibliography

ACEA (2021a), *Interactive map – Automobile assembly and production plants in Europe*, The European Automobile Manufacturers' Association, https://www.acea.auto/figure/interactive-map-automobile-assembly-and-production-plants-in-europe/ [accessed: 25.04.2022].

ACEA (2021b), *Report – Vehicles in use, Europe 2021*, The European Automobile Manufacturers' Association, https://www.acea.auto/publication/report-vehicles-in-use-europe-2022/ [accessed: 25.04.2022].

ACEA (2021c), *Electric cars: lower-income countries fall behind, with uptake linked to GDP per capita*, The European Automobile Manufacturers' Association, https://www.acea.auto/press-release/electric-cars-lower-income-countries-fall-behind-with-uptake-linked-to-gdp-per-capita/ [accessed: 25.04.2022].

Adler, K. (2022), *Europe's EV supply chain revs up*, S&P Global, New York.

Amsterdam Roundtable Foundation (2014), *EVolution. Electric vehicles in Europe: gearing up for a new phase?*, Amsterdam.

Anderson, B. (2022), *Skoda Is Hopeful VW Group Will Establish New Battery Gigafactory in Czech Republic*, Carscoops, https://www.carscoops.com/2022/05/skoda-is-hopeful-vw-group-will-establish-new-battery-gigafactory-in-czech-republic/ [accessed: 03.06.2022].

Bloomberg (2022), *Electric Vehicle (EV) Battery Market Worth $175.11 Billion by 2028 – Market Size, Share, Forecasts, & Trends Analysis Report with COVID-19 Impact*, https://www.bloomberg.com/press-releases/2022-03-08/electric-vehicle-ev-battery-market-worth-175-11-billion-by-2028-market-size-share-forecasts-trends-analysis-report [accessed: 25.04.2022].

Brown, D. et al. (2021), *The Future of the EU Automotive Sector*, Policy Department for Economic, Scientific and Quality of Life Policies Directorate-General for Internal Policies, https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695457/IPOL_STU(2021)695457_EN.pdf [accessed: 03.06.2022].

Ciepiela, D. (2021), *Polska jest największym eksporterem baterii do samochodów elektrycznych w Unii*, https://www.wnp.pl/motoryzacja/polska-jest-najwiekszym-eksporterem-baterii-do-samochodow-elektrycznych-w-unii,468420.html [accessed: 25.04.2022].

Chase, P., Pinkert, R. (2021), *The EU's Triangular Dilemma on Climate and Trade*, German Marshall Fund, Policy Brief.

CzechTrade (2021), *The project for a battery factory for electric vehicles in the Czech Republic is beginning to take real shape*, https://www.czechtradeoffices.com/en/il/news/the-project-for-a-battery-factory-for-electric-vehicles-in-the-czech-republic-is-beginning-to-take-real-shape [accessed: 03.06.2022].

Danino-Perraud, R. (2020), *The Recycling of Lithium-Ion Batteries: A Strategic Pillar for the European Battery Alliance*, https://www.ifri.org/en/publications/etudes-de-lifri/recycling-lithium-ion-batteries-strategic-pillar-european-battery [accessed: 25.04.2022].

Deutsche Welle (2021), *EU plans millions of e-vehicle batteries, jobs by 2025*, https://www.dw.com/en/eu-plans-millions-of-e-vehicle-batteries-jobs-by-2025/a-56857936 [accessed: 25.04.2022].

Dębkowska, K. et al. (2019), *The automotive industry in the Visegrad Group countries*, PEI, Warsaw, https://pie.net.pl/wp-content/uploads/2019/08/PIE-Raport_Automotive.pdf [accessed: 25.04.2022].

Dobrowolski, P., Kochman, A., Kolasa, M. (2019), *Branża produkcji baterii i akumulatorów w liczbach*, PFR, Warszawa.

EEA (2021), *CO_2 performance of new passenger cars in Europe*, https://www.eea.europa.eu/ims/co2-performance-of-new-passenger [accessed: 15.07.2022].

EIB (2022), *The EIB climate survey. Citizens call for green recovery*, European Investment Bank, Luxembourg.

