



Central Europe-East Asia EV nexus

Tracking Chinese, South Korean and Japanese electric vehicle and battery investment in the V4 countries

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Executive summary

- 1** The European automotive industry, a long-standing powerhouse of the EU economy, is now navigating unprecedented challenges. The shift towards electromobility is unfolding against a backdrop of **weakening competitiveness, geopolitical tensions** amid the US-China rivalry, a rising tide of **protectionism**, pressure from competitors' industrial policies, and the urgent imperatives of **climate action** under the EU's Green Deal. The V4 countries—Czechia, Hungary, Poland, and Slovakia—whose economies are **heavily reliant on the automotive sector**, are at the forefront of these transformations.
- 2** The V4 automotive sector has been built around foreign investment, which has transformed the region into a **key node in global automotive supply chains**, centered around Germany. Since the 1990s, East Asian actors have also been integrated into these supply chains alongside Western investors. However, the recent shift to electromobility has ushered in **a new wave of investments**, particularly in the emerging battery sector, reshaping established manufacturing and supply chain dynamics.
- 3** While South Korean and Japanese Original Equipment Manufacturers (OEMs) are **upgrading their existing lines for electric vehicle (EV) production**, Chinese OEMs have emerged as the **largest investors in future EV production**, with major investments in Hungary (BYD, up to €5 billion) and Slovakia (Volvo/Geely, €1.2 billion).
- 4** **China and South Korea are key players** in the V4 countries' battery and EV parts sector, with €14 billion and €12.4 billion in investments respectively, both already implemented and announced. Japanese investment in these parts of the supply chain has been more limited, totaling around €900 million. Most of the East Asian investments are **concentrated in Hungary and Poland**, with smaller allocations in Slovakia. Czechia remains largely absent from the investment map.
- 5** East Asian investors are driven by multiple factors when choosing where to locate manufacturing in Central Europe: leveraging **existing automotive supply chains**; meeting **political demand** from the EU; building **redundancy and spare capacity**; reducing transportation risks; diversifying supplier bases; ensuring production **continuity** in the event of geopolitical disruptions; and **circumventing tariffs**.
- 6** In addition to the quality of the investment environment and the direct and indirect incentives offered by V4 governments, **bilateral relations with East Asian countries** also play a mediating role in attracting investment.

7 In Hungary, close ties between the government and Beijing have facilitated **significant Chinese involvement** in the EV and battery sector, while South Korean investors have also benefited from generous investment support policies. In Poland, the significant presence of South Korean firms, particularly in the battery sector, appears to have fostered closer ties in other areas and contributed to enhanced political **cooperation between Warsaw and Seoul**. Meanwhile, the **Czech government's skeptical stance** towards China partly explains the lack of Chinese investments in the sector.

8 Current governmental policies across all four countries primarily emphasize **greenfield foreign direct investment (FDI)** and fostering a favorable business environment. However, low levels of government expenditure on research and development (R&D) and **insufficient investment in education and workforce development** hinder efforts to move up the value chain. As a result, the V4 states **risk remaining primarily assembly hubs**, an issue further exacerbated by the ongoing transition to electromobility.

Recommendations

- 1 Prioritizing EV sector transformation:** The electromobility transition and shifting geopolitical dynamics present new challenges to the V4 economies, requiring policymakers' attention to reap the opportunities in increasing value added, promoting further development of a high-skilled workforce, and boosting R&D in the sector.
- 2 Technology transfer:** The V4 governments must prioritize supporting technology transfer as this can facilitate industrial upgrading and increase value-added manufacturing. Promoting technology transfer also aligns with the European Commission's strategic and innovation agenda, as outlined in the Letta and Draghi reports.
- 3 State aid conditionality:** State aid must come with strings attached. Since the focus of the V4 governments should be on high-value-added production, tax cuts, subsidies, and other forms of direct and indirect aid should be extended only to firms that engage in technology sharing and include local suppliers and the workforce.
- 4 Joint ventures:** The V4 governments should promote the establishment of joint ventures between East Asian and European companies to reduce construction costs, expedite deployment, leverage synergies, and facilitate technology sharing and spillovers. Joint venture agreements should include clear requirements to ensure benefits for the local partner and the broader economy, such as equity and managerial control conditions (including veto rights), minimum R&D, and workforce-development expenditure.
- 5 Training labor force:** Reskilling and upskilling the automotive workforce must be a policy priority, especially as the V4 countries exhibit significant gaps in existing educational offerings. Governments should facilitate an increase in offerings in EV-focused courses and devise programs to enhance technical and digital skills, hands-on experience, and put acquired knowledge into practice. Governments should also encourage local companies and foreign investors to establish partnerships with vocational schools and universities and facilitate student placements. A variety of stakeholders should be included in the transition, including the governments, employers, labor unions, and educational institutions.
- 6 Addressing labor shortages:** The V4 governments must upgrade their migration policies to make their economies more attractive to foreign talent and ensure that migrants with the desired skills are entering their countries. While some countries pursue the deregulation of labor markets to facilitate migration, a comprehensive migration policy is essential to achieve a sustainable inflow of a highly skilled workforce.

7 Enhanced policy coordination: The V4 countries must strive to coordinate their industrial and technological upgrading strategies. All four would benefit from policies linked to technology transfer, such as local content requirements or R&D cooperation with domestic institutions. Coordination prevents a race-to-the-bottom competition in attracting FDI and is crucially important especially in EU's trade policy, heavily impacted by the recent imposition of countervailing duties. Additional EU-level regulatory actions are necessary to prevent regulatory arbitrage.

Introduction

A confluence of factors is challenging the industrial structure and the long-standing business model of four Central and Eastern European (CEE) countries: Czechia, Hungary, Poland, and Slovakia—collectively known as the Visegrad Four (V4). Since their transformation from command economies to free markets in the early 1990s, the automotive industry has been a backbone of their manufacturing sectors and, by extension, their economies.

Two major trends emerging in the 2020s now pose considerable challenges to the V4's established automotive sectors: the rise of EVs and the increase in geopolitical tensions and protectionism. East Asian EV and battery producers have surpassed their European counterparts in terms of production processes and technological expertise. At the same time, geopolitical tensions, such as tariffs, transportation risks, and military conflicts, have disrupted free trade and reshaped the export pathways of the automotive industry.

The consequences of these shifts are both disruptive and potentially advantageous for the V4 region. On the one hand, they undermine the position of the established automotive producers. On the other hand, they facilitate the inflow of billions of euros in East Asian greenfield and brownfield investments into the region.

This paper aims to provide a comprehensive understanding of these developments by examining them in four interlinked steps that combine empirical examination with policy-oriented analysis.

First, we present the most comprehensive dataset that maps EV and battery investments by East Asian firms from China, South Korea, and Japan across the V4 region. This dataset includes not only original equipment manufacturers (OEMs) of EVs and battery manufacturing plants, but also new investments across the entire EV and battery supply chain. This broader view allows us to see the depth of the supply chain, value-added activities, and the potential for technology transfer. Data are current as of April 2025 and are available via the **Central Europe-East Asia EV Nexus Tracker**,¹ which serves as a basis for analysis in this paper.

Central Europe-East Asia EV Nexus Tracker

An online interactive mapping tool developed by CEIAS that tracks all projects by Chinese, South Korean and Japanese investors in EV and battery supply chains in the V4 countries. The Tracker covers both projects in production and those where specific investment plans have been announced. The Tracker allows for filtering according to the host country, investor country, category (supply chain stage) and production status. Furthermore, the individual investment profiles include additional data on the investment amount, size of employment created, capacity, start of production, specific products (EV models) manufactured, and the form of cooperation with local/other foreign investors (where applicable).

Visit the Central Europe-East Asia EV Nexus Tracker →

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Second, we examine the trends affecting all V4 countries, including EU industrial and green policies as well as geopolitical shifts such as tariffs, nearshoring, workforce development, and industrial support. While all of these macro trends play out differently in each country, there are several commonalities across the region, not least because structurally all four countries are at the semi-periphery of the “Central European manufacturing core,” anchored by the German economy.²

Third, we provide individual country analyses. The transformation of domestic automotive industries is driven not only by external factors but also by domestic policy responses, or the lack thereof. While all V4 countries are active in courting East Asian investors, there are significant regional differences in approach, policy priorities, and their implementation. Each country has a unique set of factors that define its attractiveness for East Asian investors. At the same time, historical developments, regulatory demands, and policy idiosyncrasies present hurdles for investors in electromobility. To supplement the analysis, the authors have also implemented a series of interviews with experts and industry insiders in the four countries.

Lastly, we compare and contrast policy responses, toolkits, and preferences—both among the V4 countries and with other European economies—to gain a nuanced understanding of the current status of EV and battery investment. Taking stock of and comparing successes and failures allows us to identify best practices as well as pitfalls that should be avoided. This, in turn, provides a basis for recommendations to policymakers, who are intervening in the EV transition to maximize the benefits for their domestic economies. We identify measures that facilitate technology transfer and focus on workforce development as critical steps towards industrial upgrading and enhanced value-added production in the V4 region.

The big picture: The electric transition and the role of V4

This section provides a macro overview and identifies key trends affecting the development of the EV sector in the EU. We focus on the EV transition as a part of the EU's Green Deal, comparing it with similar strategies of the US and China. Then we characterize the main features of the V4 automotive sector.

