Forum Energii

Analizy i dialog

Visegrad Electromobility

– State, perspectives and challenges

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AUTHOR
Jacek Mizak – Electric Vehicles Promotion Foundation

CONTENT SUPPORT
Michał Borkowski – Forum Energii

EDITED BY
Julia Zaleska

GRAPHICS PREPARED BY
Karol Koszniec

IMAGE
Chuttersnap, Unsplash.com

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Introduction

The achievement of climate neutrality in the European Union by 2050 entails, among other things, a revolution in transport. In recent years, emissions of greenhouse gas, dust and other harmful substances in this sector have not declined, instead they have grown significantly. To reverse this trend, the necessary investment in zero-emission public transport is not enough. A strong opportunity is the widespread electrification of transport that would progress in parallel to decarbonisation of the energy sector.

A specific potential is seen in the electrification of passenger cars. The automotive industry in a major branch of the economy in the Visegrad Group countries. It is crucial that national strategies of those countries take account of the upcoming changes and it is important to prepare for them well. This is indeed a great challenge, but also a major opportunity for each of the member states.

In Poland, over 300,000 people work in the automotive sector. In Czechia, Slovakia and Hungary, the headcount in this sector accounts for more than 10% of total employment in the industry. This is why it is necessary to devise a proper strategy for electromobility development, which will address new challenges related to the climate.

There is also a need to give appropriate directions for the development of electric mobility and set up methods for its effective deployment. In this context, it will be critical to use the fiscal impetus provided by national recovery plans. It will also be vital to properly advance the competencies of employees who will be the pillars of a rapidly developing market.

A symbolic gesture of the Visegrad Group countries would be the setting up of an electric route, which would consist of a network of recharging points (hubs) that would enable free movement of electric vehicles between Warsaw, Prague, Budapest, and Bratislava. Hence, the primary objective of this report is to encourage the V4 countries to cooperate in that area.

We invite you to join the discussion.

Yours sincerely,
Dr Joanna Maćkowiak-Pandera
President of Forum Energii

Marcin Korolec
President of the Electric Vehicles Promotion Foundation

1. Key conclusions and recommendations

- In Poland, Czechia, Slovakia and Hungary, electromobility is at an early stage of development. The efforts related to schemes of direct financial support and fiscal instruments promoting the use of electric vehicles were insufficient to achieve the 2020 targets. However, in the last three years in the Visegrad Group countries a stable and rapid growth in the number of both electric vehicles in use and recharging points was recorded.

- In the Visegrad Group countries the automotive sector is an important branch of the industry, which represents a significant portion of national GDP, offers many jobs and has a significant share in exports. It is currently mostly based on the traditional internal combustion engine technology, which is already in decline. The automotive sector is thus expected to undergo major changes related to the transition to zero-emission technologies. This direction is consistent with the main pillar of a new paradigm of EU development, which is green and digital economy. Without taking effective action aimed at delivering such investments, the future of the automotive sector in the V4 countries is highly uncertain.

- The decision to increase the greenhouse gas emission reduction target in the EU from 40% to 55% by 2030 relative to 1990 entails the need to ensure a significant reduction in emissions in the road transport sector. Apart from regulations that set the standards for internal combustion engines, the primary measures to reduce emissions will be the development of electromobility and decarbonisation of the energy mix. The Visegrad Group countries may largely contribute to the achievement of these goals as they have a significant potential in the automotive sector.

- The development of electromobility should be reflected in national projects co-financed with funds from national recovery plans, multiannual financial frameworks 2021-2027 and other external sources. However, the absorption of such huge resources will require identification of priority initiatives and projects that would make it possible to achieve tangible results. The electrification of public transport and the development of EV charging infrastructure offer the greatest potential in terms of effective use of available resources.

- The first flagship project recommended for the V4 countries is the creation of the Electric Route (EV4 Route). This is a plan to connect the capitals of the V4 member states with a network of multifunctional recharging stations (hubs), which would enable the smooth movement of electric vehicles of all types between Warsaw, Prague, Budapest, and Bratislava.

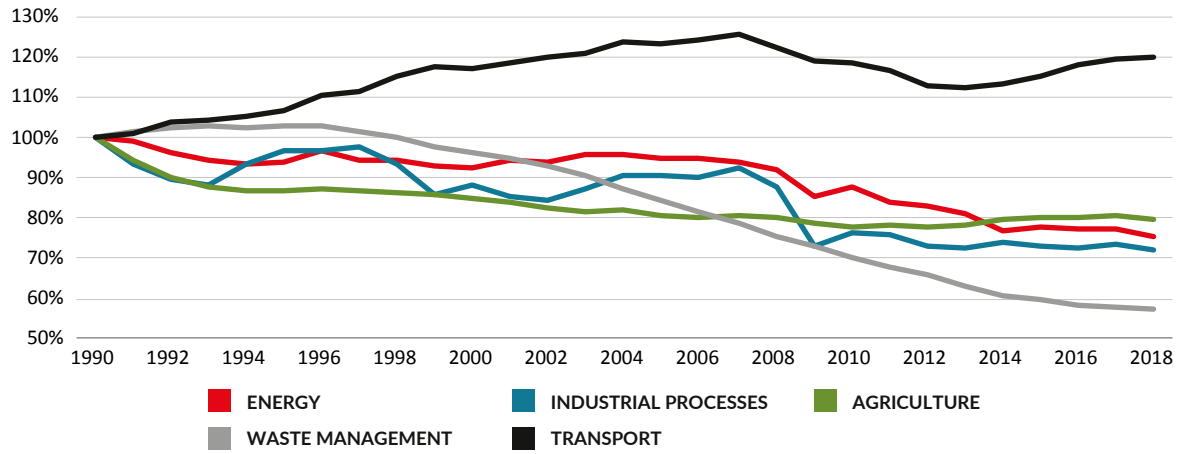
- The second recommended flagship project is the establishment of a Regional Competence Centre for Electromobility, which will strengthen the potential for electromobility development, not only in the V4 countries but also in the entire eastern part of the European Union. The Centre should support the education of engineering staff in new fields at technical universities, as well as develop and launch a programme of training and apprenticeship placements for production workers. The Visegrad Fund could play a key role in the establishment and operation of such an institution.

2. Analysis background – road transport and objectives of EU climate policy

In recent years, the efforts aimed at reducing greenhouse gas emissions both at the level of EU policies and the policies of individual Member States focused mostly on the power sector and the industry as they were responsible for the largest emissions of greenhouse gases into the atmosphere. Road transport was considered as one of the key sources of air pollution in cities. This is why the successive Euro emission standards for vehicles developed and implemented for many years did not account for emissions of carbon dioxide.

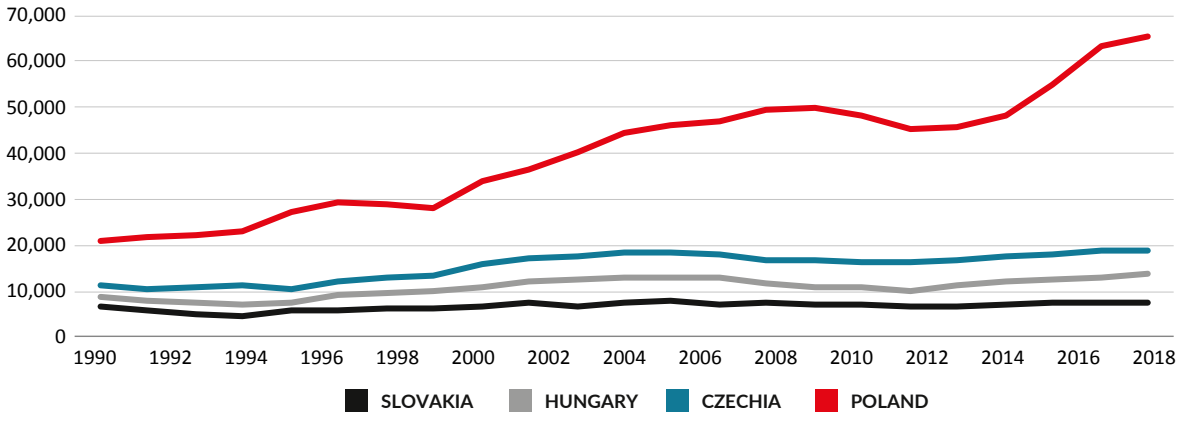
Transport is currently the sector with the largest share in greenhouse gas emissions in the European Union and the only one, whose emissions have been growing in the recent years. Fig. 1 shows that unlike in transport, in other sectors emissions have been steadily declining. A similar situation is seen in the V4 countries, where in the last 30 years emissions from the transport sector grew significantly (Fig. 2).

Fig. 1. Trends in greenhouse gas emissions in EU28 in selected sectors of the economy in 1990-2018



Source: In-house analysis based on EUROSTAT data, https://ec.europa.eu/eurostat/databrowser/view/env_air_gge/default/table?lang=en.

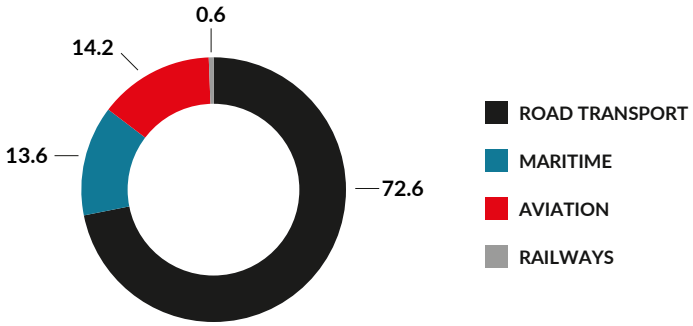
Fig. 2. Changes in greenhouse gas emissions in road transport in the V4 countries in 1990-2018 in million tonnes of CO_2 equivalent



Source: In-house analysis based on EUROSTAT data, https://ec.europa.eu/eurostat/databrowser/view/env_air_gge/default/table?lang=en.

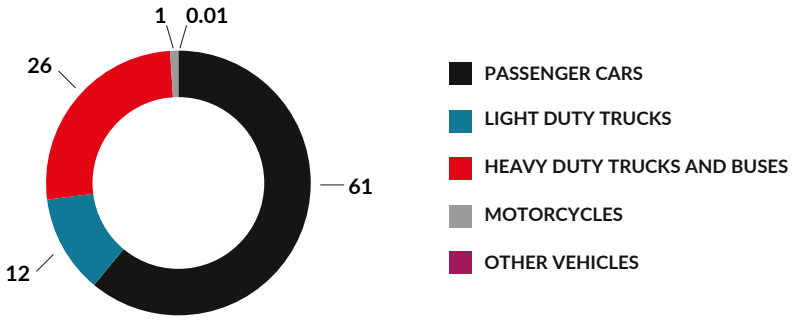
In the EU transport sector, road transport has by far the largest share in greenhouse gas emissions (Fig. 3). Fig. 4 shows that the largest source of emissions in road transport are passenger cars (61%), which is followed by heavy duty trucks and buses (more than 25%) and light delivery trucks (12%).

Fig. 3. Percentage share of greenhouse gas emissions from the transport sector in the EU in 2018



Source: In-house analysis based on the European Environment Agency's data, https://www.eea.europa.eu/data-and-maps/daviz/share-of-transport-ghg-emissions-2#tab-googlechartid_chart_11.

Fig. 4. Percentage share of greenhouse gas emissions from the road transport sector in the EU in 2019

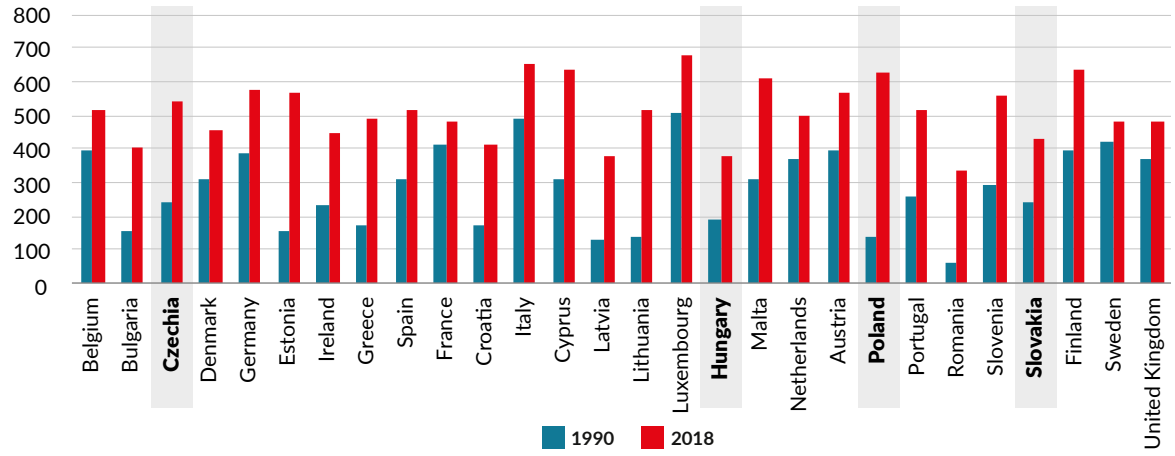


Source: In-house analysis based on the European Environment Agency's data, https://www.eea.europa.eu/data-and-maps/daviz/share-of-transport-ghg-emissions-2#tab-googlechartid_chart_11.

A reversal of the current trends in road transport emissions in the V4 countries is a demanding challenge. This results most of all from a consistent increase in the number of imported registered used and high-emission vehicles driven by their increased availability. This is a consequence of growing household wealth and increasing supply of used vehicles from more prosperous EU Member States.

In early 1990s, the number of passenger cars per 1,000 inhabitants in Poland, Czechia, Slovakia and Hungary was much lower than in the Member States of the former EU15. However, the rate is similar to that recorded in other EU Member States, and in the case of Poland, it is even one of the highest (Fig. 5).

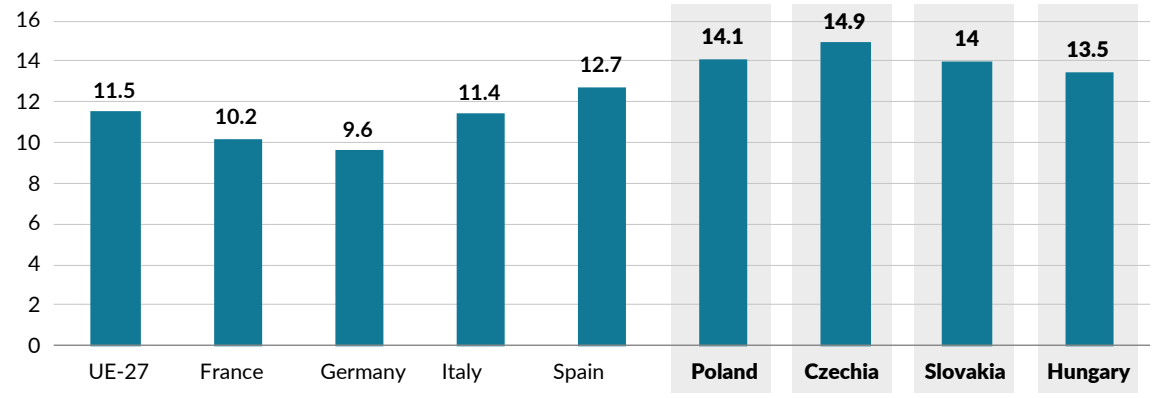
Fig. 5. Passenger cars per 1,000 inhabitants in EU28 Member States



Source: In-house analysis based on EUROSTAT data, https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset= road_eqs_carhab&lang=en.

The average age of a passenger car in the V4 countries and other countries of our region is higher than in the remaining EU Member States (Fig. 6). This means that the majority of the fleet are vehicles generating higher emissions, both in terms of releasing CO_2 and other harmful substances, such as nitrogen oxides and particulate matter.