EIT InnoEnergy (2022), *Building a European battery industry*, https://www.eba250.com/#:~:text=The%20need%20for%20efficient%20batteries,250%20billion%20from%202025%20onwards [accessed: 25.04.2022].

ElementEnergy (2022), *Electric Mobility: Inevitable, or Not?*, Cambridge.

Energetyka24 (2021), *Polska unijną potęgą w eksporcie baterii litowo-jonowych*, https://energetyka24.com/elektromobilnosc/polska-unijna-potega-w-eksporcie-baterii-litowo-jonowych [accessed: 25.04.2022].

Erbach (2022), *CO_2 emission standards for new cars and vans 'Fit for 55' package*, European Parliament, Brussels.

Eurostat (2016), *Eurostat Air Emission Accounts Database: Air Emissions Accounts by NACE Rev. 2 Activity*, https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_A64__custom_528948/default/table [accessed: 25.04.2022].

Eurostat (2020), *Recycling of batteries and accumulators*, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics_-_recycling_of_batteries_and_accumulators [accessed: 25.04.2022].

Eurostat (2022), *Annual enterprise statistics for special aggregates of activities (NACE Rev. 2) [sbs_na_sca_r2]*, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en [accessed: 25.04.2022].

FEV (2019), *Next milestone for electromobility – consumer acceptance significantly higher according to fev survey*, Aachen.

Forum Energii (2021), *Elektromobilny Wyszehrad – stan, perspektywy i wyzwania*, https://fppe.pl/wp-content/uploads/2021/08/Elektromobilny-Wyszehrad_analiza.pdf [accessed: 30.06.2022].

GUS (2022), http://swaid.stat.gov.pl/HandelZagraniczny_dashboards/Raporty_konstruowane/RAP_SWAID_HZ_3_1.aspx [accessed: 25.04.2022].

Gramwzielone (2022), *Kolejna bateryjna inwestycja na Dolnym Śląsku*, https://www.gramwzielone.pl/magazynowanie-energii/107142/kolejna-bateryjna-inwestycja-na-dolnym-slasku [accessed: 25.04.2022].

Hampel, C. (2020), *InoBat Auto is planning a 10-GWh-cell plant in Slovakia*, https://www.electrive.com/2020/07/02/inobat-auto-is-planning-a-10-gwh-cell-plant-in-slovakia/ [accessed: 12.07.2022].

ICCT (2021), *Fit for 55: A review and evaluation of the European Commission proposal for amending the CO_2 targets for new cars and vans*, International Council on Clean Transportation.

IPCC (2022), *Climate Change 2022. Mitigation of Climate Change*, https://www.ipcc.ch/report/ar6/wg3/ [accessed: 30.06.2022].

European Commission (2021), *State aid: Commission approves €2.9 billion public support by twelve Member States for a second pan-European research and innovation project along the entire battery value chain*, https://digital-strategy.ec.europa.eu/en/news/commission-approves-eu29-billion-public-support-twelve-member-states-second-pan-european-research [accessed: 30.06.2022].

European Commission (2022a), *A new European Battery Academy launched to boost skills for fast-growing battery ecosystem in Europe*, https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=10183&furtherNews=yes [accessed: 30.06.2022].

European Commission (2022b), *European Battery Alliance moves ahead: new European Battery Academy launched to boost skills for fast-growing battery ecosystem in Europe*, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_1256 [accessed: 30.06.2022].

KPMG (2016), *Global Automotive Executive Survey 2016*, KPMG International, https://home.kpmg/pl/pl/home/insights/2015/12/kpmg-global-automotive-executive-survey-2016.html [accessed: 30.06.2022].

Kubera, G. (2021), *Raport Elektromobilność. Polska stoi autobusami i bateriami*, 'My Company Polska', No. 9(72), https://mycompanypolska.pl/artykul/raport-elektromobilnosc-polska-stoi-autobusami-i-bateriami/7568 [accessed: 25.04.2022].

Kuhlmann, K. et al. (2020), *Shifting Gears in Auto Manufacturing*, https://www.bcg.com/en-in/publications/2020/transformative-impact-of-electric-vehicles-on-auto-manufacturing [accessed: 25.04.2022].