A steep road for the EU's electromobility transition

The rapid development of electromobility in recent years has generated considerable concern within the European automobile industry, which has long been a cornerstone of the continent's economy. The pressure has come from both the US and China. The American EV producer Tesla has not only achieved significant success in technology development but has also secured a strong position in the EU's premium EV segment, albeit one that has been impacted by the involvement of Elon Musk, Tesla's CEO, in US policy following Donald Trump's return to the White House in January 2025.³ Furthermore, China has demonstrated its ability to implement an innovative industrial policy that leverages its economies of scale and substantial state aid.

Beijing made its intentions clear in 2015 with the publication of the "Made in China 2025" strategy, which aimed to establish China as a leader in electric vehicle (EV) production. Regulatory pressure has been complemented by subsidies designed to localize the entire electromobility value chain within China, as well as by state involvement in securing access to essential resources abroad. Additionally, competitive mechanisms among Chinese producers have been vigorously maintained. Consequently, China successfully built up refining capacities for resources required in lithium-ion battery production, subsequently advancing up the value chain. Ultimately, this has established a comprehensive ecosystem of highly competitive companies among EV suppliers.

The United States quickly recognized the sources of China's economic competitiveness and responded with industrial policy measures aimed at countering Beijing. Under the Biden Administration, Washington introduced the Inflation Reduction Act, which offers substantial subsidies to investors willing to establish clean technology manufacturing in the United States. This policy—currently under re-evaluation by the Trump administration—marks a significant shift, as the US has chosen to subsidize the operational costs of factories to align production costs with those in China. As a result, this initiative has fostered competition for investment in electromobility, attracting interest not only from China but also from Europe.

The situation in the EU is markedly different. Europe has been a dominant force in the manufacturing of internal combustion engine (ICE) vehicles for several decades. The competitiveness of German, French, and Italian manufacturers and their suppliers has remained high, generating a significant trade surplus with the United States and enabling the EU to navigate serious crises, such as the global financial crisis and the eurozone crisis. However, due to their strong position in ICE vehicle production, EU producers have been slow to adopt EV technology.

EV & battery supply chain



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The expansion of Chinese producers has raised questions about the EU's strategy of accelerating the transition to electromobility through regulatory pressure on European car manufacturers. Historically, the EU has favored strict regulations to encourage car manufacturers to transition to electromobility. In recent years, the EU has focused on implementing stringent climate regulations to limit the CO₂ emissions of cars. Since 2020, for instance, car producers have been required to limit average emissions per vehicle to specific levels (95 g CO₂/km for cars and 147 g CO₂/km for light commercial vehicles from 2020 to 2024, and subsequently 93.5 g CO₂/km and 147 g CO₂/km from 2025 onward). Additionally, a ban on the sale of ICE cars will take effect in 2035, a move that no other major market has undertaken, as most still regard internal combustion engines as valuable for certain applications.

While consumer subsidies for EV purchases are implemented on the member state level, the EU has allocated some support for such expenditures through the Recovery and Resilience Fund. Nevertheless, this regulatory framework presents challenges for traditional European car producers, who have been slow to adapt to the electric transition. Some programs supporting EV purchases have ended, resulting in a slowdown in the growth of EV sales. Consequently, some EU manufacturers are struggling to meet CO₂ requirements and are compelled to pay non-European manufacturers to participate in the pooling mechanism.⁴ In response, the EU Commission announced in March 2025 that it would soften the regulations by allowing car producers to average out their performance over three years (2025-2027) to meet their CO₂ targets.⁵

Additionally, the EU has sought to implement modest industrial policy initiatives. The Important Projects of European Common Interest (IPCEI) initiative serves as a small-scale experimental framework designed to stimulate private-sector innovation. Its objective is to co-fund joint initiatives that will establish factories and develop competencies in the production of strategic components. The first two editions of the program, in 2019 and 2021, focused on lithium-ion batteries, with the EU providing €6.1 billion across 69 projects, including gigafactories and recycling initiatives.

Compared to its main trade competitors, the EU has been slow to propose new industrial policy measures. However, discussions are underway regarding the redirection of EU resources from external debt to financing cutting-edge technologies, as suggested in the Draghi Report, "The Future of European Competitiveness." This report emphasizes strategies to restore EU competitiveness, with one of the key proposed solutions being the establishment of conditions through industrial policy to enhance the competitiveness of battery production, including access to rare earth and critical resources, new financial instruments, and the intensification of R&D. Others highlight the importance of deepening the Single Market, as noted in the Letta Report, "Much More than a Market."

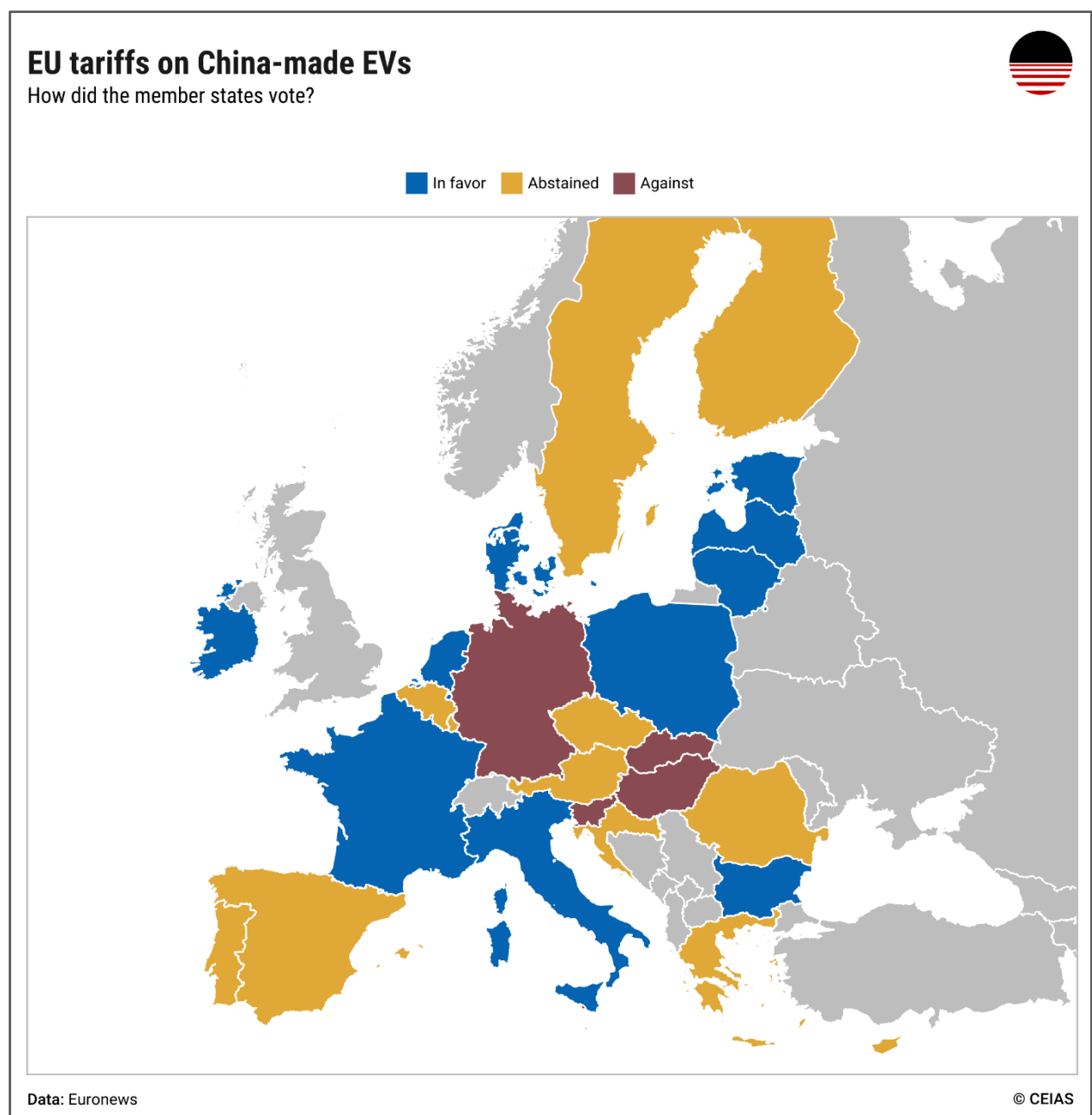
Based on the arguments presented in the Draghi Report, the European Commission announced an industrial action plan in March 2025 aimed at enhancing the competitiveness of the automotive industry. In addition to providing greater flexibility in achieving CO₂ targets, the plan includes incentives to stimulate demand for EVs, subsidies for EV battery production, the construction of charging stations, and the enhancement of skills for workers in the automotive sector. However, the bankruptcy of Northvolt—once touted as the EU's champion in a bid to escape the dependency on predominantly Chinese and South Korean battery makers—in 2024 highlights the struggles of European industrial policy.⁶

A significant new factor influencing the development of the automotive sector is trade policy. Between 2019 and 2024, Chinese car exports to the EU surged by nearly 1,600%, positioning China as the EU's primary import partner, with the EU accounting for almost 30% of China's EV exports in 2024.⁷ The share of EVs made in China on the European market rose from 2.9% in 2020 to

around 25% in 2024, with the proportion of Chinese brands increasing from 2% to 12% over the same period.⁸ Growing concerns in various markets about the rapid influx of EV imports from China have led many countries, including Brazil, Turkey, and Russia, to introduce tariffs and non-tariff barriers, despite the close political relationships some of these countries have with China.

Following an investigation that revealed the high level of subsidies within Chinese automobile production, in October 2024, the European Commission imposed countervailing duties on battery electric vehicle (BEV) manufacturers in China, aiming to create a more level playing field in the EU car market. The V4 countries were split on the vote, with Hungary and Slovakia voting against it, Czechia abstaining, and Poland supporting the increased duties.