Fig. 6. Average age of a passenger car in EU27 and selected Member States in years (data from 2019)



Source: In-house analysis based on the European Automobile Manufacturers Association's data (ACEA, *Average Age of the EU vehicle fleet*, 2021, https://www.acea.be/statistics/tag/category/average-vehicle-age).

The current EU climate policy has not facilitated effective reduction of emissions in the transport sector. The power sector and a large part of industry were covered by the EU Emissions Trading System (EU ETS). However, transport, along with agriculture, waste management, and residential buildings, were covered by a regulation on the sharing of EU greenhouse gas emission reduction commitment, i.e. effort sharing (also called the non-ETS sector). For each Member State, individual reduction targets are set.

Until 2020, the V4 countries were required not to reduce emissions in the non-ETS sectors, but to curb the increase in such emissions relative to 1990 (Table 1).

Table 1. Current greenhouse gas emission reduction targets for the non-ETS sector until 2020 and 2030 relative to 2005 emissions

Country	2020 target	2030 target
Poland	+14%	-7%
Czechia	+9%	-14%
Slovakia	+13%	-12%
Hungary	+10%	-7%

Source: In-house analysis.

The situation changed when the EU adopted the emission reduction target for 2030. The 40% target adopted in 2014 required Member States to commit to a reduction of emissions also in non-ETS sectors. Given that the V4 countries did not have any effective policies in this area for years, the implementation of measures aimed at cutting emissions, also in the transport sector, became an urgent challenge. The pressure mounted even more when the EU adopted a long-term objective of climate neutrality by 2050 and increased the emission reduction target from 40% to 55% by 2030 relative to 1990.

The EU's climate neutrality cannot be achieved without decarbonising road transport. The European Green Deal, a new strategy developed and adopted in 2020, clearly states that decarbonisation of transport is one of EU's priorities[1]. This assumption was confirmed in the new Sustainable and Smart Mobility Strategy[2] published by the European Commission at the end of 2020.

Many European countries (Norway, United Kingdom, France, the Netherlands, Sweden, Slovenia) declared that in the next 10-20 years they will impose a ban on registration of vehicles with an internal combustion engine[3]. The steps taken at EU level to introduce ever stricter carbon emission limits for vehicle manufacturers are also intended to phase out the use of fossil fuels in transport.

The new carbon dioxide emission limit set at 95 g CO_2/km, effective as of 1 January 2021[4], in practice pushes vehicle manufacturers to further increase the share of zero-emission vehicles in their offer. The ongoing discussions regarding a new emission standard Euro 7 will certainly bring new solutions promoting clean transport.

On 14 July 2021, the European Commission presented the awaited package of legislative changes **Fit for 55**. It includes proposed changes to 10 regulations related to energy and climate policy that are expected to guarantee a reduction of emissions by 55% compared to 1990. Transport, which is currently the main source of greenhouse gas emissions in the European Union, is the most important sector addressed in the package.

The measure proposed by the European Commission which is the most important for the sector is the accelerated electrification of passenger cars and trucks. By 2030, average emissions of new vehicles are to be reduced by 55% and 50%, respectively, and by 2035 they are set to be reduced to zero. This means a de facto ban on the sale of vehicles with internal combustion engines in the EU after 2035.

This is a revolutionary change for the automotive industry in the entire European Union, which will need to focus on the production of electric vehicles. This will also be a historical change for car users, who in the coming years will shift to zero-emission vehicles, primarily battery electric vehicles.

1 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *The European Green Deal*, COM(2019)640, 2019, http://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0016.02/DOC_1&format=PDF.

2 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Sustainable and Smart Mobility Strategy*, COM(2019)789, 2020, http://ec.europa.eu/commission/ presscorner/api/files/document/print/pl/ip_20_2329/IP_20_2329_PL.pdf.

3 S. Wappelhorst, H. Cui, *Growing momentum: Global overview of government targets for phasing out sales of new internal combustion engine vehicles*, International Council on Clean Transportation (ICCT), 2020, http://theicct.org/blog/staff/global-ice-phaseout-nov2020.

4 *Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011*, OJ L 111/13.

A crucial measure is also the proposed replacement of the existing directive on the deployment of alternative fuels infrastructure (the AFID Directive) with a regulation that will impose binding targets for electric vehicle recharging infrastructure, with particular emphasis on recharging points located along major transport routes (TEN-T) intended for light and heavy duty trucks.

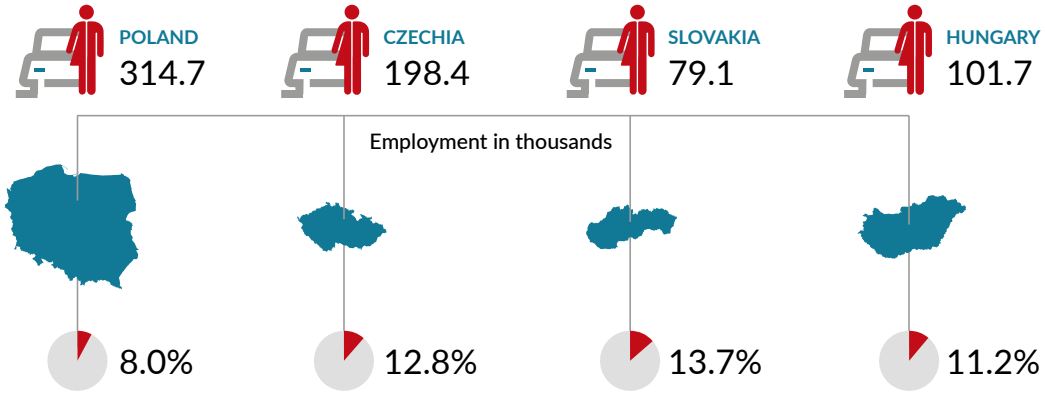
3. The V4 countries vs. the EU automotive sector

The automotive sector in Europe is a vital part of the economy – it provides as many as 15 million jobs and accounts for over 6.7% of total employment in the EU. In 2019, 18.5 million vehicles were produced in Europe, representing approximately 20% of global production. More than 5.5 million vehicles were exported, which generated a trade surplus of the EU amounting to EUR 74 billion. There are currently 313 million vehicles on the roads in Europe.

Manufacturing of vehicles and their components is one of the specialisations of the manufacturing industry in the V4 countries. Poland and Czechia have the largest number of companies operating in the automotive sector. In 2010-2017, production in the sector grew exceptionally fast also in Slovakia and Hungary (Slovakia doubled its production value in current prices in this area, while in Hungary the increase reached almost 90%).

The automotive industry is the most important for the economy of Slovakia. In 2010-2017, the increase in employment in the automotive sector was record high (54%) and in terms of annual vehicle production per 1,000 inhabitants Slovakia is currently the global leader[5] (Fig. 7).

Fig. 7. Employment (in thousands) in the automotive sector in the V4 countries



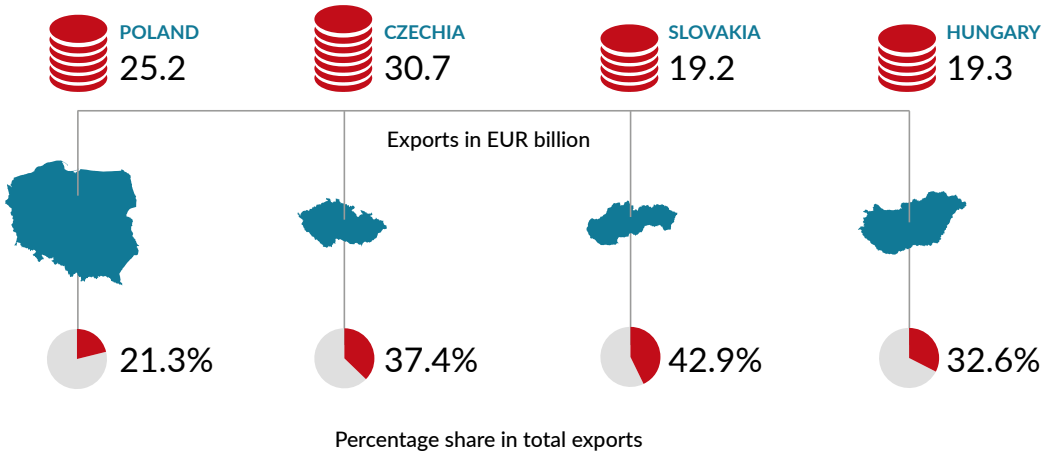
Share of employment in the automotive sector to employment in industry (%)

Source: K. Dębkowska et al., *The automotive industry in the Visegrad Group countries*, Polish Economic Institute, 2019, https://pie.net.pl/wp-content/uploads/2019/08/PIE-Raport_Automotive.pdf.

The automotive industry in the V4 countries is also a very important part of exports (Fig. 8). Relative to other member of the group, Poland shows a considerable share of the auto parts and components manufacturing sector. When in Czechia, Slovakia and Hungary the most important role is played by factories producing vehicles and major components (engines), Poland specialises in the production of spare parts and smaller automotive components.

5 K. Dębkowska et al., *The automotive industry in the Visegrad Group countries*, Polish Economic Institute, 2019, https://pie.net.pl/wp-content/uploads/2019/08/PIE-Raport_Automotive.pdf.

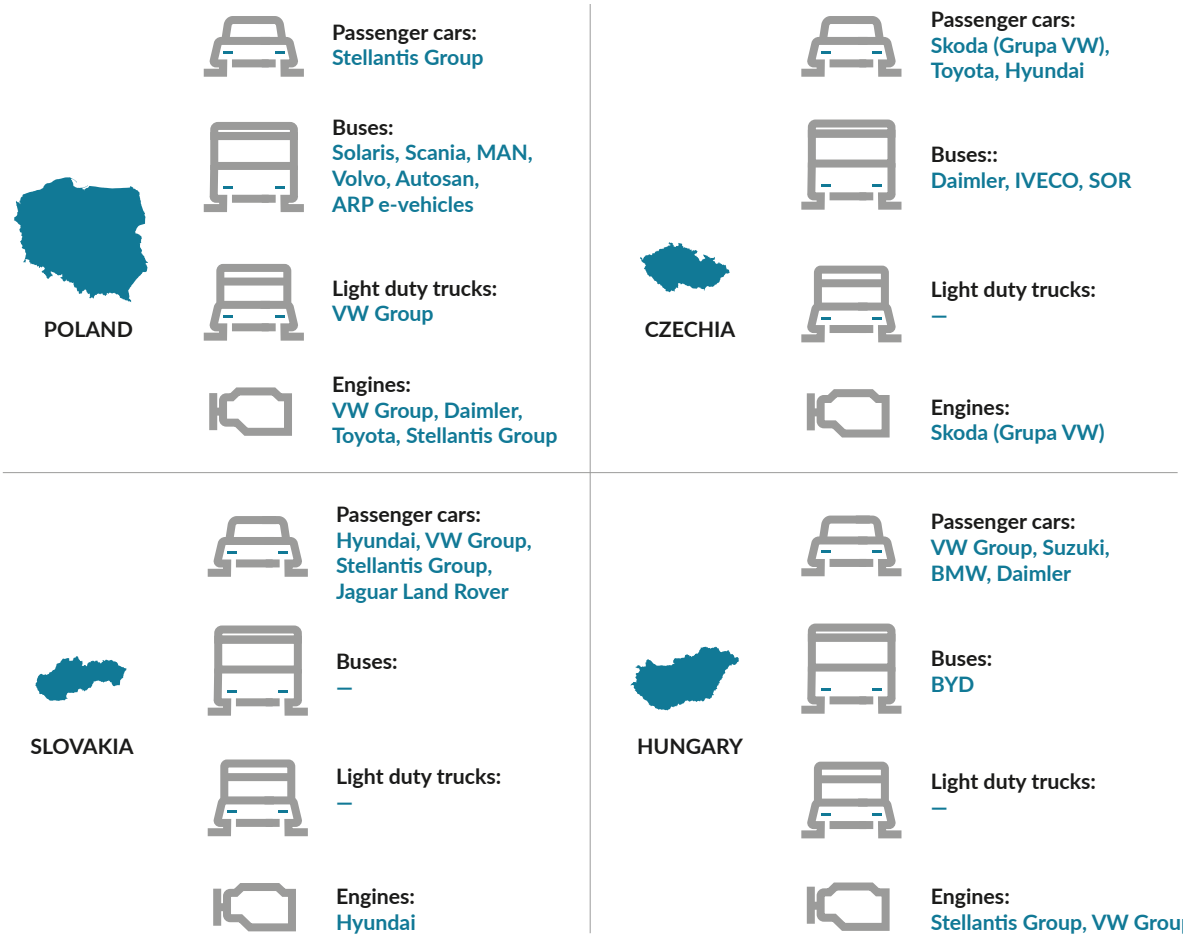
Fig. 8. Value and share of exports (in EUR billion) in the automotive sector in the total value of exports in the V4 countries



Source: K. Dębkowska et al., *op.cit.*

The Polish automotive sector is more diversified than those in other V4 countries. The existing global and European linkages in the value chain make Poland capable of adapting to new trends and technologies more effectively and faster (Fig. 9).

Fig. 9. Key vehicle and engine manufacturers in the V4 countries

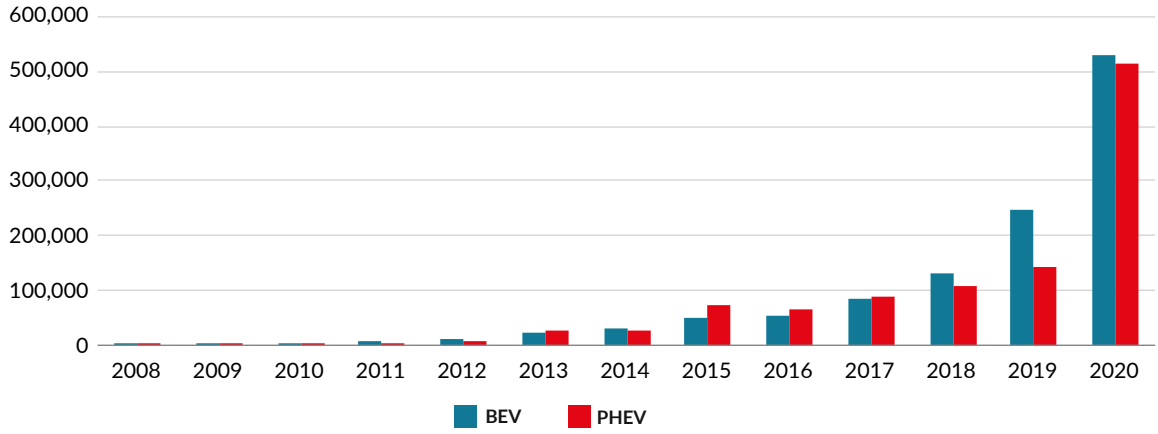


Source: In-house analysis.

The automotive industry in the V4 countries is based on traditional drive technologies. However, measures related to decarbonisation of road transport in the years to come will curb demand for vehicles with internal combustion engines (most of all diesel engines). This means that today's strong position of the automotive industry in the V4 countries in the European and global value chain may be at risk.

In 2019, more than 550,000 electric vehicles were sold in the EU (battery electric vehicles – BEV, and plug-in hybrid electric vehicles – PHEV), 45% more than in 2018. Data for 2020 suggests that despite a more than 25% decline in sales of passenger cars in the EU caused by the COVID-19 pandemic, the sales of electric vehicles grew dynamically and doubled the 2019 performance (Fig. 10). In total, over one million BEVs and PHEVs was sold. As a result, the share of electric vehicles in the market of new vehicles in Europe exceeded 10%[6].

Fig. 10. Number of new registrations of electric vehicles (BEV and PHEV) in the EU in 2008-2020



Source: The European Alternative Fuels Observatory's database, European Union, https://www.eafo.eu/countries/european-union/23640/vehicles-and-fleet.