Kutlu, Ö (2022), *Europe approves €95M for expanding EV battery plant in Poland*, Anadolu Agency, https://www.aa.com.tr/en/economy/europe-approves-95m-for-expanding-ev-battery-plant-in-poland/2539744 [accessed: 25.04.2022].

Lee-Makiyama, H. (2021), *The EU Green Deal and Its Industrial and Political Significance*, 'European Centre For International Political Economy', No. 1.

Lewicki, W. et al. (2021), *The road to Electromobility in Poland: Consumer Attitude Assessment*, 'European Research Studies Journal', No. 1.

Lincicome, S. (2021), *Manufactured Crisis: "Deindustrialization," Free Markets, and National Security*, 'Cato Institute, Policy Analysis', No. 907.

McKinsey & Company (2021), *McKinsey Center for Future Mobility: Why the automotive future is electric*, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/why-the-automotive-future-is-electric [accessed: 25.04.2022].

PAIH (2021), *Northvolt stawia na dalszy rozwój w Polsce. Nakłady na realizację nowego projektu sięgną 200 mln USD*, https://www.paih.gov.pl/20210219/northvolt_gdansk [accessed: 12.07.2022].

PSPA (2021), *Jak elektromobilność zmieni rynek pracy w Polsce?*, https://pspa.com.pl/wp-content/uploads/2021/10/PSPA_BCG_Jak_elektromobilnosc_zmieni_rynek_pracy_w_Polsce_2021-10-19.pdf [accessed: 17.07.2022].

Reiserer, A. (2021), *With EBRD financing, Poland builds first recycling plant for car batteries*, EBRD, https://www.ebrd.com/news/2021/with-ebrd-financing-poland-builds-first-recycling-plant-for-car-batteries-.html [accessed: 25.04.2022].

Samandari, H., Pinner, D., Bowcott, H., White, O. (2022), *The net-zero transition in the wake of the war in Ukraine: A detour, a derailment, or a different path?*, https://www.mckinsey.com/business-functions/sustainability/our-insights/the-net-zero-transition-in-the-wake-of-the-war-in-ukraine-a-detour-a-derailment-or-a-different-path [accessed: 30.06.2022].

Sovacool, B.K. et al. (2018), *The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region*, "Global Environmental Change", No. 52.

SKinno News (2021), *SK Innovation decided to invest in the 3rd European battery plant in Hungary*, https://skinnonews.com/global/archives/3820 [accessed: 10.06.2022].

Taylor, B. (2022), *Umicore boosts battery recycling tech*, https://www.recyclingtoday.com/article/umicore-stellantis-ev-battery-recycling-europe-lithium/ [accessed: 25.04.2022].

Transport & Environment (2018), *Consumer attitudes to low and zero-emission cars*, https://www.transportenvironment.org/wp-content/uploads/2021/07/2018_10_Ipsos-consumer_survey-on-attitudes-towards-cleaner-cars_final-1.pdf [accessed: 10.06.2022].

Transport & Environment (2021), *From dirty oil to clean batteries*, Brussels.

Transport & Environment (2022), *Battery electric cars climbed to 9% of sales in 2021*, driven by EU targets, https://www.transportenvironment.org/discover/battery-electric-cars-climb-to-9-of-sales-driven-by-eu-targets/ [accessed: 25.04.2022].

Whiteaker, J. (2021), *Europe overpowers China in EV production charge*, Investment Monitor, https://www.investmentmonitor.ai/analysis/europe-overpowers-china-in-ev-production-charge [accessed: 25.04.2022].

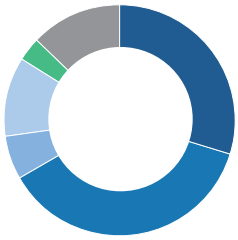
Wi, J. (2021), *Central Europe becomes the EU's e-car battery supplier*, https://www.politico.eu/article/central-europe-eu-e-car-battery-supplier/ [accessed: 25.04.2022].