Geopolitical tensions have further shaped the debate surrounding EV development, prompting EU countries to reassess their economic security. This was catalyzed by China's expansion of influence in areas previously deemed purely economic, as well as the recognition of its dependence on Chinese raw materials, components, and products during the COVID-19



pandemic. The escalating China-EU trade war, along with the growing risk of military conflict in the Indo-Pacific region, has exacerbated the situation.

Economic security has become a flagship initiative of the European Commission under President Ursula von der Leyen, leading to the development of the European Economic Security Strategy, which is currently being detailed and implemented among EU member states. For the most part, the EU rejects a strategy of decoupling from China, opting instead for the concept of "derisking." This term refers to the objective of better managing the risks associated with overdependence on China in specific sectors. Nevertheless, there is a growing level of distrust among EU institutions towards China, evidenced by a shift in the EU consensus from viewing China as a partner and competitor to primarily recognizing it as a systemic rival. However, significant differences remain in the approaches of individual national governments.

The re-election of Donald Trump might further fuel the debate in the EU. In the final days of the Biden administration, the US finalized its ban on vehicles connected to China and Russia, effectively resulting in a complete ban on imports of Chinese-made EVs. This was based on concerns about data security and the potential for remote access in connected vehicle systems, with fears that these EVs might be used for espionage or, in the worst-case scenario, sabotage. While the EU Commission has also signaled that it shares the US concerns, no concrete measures akin to the US regulation have been adopted so far.⁹

Meanwhile, the confrontational US trade policy, including general tariffs against the EU, as well as additional tariffs on the automotive sector, is putting further pressure on the region. While the signals from the US are mixed, it appears that at least some actors in Washington want to see a much closer alignment between the EU and the US on China policy, including cutting ties with China in the automotive sector and establishing China-free supply chains. However, this is complicated by the EU's ambiguous stance on the ultimate goal of the EV tariffs on China and general trade defense measures. Some regard it as an opportunity to incentivize Chinese producers to invest in Europe and produce locally, thereby providing employment, technology, and know-how. Others view these investments as a security risk that cannot be mitigated, echoing the 5G debate.¹⁰

Under pressure from competition from the US and China, the EU is recalibrating its instruments for stimulating the EV transition, shifting away from strong regulatory pressure on car manufacturers towards developing new industrial policy tools to support them. This shift might be conducive for the V4 countries, provided the new instruments are fairly distributed among EU member states rather than favoring richer countries. Similarly, if the use of Chinese software in cars sold on the European markets was limited, it could create opportunities for software designers from Central Europe.

Overall, the evolving policy landscape in the EU, marked by a shift towards more balanced industrial support and a reassessment of ties with China, presents both challenges and potential benefits for the V4 countries as they navigate the transition to electromobility.

The V4 automobile industry: A snapshot

The automotive industry has undergone significant structural transformations due to globalization, resulting in the establishment of global production systems and the formation of cross-border market structures involving the V4 countries. The integration of the V4 into global supply chains has been facilitated by the expansion of liberalized trade and investment activities, economic integration processes, and the development of a regulatory environment favorable to

foreign direct investment. OEMs in industrialized countries have evolved into multinational companies and also global industry players, aiming to capitalize on diverse opportunities in emerging countries, including those in European peripheries.

Since the beginning of the democratic transition in the early 1990s, the V4 region has been a significant hub for automotive investments. It has become a significant player in the European automotive industry by offering attractive manufacturing locations close to large and prosperous markets in developed economies, along with lower production costs, including relatively low wages. The V4 region has been providing the manufacturing know-how that is key to ensuring the competitiveness of the European (in particular, the German) car industry.¹¹ Since the 1990s, not only has car manufacturing grown significantly, but the accompanying supply chains have also grown even faster: OEMs selected V4 countries as early as the early 1990s, followed by numerous international automotive suppliers. Consequently, the V4 region has become a major automotive cluster and is deeply integrated into global supply chains. The automotive industry—and the related foreign investors—have become the primary catalyst for industrial production, contributing significantly to GDP growth in the V4 economies.

The automobile sector provides significant employment. In Poland, the sector employs the largest number of individuals, totaling 318,900, surpassing Czechia (216,100), Hungary (138,300), and Slovakia (128,300).¹² However, the situation changes when considering the share of total employment. In this context, Slovakia has the highest share of employment in the automobile sector, accounting for 25% of employment in manufacturing, followed by Czechia (16%), Hungary (15.8%), and Poland (9.8%). This data indicates that the automobile sector plays a dominant role in Slovakia. While it remains a key sector in Czechia and Hungary, Poland's larger population leads to a more diversified economic structure.

The formation of the V4 automotive cluster occurred in several stages, shaped by the involvement of foreign investors.¹³ The first was the acquisition of existing car factories, most of which took place in the 1990s. Volkswagen led this process by establishing joint ventures with established companies in Czechia (Škoda Auto) and Slovakia (BAZ) and by manufacturing commercial cars in Poland. During this period, Fiat made investments in Poland (FSM). This was followed by new greenfield investments from leading companies, including GM, TPCA, and Mercedes. Since spatial proximity plays a crucial role in modular manufacturing, key foreign suppliers followed these leading firms to supply them with essential components. Low-cost production and the proximity of assembly plants in Western Europe have attracted more foreign component suppliers over the years, with them investing heavily in both the acquisition of domestic companies and greenfield manufacturing sites, resulting in the establishment of more than a thousand automotive component plants in the V4. Following EU accession in 2004, other European manufacturers have continued to invest in the V4 states by constructing new greenfield facilities, including Peugeot Citröen, Mercedes, and BMW.¹⁴

East Asia-V4 automotive nexus

Since the 1990s, the V4 economies have seen investments from East Asian countries, predominantly Japan and South Korea, in the automotive sector. With the ongoing transition to electromobility, new opportunities have emerged for investors from these countries to participate in the automotive supply chain, including the rapidly growing battery sector. China, a relatively new player, has rapidly become a major force in automotive manufacturing over the past few years.

The role of East Asian investors in the V4 automotive sector

East Asian automotive investments reached the V4 countries in three waves.¹⁵ The first wave began in the 1990s, during the period of democratic transition, with Japanese companies primarily indicating their intention to invest in the V4 region, in some cases even before the fall of the Iron Curtain. Most of their investments took place in the early years of the democratic transition and were driven by market-seeking motives. Suzuki established operations in Hungary in 1991, followed by several Tier 1 automotive suppliers from Japan. In Poland, the South Korean firm Daewoo acquired the local FSO factory, although the entire corporation went bankrupt in 2000, marking an early unsuccessful entry by South Korea into the region.

The second wave was triggered by the process of accession of the V4 countries into the EU. East Asian OEMs established operations in the region, including Kia Motors in Slovakia and Hyundai and Toyota in Czechia. The EU membership of the V4 countries enabled East Asian automotive investors to circumvent trade barriers while utilizing the V4 countries as an assembly base, capitalizing on the relatively inexpensive and skilled labor force. As such, market-seeking and efficiency-seeking motives also played a role.

The third wave began after 2020, coinciding with the transition to electromobility and the EU's efforts to meet its climate targets.¹⁶ This wave has primarily attracted EV investors and continues to be driven by access to the European market and tariff avoidance. East Asian investments in the automotive sector are typically of the export platform type, meaning goods produced in the region are not only sold in the CEE region or Europe but also globally. The legacy factories in the region, including those of South Korean and Japanese OEMs, are upgrading their production lines to manufacture full BEVs as well as Mild Hybrid Electric Vehicles (MHEVs) and Plug-in Hybrid Electric Vehicles (PHEVs), often as adapted versions of established models.

While Czechia, Hungary, and Slovakia continue to focus predominantly on passenger car production, Poland stands out for its specialization in the production of electric buses and their components. Between 2017 and 2021, Poland exported 1,937 electric buses, accounting for 31% of the EU's total exports of these products.¹⁷ Hungary, the next main location for such production in the EU, saw the BYD factory in Komárom produce around 700 e-buses between 2017 and 2024.

Meanwhile, Chinese OEMs are entering and investing in greenfield projects for vehicle manufacturing. In Hungary and Slovakia, new plants are being built to produce BEVs (Volvo/Geely in Košice and BYD in Szeged). The Polish government has also developed a plan to launch the production of BEVs in collaboration with China's Geely, although negotiations are still ongoing.

Central Europe-East Asia EV nexus

Tracking Chinese, South Korean and Japanese electric vehicle and battery investment in the V4 countries

Another interesting case is the partnership of Stellantis and Chinese Leapmotor. In 2023, the Franco-Italian company bought a 20% stake (worth \$1.5 billion) in the Chinese start-up and reserved the right to produce and distribute Leapmotor's cars beyond China. As a result, Leapmotor's Model T03 was produced at the Stellantis factory in Tychy, Poland, although production was halted in April 2025.

Along with the EV transition, the V4 is becoming an important player in battery supply chains, a core component of EVs. Again, there is a major East Asian footprint. East Asian investors play a dominant role in battery production and upstream supply chains in the V4 region, with Chinese and South Korean firms competing directly. China has invested or plans to invest approximately €14 billion, while South Korea plans to invest around €12.4 billion in battery supply chains and EV parts. In contrast, Japanese investments are significantly lower, totaling about €1.2 billion.¹⁸ The overall picture reflects Japan's weaker position in the EV industry transition, with Japanese OEMs focusing on hybrids and investing in Southeast Asia.