It is very likely that the transport sector will undergo significant changes and the prevailing trends will include:

1. Vehicle electrification;
2. Carsharing;
3. Development of autonomous vehicles;
4. Cars connected with the Internet[7].

These trends will not only affect the decisions of consumers, today's drivers and passengers, but also the market of vehicle and auto parts and component manufacturers.

An electric motor in cars is significantly different from the traditional internal combustion engine because it is simple to build, less prone to failure, and relatively cheap. The automotive industry will have to open up to batteries – a completely new component mostly produced by sub-suppliers.

An important element of an electric vehicle is also its software responsible for energy management and control of all key systems. The reliability and functionality of EV software will be the main indicator of its quality, hence also the competitive edge in an ever more demanding market. The importance and value of software, including commercial applications, that will be used in the future will be growing along with the development of autonomous vehicles.

6 The European Alternative Fuels Observatory's database, European Union, https://www.eafo.eu/countries/european-union/23640/vehicles-and-fleet.

7 In general, a vehicle connected with the Internet may be any vehicle equipped with a device with access to the Internet and relevant applications. It should enable, among other things, transmission of data from the engine, chassis and other components to a data management system, as well as the processing of such data and its provision (also in the form of alerts) to the driver.

The way vehicles are used will also change. Shared cars, and ultimately autonomous vehicles, will be used much more often and with greater intensity than private or company cars currently are. Because the former will gradually replace the latter, the total number of registered vehicles will decrease consistently. All these changes will slowly transform the market, in particular the auto parts and accessories manufacturing sector.

Today's strong position of vehicle and component manufacturers in the economies of the V4 countries may reinforce the belief that the coming changes are still too far away to take action now. This is particularly the case for many smaller companies in the complex automotive supply chains.

Without the automotive sector taking action and without a conscious industrial policy of countries, their situation may change in a short period of time.

The same transformation is also expected to take place in the maintenance and repair sector. A significantly reduced number of maintenance and repair procedures combined with the elimination of specific services (e.g. oil or coolant change) will lead to a drop in the number of maintenance and repair shops, which may adversely affect employment in this sector.

4. Overview of electromobility development in the V4 countries

Electromobility, both in terms of the number of registered electric vehicles and growth of EV recharging infrastructure, is at an early stage of development in all Visegrad Group countries.

What played a key role in its expansion was the adoption in 2014 of the directive on the development of alternative fuels infrastructure[8], whose purpose is to support the use of alternative fuels in transport (AFID Directive). In accordance with the directive, alternative fuels are fuels or power sources which:

- serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport,
- have the potential to contribute to reduced oil imports by the EU Member States,
- have the potential to contribute to emission reduction in the transport sector.

Alternative fuels falling within this definition include: electricity, hydrogen, biofuels, synthetic and paraffinic fuels, natural gas (including biomethane) in the form of compressed natural gas (CNG) and liquefied natural gas (LNG), and liquefied petroleum gas (LPG).

Under the directive, the EU Member States are obliged to elaborate and adopt national policy frameworks for the development and build-up of alternative fuels infrastructure. The implementation of tasks set out in the directive was in each country the first and the most important incentive to start developing policies and the regulatory environment, whose purpose is to support electromobility.

8 *Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure,* OJ L 307/1.

4.1. Poland

4.1.1. Policies and regulatory environment

One of the key documents currently in effect that define Poland's electromobility policy is the Strategy for Responsible Development adopted in 2017[9]. The document for the first time sets an indicative target, as part of which by the end of 2025 there should be at least 1 million electric vehicles on Polish roads[10].

In March 2017, the Polish government adopted the Electromobility Development Plan in Poland[11]. The document sets out priority orientations for electromobility measures to be undertaken. The most important of these are:

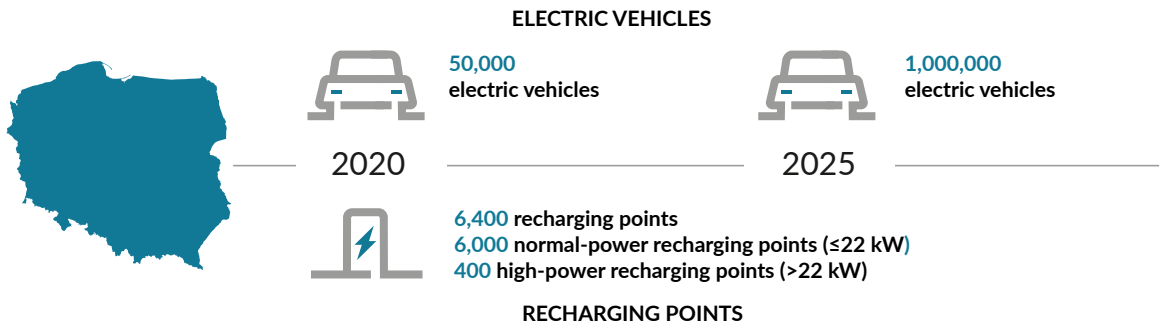
- change of awareness of potential users of electric vehicles,
- development of an incentive scheme for users of electric vehicles, including tax measures,
- development and support for manufacturers in the electromobility segment,
- regulatory changes determining and supporting the development of electromobility,
- power grid upgrade and its adjustment to the specific characteristics of drawing power from the grid by electric vehicles.

According to the forecast presented in the document, the implementation of the above measures was expected to result in the achievement of the following targets for 2020 and 2025 (Fig. 11):

1. In 2020, in 32 selected agglomerations 50,000 electric vehicles were assumed to be on roads, 6,000 normal-power recharging points and 400 high-power recharging points were assumed to be built, mainly along motorways, expressways and main national roads.
2. The forecast for 2025 provided for 1 million electric vehicles driven in the entire country.

The above electromobility targets were confirmed in the National framework for development of alternative fuels infrastructure[12] developed and adopted by the government in 2017 as part of implementation of the directive on the deployment of alternative fuels infrastructure.

Fig. 11. Indicative electromobility targets for 2020-2025 in Poland



Source: Ministry of Energy, *Electromobility Development Plan in Poland "Energy for the future"*, 2016, https://www.gov.pl/attachment/75d21d4a-fd28-400e-b480-a3bbc3f7db5e.

9 *Strategy for Responsible Development until 2020 (with an outlook to 2030)* adopted by the Council of Ministers on 14 February 2017, 2017, https://www.gov.pl/documents/33377/436740/SOR.pdf.

10 In the Strategy for Responsible Development and in other strategic documents (Electromobility Development Plan in Poland, National framework for development of alternative fuels infrastructure), the term electric vehicle means both a battery electric vehicle (BEV) and a plug-in hybrid electric vehicle (PHEV).

11 Ministry of Energy, *Electromobility Development Plan in Poland "Energy for the future"*, 2016, https://www.gov.pl/attachment/75d21d4a-fd28-400e-b480-a3bbc3f7db5e.

12 Ministry of Energy, *National framework for development of alternative fuels infrastructure*, 2017, https://www.gov.pl/attachment/c719b539-bbaa-4875-9adf-b7bf9010e62c.

To implement the measures and priorities specified in the above planning documents, in 2018 the Act on Electromobility and Alternative Fuels[13] was passed. It sets out the following:

- conditions for development and rules of location of alternative fuels infrastructure in transport and rules of the provision of electric vehicle recharging services (including the establishment of an intervention system for the construction of recharging infrastructure in 32 municipalities, and exemption of operators from the obligation to hold a licence for the sale of electricity),
- obligations of public entities related to ensuring a specific share of zero-emission vehicles in their fleets and in the fleets of public transport buses,
- rules of functioning of clean transport zones in cities.

The Act also includes provisions that pave the way for granting benefits and incentives for owners and users of electric vehicles. They include:

- exemption from the excise tax on the purchase of passenger battery electric vehicles (BEV) and until 1 January 2021 also for the purchase of passenger plug-in hybrid electric vehicles (PHEV)[14],
- allowing electric vehicle drivers to use bus lanes until the end of 2025,
- exemption of electric vehicles from fees applicable in paid parking zones,
- increasing the upper limit of depreciation charge.

In November 2020, in response to numerous calls regarding the need to change the existing regulations, a draft of a major amendment to the Act was referred for consultation. The proposed changes relate to, among other things, establishment and functioning of clean transport zones, new tax measures and changes in the rules of development of recharging infrastructure.

Provisions on electromobility were also included in the Energy Policy of Poland until 2040[15] adopted in February 2021. As part of Specific Objective 4 – Development of energy markets, and its Part C) – Market development for petroleum products and alternative fuels, including biocomponents and electromobility, a directional goal was identified, under which in 2030 the numbered of battery electric vehicles and plug-in hybrid electric vehicles registered in Poland should be 600,000. In order to ensure the possibility of recharging them at public recharging stations, by 2030 49,000 normal-power points and 11,000 high-power points should be built.

The previously adopted targets for the number of electric vehicles were therefore reviewed accounting for the existing status and pace of development of the sector in Poland. The document also specifies the lines of action aimed at reducing emissions in public transport.

To increase the role of public transport in reducing the so-called low emission of pollutants, the document also set the following targets for cities with a population of more than 100,000 inhabitants:

- from 2025 – all new buses purchased to provide public transport services will be electric and hydrogen buses;
- from 2030 – fully zero-emission public transport bus fleet.

13 *Act of 11 January 2018 on Electromobility and Alternative Fuels*, Journal of Laws of 2018, item 317.

14 The exemption from the excise tax and a higher depreciation limit became effective on 18 December 2018 after obtaining the European Commission's compliance with State aid rules. The exemption for plug-in hybrid electric vehicles was extended until the end of 2023 in an amendment to the Act on Excise Tax.

15 Ministry of Climate and Environment, *Energy Policy of Poland until 2040*, 2021, https://www.gov.pl/web/klimat/polityka-energetyczna-polski.

4.1.2. Support instruments

To secure financing for the planned activities related to the development of the alternative fuels and electromobility infrastructure, in July 2018 the Low-Emission Transport Fund was established under an amendment to the Act on Biocomponents and Liquid Biofuels[16]. The primary goal of the Fund was to provide financial support for the implementation of tasks set out in national documents on the development of electromobility and the related infrastructure. The source of its financing was the introduced emission charge, which was set at PLN 0.08 per litre of fuel. The Fund was to receive 15% of proceeds from the charge. Based on the estimates presented in the Regulatory Impact Assessment it was stated that in 2019 the proceeds should amount to PLN 1.7 billion, from which PLN 340 million was to be transferred to the Low-Emission Transport Fund. It was expected that during 10 years the income of the Low-Emission Transport Fund would total PLN 6.75 billion.

Despite the implementing acts elaborated and published in 2019 that specified the rules of disbursement of funds (including to facilitate the purchase of electric vehicles for natural persons, companies and institutions), the regulations never materialised and no application call was made. Ultimately, the operation processes of the Low-Emission Transport Fund were considered too complex and a decision was made to liquidate the Fund.

In practice, the Low-Emission Transport Fund was replaced by a multiannual commitment of the National Fund for Environmental Protection and Water Management. The shift was designed to speed up the allocation of public funds for the development of low-emission transport by simplifying the procedures of their disbursement. All funds collected in the Low-Emission Transport Fund (their amount as at the end of September 2020 was estimated at approximately PLN 610 million)[17] were transferred to the National Fund for Environmental Protection and Water Management.

To date, in Poland only a small pilot project of support for the purchase of electric vehicles was completed. In June 2020, based on own funds the National Fund for Environmental Protection and Water Management announced a call for applications as part of priority programmes aimed at co-financing of the purchase of the following vehicles:

- passenger cars for private individuals[18],
- vans for small and medium-sized enterprises (SMEs)[19],
- passenger cars to be used as a taxi[20].

The low amount of maximum support, quite complex procedures for obtaining a reimbursement and launch of the programme with no pre-announcement were the cause of little interest from customers. From nearly PLN 150 million earmarked for its implementation, only 7% was disbursed[21].

> At the end of June 2021, the National Fund for Environmental Protection and Water Management announced the long-awaited priority programme supporting the purchase of electric vehicles under the name “Mój elektryk” (My EV). The programme is scheduled to last long, until the end of 2025, and its total budget is PLN 500 million, including PLN 100 million for the application call for natural persons and PLN 250 million for supporting the purchase of vehicles for other entities in the form of a lease.

16 *Act of 6 June 2018 Amending the Act on Biocomponents and Liquid Biofuels, and Certain Other Acts*, Journal of Laws of 2018, item 1344.

17 Przemysł i Środowisko, *Likwidacja FNT - zmiany w ustawie o biopaliwach*, 2020, https://przemyslisrodowisko.pl/likwidacja-fnt-zmiany-w-ustawie-o-biopaliwach/.

18 The National Fund for Environmental Protection and Water Management, Green car – co-financing of purchase of an electric passenger car (M1), http://nfosigw.gov.pl/oferta-finansowania/srodki-krajowe/programy-priorytetowe/zielony-samochod/.

19 The National Fund for Environmental Protection and Water Management, eVAN – co-financing of purchase of an electric delivery van (N1), http://nfosigw.gov.pl/oferta-finansowania/srodki-krajowe/programy-priorytetowe/evan/.

20 The National Fund for Environmental Protection and Water Management, Koliber – a taxi good for climate – pilot project, http://nfosigw.gov.pl/oferta-finansowania/srodki-krajowe/programy-priorytetowe/koliber/.

21 Puls Biznesu, *PSPA: program dopłat do zakupu samochodów elektrycznych do poprawy*, 2020, http://www.pb.pl/pspa-program-doplat- do-zakupu-samochodow-elektrycznych-do-poprawy-999442.

For natural persons, the programme supports the purchase of only M1 category passenger cars (that can carry not more than 8 passengers), while for other entities the catalogue of electric vehicles covered by the support is much broader. These include:

- public sector entities,
- research institutes,
- entrepreneurs,
- associations,
- foundations,
- cooperative societies,
- individual farmers,
- churches and religious associations,
- religious organisations.

For those entities, the co-financing covers also vehicles with the following categories: M2 (that can carry more than 8 persons, with a weight of up to 5 tonnes), M3 (that can carry more than 8 persons, with a weight of more than 5 tonnes), N1 (light duty trucks with a total weight of up to 3.5 tonnes), and L1e-L7e category vehicles, i.e. two- and three-wheel mopeds, two- and three-wheel motorcycles, and quadricycles (e.g. quads).

Compared to the pilot projects, the vehicle upper price limit was increased from PLN 125,000 to PLN 225,000 and the minimum annual mileage requirement for natural persons was lifted. As a result, the support will cover a vast majority of currently offered electric vehicles, but as in other countries the purchase of very expensive and luxury models will not be supported.

Also, the approach to determination of the amount of funding changed. In the case of natural persons, the determination of the amount as a percentage (15% of eligible costs, but not more than PLN 18,750) was abandoned in favour of a fixed amount of PLN 18,750, irrespective of the purchase price of the vehicle. This does not apply to holders of the Large Family Card, who can receive PLN 27,000 without a cap on the purchase price.

As regards support for other entities, the system is slightly more complicated. For M1 category vehicles the price limit is the same as for natural persons (PLN 225,000), but the amount of funding is PLN 18,750, if the annual mileage will not be verified, or PLN 27,000, if the annual mileage will be verified and will be at least 15,000 km.

In the case of M2, M3 and N1 category vehicles, the co-financing may amount up to 20% of eligible costs, but not more than PLN 50,000, if the annual mileage will not be verified, or 30% of eligible costs, but not more than PLN 70,000, when the annual mileage will be over 20,000 km. No upper price limit applies to those categories.

No upper price limit and annual mileage requirement were set for mopeds and motorcycles, and the amount of co-financing is 30% of the purchase price, but not more than PLN 4,000.

The eligibility period started on 1 May 2020. This means that if an electric vehicle that meets the criteria of the programme was purchased not earlier than in May of last year, its owner may apply for a subsidy.