Williams, M. (2022), *Mercedes-Benz opens battery logistics centre in Poland*, Automotive Logistics, https://www.automotivelogistics.media/battery-supply-chain/mercedes-benz-opens-battery-logistics-centre-in-poland/42898.article [accessed: 25.04.2022].

Zduniuk, K. et al. (2019), *Nowa era motoryzacji Jak odnajdzie się w niej polski przemysł?*, https://www.pekao.com.pl/dam/jcr:59ba00a1-3940-4bbb-b329-f55c25d8e0a7/Nowa%20era%20motoryzacji.%20Jak%20odnajdzie%20si%C4%99%20w%20niej%20polski%20przemys%C5%82.pdf [accessed: 30.06.2022].

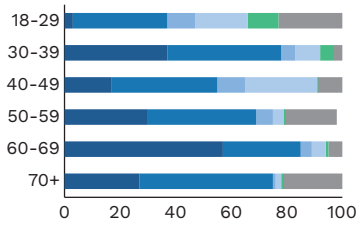
Annex 1. Opinion poll on electrically chargeable vehicles

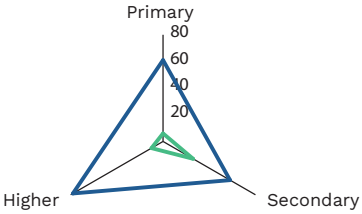
Infographic A1. Do you think sales of electric vehicles will replace sales of internal combustion engine vehicles by 2035?

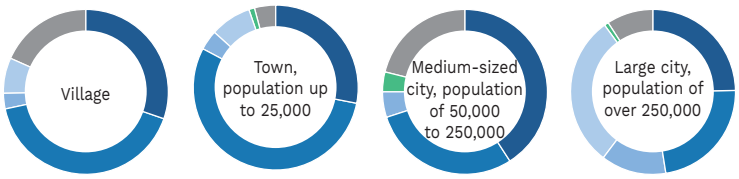


67 per cent 13 per cent

66 per cent 14 per cent





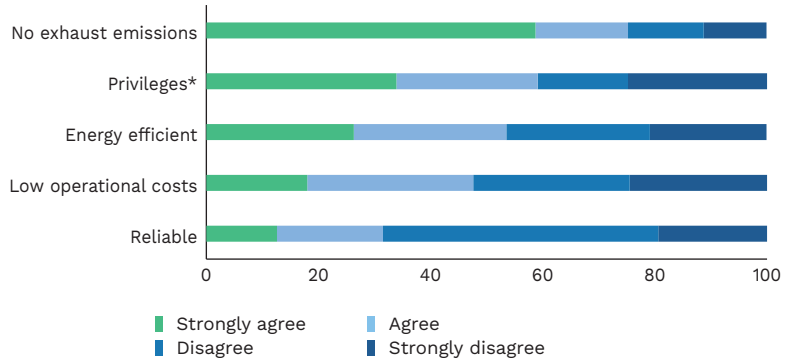


Strongly disagree | Rather disagree | Neither agree nor disagree | Rather agree
Strongly agree | Do not know/Difficult to say/No opinion

Source: prepared by the PEI.

In this context, it is worth stressing that **two-thirds (66.8 per cent) of Poland's population believe that electrically chargeable vehicles will not replace internal combustion engine vehicles by 2035**[2]**.** This opinion is most frequently expressed by persons aged 60 to 69 (85.0 per cent) and 30 to 39 (78.4 per cent). It is the least common to think so for the youngest individuals – aged under 30 (37.3 per cent) – whereby persons from this age group find it the most difficult to take a specific view on the subject. In terms of educational attainment level and size of the place of residence, the most sceptical persons are university graduates and inhabitants of towns with a population of up to 50,000.

Chart A1. Poles' opinions on electrically chargeable vehicles (in per cent)
To what extent do you agree or disagree with the following statements about an electrically chargeable vehicle?



* such as special parking spaces, access to city centres, bus lanes
Source: prepared by the PEI.

[2] Based on a national opinion poll on electromobility conducted using the computer-assisted telephone interviewing (CATI) method on 18–20 February 2022; sample: n=1078, sampling error: 3 per cent, confidence threshold: 0.95.

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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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