Among the V4 countries, Hungary has emerged as the leading destination for East Asian investment, followed by Poland and Slovakia. In contrast, Czechia has seen little to no investment from these countries in the sector. These investments have significantly contributed to Poland becoming the main battery producer in Europe in 2023, accounting for 60% of the production, while Hungary comes in second place with 30%.¹⁹

East Asian OEMs and their EV production in the V4



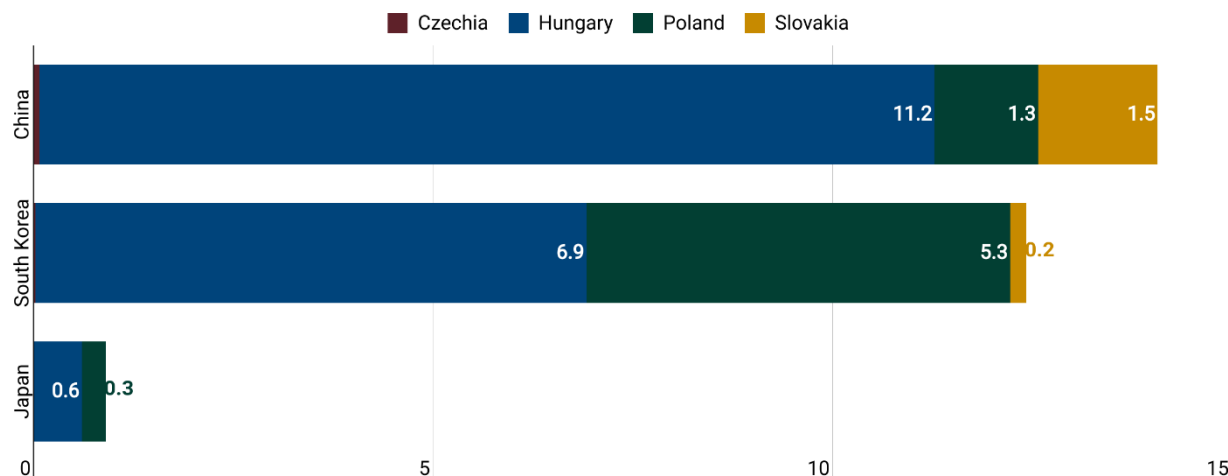
Home economy	Investor country	Company name	Location	EV model and type	Production status	EV production start	Investment amount (mln EUR)
Czech Republic	South Korea	Hyundai	Nošovice	i30 (HEV), Kona (BEV), Tucson (HEV)	live	2016	unknown
				not yet decided (BEV)	planned	unknown	unknown
Czech Republic	Japan	Toyota	Kolín	Yaris (HEV)	live	2021	unknown
Hungary	Japan	Suzuki	Esztergom	SX4 S-Cross, Vitara (all HEV)	live	2013	unknown
Hungary	China	CRRC	Székesfehérvár	Ikarus 120e (bus BEV)	live	2019	unknown
Hungary	China	BYD	Komárom	BYD 12m (bus BEV)	live	2017	15.79
Hungary	China	BYD	Szeged	Atto 3, Dolphin, Seal (all BEV)	planned	2027	5000
Poland	China	Stellantis/Leapmotor	Tychy	T03	suspended	2024	unknown
Poland	China	Electromobility Poland/Geely	Jaworzno	C-Hatchback, C-SUV (all BEV)	planned	unknown	unknown
Slovakia	South Korea	KIA (Hyundai Group)	Teplice nad Váhom	Ceed Sportswagon, Sportage, XCeed (all HEV)	live	2018	unknown
				EV2, EV 3, SUV EV 5, Niro (all BEV)	planned	2025	104
Slovakia	China	Volvo (Geely)	Valalíky	not yet specified (BEV)	planned	2027	1200

Data: Bloomberg and authors' compilation from open sources

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East Asian battery and EV parts investment per V4 country

2016–2024, billion EUR

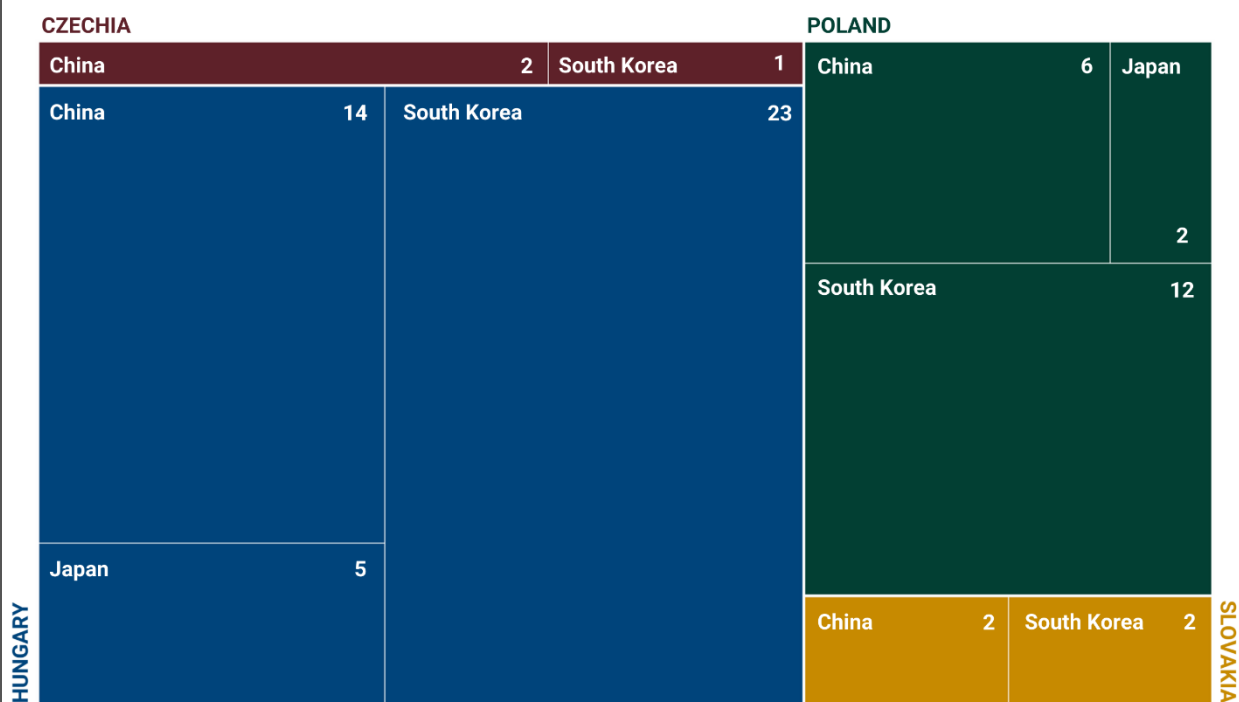


Note: Both operational and planned investments. For six investments with unknown amounts, we included dummy values of €10 million per investment.

Data: Authors' compilation from open sources

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Number of East Asian companies in EV batteries and EV parts sector



Data: Bloomberg and authors' compilation from open sources

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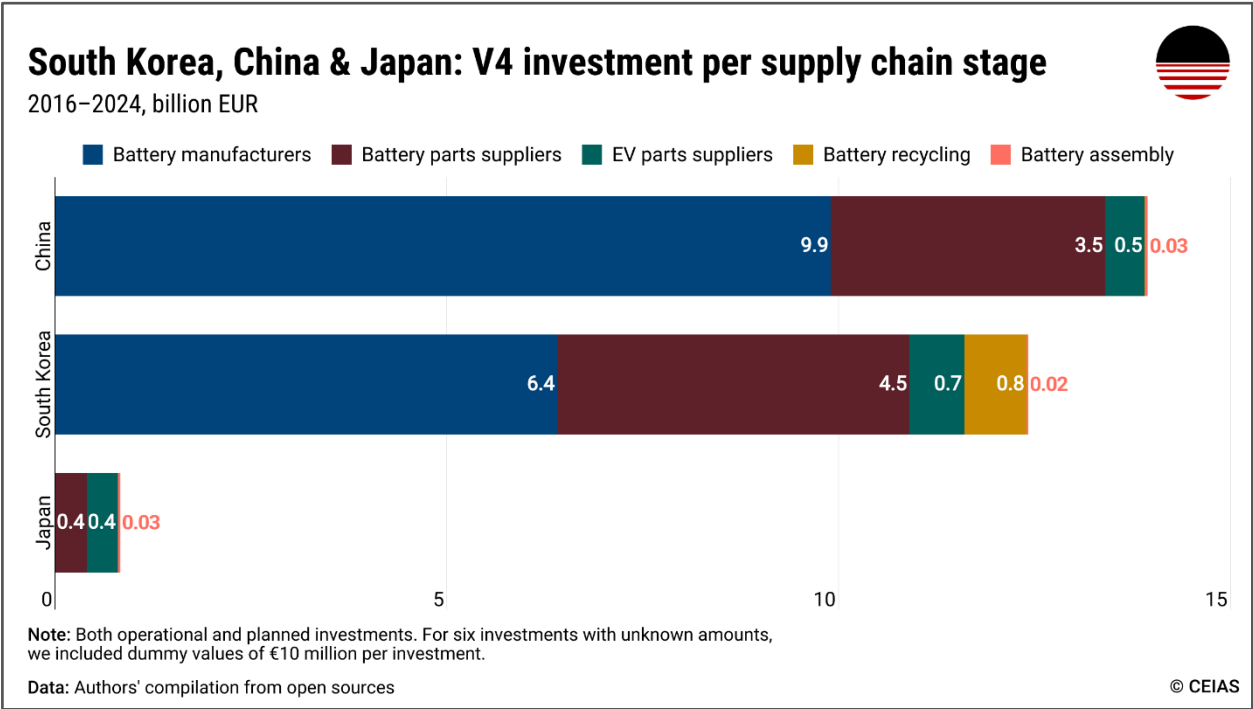
However, the specific distribution of investments varies by country. Chinese investors primarily focus on Hungary, with smaller investments directed to Slovakia and Poland. Meanwhile, South Korean companies have split their investments between Poland and Hungary. Existing business relationships largely influence these decisions, as battery and EV parts manufacturers tend to establish operations near their EV clients. Some investment decisions, such as CATL’s major investment in Hungary, also appear to be driven by political considerations.