Support for the purchase of zero-emission buses has been provided by the EU Transport Projects Centre with the use of EU funds under the cohesion policy (Infrastructure and Environment Operational Programme and regional operational programmes). Virtually all electric buses that have been registered in Poland to date were purchased thanks to that co-financing, and the maximum support rate could be even 85%[22]. The support was provided not only for the purchase of buses, but also the purchase and installation of the related recharging infrastructure.

22 Ministry of Development Funds and Regional Policy, *New electric buses for Polish cities*, 2020, https://www.gov.pl/web/fundusze-regiony/nowe-autobusy-elektryczne-dla-polskich-miast.

In 2020, the National Fund for Environmental Protection and Water Management launched the Kangur programme[23]. Its purpose was to support the purchase of zero-emission buses (together with the purchase and installation of charging infrastructure) that would take children to schools, in particular in rural communes. The amount of funding was dependent on the number of inhabitants and wealth of the commune. In the case of the smallest (up to 5,000 inhabitants) and the least wealthy communes, the programme could cover even 95% of costs of purchase of an electric bus and costs of purchase and installation of the related charging infrastructure. Funds earmarked for the programme amounted to PLN 60 million, including PLN 40 million for subsidies and PLN 20 million for loans. The Kangur programme was implemented from the funds of the Green Investment Scheme (GIS).

In early 2021, the National Fund for Environmental Protection and Water Management launched the Green Public Transport programme, a three-year programme of support for the development of zero-emission public transport[24]. The programme budget for the first stage (for 2021) is PLN 1.3 billion. PLN 1.1 billion of that amount is designated for support to be provided in the form of subsidies and the remaining PLN 200 million as loans. A total of three applications calls under the programme are scheduled until the end of 2023.

In the first stage, the funding will be provided as follows:

- up to 80% of the cost of purchase or lease of electric buses and hybrid trolleybuses[25], including the cost of driver and maintenance staff training,
- up to 90% of the cost of purchase or lease of hydrogen buses, including the cost of driver and maintenance staff training,
- up to 50% of the cost of upgrade and/or construction of charging and/or hydrogen filling infrastructure.

In further stages of the programme, scheduled for 2022-2023, the support rate for the purchase or lease of electric buses and trolleybuses will be reduced to 70% and 60%, respectively (but the 90% support rate for hydrogen buses will remain unchanged). The second call for applications is planned to be launched in 2022, while the third in 2023.

No support programme has been set up yet for the construction of publicly available charging infrastructure. In December 2020, consultations were launched for a draft regulation of the Minister of Climate and Environment specifying the rules of co-financing of the purchase and installation of public and private electric vehicle charging stations[26]. According to the document, PLN 800 million is to be allocated for that purpose. The support would be provided under priority programmes of the National Fund for Environmental Protection and Water Management until 31 December 2023.

In accordance with the published draft, the subsidy will be available for:

- local government units,
- entrepreneurs,
- housing cooperatives and communities.

A subsidy of 50% of eligible costs can be received for the construction of public EV charging stations with maximum power of 150 kW or for the increase of power of an existing station to that level, as well as for the construction of a hydrogen filling station. In the case of public stations in municipalities with populations of up to 100,000 inhabitants, the support rate will be 75%, as the electric vehicle charging market grows more slowly there than in larger municipalities.

23 The National Fund for Environmental Protection and Water Management, Kangur – Safe and eco-friendly journey to school 2020, http://nfosigw.gov.pl/oferta-finansowania/system-zielonych-inwestycji---gis/konkursy/kangur--bezpieczna-i-ekologiczna-droga-do-szkoly-2020/.

24 The National Fund for Environmental Protection and Water Management, Green public transport, http://nfosigw.gov.pl/oferta-finansowania/srodki-krajowe/programy-priorytetowe/zielony-transport-publiczny-faza-i/.

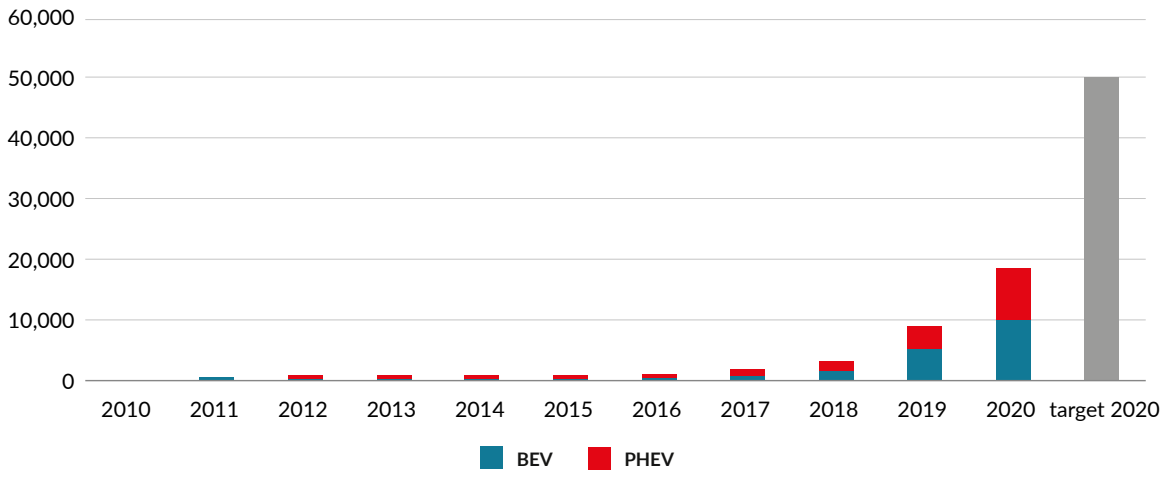
25 A hybrid trolleybus, apart from collecting current from an overhead line, it is equipped with an additional zero-emission drive system (e.g. batteries or hydrogen fuel cell). This allows it to cover routes without overhead wiring on some sections.

26 Ministry of Climate and Environment, *Draft regulation of the Ministry of Climate and Environment on detailed conditions for granting state aid for electric vehicle charging infrastructure and hydrogen refuelling infrastructure*, 2020, http://legislacja.rcl.gov.pl/projekt/12341508.

4.1.3. Electric vehicle fleet

At the end of 2020, the number of electric vehicles (BEV and PHEV) registered in Poland was 18,875, including 10,041 battery electric vehicles (BEV) and 8,834 plug-in hybrid electric vehicles (PHEV)[28]. This means that the target set out in the Electromobility Development Plan (50,000 EVs) was completed only in 38% (Fig. 12).

Fig. 12. Number of electric vehicles (BEV and PHEV) in Poland in 2010-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Poland, https://www.eafo.eu/countries/poland/1748/vehicles-and-fleet.

When analysing data on the registration of electric vehicles, it should be noted that despite their considerably lower presence in the market compared to e.g. the Netherlands, United Kingdom, Germany or the Scandinavian countries, the growth rate in Poland is similar to that recorded in those countries several years ago. If the growth rate from the last three years will be the same in subsequent years, by the end of 2025 approximately 100,000 electric vehicles will be registered and the 1 million target will be achieved around 2030.

The situation is better in the case of electric buses. At the end of 2020, there were already 372 electric buses on Polish roads[27][28], as a result of which Poland ranks 8th in the EU. Such strong performance is in large part the effect of legally binding targets imposed for the share of zero-emission buses in public transport fleet of municipalities.

In accordance with the provisions of the Act on Electromobility and Alternative Fuels, a local government unit (municipality or county whose population exceeds 50,000 inhabitants) is required to ensure that the share of zero-emission buses in its vehicle fleet is at least:

a) 5% – from 1 January 2021,

b) 10% – from 1 January 2023,

c) 20% – from 1 January 2025,

d) 30% – from 1 January 2028.

27 Polish Alternative Fuels Association, E-mobility Meter, https://pspa.com.pl/research/licznik-elektromobilnosci/.

28 European Alternative Fuels Observatory, Poland, https://www.eafo.eu/countries/poland/1748/vehicles-and-fleet.

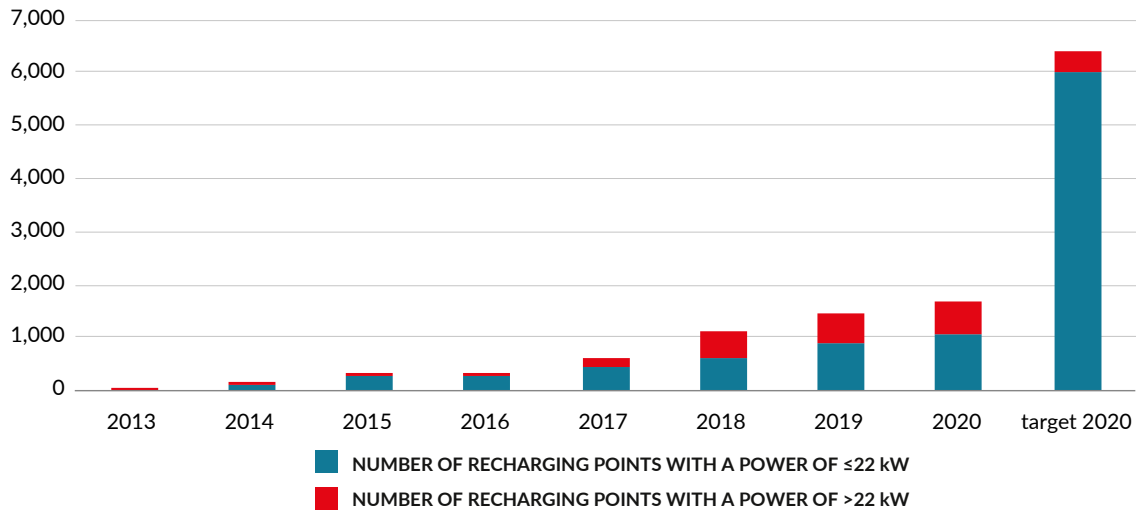
4.1.4. Recharging infrastructure

According to the forecast provided in the Electromobility Development Plan[29], at the end of 2020 there should have been approximately 6,400 public EV recharging points in Poland, including 6,000 normal-power points (up to 22 kW) and 400 high-power points (more than 22 kW). To that end, the Act on Electromobility and Alternative Fuels provided for the obligation to ensure an appropriate number of public recharging points in municipalities that meet certain criteria. In accordance with the Act, the minimum number of recharging points installed by 31 March 2021 at public recharging stations should have been as follows:

- 1,000 – in municipalities with a population of more than 1 million people, where at least 600,000 motor vehicles are registered and there are at least 700 motor vehicles per 1,000 inhabitants,
- 210 – in municipalities with a population of more than 300,000 people, where at least 200,000 motor vehicles are registered and there are at least 500 motor vehicles per 1,000 inhabitants,
- 100 – in municipalities with a population of more than 150,000 people, where at least 95,000 motor vehicles are registered and there are at least 400 motor vehicles per 1,000 inhabitants,
- 60 – in municipalities with a population of more than 100,000 people, where at least 60,000 motor vehicles are registered and there are at least 400 motor vehicles per 1,000 inhabitants,

According to the European Alternative Fuels Observatory's data, as at the end of 2020 the number of public recharging points in Poland was approximately 1,700 (Fig. 13), of which fast charging points represented 38% (648) and normal-power points accounted for 62% (1,039).

Fig. 13. Number of recharging points in Poland in 2013-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Poland, https://www.eafo.eu/countries/poland/1748/vehicles-and-fleet.

29 Ministry of Energy, *Electromobility Development Plan..., op. cit.*

The available data shows that the indicative target for EV recharging infrastructure as at the end of 2020 was completed in 37.5%. However, it should be noted that this was caused primarily by insufficient number of normal-power recharging points – just over 1,000 out of 6,000 points were installed, which is 17% of the planned number. The number of high-power charging points (648) exceeded the target (400) by more than 50%.

The insufficient number of recharging points is mostly a consequence of delayed achievement of targets set out in the Act on Electromobility and Alternative Fuels[30] coupled with the lack of any instruments of financial support for the construction of such points.

The largest share in the Polish electric vehicle charging market was held by Greenway of Slovakia. According to estimates based on an analysis of the Register of Alternative Fuels Infrastructure data, as at the end of 2020 Greenway operated more than 800 recharging points, including most of high-power points. The leader was followed by State-owned energy companies, such as Orlen-Energa, PGE and Tauron[31]. It is worth noting that the rapid expansion of the recharging infrastructure by those entities was achieved thanks to EU funding provided as part of a special instrument – the Connecting Europe Facility.

ElectroMobility Poland

The Polish government, as the only one in the V4 countries, launched an initiative to create a completely new brand of purely electric cars. The intention was first announced in June 2016, when four large State-owned energy companies (Energa, Enea, Tauron and PGE) and the National Centre for Nuclear Research signed a letter of intent.

In October 2016, the establishment of ElectroMobility Poland (EMP) was announced. At inception, its share capital amounted to PLN 10 million and each of the four shareholders held an equal equity interest of 25%. At the beginning of the company's operations, it was announced that its primary objective is to support the implementation of the target specified in the Electromobility Development Plan, which is to create conditions for the use of 1 million electric vehicles in Poland in 2025.

The original assumptions based on utilising the potential of Polish designers, constructors and automotive companies from the SME sector were abandoned when the attempt to establish a production consortium failed. In May 2018, a new action plan for the company was announced, which involved the design of two body versions of an electric vehicle in cooperation with renowned third parties and the construction of a new car factory by the end of 2023. The company received an injection of approximately PLN 40 million.

The official presentation of the Izera brand of electric vehicles to be manufactured by the Polish company was held on 28 July 2020. The event was combined with a demonstration of two prototypes. In December 2020, it was announced that the Izera factory would be built in Jaworzno within the Katowice Special Economic Zone. The series production of the first two Izera models is expected to begin in 2024, which is one year later than originally assumed.

At first, the production capacity will be 50,000 cars per annum, with a target capacity of even more than 100,000 per annum. The vehicles are to be offered for sale online or as part of instalment schemes, which is expected to ensure that Izera will become more attractive that its competitors and vehicles with internal combustion engines. In April 2021, the Minister of Climate and Environment announced plans for the takeover of EMP by the State Treasury[32].

30 As announced by the Ministry of Climate and Environment in January 2021 during public consultations of the draft amendment to the Act on Electromobility and Alternative Fuels, by the end of 2020 there was only about a third of the points that should have been placed in service by the end of March 2021.

31 Office of Technical Inspection, Register of Alternative Fuels Infrastructure, http://eipa.udt.gov.pl/.

32 P. Myszor, *Skarb Państwa przejmie Electromobility Poland*, WNP.pl, 2021, http://www.wnp.pl/motoryzacja/skarb-panstwa-przejmie-electromobility-poland,461473.html.

4.2. Czechia

4.2.1. Policies and regulatory environment

In Czechia, electromobility as a part of sustainable transport occurred for the first time in the National Environmental Policy for 2012-2020 and the National Transport Policy for 2014-2020[33]. In those documents it was stated that the development of low- and zero-emission vehicles is one of priority actions, but no specific plans in that area were presented. Electromobility was addressed more broadly in the National Energy Policy until 2040[34], in which it was identified as a measure of priority actions aimed at:

- reducing the domestic consumption of liquid fuels,
- improving energy efficiency in road transport,
- increasing the share of alternative fuels, including electricity.

The first and currently the only planning document with a comprehensive approach to electromobility in Czechia is the National Action Plan for Clean Mobility[35] adopted in October 2015 in fulfilment of commitments resulting from the implementation of the EU Directive 2014/94/UE on the deployment of alternative fuels infrastructure.

In the part concerning the deployment of electromobility, the following priorities were identified:

- building a backbone network of high-power recharging stations,
- creating demand for electric vehicles,
- creating conditions for social acceptance of electric vehicles,
- increasing the economic benefits for companies resulting from the purchase and use of electric vehicles.

The EU funds available under the cohesion policy, mostly as part of the Operational Programme "Transport" from EU structural funds, were indicated as the main source of financing. The planned financial support covers both the purchase of electric vehicles and development of public and private recharging infrastructure.

The scenario for electromobility development in Czechia provided in the National Action Plan for Clean Mobility covers an outlook until 2030. The indicative targets presented in the document are structured in a rather unusual way – not only in the quantitative, but also the spatial aspect.

In the adopted scenario, by the end of 2020 there should have been 17,000 electric vehicles on roads in Czechia, including 6,000 BEVs and 11,000 PHEVs. The recharging infrastructure was assumed to be composed of at least 1,300 public points, including at least 500 high-power points located:

- along motorways,
- expressways,
- main national roads,
- in localities with a population of more than 100,000 people.

33 Ministry of Transport, *The Transport Policy of the Czech Republic for 2014-2020 with the Prospect of 2050*, 2013, https://www.dataplan.info/img_upload/7bdb1584e3b8a53d337518d988763f8d/b13-00298_ministerstvo_dopravy_2014_2020_eng-05_1.pdf; Ministry of the Environment of the Czech republic, *Environmental Policy of the Czech Republic 2012-2020*, 2016, https://www.mzp.cz/en/state_environmental_policy.

34 Ministerstvo průmyslu a obchodu, *State Energy Policy of the Czech Republic*, 2014, https://www.mpo.cz/assets/en/energy/state-energy-policy/2017/11/State-Energy-Policy-_2015__EN.pdf.

35 Ministerstvo průmyslu a obchodu, *National Action Plan for Clean Mobility*, 2015, http://www.eafo.eu/sites/default/files/npf/1%20CZECH%20REPUBLIC%20NPF.en.pdf.

High-power recharging points make up the so-called basic backbone network that enables smooth movement of electric vehicles across Czechia – the points are located up to 150 km away from one another, which is less than the range of a passenger electric vehicle.

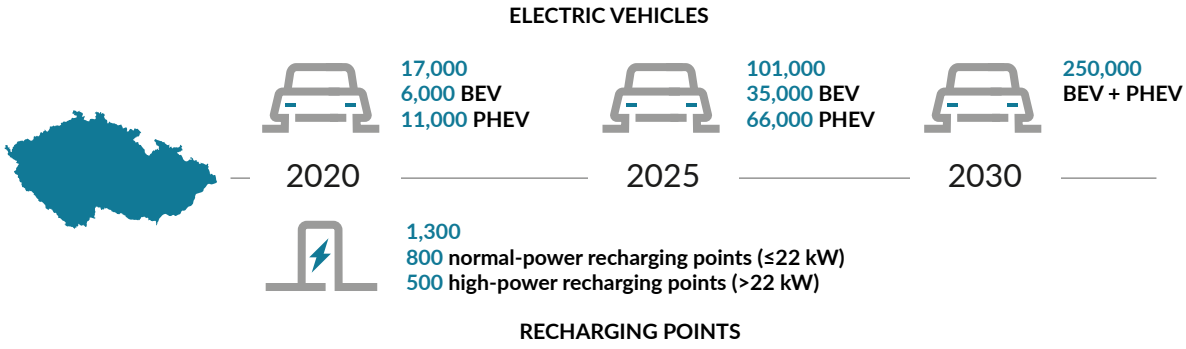
The remaining 800 points, mostly normal-power points, should create an additional backbone network, located mainly in localities with a population of at least 15,000 inhabitants. According to estimates, the construction of such a network in 2020 was supposed to ensure access to recharging infrastructure for at least a quarter of the country's population.

By 2025, the electric vehicle fleet is planned to be 35,000 BEVs and 66,000 PHEVs. The infrastructure network will be extended to include localities with more than 10,000 inhabitants (Fig. 14).

In 2030, the electric vehicle fleet is intended to include approximately 250,000 BEV and PHEV cars, and the recharging service will be based on real time pricing, in which the price of the service will depend on the time of day and current network load, also ensuring two-way flow of energy based on the V2G technology (Vehicle-to-Grid). It is assumed that after 2030 the operation of mechanisms supporting electromobility will be discontinued due to the achievement of full maturity and competitiveness, including in terms of costs, compared to traditional drive technologies.

The initiative regarding education in Czechia is also very interesting. In 2018, elements related to the significance of environmentally friendly forms of transport and mobility were introduced to school curricula. This is aimed at building social awareness and acceptance of zero-emission transport already in the school age.

Fig. 14. Indicative targets for electromobility in Czechia until 2030



Source: Ministerstvo průmyslu a obchodu, *National Action Plan for Clean Mobility*, 2015, http://www.eafo.eu/sites/default/files/npf/ 1%20CZECH%20REPUBLIC%20NPF.en.pdf.

In Czechia, other legislative solutions were adopted than e.g. in Poland. Matters related to electromobility were not addressed comprehensively in a separate legislative act. Technical aspects of the recharging infrastructure were covered in an amendment to the Act on Fuels and Petrol Stations[36]. The Public Procurement Act[37] includes provisions allowing public entities to use in their procurement processes the criteria based on an analysis of a vehicle's entire lifecycle costs[38], making it possible to take account of the full spectrum of benefits related to the purchase and use of electric vehicles.

In Czechia, an amended road law became effective in 2019, under which electric vehicles are issued special registration plates that facilitate their identification on roads.

36 *Act of 3 June 1994 on fiscal colouring and marking of some hydrocarbon fuels and lubricants and related measures, and amending some other Acts*, No. 136/1994, http://www.mpo.cz/assets/dokumenty/27629/31103/331518/priloha001.doc.

37 *Act of 19 April 2016 on Public* Procurement, nr 134/2016, http://sovz.cz/wp-content/uploads/2017/08/act-no.-134_2016-coll.-on-publicprocurement.pdf.

38 According to the methodology set out in *Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles*, OJ L 120/5.

4.2.2. Support instruments

To date, financial support for the purchase of vehicles and development of recharging infrastructure was ensured thanks to EU funds under the cohesion policy. They were made available primarily to companies and local government institutions. The projects that were completed in that area were described in the report on implementation of a national policy framework for the development of an alternative fuels market[39].

The operational programme focused on improving the competitiveness of businesses helped finance the purchase of more than 500 electric vehicles and the purchase and installation of approximately 270 recharging stations. The total amount of funding was EUR 20 million (including some EUR 4 million for the purchase of electric vehicles). The funding rate was up to 75% of eligible costs and subsidies were made mostly to local government units.

The amount of subsidy for the purchase of an electric vehicle was up to EUR 10,000. It was also possible to obtain a subsidy for the purchase of an electric bus, but its amount was only EUR 40,000. In addition, a programme supporting the purchase of electric vehicles for self-governments located in national parks was completed, with a budget of EUR 400 thousand.

Despite high expectations, no mechanism of financial support for the purchase of electric vehicles for natural persons has been launched. Given that the EU funds under the financial framework until 2020 have depleted, the existing financial support programmes have been discontinued. As announced recently, further programmes are planned to be launched in 2021 but not details have been released.

In terms of tax measures, the following incentives were applied:

- exemption from road tax for electric vehicles (the tax applies only to businesses),
- waiver of the fee for the issue of dedicated registration plates,
- as of 1 April 2020, passenger electric vehicles are also exempt from fees for the use of motorways.

Local self-governments were also given the power to exempt electric vehicles from parking fees[40] and allow such vehicles to be driven in bus lanes.

As previously announced by the Czech government, further tax incentives were planned to be introduced in 2021, such as exemption from tolls for electric heavy duty trucks DMC >12 t and an increase of the depreciation amount in the first year of use of a charging station. However, due to the economic slump caused by the COVID-19 pandemic, the implementation of these plans is uncertain.

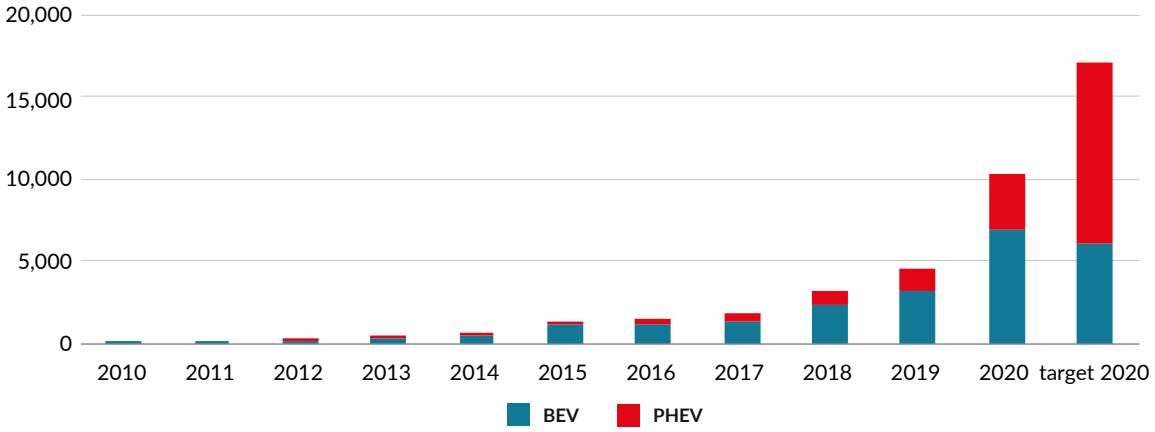
39 *Report of the Czech Republic on implementation of a national policy framework for the development of an alternative fuels markets in the transport sector and related infrastructure in accordance with Article 10 of Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure*, http://www.eafo.eu/sites/default/files/nir/Czech%20 Republic%20NIR%20 2019.zip.

40 To date, such exemption was applied only in Prague in its blue parking zone covering districts in the city centre. Source: http://www.parkujvklidu.cz/cs/zakaznici-zon-placeneho-parkovani/vytah-z-ceniku/.

4.2.3. Electric vehicle fleet

In accordance with the forecast presented in the National Action Plan for Clean Mobility, as at the end of 2020 there should have been some 17,000 electric vehicles on roads in Czechia, including 6,000 BEVs (Fig. 15).

Fig. 15. Number of electric vehicles (BEV and PHEV) in Czechia in 2010-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Czechia, https://www.eafo.eu/countries/czech-republic/1729/vehicles-and-fleet.

However, data from the end of 2020 shows that there were 10,000 electric vehicles registered in Czechia, including nearly 7,000 BEVs and over 3,300 PHEVs. Thus, the combined target was achieved in approximately 60%, but the target for BEV was exceeded by 15%. This means that in the forecast from 2015 the domestic market's potential for plug-in hybrid electric vehicles was greatly overestimated (target completed only in 28%). The data shows explicitly that these types of vehicles, which had not been previously covered by financial and non-financial support mechanisms, are much less attractive for Czech customers than purely electric cars.

The growth rate of registration of electric vehicles in the last three years is similar to that recorded in Poland, but EV share in the market of new vehicles in 2020 was higher than in Poland, at nearly 2.5%[41]. With continued support mechanisms, including the expansion of subsidies for the purchase of EVs to include natural persons, the outlook for further growth of the EV market in Czechia is very promising.

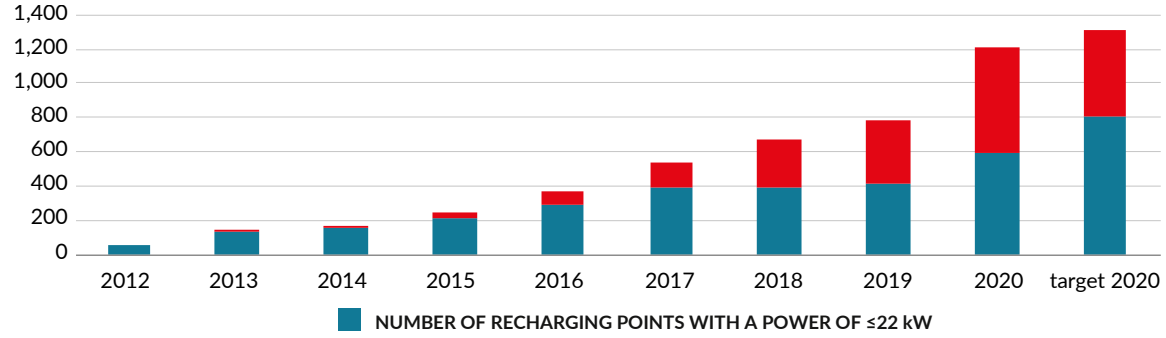
Hence, the achievement of directional goals set in the National Action Plan for Clean Mobility for 2025 and 2030 is fully within reach.

41 S. Hargreaves, *CO_2 targets propel European EV sales, transport and Environment*, Transport&Environment, 2021, https://www.transportenvironment.org/publications/co2-targets-propel-european-ev-sales.

4.2.4. Recharging infrastructure

According to the forecast presented in the National Action Plan for Clean Mobility, as at the end of 2020 in Czechia there should have been 1,300 recharging points, including 500 high-power points. Based on the available data, the total number of recharging points operated in Czechia as at December 2020 was 1,200, of which more than 600 were fast charging points. This means that the 2020 indicative target for recharging infrastructure was completed in approximately 92%, while the target for the number of fast charging points was exceeded by more than 20%[42] (Fig. 16).

Fig. 16. Number of recharging points in Czechia in 2012-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Czechia, https://www.eafo.eu/countries/czech-republic/1729/vehicles-and-fleet..

The result is to be regarded positively, given that contrary to e.g. Poland the Czech legal system does not provide for any binding targets for the development of electric vehicle recharging infrastructure.

The EV charging services market in Czechia is diverse. ČEZ, a power company, is the market leader. According to estimates, at the end of 2020 the company operated more than 230 recharging stations (some 400 points), with a market share of more than 35%. The second largest market player in terms of number of recharging stations is an energy major E.ON (approximately 12% of market share)[43]. Just like in Poland and Hungary, two large foreign entities begin to roll out their infrastructure network: the US-based Tesla (Supercharger with a capacity of at least 150 kW) and a consortium of European automotive companies IONITY (high-power points – at least 150 kW). What is important, investment plans of both companies involve the construction of several dozen charging hubs[44] in Poland, Czechia and Hungary over the next 2-3 years.

4.3. Slovakia

4.3.1. Policies and regulatory environment

As in the case of other V4 countries, the impulse for comprehensive measures supporting electromobility development at the national level was the need to implement commitments resulting from the EU directive on the deployment of alternative fuels infrastructure. In response to the requirements set out in the directive, the National Policy Framework for the Development of the Market in Alternative Fuels[45] and the National Policy for the Deployment of Alternative Fuels Infrastructure[46] were elaborated and adopted.

42 Database of the European Alternative Fuels Observatory, Czechia, https://www.eafo.eu/countries/czech-republic/1729/infrastructure/electricity.

43 Mapa dobíjecích stanic, EMobilita, https://www.elektromobilita.cz/cs/mapa-dobijecich-stanic.

44 Charging hubs are mostly located alongside motorways, expressways and in larger cities. They usually comprise several, more than a dozen or even several dozen high-power recharging points.

45 *National Policy Framework for the Development of the Market in Alternative Fuels*, 2015, https://www.eafo.eu/sites/default/files/npf/1%20SLOVAKIA%20NPF.en.pdf.

46 *Národná politika zavádzania infrastruktury pre alternatívne palivá v podmienkach Slovenskej republiky*, LP/2016/742, http://www.slov-lex.sk/legislativne-procesy/-/SK/LP/2016/742.