Examining investment allocation across different parts of the supply chain, Chinese and South Korean investors clearly prioritize battery manufacturing, which, by definition, is the stage in the battery supply chain with the largest output value. Hungary accounts for nearly two-thirds of this investment, primarily due to CATL’s planned €7.3 billion plant near Debrecen in eastern Hungary. This single investment surpasses all the others in the region. It is twice the size of South Korea’s LG Energy Solution’s investment in Poland and equivalent to the combined value of the next four largest investments.

Chinese companies are creating industrial clusters—geographically concentrated hubs of interconnected businesses and suppliers—similar to those used in China. This approach enhances efficiency, innovation, and the development of a specialized labor force, but also introduces risks, such as political uncertainties and over-reliance on a limited number of key suppliers.²⁰

In contrast, South Korean investments are more diversified across multiple countries, favoring risk mitigation over maximum efficiency. This is reflected in a greater number of smaller investments in battery component manufacturing, which tend to align geographically with battery production plants as suppliers follow major clients.²¹ While the overall size of announced and implemented investments in the sector is larger for China, the number of South Korean companies is higher.

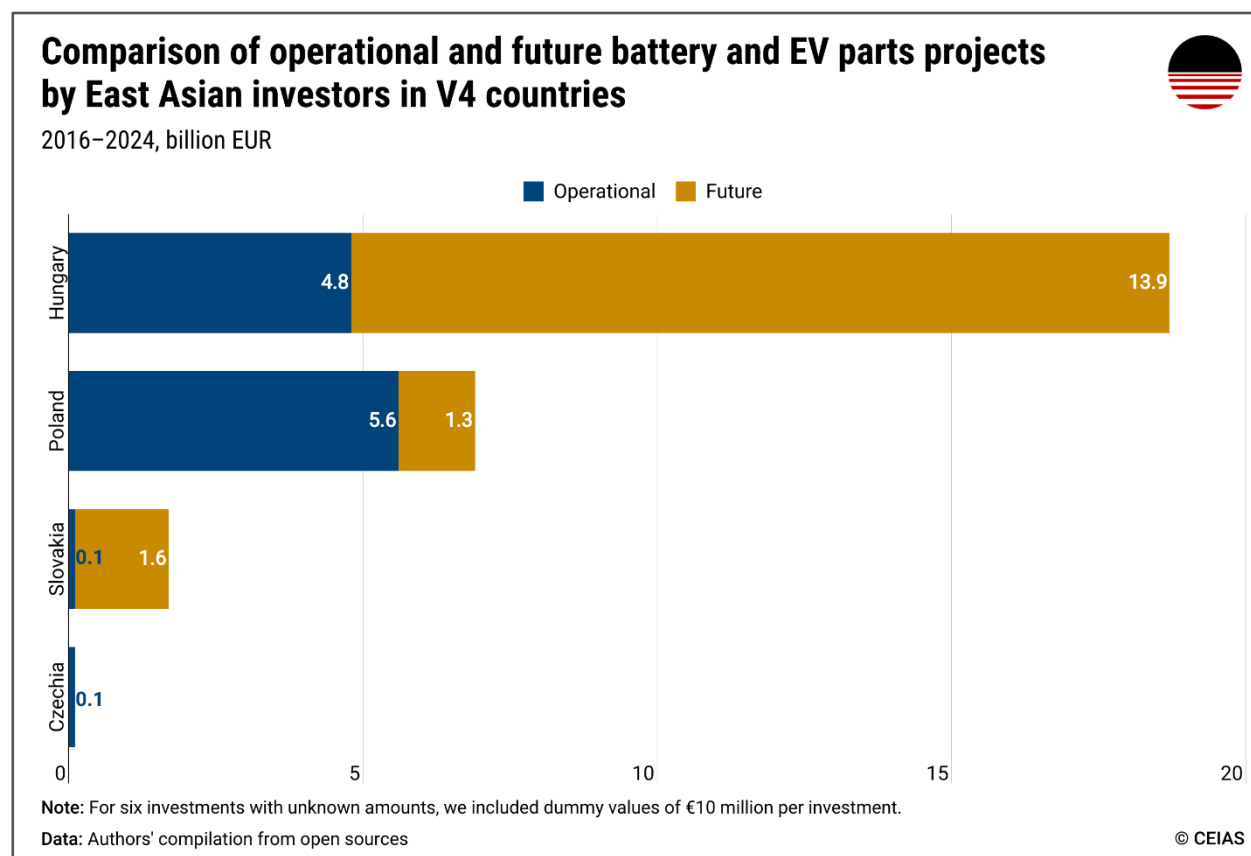
A notable trend is seen in battery recycling, where South Korean firms lead the market, with only one known Chinese investment into recycling operations in the V4 region. In October 2023, South



Korea's Ministry of Environment unveiled plans to reclassify EV battery waste as recyclable resources, removing its previous exemption under the Waste Control Act.²² This policy shift aligns with South Korea's broader strategy of reducing its dependence on Chinese raw materials and strengthening its domestic EV circular economy.

Currently, a significant part of the battery production involving East Asian investments in the V4 is in the planning and preparation stage, accounting for around one fourth of the total investment amount in Hungary and almost all investment in Slovakia, where there is a single large-scale project of Inobat-Gotion, which is planned to start production in 2027. Meanwhile, the majority of investment in Poland is already operational. However, a large Samsung SDI project near Gdansk is not yet confirmed as Hungary has also been touted as a potential location.²³

The current transition of the automotive industry from ICEs to EVs is accompanied by a technological transformation that also affects supply chains, thereby impacting the V4 economies. Although the region has the right conditions to engage in the EV supply chain, the fact that labor-intensive, medium-skill assembly of imported components constitutes the majority of local value added means the region is likely to face the adverse effects of this transition. Economies that have, so far, followed a manufacturing-led development model will only be able to maintain their current position if they meet higher standards in terms of production capacity, functional capabilities, local supplier base, and infrastructure.²⁴



Why East Asian EV and battery makers invest in the V4

There are several factors attracting investors from China, South Korea, and Japan in EV and battery supply chains to the region, including leveraging existing automotive supply chains, meeting political demand on the side of the EU, building redundancy/spare capacity, reducing transportation risks, diversifying supplier base, ensuring production continuity in case of geopolitical events, and circumventing tariffs. Localization of manufacturing plants in Europe offers significant advantages, including closer proximity to key markets, which enables faster responses to customer needs and shifting market demands. However, the decision to localize goes beyond commercial benefits; it also serves as a strategic measure to manage geopolitical risks. Amid the ongoing US-China trade dispute and rising tensions between the EU and China, East Asian automakers are grappling with a rapidly evolving geopolitical and regulatory landscape. Additionally, the post-COVID-19 era has underscored the vulnerabilities of global supply chains, rendering regional production hubs increasingly crucial for ensuring resilience in times of instability.

East Asian manufacturers are interested in setting up manufacturing operations in established locations and want to penetrate the European market with their products and components. Japan and South Korea are already well placed to do so, having been present in the region for several decades. China, on the other hand, needs to establish new European production centers, especially in countries with strong experience in automotive assembly, where other automotive OEMs have manufacturing operations and where the major European car manufacturers are located nearby. By meeting all the criteria mentioned here, the V4 appears to be an ideal platform and a stepping stone to the wider European market for Chinese EV manufacturers.

Navigating EU-China(-US) tensions: nearshoring

As tensions rise over China's booming EV industry, the influx of Chinese-made EVs is increasingly seen as a threat to the European market, with concerns over the lack of competitiveness of European automakers and the resulting decline in European car manufacturing and related threats to employment.²⁵ In response, Chinese automakers seek to localize their production in the EU to appease European politicians and align with European interests. By establishing plants within the EU, companies can create jobs, stimulate economic growth, and engage local supply chains—key factors that can help mitigate political resistance and prevent harsher measures against China's dominance in the EV sector. Additionally, if Chinese companies can offer benefits such as knowledge transfer and technology spillovers, European politicians have a compelling case to present to their electorates.

As European governments focus on reindustrialization and decarbonization, this creates an opportunity for East Asian automakers to play a vital role in revitalizing the region's manufacturing base and advancing the shift from traditional automotive industries towards EV production. Due to significantly higher profit margins on the sale of EVs in Europe compared to China, the EU market remains crucial for Chinese EV manufacturers, making it in their interest to maintain good relations with both European institutions and governments.²⁶

At the same time, the Chinese government is seeking to use the offer of investments as a form of political leverage, as exemplified by Beijing's instructions for Chinese firms to halt investments in European countries that supported additional tariffs on Chinese EVs.²⁷ These political dynamics, in turn, create an opportunity for non-Chinese East Asian automakers to capitalize on. With European governments seeking like-minded investment partners, these automakers can

position themselves as trusted allies, leveraging favorable conditions to expand their presence in Europe.