The documents specify strategic goals and development directions for road transport using alternative fuels. In relation to electromobility, the key goals include:

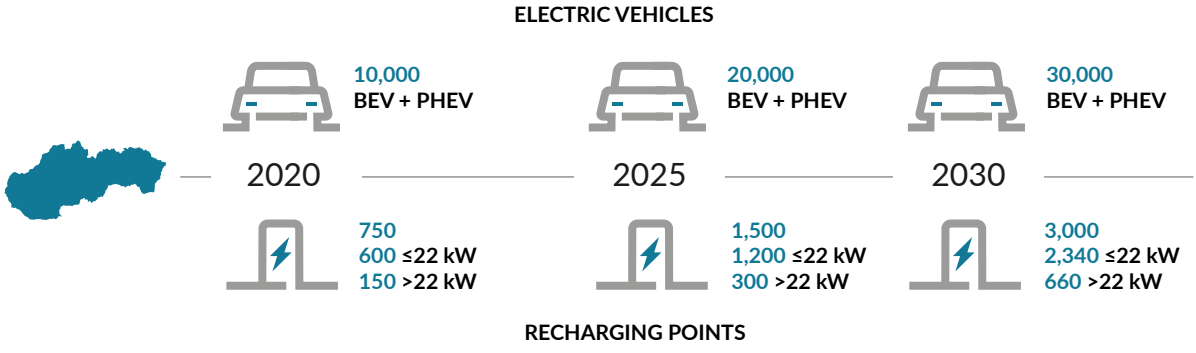
- stimulating demand for electric cars,
- creating social acceptance of electric vehicles, with particular emphasis on economic and environmental benefits of the purchase and use of electric vehicles,
- development of the recharging infrastructure based on the construction of nationwide backbone network,
- creating conditions for the national automotive sector to facilitate its involvement in the transformation of the transport sector in terms of deployment of low- and zero-emission technologies.

Based on the prepared electromobility development scenarios and in connection with their impact on the growth of national economy, indicative targets were proposed for the number of electric vehicles (BEV and PHEV) and recharging infrastructure to be achieved by 2030:

- by the end of 2020 there should have been 10,000 electric vehicles on roads in Slovakia,
- by the end of 2025 – 20,000 electric vehicles,
- by the end of 2030 – 30,000 electric vehicles.

As regards the deployment of recharging infrastructure, at the end of 2020 the total number of planned recharging points was 750, including 600 with a power of up to 44 kW and 150 with a capacity of more than 44 kW. The targets for 2025 and 2030 are, respectively, 1,500 (1200 + 300) and 3,000 (2,340 + 660). A noteworthy assumption is that the backbone network of the high-power recharging points (over 44 kW) was planned to cover primarily motorways, expressways, main national roads and cities with a population of more than 30,000, where approximately 90% of the planned high-power stations was to be located (Fig. 17).

Fig. 17. Indicative targets for electromobility in Slovakia until 2030



Source: National Policy Framework for the Development of the Market in Alternative Fuels, 2015, https://www.eafo.eu/sites/default/files/npf/1%20SLOVAKIA%20NPF.en.pdf.

In strategic documents, electromobility was not treated as a priority development direction in the alternative fuels sector and it was given relatively little attention. Much more emphasis was placed on the development of vehicle fleet powered by natural gas (CNG and LNG) and the related filling infrastructure. For example, in the case of natural gas vehicles the indicative targets for 2020, 2025 and 2030 are 5,000, 15,000 and 30,000, respectively – almost the same values as for electric vehicles. Very little attention was also given to the development of vehicles using hydrogen as fuel and their filling infrastructure, as no targets were set for that technology.

Due to insufficient implementation of the EU law proposed in strategic documents[47], in 2019 Slovakia adopted another document: Action Plan for Electromobility Development[48]. The document expands the scope of actions planned to be undertaken by 2030 to include the electrification of public transport in cities and provides for a programme supporting hydrogen as an alternative fuel. However, the indicative targets for electromobility remained unchanged.

What's particularly important is how the financing of the development of the alternative fuels market and infrastructure is planned after 2020. In accordance with the assumptions set out in the plan of 2019, the support for electromobility development is to be financed almost entirely from EU funds, and the availability of the funds was defined as a condition for its implementation. However, efforts in the same areas but related to gaseous fuels (CNG, LNG) are to be financed primarily from the state budget.

This means that in its policies Slovakia identifies natural gas as the priority direction for the development of low-emission transport. However, in the wake of current approach to natural gas in the European Union, adoption of such a strategy should be considered as risky and one that does not guarantee the achievement of new greenhouse gas emission reduction targets by 2030, as well as the strategic goal of climate neutrality by 2050.

Similarly to Czechia, in Slovakia electromobility is not covered by a separate legislative act. Matters related to technical aspects of the recharging infrastructure and the classification of electric vehicles have been incorporated in existing regulations. The only act devoted entirely to electromobility covers only the rules of financial support for the purchase of vehicles and construction of recharging infrastructure.

4.3.2. Support instruments

As provided for in planning documents, mechanisms of financial support for the purchase of vehicles and development of recharging infrastructure have operated based on EU funds under the cohesion policy. In 2016-2018, a programme supporting electric vehicle purchase was completed, in which the maximum amount of subsidy for an all-electric vehicle was EUR 5,000, and for a plug-in hybrid electric vehicle it was EUR 3,000. Over 830 vehicles in total (BEV and PHEV) were covered by the subsidies. Further support schemes are expected to be launched after the receipt of EU funds under the new financial framework[49].

The development of recharging infrastructure along TEN-T corridors, in particular high-power stations, was supported mainly under the Connecting Europe Facility, an EU instrument that helped finance the construction of nearly 100 recharging stations for two companies: GreenWay[50] and ZSE Energia[51].

In the fiscal area, the only implemented instrument is a registration fee for electric vehicles reduced by 50%, whose amount depends on the power of the motor and ranges from EUR 167 for motors with a power of up to 86 kW to EUR 2,997 for vehicles with a motor whose power exceeds 254 kW[52]. As the fee is low for vehicles most popular in the market and because it is a one-time cost, it has a negligible impact on purchase decisions of potential buyers.

In the area of non-financial support instruments, it was made possible to use criteria favouring the purchase of electric vehicles in the green public procurement system. However, only few entities have used that option and to a very limited extent[53].

47 In its opinion on the Slovak National Policy Framework for the Development of the Market in Alternative Fuels, the European Commission highlighted many gaps and that it was necessary to supplement the framework. Source: European Commission, *Summary on national plans for alternative fuel infrastructure*, 2021, https://ec.europa.eu/transport/sites/transport/files/2017-11-08-mobility-package-two/summary_of_national_policy_frameworks_on_ alternative_fuels.pdf.

48 Ministerstvo hospodárstva Slovenskej republiky, *National Policy Framework for the Development of the Market in alternatívě Fuels - Review and Update*, 2019, https://www.eafo.eu/sites/default/files/nir/Slovakia%20NIR%202019.zip.

49 Ministerstvo hospodárstva Slovenskej republiky, *National Policy Framework..., op.cit.*

50 CEF Programme, Greenway, https://gdzieladowac.eu/en/about-the-project/.

51 ZSE Drive Group, https://zsedrive.sk/o-nas/.

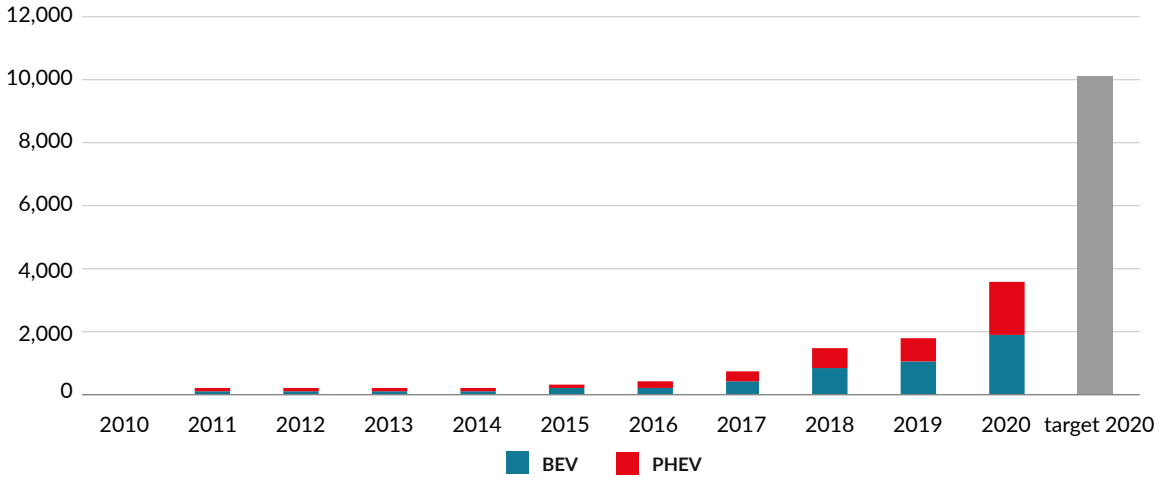
52 Podatki.sk, *Rejestracja samochodu na Słowacji*, 2017, http://podatki.sk/2017/03/20/rejestracja-samochodu-na-slowacji/.

53 Ministerstvo hospodárstva Slovenskej republiky, *National Policy Framework., op.cit.*

4.3.3. Electric vehicle fleet

According to the forecast included in the National Policy Framework for the Development of the Market in Alternative Fuels, as at the end of 2020 there should have been a total of 10,000 all-electric and plug-in hybrid vehicles on Slovak roads. Based on the available data, as at the end of December 2020 in total there were approximately 3,500 such vehicles registered in Slovakia. Therefore, the planned target was completed in 35%[54] (Fig. 18).

Fig. 18. Number of electric vehicles (BEV and PHEV) in Slovakia in 2010-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Slovakia, http://www.eafo.eu/countries/slovakia/1751/vehicles-and-fleet.

Nonetheless, it should be pointed out that as in other V4 countries, the number of such vehicles has been growing rapidly since 2018 and in 2020 they accounted for nearly 2%[55] of the market of new vehicles. It bodes well for the years to come, given the significant decline in the number of new vehicles sold in all European markets in 2020 driven by the COVID-19 pandemic.

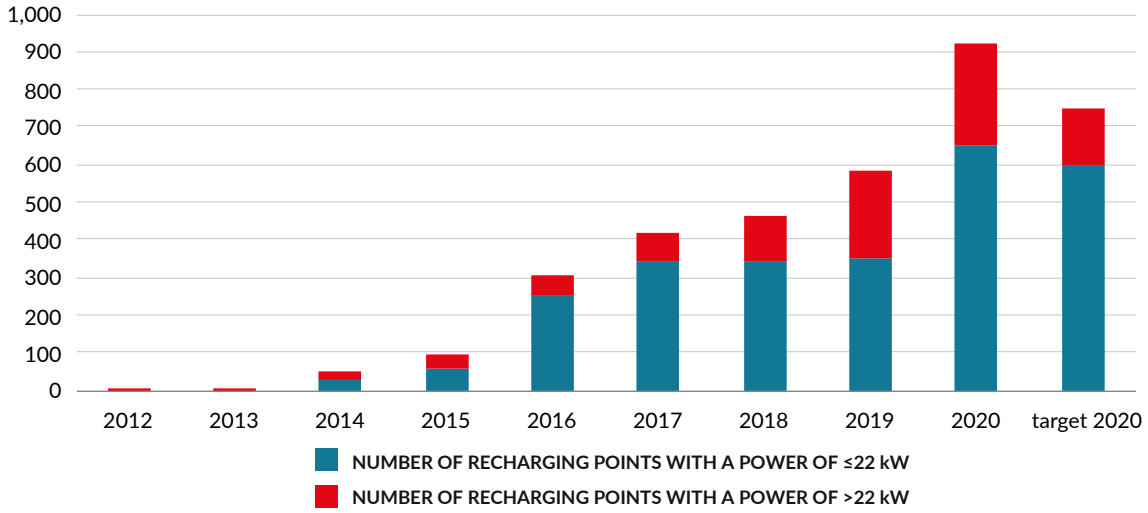
The primary goal of policies and regulations in the coming years should be to maintain the current trends, which will make the indicative targets for 2025 and 2030 in Slovakia entirely achievable.

4.3.4. Recharging infrastructurea

As at the end of 2020, there were 924 functioning charging points in Slovakia. This means that the indicative target defined in the forecast (750 points) was exceeded by over 23%. It should be noted that Slovakia, as the only V4 country, achieved (and even exceeded) the 2020 indicative targets for both normal-power (up to 22 kW) and high-power (more than 22 kW) charging points. The number of recharging points with a power of more than 22 kW exceeded the target by over 78%, while in the case of points with a capacity of up to 22 kW the target was exceeded by more than 9%[56] (Fig. 19).

54 Database of the European Alternative Fuels Observatory, Slovakia, http://www.eafo.eu/countries/slovakia/1751/vehicles-and-fleet.
55 S. Hargreaves, CO_2 *targets..., op.cit.*
56 Database of the European Alternative Fuels Observatory, Slovakia, http://www.eafo.eu/countries/slovakia/1751/infrastructure/electricity.

Fig. 19. Number of recharging points in Slovakia in 2012-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Slovakia, http://www.eafo.eu/countries/slovakia/1751/infrastructure/electricity.

In the market of recharging station operators, the largest player in the segment of recharging points with a capacity of more than 22 kW is GreenWay of Slovakia (which is also the market leader in Poland). The largest share in the segment of recharging points with a power of up to 22 kW is held by ZSE Energia, a power company. As indicated in the investment plans released by Tesla and IONITY, in the next few years in Slovakia those companies intend to build and launch at least several charging hubs along main roads, equipped with high-power charging points (with a capacity of at least 150 kW).

4.4. Hungary

4.4.1. Policies and regulatory environment

Compared to other V4 countries, Hungary has an advantage because of its comprehensive approach to electromobility development. The basic planning document is the National Programme for Electromobility Development[57] (also referred to as the Anyos Jedlik Action Plan[58]), which was elaborated and approved in 2015. The document identifies key areas of activities until 2030:

- elaboration and implementation of financial support instruments and incentives for electric vehicle users and development of recharging infrastructure,
- creation of an adequate and supportive regulatory environment for electromobility development,
- rollout of recharging infrastructure based on a backbone network (also in spatial terms),
- strengthening research and development in the domestic automotive industry,
- electrification of public transport,
- implementation of pilot projects designed to enhance social awareness and acceptance of electromobility.

57 Z. Bibok, *The Ányos Jedlik Plan: electric vehicles-> sustainable mobility*, Ministry of Agriculture, 2017, https://eionet.kormany.hu/download/1/46/c1000/03_Bibok_Jedlik_Anyos_Terv.pdf.

58 Jedlik Anyos was a renowned Hungarian physicist, inventor and researcher in the science of electricity, who lived in the 19th century. His most important inventions include a motor powered with direct current (1829) and an electric dynamo (1869).

Based on the assumptions of the plan, the National Policy Framework for the Development of Alternative Fuels Infrastructure[59] was devised and adopted in 2016 in fulfilment of the commitments set out in Directive 2014/94/EU. An implementation report was submitted to the European Commission in 2020 which presents scenarios in line with the National Energy and Climate Plan. The indicative targets set out in both documents for the electric vehicle fleet and recharging infrastructure were as follows:

- 2020 – 21,200 electric vehicles and 1,500 recharging points,
- 2025 – 81,800 electric vehicles and more than 8,200 recharging points,
- 2030 – 182,000 electric vehicles and more than 20,600 recharging points

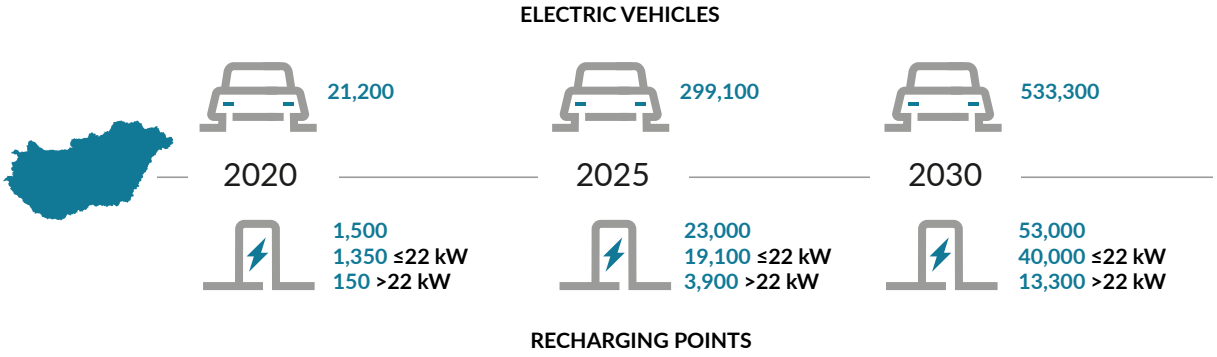
In 2019, a comprehensive review of the National Programme for Electromobility Development was carried out, and in consequence its completely new version was presented and adopted – the Jedlik Anyos Action Plan 2.0[60]. The document identifies new, long-term policy goals for electromobility development:

- implementation of a national model of the electromobility market, which will ensure that electric vehicles will be available to the broadest possible group of retail and institutional customers,
- further extension of the recharging infrastructure,
- promotion of electric vehicles,
- commitment of central and local authorities to the rollout of recharging infrastructure and fleet expansion using electric vehicles,
- decarbonisation of public transport (buses).

It is worth noting that electromobility was considered in the document as a vital element of decarbonisation of the road transport sector, which is necessary for achieving national and EU climate policy goals. Concurrently, unlike in other V4 countries, natural gas was explicitly regarded as unpromising fuel, which does not contribute to the implementation of climate policy goals. It is expected to play a role, albeit a limited one, only in the segment of heavy road transport, where the application of electric drive will be the most challenging.

The new programme also provides for updated electromobility development scenarios, in which new, more ambitious indicative targets for 2025 and 2030 were set. It is envisaged that nearly 300,000 (2025) and more than 500,000 (2030) electric vehicles will be on the roads, and that 23,000 (2025) and over 53,000 (2030) recharging points will be operated. The 2020 targets were left unchanged (Fig. 20).

Fig. 20. Indicative targets for electromobility in Hungary until 2030



Source: Ministry of National Development, The programme 'National policy framework as defined by the Directive on the deployment of alternative fuels infrastructure', 2016, https://www.eafo.eu/sites/default/files/npf/1%20HUNGARY%20NPF.en.pdf.

59 Ministry of National Development, *The programme National policy framework as defined by the Directive on the deployment of alternative fuels infrastructure'*, 2016, https://www.eafo.eu/sites/default/files/npf/1%20HUNGARY%20NPF.en.pdf.

60 R. Jánoska, *Ez a terv a magyar elektromos autózással kapcsolatban*, StartUp!, 2019, https://startuponline.hu/ez-a-terv-a-magyar-elektromos-autozassal-kapcsolatban/.

As part of an effort to adjust the regulatory environment, a legislative act devoted entirely to electromobility[61] was elaborated and passed, addressing definitions and key rules of creating the electromobility market and introducing them to the legal order. In an amendment to the existing legal acts, attention was given to other aspects of electromobility:

- in the energy law of Hungary, the obligation to hold a licence for trade in electricity was waived for operators of recharging stations (a similar measure was applied in the Polish Act on Electromobility),
- an RTP system for operators was introduced[62],
- procedures related to the construction and connection of recharging stations were greatly simplified.
- special registration plates for electric vehicles were introduced in the road law.

In 2019, a national plan for electrification of public transport (Green Bus)[63] was adopted, whose purpose is to ensure at least a 30% share of zero-emission buses in the urban bus fleet by 2030. In practice, this means the replacement of some 900 buses with electric-powered vehicles in the next 10 years.

4.4.2. Support instruments

The Hungarian system of support for electromobility is surely the most extensive of those adopted in the Visegrad Group countries. Notably, it is backed by significant funding based not only on EU funds under the cohesion policy, but most importantly on national funds.

The key source of Hungarian support for the development of electromobility is the Green Economy Funding System, supported with proceeds from the sale of emission allowances under the EU Emissions Trading System (EU ETS). At present, approximately 50% of funds spent in this system is used to support both vehicle purchase and recharging infrastructure expansion. Thanks to consistent inflow of proceeds from the sale of emission allowances in the coming years, the system has a stable, off-budget source of financing of electromobility, similarly to the National Fund for Environmental Protection and Water Management.

In 2021-2027, it is also planned that further expansion of recharging infrastructure will be financed with funds under new operational programmes (non-refundable grants) and from the European Investment Bank (EIB) provided as repayable assistance (preferential loans).

Several financial support schemes focused on the purchase of EVs by natural persons, companies and public institutions have been completed in Hungary since 2016. In accordance with the applied criteria, the scheme favoured the purchase of smaller and less expensive passenger cars, whose price did not exceed EUR 48,300. A subsidy of EUR 5,000 was granted only for all-electric vehicles (BEV). By 2020, a total of four calls for application were carried out for an aggregate of some EUR 40 million.

In June 2020, another edition of subsidies for the purchase of EVs was launched with different terms. In the case of an electric vehicle whose gross price does not exceed EUR 32,000, the buyer receives a subsidy of EUR 7,350. For vehicles with a price between EUR 32,000 and EUR 44,000, the subsidy if EUR 1,500. The purchase of more expensive vehicles is not covered by financial support[64].

In 2019, as a consequence of the national bus strategy, the Hungarian Government launched the Green Bus Programme which aims to replace the outdated bus fleet in public transport by supporting the purchase of electric buses and encouraging domestic bus manufacturing. One part of the Programme is the implementation of a Green Bus Demonstration Project, which brings electric buses to rural towns in order to get driving, route management and operational experience and raise awareness of the importance of the non-polluting vehicles in the public transport as well.

61 E. F. Csamangó, *The legal environment of electromobility in Hungary*, Journal of Agricultural and Environmental Law, Vol. XV No. 28 (2020), pp. 181-201, https://doi.org/10.21029/JAEL.2020.28.181.

62 RTP – Real Time Pricing, a tariff system in which the price changes in real time (usually every hour) depending on the supply and demand balance. The reference price is usually the day-ahead price.

63 M. Modijefsky, *Hungary launches Green Bus Programme*, ELTIS - The Urban Mobility Observatory, 2020, https://www.eltis.org/in-brief/ news/ hungary-launches-green-bus-programme.

64 Ministry for Innovation and Technology, *Report on alternative fuels infrastructure development in Hungary*, https://www.eafo.eu/sites/ default/ files/nir/Hungary%20NIR%202019.zip.

In addition to the HUF 35.9 billion domestic funding of the Green Bus Programme (Energy and Climate Modernisation Mechanism: ECMR), the greening component of the EU's Recovery and Resilience Instrument (RRF) with HUF 52.7 billion and the Cohesion Fund's IKOP Plus with HUF 91.4 billion, the three funds will enable the purchase of approximately 1,100 electric buses and charging devices in Hungary.

What is also very interesting is the system of tax incentives, which is the most extensive in the V4 countries. Buyers of electric vehicles are exempt from the registration fee, and in the case of company fleet vehicles – also from the tax on company vehicles[65]. Companies are also entitled to receive a 100% refund of VAT on the purchased electricity used to charge electric vehicles[66].

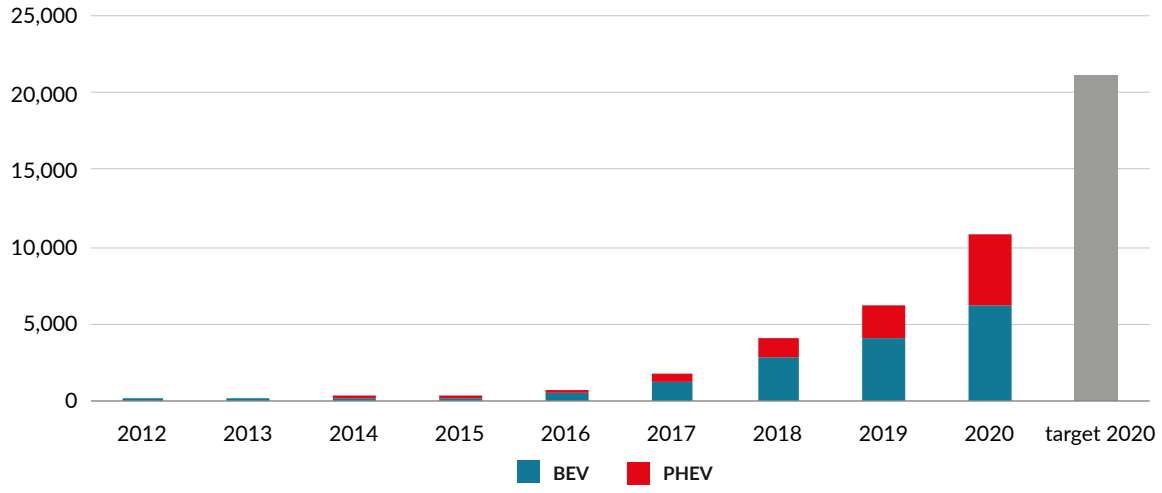
Among non-financial incentives introduced in Hungary, it is worth noting that electric vehicles are allowed on the roads during so-called smog alerts. They are announced in larger cities when according to forecast air quality standards may be significantly breached for a period of more than 24 hours. During a smog alarm, the use of vehicles with internal combustion engines may be prohibited, while their owners are allowed to use public transport free of charge[67].

Local governments also have the power to exempt electric vehicles from parking fees and issue permits for entry to limited traffic zones, e.g. areas of unique natural value. As in Poland, EVs in Hungary are allowed on bus lanes for a period specified by law.

4.4.3. Electric vehicle fleet

Based on the scenario adopted in the National Policy Framework for the Development of Alternative Fuels Infrastructure, the number of electric vehicles in Hungary should have reached 21,000 by the end of 2020. According to the available data, the target was achieved in about 50%, with the number of purely electric vehicles (BEVs) at more than 6,100[68] (Fig. 21).

Fig. 21. Number of electric vehicles (BEV and PHEV) in Hungary in 2010-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Hungary, http://www.eafo.eu/countries/hungary/1736/vehicles-and-fleet.

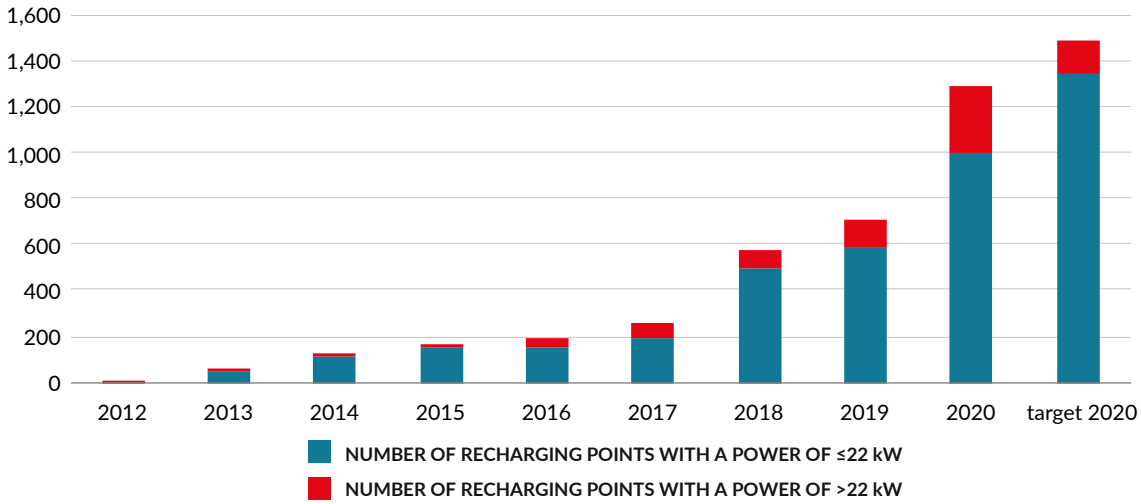
The growth rate for electric vehicles in Hungary is by far the highest in all V4 countries. In 2020, the share of electric vehicles (BEVs and PHEVs) in the market of new vehicles exceeded 5.7%[69], which was nearly two times higher than in other countries of the Visegrad Group.

65 The tax is charged when a company car is also used privately.
66 E. F. Csamangó, *The legal environment...*, *op.cit.*
67 *V. Ehsani*, G. Mwaniki, *Hungary Air Quality Policies*, UNEP, 2015, http://wedocs.unep.org/bitstream/handle/20.500.11822/ 17213/1/Hungary.pdf.
68 Database of the European Alternative Fuels Observatory, Hungary, http://www.eafo.eu/countries/hungary/1736/vehicles-and-fleet.
69 S. Hargreaves, *CO_2 targets.*, *op.cit.*

4.4.4. Recharging infrastructure

There was a total of 1,300 recharging points at the end of 2020 (including 1,008 up to 22 kW and 287 over 22 kW[70]), representing approximately 87% of the assumed target of 1,500. It should be noted that the target for recharging stations with a power of more than 22 kW was achieved with a large surplus, and the location of the stations along motorways, expressways and major national roads enables smooth movement of electric vehicles across Hungary. The pace of expansion of recharging stations with a power of up to 22 kW was somewhat slower, except in several largest cities (Fig. 22).

Fig. 22. Number of recharging points in Hungary in 2010-2020



Source: In-house analysis based on the European Alternative Fuels Observatory's data, Hungary, http://www.eafo.eu/countries/hungary/1736/infrastructure/electricity.

The charging services market in Hungary is diverse. More than a dozen entities operate in the country, and the largest networks of charging points (from 10 to 40 points) are operated by E.ON, ELMU, E-MOBI, NKM Mobiliti and MOL.

5. Growth prospects for electromobility in the V4 countries and the role of EU policies

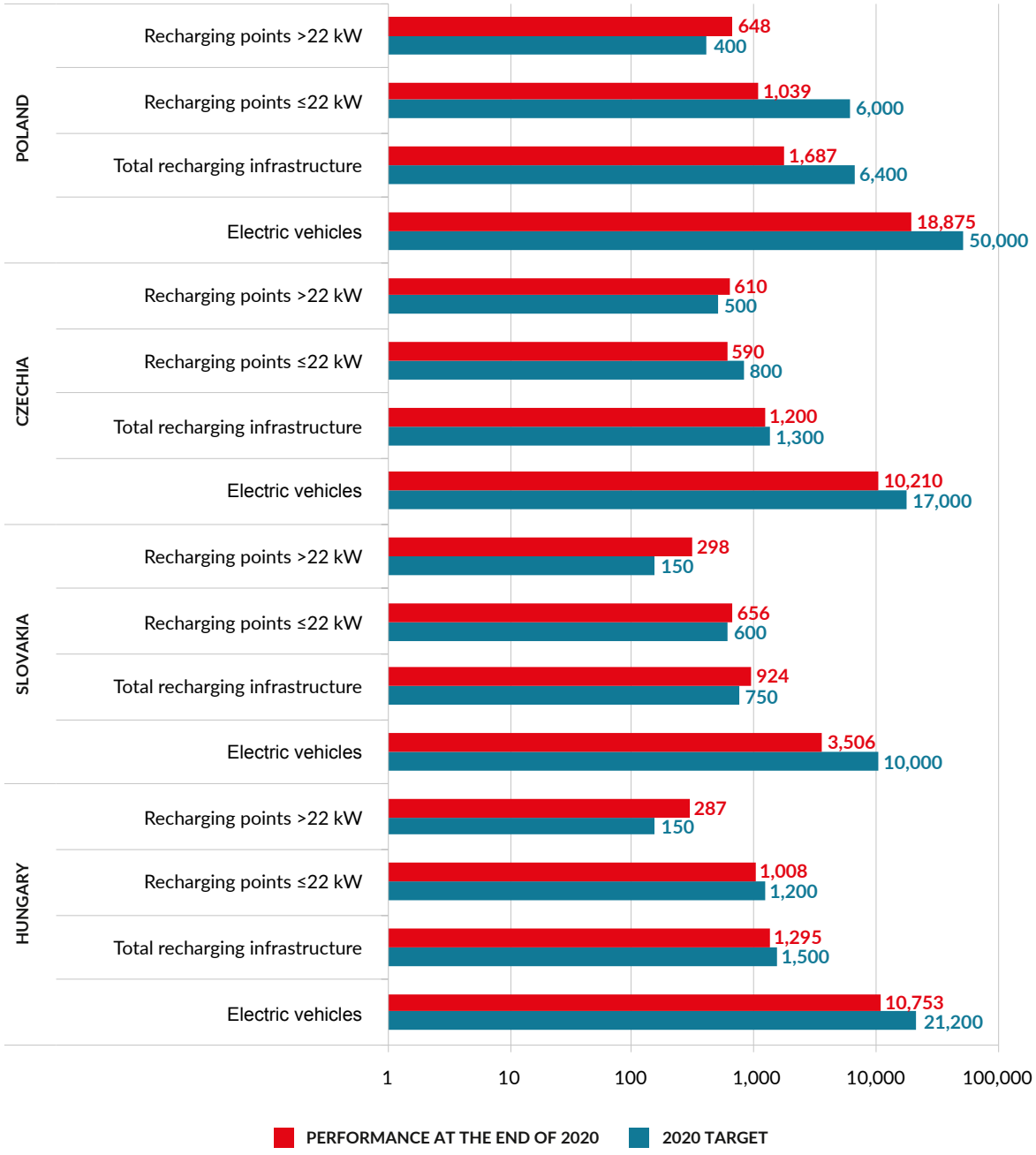
Further development of electromobility in the Visegrad Group countries should be assessed in the light of two key factors:

- EU policies,
- commitment of the country to actions aimed at decarbonising transport.