Building redundancy

The COVID-19 pandemic, the war in Ukraine, and various regional crises have underscored the importance for automakers to build redundancy and spare capacity into their operations. Relying heavily on a single geographical region can be risky, as unexpected local disruptions, such as lockdowns in China, floods in Thailand, or blockages of key trade routes like the Suez Canal, can severely impact supply chains.²⁸

A prime example of this vulnerability is the Bab al-Mandab Strait, a key global trade chokepoint connecting the Red Sea to the Gulf of Aden, which has faced disruptions from Houthi rebel attacks, forcing many shipping companies to reroute around the Cape of Good Hope.²⁹ Consequently, transit times from China to Europe have increased by 25%.³⁰ Localizing production within Europe mitigates these risks, reduces customer waiting times, and lowers transportation costs. Diversifying operations across multiple regions and continents lowers dependence on any single country,³¹ enabling companies to proactively adapt to geopolitical shifts.³²

The electromobility sector, in particular, faces high levels of uncertainty, with consumer demand fluctuating and regulatory landscapes evolving rapidly.³³ Building spare capacity provides flexibility to scale production quickly in response to local demand and market changes, giving automakers a competitive edge in a volatile market.

Reducing transportation risks

The EU remains a key market for East Asian EV manufacturers, accounting for over 35% of new EV sales globally.³⁴ Given this, East Asian automakers must strategically position themselves to serve this critical market.³⁵ Localizing production within Europe helps reduce transportation risks and costs, ultimately benefiting both the companies and their customers by shortening waiting times and improving supply chain efficiency.

Moreover, the rising global demand for EVs has strained the availability of specialized ships for transporting them.³⁶ The supply of Roll-on/Roll-off (RORO) ships has not kept pace with demand, resulting in record-high rental prices in 2023. Companies like BYD have launched their own fleets to mitigate these rising costs. Additionally, transporting EVs, which have special fire safety considerations compared to ICE vehicles, requires specialized handling, further complicating logistics.³⁷

Central Europe boasts robust logistics and transportation networks, making it an ideal location for establishing production facilities.³⁸ Local production in the region helps reduce both transportation costs and the associated risks, particularly as EV prices decrease and transportation costs rise, meaning these account for a larger share of the total cost structure. Additionally, when factoring in the additional duties imposed by the EU, local production will be essential to safeguard profitability. Furthermore, the EU's decision to expand its CO2 emissions trading system to include maritime emissions, starting in 2024, will add another layer of cost to shipping EVs into the EU market, making local production even more financially appealing.³⁹

Diversifying the supplier base

Localization provides a strategic opportunity to diversify supplier networks, enhancing supply chain resilience. By partnering with new European suppliers, companies can reduce their reliance

on single-source suppliers, mitigating the risks of disruptions.⁴⁰ The COVID-19 pandemic and the war in Ukraine have underscored the importance of supply chain diversification, revealing how disruptions in any part of the chain can jeopardize entire operations, especially, as such disruptions can potentially trigger a bullwhip effect where small fluctuations in demand are amplified as they move up the supply chain, leading to inventory shortages or surpluses, increased costs, and inefficiencies. By decentralizing production and supply chains, manufacturers can reduce their dependence on Asian-based manufacturing hubs, allowing production to continue and meet European market demand without significant delays.⁴¹

Generally, Chinese EV companies aim to source at least 40% of their components locally for production at their key overseas facilities.⁴² However, these commitments are typically made in markets that mandate local sourcing, and the EU does not have such requirements. Central European countries offer a robust supplier base, and Chinese companies are actively exploring partnerships with European suppliers to tap into the region's innovative automotive industries in line with their declared promises to localize the supply chains and work with European partners.⁴³ For example, in July 2024, BYD organized a supplier conference in Vienna to attract local suppliers.⁴⁴ However, at least initially, the involvement of local suppliers in the region may be limited due to a lack of experience and infrastructure.⁴⁵

While Japanese and South Korean automakers already have well-established supplier networks in Europe, Chinese EV manufacturers still face challenges in building brand recognition and establishing a distribution network.⁴⁶ Their success in expanding market share will depend on their ability to reach customers more directly, possibly through joint ventures with well-established European automakers,⁴⁷ alternative distribution models, such as Tesla's direct sales model, or potentially acquiring dealerships that traditional carmakers have abandoned in their efforts to reduce their networks.

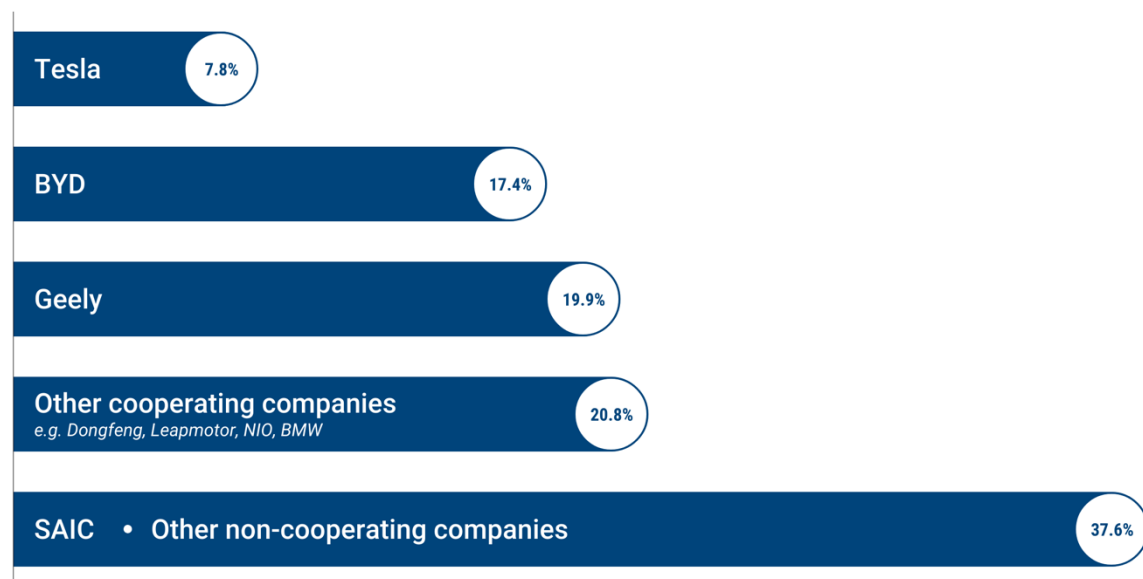
To maintain long-term market share in Europe, Chinese EV makers must invest in local service networks, as limited after-sales support is a key barrier to consumer adoption. Additionally, the slow expansion of charging infrastructure hampers overall EV growth in the region. Chinese luxury EV maker Nio is pursuing an alternative solution: battery swap stations. Nio is rolling out these stations across Europe.⁴⁸ To support this initiative, it is opening an assembly plant in Biatorbágy, Hungary, to manufacture battery swap stations for the European market.⁴⁹ The company is also investing in training, R&D, and after-sales services.

Tariff circumvention

In October 2024, the European Commission announced the imposition of countervailing duties on China-based BEV manufacturers.⁵⁰ Due to the Chinese producers' technological advantage, policymakers in many EU countries are keen to have Chinese OEMs build factories in Europe to facilitate technology transfer and create new jobs in the bloc, which would help grow their economies.

Chinese producers view the EU as a crucial market for their car exports, as the profit margins in the EU are more than double those in the Chinese market. Due to the steep growth in production capacity of China-based OEMs, companies are exporting ever-larger volumes of EVs abroad. Due to their relatively low production costs, EVs manufactured in China are in high demand worldwide. Nevertheless, the highest profit margins are earned in advanced economies, where populations have higher purchasing power. After the US implemented a de facto ban on importing Chinese EVs by imposing a 100% tariff, the EU remains the largest advanced economy to which Chinese OEMs can export cars, earning higher profit margins.

EU's countervailing duties on BEVs imported from China



Data: Commission Implementing Regulation (EU) 2024/1866

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To remain competitive and maintain a high profit margin, several China-based car producers exporting to the EU, most notably BYD and Tesla, fully cooperated with the investigation conducted by the European Commission. As a result, the countervailing duties imposed on these companies were less than half of those imposed on non-cooperative companies.

Cooperating with the European Commission was one way of protecting profit margins. If this does not suffice, an alternative is to relocate manufacturing to the EU, where duties are no longer applicable. The European subsidiaries are likely to incur higher labor and other costs and will not operate in highly efficient industrial clusters. However, a solution for Chinese investors is to relocate the final stage of production, assembly, to the EU. Almost all intermediate inputs can be shipped from China, as no additional tariffs or countervailing duties have been imposed on them. This model enables Chinese producers to maintain relatively low production costs, continue procuring inputs from their domestic supply chains, and limit potential technology transfer.

There is a historical precedent. In the 1980s, Japan agreed to the US's demands to limit exports of Japanese cars and implemented the Voluntary Import Restraint program. Consequently, Japanese car producers, led by Honda and Toyota, built factories in the US during the 1980s. They first built assembly facilities. Over time, however, they expanded the scope of their manufacturing activities, developed a supply chain in the US, and largely localized the content of their parts.⁵¹

While Chinese OEMs may follow a similar path, several obstacles lie in their way. The first point is that, to avoid countervailing duties, it is not necessary to manufacture cars in the EU. Several countries have free trade agreements (FTAs) with the EU, enabling tariff- and duty-free exports to the EU, which may undermine the hopes of European politicians that countervailing duties could prompt Chinese producers to relocate factories to the EU and protect European jobs.

Furthermore, the Chinese government is discouraging its EV companies from investing in Europe. Their rationale is twofold. First, economic security interests, coupled with macroeconomic

considerations, necessitate maintaining production in China, which not only reduces dependencies and vulnerabilities but also creates jobs and boosts GDP. Second, technology transfer could deprive Chinese companies of their global leadership in EV technology and production. Therefore, Beijing is pressuring companies to forgo higher margins and maintain manufacturing in China. This is more likely to apply to state-owned EV manufacturers, such as SAIC, BAIC, and Dongfeng. Private companies will have more freedom in decision-making, although the Chinese government can apply pressure to the companies and reverse investment decisions.

While the imposition of countervailing duties may eventually force investments by Chinese EV makers in the EU, a forced market entry might not be conducive to sustainability. First, entry timing should ideally be driven by market conditions, such as demand for EVs, brand recognition, and the level of market saturation. If the timing is not right, the investment may not yield the expected returns and may be susceptible to an early exit. Additionally, the EV industry is still undergoing rapid technological advancements and experiencing a significant transformation. The factories might be in constant need of upgrading and continuous investment, which might prove too costly for Chinese EV companies.

Market access

Market access has been one of the major drivers of East Asian automotive investment in the Central European region since the early 1990s, becoming even more crucial after the 2004 accession of the countries to the EU, which removed tariffs and non-tariff barriers between the region and Western Europe.⁵² The region's geographical proximity to major Western European markets was further enhanced by the continuous upgrading of infrastructure, which further cut transportation times.

Additionally, by producing in the V4 instead of exporting cars from their home economies, East Asian carmakers are bypassing the EU's 10% tariffs on car imports and any countervailing duties that may apply on top of these tariffs. The same applies to the potential fees paid under the Carbon Border Adjustment Mechanism, which is set to take effect in 2026. Lastly, EU membership ensures compliance with all regulatory requirements applicable to the production, transportation, and sale of vehicles.

Indirect drivers of market access are cost efficiency, supply chain integration, and a skilled workforce. Additionally, most East Asian automotive companies in the region benefit from state subsidies, which enable further reductions in production costs.⁵³ The topic of the Central European automotive workforce is discussed in a separate section; however, it is essential to note at this point that a highly qualified and experienced workforce enhances car manufacturers' comparative advantage, thereby facilitating market access in highly competitive environments.

Market access and the benefits it brings have been repeatedly cited by all investors as one of the top reasons for investment.⁵⁴ However, the calculations of Japanese and South Korean companies, which predominantly invested in the 1990s and 2000s, and those of Chinese companies, which accelerated their investments in the 2020s, are significantly different. While Japanese and South Korean investors, operating in a more liberal political environment, have considered market access as a combination of factors that provide a comparative advantage, Chinese investors have primarily focused on geopolitical considerations. As discussed in the section on tariffs, Chinese car- and battery makers are keen to bypass tariffs,⁵⁵ countervailing duties and other regulatory requirements that may exacerbate their ability to access Western European consumer markets. This nearly singular focus on regulatory arbitrage is further strengthened by the fact that Chinese carmakers do not draw as many benefits from the V4 countries' comparative advantage as their Japanese and South Korean competitors. This is

because Chinese manufacturers can produce competitively priced cars domestically, thanks to lower labor costs, efficient utilization of economies of scale, government subsidies, and advanced automation of production.

The shifting geopolitical constellations and manufacturing preferences may, over time, erode some of the advantages of the V4 in terms of their market access offerings. One of the factors is the availability of alternative production locations in countries that have an FTA or customs union with the EU.⁵⁶ Countries such as Morocco, Serbia, and Turkey, which benefit from lower labor costs, relative proximity to the EU markets, and tariff-free trade with the EU, are attracting an increasing number of East Asian investors. While Japanese and South Korean car producers are present in all three countries, Chinese firms lead in terms of announced investments.⁵⁷

The increase in Chinese investors' interest in these countries may come at the expense of Central European countries for three reasons. Firstly, tariff avoidance is a priority for Chinese carmakers. Second, many European regulations, such as those related to investment screening, do not apply in these countries, which provides a more desirable regulatory environment for these companies. Potential industrial policy measures of EU countries aimed at technology transfer, such as local content requirements, collaborations with domestic firms, and local employment in managerial capacities, would likely be viewed as undesirable by most Chinese investors and could prompt them to invest elsewhere. Finally, Chinese companies are mostly interested in the final assembly of intermediate inputs imported from China.⁵⁸ Therefore, low labor cost is their main requirement. The advantages of the V4 countries, such as a skilled workforce and dense supply chain networks, are largely irrelevant in this setup.

National approaches to cooperation with East Asian investors

While the previous sections considered trends and developments affecting the V4 countries as a whole, the following section examines the specific situations in Czechia, Hungary, Poland, and Slovakia from the perspective of East Asian investors and related country-level policies. The section also dedicates attention to the role of political factors in cooperation.

Czechia: An investment laggard

Despite Czechia having the largest automotive sector in the region in absolute terms,⁵⁹ accounting for 9% of the country's GDP and directly employing around 216,000 people,⁶⁰ it is falling behind in the transition to electromobility. In 2024, EVs accounted for just 10% of total car production, a 16% decline from the previous year, with a total output of 151,162 electric and plug-in hybrid cars.⁶¹ The domestic development of electromobility remains sluggish, with Czechia ranking among the lowest in the EU for the number of registered EVs.⁶² Unlike most EU countries, Czechia has historically lacked systematic direct incentives for EV purchases, particularly for private individuals who are not business owners.

In contrast to the other V4 countries, Czechia remains a relatively blank spot on the map of new East Asian investments in electromobility. The lack of investments in the EV or battery production sectors in Czechia can be attributed to an unfavorable investment environment that has deteriorated over the past decade.⁶³ Potential foreign investors face significant regulatory and bureaucratic hurdles. The slow and complex permitting and construction approval processes continue to be a major obstacle.⁶⁴ A prime example of this is the unfulfilled promise of building a roundabout at the industrial zone in Nošovice, eastern Czechia, where the Hyundai car manufacturing plant is located, which would provide easier access to the highway.⁶⁵ Despite being part of the original investment agreement, the project has yet to materialize. While delays may not deter established investors like Hyundai, they could influence decisions on expanding operations or discourage new companies from considering Czechia as an investment destination.

Additionally, Czechia faces a shortage of suitable land for industrial development. Battery gigafactories require 200–300 hectares, yet such large plots are scarce.⁶⁶ Moreover, a strong "not in my backyard" sentiment prevails in the country, posing another challenge for investors, as public opinion is closely monitored. Protests and referendums, like the one in Dolní Lutyně that rejected a gigafactory project, can be particularly discouraging.⁶⁷ High energy prices and a limited workforce further deter investment. With Czechia's low unemployment rate, the labor market is frozen, exacerbating the situation by a general reluctance among Czechs to relocate or commute for work.⁶⁸ Finally, compared to other countries in the region, Czechia offers the least attractive investment incentives, and the entire process lacks transparency.

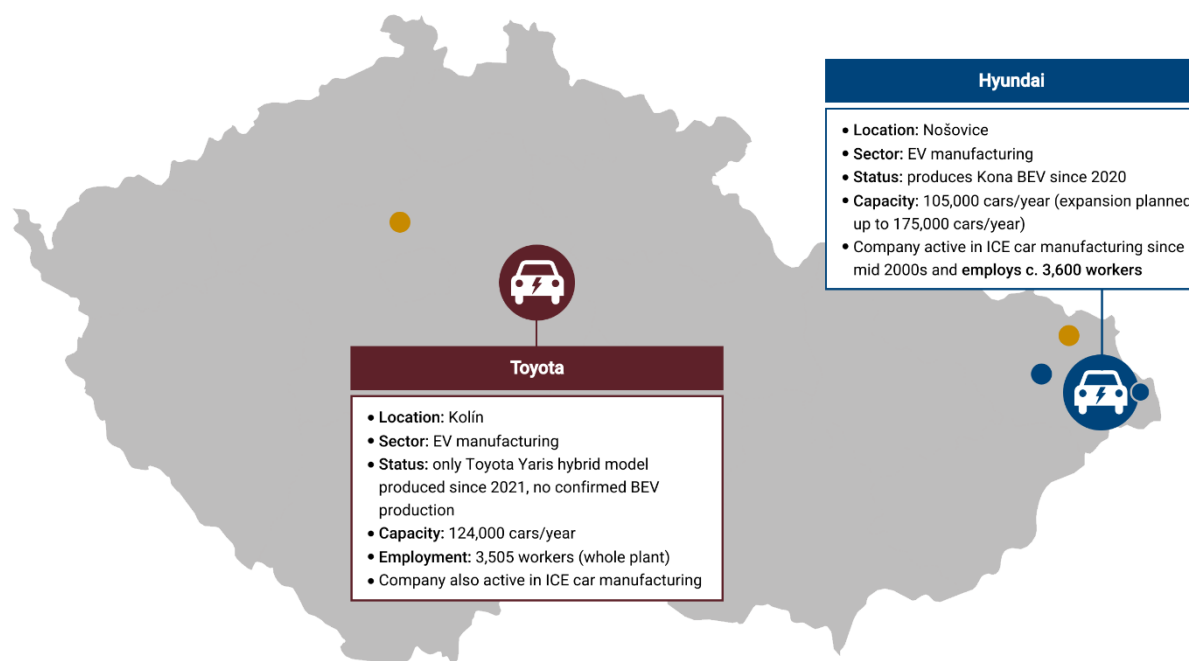
Since last year, the investment environment has shown signs of slight improvement. The new amendment to the Investment Incentives Act, effective from January 2024, removes the obligation for the Ministry of Industry and Trade (MIT) to submit every investment incentive