The above review suggests that a vast majority of indicative targets for 2020 in the Visegrad Group countries was not achieved. In this context, the only positive development was the expansion of the infrastructure of high-power recharging points (over 22 kW), in the case of which the 2020 targets were met in all V4 countries. Fig. 23 presents the level of achievement of electromobility development targets for 2020 in terms of vehicle fleet and recharging infrastructure. A noteworthy fact is that despite the crisis in the automotive market caused by the COVID-19 pandemic, the development of electromobility greatly accelerated in 2020 in all V4 countries.

70 Database of the European Alternative Fuels Observatory, Hungary, http://www.eafo.eu/countries/hungary/1736/infrastructure/electricity.

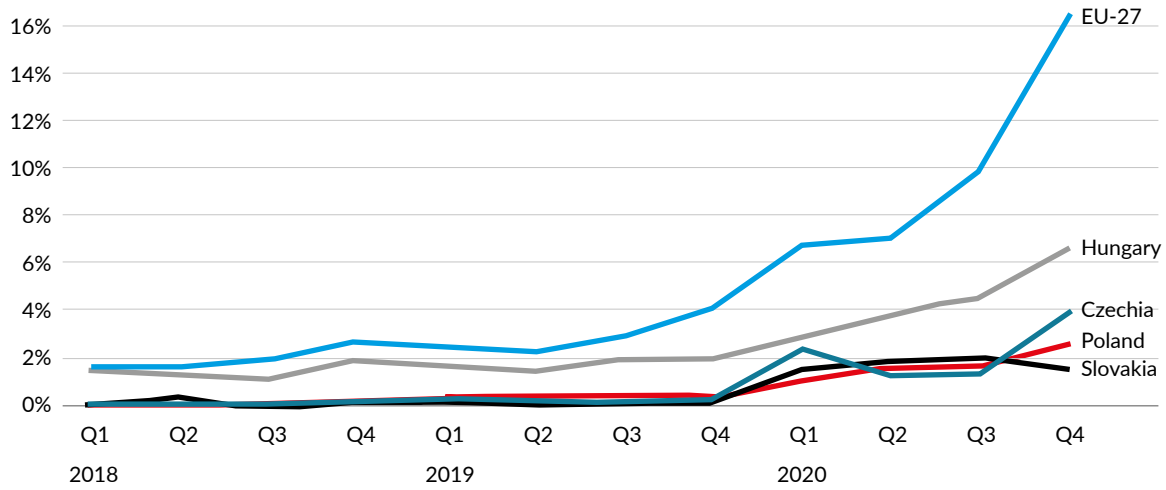
Fig. 23. Achievement of indicative targets for electromobility in the V4 countries as at the end of 2020



Source: In-house analysis based on the database of the European Alternative Fuels Observatory', www.eafo.org

In 2020, when the restrictions related to the pandemic caused a serious crisis in the market of new vehicles in Europe, sales of electric vehicles grew rapidly (Fig. 24). This means that electromobility is much more resilient to downturns in the automotive industry and supporting its development should fully match the primary goal of national recovery plans.

Fig. 24. Percentage share of passenger electric vehicles (BEVs and PHEVs) in new registrations in the V4 countries and EU27 in 2018-2020



Source: In-house analysis based on the European Automobile Manufacturers Association's data (ACEA, Alternative fuel vehicle registrations, 2021, https://www.acea.be/statistics/tag/category/electric-and-alternative-vehicle-registrations).

The scale of electromobility development in the Visegrad Group countries is comparable to what was observed only several years ago in Western European countries, which today have achieved greater progress in the development of zero-emission road transport. However, maintaining and further accelerating that growth rate will require greater commitment of governments of the V4 countries and a more active transport policy.

Main barriers for electromobility development

1. Electric vehicle purchase cost

Despite continuing downward trends in prices of battery cells, the prices of electric vehicles are still up to 50% higher than the prices of their internal combustion engine counterparts. It must be stressed that at the current stage of development the EV market primarily comprises the new vehicles market. At this stage, it is crucial that the Visegrad Group countries become more active to boost demand for electric vehicles.

At the early stage of development of zero-emission technologies, an important role in their popularisation may be played by subsidies (direct support for the purchase of an EV). However, in the longer run, such instrument will be too costly for state budgets.

A large potential and effectiveness in stimulating the low- and zero-emission vehicles market is demonstrated by fiscal measures, i.e. an appropriate tax policy.

At present, owning and using a vehicle with an internal combustion engine in the V4 countries does not entail the need to pay any environmental charges. As demonstrated by many years of experience of such countries as Norway and the Netherlands, the differentiation of taxes and charges depending on the environmental impact, i.e. the implementation of the "polluter pays" principle, may be an effective way to promote low-emission and zero-emission vehicles. It may also make the purchase and use of electric vehicles more attractive.

2. Imports of old high-emission vehicles

Electromobility development in EU Member States, where ever greater restrictions are imposed on the use of vehicles that do not meet the latest emission standards, causes a consistent decline in the prices of such vehicles in the secondary market. This is when they become attractive for importers. This effect is particularly apparent in the V4 countries, where used car imports much exceeds the number of new vehicles registered.

In 2020, the average age of imported vehicles further increased – data shows that in Poland it was more than 12 years. This means that Central and Western Europe, including the Visegrad Group countries, became the main export market for old vehicles with internal combustion engines (in particular with a diesel engine) phased out from other European countries.

The share of used diesel vehicles imported in 2020 was approximately 43%[71]. Concurrently, the number of vehicles per 1,000 inhabitants in Poland has already exceeded that in wealthier countries. Without introducing fiscal measures that will increase the cost of owning and using the most emissive vehicles (especially those with a diesel engine), it will be difficult to slow down their uncontrollable inflow and effectively advance the deployment of electromobility. It will also be harder to achieve the goals related to emission and pollutant reduction set out in strategic documents. Also, the implementation of a more sustainable transport policy with the emphasis on increased role of public transport and pedestrian and cycling mobility is gaining in importance.

Best practice examples

The review of national policies and the regulatory environment shows that despite the difficulties in creating a comprehensive ecosystem supporting electromobility, there are a number of measures that are worth to be implemented in other states in the region.

- What proved to be effective in Czechia and Slovakia was the location of key points of fast charging infrastructure along main transport routes and focusing support on the deployment of fast charging points. As a result, in the V4 countries driving an electric vehicle is by far the easiest on Czech and Slovak roads.
- What is also worth noting is the Polish model of electrification of public transport, in which legally binding targets were set for the share of zero-emission buses and their purchase support programmes were launched. The fact that the PLN 1.3 billion earmarked for the first stage of the Green Public Transport support programme was used up in just 15 days is a clear indication that local self-governments want to reduce the emissivity of public transport and switch their fleets to zero-emission buses. In effect, Poland is far ahead of other member states in terms of number of electric buses and as the only country in the region it is recorded in European statistics and reports on this market.
- An interesting solution worth dissemination is also the implementation of instruments granting state funds for decarbonisation of transport. Such measures were used in Poland (emission charge) and Hungary (proceeds from the sale of emission allowances).
- A very positive concept in terms of building social awareness at an early stage of education is the update of the school curriculum that was carried out in Czechia in 2018. As a result of the review, elements related to the significance of environmentally and climate friendly forms of transport and mobility were introduced to school curricula. This helps enhance social awareness and acceptance of zero-emission transport.

Public pressure to improve air quality in cities and reduce carbon dioxide emission has consistently grown. It is reflected in national and EU regulations on emission reduction in transport.

The EU budget adopted in December 2020, together with the auxiliary financial instruments, is the greenest budget in history. The targets related to protection of the environment had a record-high share in main financial instruments, such as the Cohesion Fund (37%), the Regional Development Fund (30%) and the Recovery and Resilience Facility (37%). The cause also became the sole pillar of a new instrument – the Just Transition Fund.

71 Money.pl, *Samar: Import aut używanych spadł o 16% r/r do 848,15 tys. sztuk w 2020 r.*, 2021, https://www.money.pl/gielda/samar-import-aut-uzywanych-spadl-o-16-r-r-do-848-15-tys-sztuk-w-2020-r-6594616458266241a.html.

However, it should be noted that additional funds in the Recovery and Resilience Facility[72] and the REACT-EU programme[73] must be allocated and contracted relatively fast, by the end of 2023. National recovery plans should include a significant component focused on supporting zero-emission transport, including the following most important objectives:

- support for electrification of public transport, in particular urban buses,
- support for the development of recharging infrastructure – especially fast charging hubs along main roads and normal charging points in multi-family residential buildings.

These two areas should be considered as priorities for the effective use of EU funds in the V4 countries as part of implementation of a long-term action plan for the decarbonisation of road transport.

Key recommendations

A flagship and symbolic project of the Visegrad Group countries could be the construction of an electric route (EV4 Route) linking all four capitals: Warsaw, Prague, Bratislava and Budapest. Along main roads between the cities (comprising the TEN-T network), a network of operational recharging points should be built to enable fast charging of not only passenger cars, but also light and heavy duty trucks. The distance between such hubs should not exceed 100 km and recharging stations should offer power of at least 150 kW for passenger cars and light duty trucks and 300 kW for heavy duty trucks. The project could contribute to further promotion of electromobility among the inhabitants of the V4 countries and support local businesses operating in the electromobility industry. It could also be the first stage of a pan-European project aimed at establishing links between all capitals in the continental territory of the European Union based on a backbone network of EV fast charging stations.

Forming a coalition for the development of transport electrification is important also due to the strong position of the automotive sector in the economies of the V4 countries. It is currently mostly based on the traditional internal combustion engine technology, which is already in decline. The automotive sector is expected to undergo major changes related to the transition to zero-emission technologies. The supply chain will be shortened and simplified and advanced IT technologies will gain in importance. This direction is consistent with the main pillar of a new paradigm of EU development, which is green and digital economy.

Investments in electromobility have already become a fact in the V4 countries:

- Poland became the main centre of production of electric buses (Solaris, MAN, Volvo) and LG Chem's battery factory in Kobierzyce is the largest such facility in Europe and third in the world. Another large investment in that market has been announced by Northvolt.
- In Hungary, an electric bus manufacturer BYD is expanding its production capacity[74], SK Innovation intends to build a battery plant[75] and the output of electric motors for Audi is increasing[76].
- The Czech Skoda is rapidly entering the electric vehicles segment and its plans for its EV model range indicate that this will be the main growth direction for the brand owned by the VW AG Group, one of the current leaders in electromobility in Europe. The production of Kona, Hyundai's electric model sold in European markets, has also been moved to Czechia[77].
- InoBat, a Slovak start-up that produces innovative car battery packs, is to increase its production capacity following the signing of an agreement for the supply of traction batteries to SOR, a Czech electric bus maker.

72 European Commission, *The Recovery and Resilience Facility*, 2021, http://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en.

73 European Commission, *REACT-EU*, 2020, http://ec.europa.eu/regional_policy/en/newsroom/coronavirus-response/react-eu.

74 Sustainable BUS, *BYD to expand production capacity in Hungary from 200 to 1,000 e-buses/year*, 2020, https://www.sustainable-bus.com/news/byd-production-plant-hungary-expansion/.

75 Z. Simon, *$2.3 Billion Battery Plant Planned for Hungary, Europe's Largest*, *Bloomberg*, 2021, https://www.bloomberg.com/news/articles/2021-01-29/sk-innovation-to-build-2-3-billion-battery-plant-in-hungary.

76 Audi MediaCenter, *Audi Hungaria produces e-motors for future PPE model generation*, 2021, https://www.audi-mediacenter.com/en/press-releases/audi-hungaria-produces-e-motors-for-future-ppe-model-generation-13713.

77 Hyundai Motor Group, *Hyundai starts delivery of Kona Electric produced in Czech Republic*, 2020, https://news.hyundaimotorgroup.com/MediaCenter/News/Press-Releases/Hyundai-starts-delivery-of-Kona-Electric-produced-in-Czech-Republic.

Relatively the worst performance in terms of investment was seen in Slovakia, where the automotive industry's share GDP is the highest. Without taking effective action to boost investment in new zero-emission technologies, the future of this part of the economy of our southern neighbour will be highly uncertain.

In view of the expected changes in the automotive industry in the coming years, it would be reasonable for governments of the V4 countries to commence work on national strategies for development of new, prospective directions in the automotive industry. These include:

- manufacturing of batteries and powertrains units for electric vehicles,
- giving a second life to traction batteries phased out from vehicles by using them for storing energy generated from RES,
- recycling of traction batteries, including recovery of such resources as lithium and cobalt,
- development of software for energy management in electric vehicles and commercial applications.

Significant changes in the automotive sector will also cause a stir in the labour market. New professional qualifications will be needed to support the quickly growing market of electromobility. Another project could be the establishment of a **Regional Competence Centre for Electromobility.** This initiative could involve the development and implementation of dedicated curricula on new specialisations at technical higher education institutions, covering, among other things:

- traction battery and drive unit technologies,
- EV energy management,
- recharging infrastructure and smart distribution networks,
- software and vehicle to grid communication.

Dedicated specialisations or postgraduate programmes could be launched at selected technical higher education institutions together with a system of scholarships that would enable students to supplement, share and expand their knowledge in an area of their choice. The role of the coordinator of such a scholarship scheme could be played by the Visegrad Fund.

As in the case of engineering staff, electromobility will also require new competencies of production workers. That is why the Regional Competence Centre for Electromobility should also ensure that they can be provided with relevant training. This would enable the preparation and assembly of staff ready to take up jobs related to new technologies applied in the production of electric vehicles, their components and recharging infrastructure.

> Electromobility has moved from being a fantasy to a megatrend, which, if reasonably implemented, may bring many tangible benefits to both power systems and economies of individual countries, as well as their societies. The countries of the Visegrad Group have a tremendous opportunity, but the question is: will they react fast enough and embrace it.

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FORUM ENERGII
ul. Wspólna 35/10, 00-519 Warszawa
NIP: 7010592388, KRS: 0000625996, REGON: 364867487

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