East Asian EV and battery investors in Czechia

Most significant projects highlighted



● China ● Japan ● South Korea



Data: Central Europe-East Asia EV Nexus Tracker

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request to the government.⁶⁹ Additionally, last year, the government approved the creation of the State Investment and Development Company (SIRS), a state agency tasked with identifying and preparing land for foreign investment.⁷⁰

In the case of the small engagement by Chinese companies, generally unfavorable Czech-Chinese political relations can be a factor, as well as the reluctance to provide investment support. In 2021, the Chinese company Minth Automotive Technology applied for investment incentives to launch the production of battery housings in Kralupy nad Vltavou⁷¹, but the government of Prime Minister Andrej Babiš rejected its request.⁷² Despite this, the company proceeded with its investment and established operations in Czechia, supplying components for EVs, including Škoda's Enyaq model.⁷³

Another Chinese company, Tinci, was awarded an investment incentive in 2020 and planned to invest approximately €32.68 million in the production of electrolyte for lithium batteries. However, before the factory's construction even began, the company decided to redirect its investment to Morocco, citing an unfavorable investment environment in Czechia, a lack of a suitable workforce, and logistical challenges related to transporting materials to the production site.⁷⁴

Despite the current low involvement of Chinese companies in the sector, a future change in the government after the October 2025 elections could make the political climate more favorable to Chinese investment.

OEMs

In the absence of new investors, the production of BEVs and hybrid models in Czechia is spearheaded by Škoda Auto and Japanese and South Korean automakers that established their production in the country in the mid-2000s. Their transition to electromobility is happening through the expansion and repurposing of existing facilities rather than large-scale greenfield investments. Hyundai is the only East Asian automaker currently producing BEVs in Czechia. Its factory in Nošovice, in the east of the country, is Hyundai's sole manufacturing facility in Europe. In early 2020, the company launched BEV production with the Hyundai Kona to meet the strong global demand for the model at the time. Despite a general decline in car sales during the COVID-19 pandemic, Kona production continued as planned.⁷⁵ With the release of the new Tucson model in the autumn of 2020, Hyundai's plant in Nošovice also began manufacturing hybrid and plug-in hybrids. Currently, the Hyundai Kona accounts for 10% of the plant's production, falling short of the initial 17% projection, while hybrid and plug-in hybrid Tucsons represent 70%.⁷⁶ In 2024, the plant met its production target of 330,890 cars. However, due to declining demand and stricter CO₂ emissions limits, production is expected to drop to around 295,000 cars in 2025.⁷⁷ The company also intends to reduce its workforce of 3,100 workers by 100 in 2025.⁷⁸

Hyundai's total investment in EV production has not been as publicized as recent Chinese or South Korean investments in the region, but it is estimated to be in the low tens of millions of euros.⁷⁹ This investment primarily involved expanding the production line for battery assembly, with additional investments made alongside the launch of each new hybrid or plug-in hybrid model. The plant sources its batteries from LG Energy in Poland, which are assembled by Hyundai Mobis, an automotive parts vendor from the Hyundai Motor Group, in a repurposed transmission assembly hall in Nošovice. Previously used for manual transmission production, this hall was converted for battery assembly in 2021, with operations beginning in December 2022.⁸⁰ A second transmission hall is now also being converted to support battery assembly for the Kona EV in both 39.2kWh and 64kWh capacities. Batteries are also assembled in Hyundai Mobis's other plant in Mošnov. A small percentage of batteries for Hyundai's Czech production are sourced from South Korea and contain battery cells from CATL.⁸¹

Currently, 30% of the Nošovice plant's capacity is for EVs. Hyundai initially planned a major modernization to transition fully to EV production, but is now taking a more cautious approach due to the cooling market demand. The company now plans to expand EV production capacity to 50%, but modifications to the production lines will not begin until late 2026 at the earliest.⁸² This is expected to require only modest investments in the millions of euros. The company's future plans will depend on whether demand rebounds.

Japanese Toyota remains the last of the three major automakers in Czechia without a BEV in production. Since 2021, the company has been manufacturing a hybrid version of the Toyota Yaris, with total output reaching 293,000 units by November 2024. Currently, hybrids account for more than half of the plant's production, with over 114,000 cars.⁸³ While the exact investment in hybrid production remains undisclosed, Toyota invested approximately €160 million between 2019 and 2021, ahead of the launch of the Yaris.⁸⁴

In the Czech market, Toyota leads hybrid sales, with 10,168 units sold.⁸⁵ However, despite hybrids making up a significant portion of production, none of its current models meet the criteria for the 2035 phase-out of CO₂-emitting cars. This means that after 2035, any cars produced in the company's plant in Kolín would have to be exported to non-European markets—an economically nonviable scenario. The head of Toyota's production in Czechia has openly warned that without securing EV production, the Kolín plant could face closure. The Czech management is actively lobbying Toyota's headquarters in Japan, emphasizing Kolín's strategic location near Germany and its proximity to key suppliers. A decision on whether the plant will produce an EV model is

expected in 2025, as competition for EV production remains fierce among Eastern European EU member states.⁸⁶ The Kolín-based plant currently employs around 3,500 people.⁸⁷

Batteries

Czechia has the potential to become a significant player in the battery sector, both in production and recycling.⁸⁸ The country boasts significant reserves of critical materials needed for battery production, a technically skilled workforce, and is firmly integrated into the automotive industry's value chains.⁸⁹ Despite these advantages, foreign investments in battery production have so far eluded Czechia. The government largely missed the first wave of battery investments, while neighboring countries took a more proactive approach in offering incentives.⁹⁰

For example, in contrast to Hungary, where the government and the Hungarian Investment Promotion Agency (HIPA) actively engaged South Korean investors, the Czech government showed little interest or initiative in attracting such investments.⁹¹ According to a source within the industry, in the early days, when battery factories were scarce in the region, representatives from Samsung and SK Innovation approached Czech officials but encountered a lack of interest.⁹² In July 2021, the Czech government and the energy company ČEZ signed a memorandum of understanding to support a battery gigafactory project.⁹³ The proposed gigafactory was expected to be linked to lithium extraction at Cínovec, where Czechia has significant reserves of the mineral.⁹⁴ According to reports, the government was in talks with Volkswagen, while the South Korean company LG also reportedly expressed interest.⁹⁵ However, after prolonged negotiations, Volkswagen withdrew from the talks due to declining demand for EVs and the need to reduce production costs.⁹⁶

Currently, the Czech government is in talks with Samsung SDI regarding the construction of a gigafactory in Dolní Lutyně near Karviná. The Ministry of Industry and Trade anticipates the creation of thousands of jobs and an investment of billions of euros.⁹⁷ However, the project faces local opposition. In June 2024, residents voted to obstruct the project in a referendum.⁹⁸ It remains uncertain whether the investment will move forward. The battery sector is entering a consolidation phase, and with substantial investments already in place in the region, investors are questioning the profitability of new projects, especially as the market for EVs slows down.

The development of new battery technologies, such as solid-state and sodium-ion batteries, could reshape the future of the sector. However, even if these technologies take the lead, new factories will likely build on existing production infrastructure, which Czechia currently lacks.

New partnerships between the Czech battery industry and South Korean stakeholders could help position the country as a key player in the development and production of batteries. In September 2024, the Czech Battery Cluster (CBC), Brno University of Technology (BUT), the Korea Planning and Evaluation Institute of Industrial Technology (KEIT), and the Korea Electronics Technology Institute (KETI) signed a memorandum of understanding.⁹⁹ One of the key initiatives under this agreement is the establishment of a battery development center in Brno. As part of the cooperation, it is also envisaged that Czech students will have the opportunity to study in South Korea and gain hands-on experience in the field.¹⁰⁰

Hungary: Betting on China

Hungary is the seventh-largest car producer in the EU, with a high level of exposure to automotive FDI.¹⁰¹ The main German OEMs have been present in the country for years, with the automotive sector accounting for more than 26% of manufacturing output in 2023. According to Eurostat data, 90% of the assembled products were exported. Vehicle manufacturing contributes around 5-6% to Hungary's GDP, but when combined with automotive suppliers, it accounts for 8-9%. The sector also provides nearly 16% of manufacturing jobs in Hungary. The Hungarian automotive sector produces approximately half a million passenger cars annually, and this number is expected to continue growing in the coming years. This growth is partly due to the domestic factories of Mercedes and Audi, which are gradually transitioning to EVs, and Suzuki, which is producing hybrid cars. In addition, newly announced investments by BMW and BYD will also contribute to this trend and the growing number of EVs produced in Hungary.

The Hungarian automotive industry has expanded significantly in recent years due to several factors, including the investment of foreign manufacturers in the country, the relocation of more models, and the presence of an increasing number of spare part manufacturers in Hungary. In addition to responding to the challenge posed by the EV transition, Hungary has transformed itself into a potential EV powerhouse over the past few years by hosting both car and battery manufacturing. The wave of EV-related investments emerged after 2017 and has accelerated between 2022 and 2024, especially with South Korean and Chinese companies investing in the country. As a result, Hungary already ranks fourth globally in EV battery production, a position that is likely to continue improving in the years to come.¹⁰²

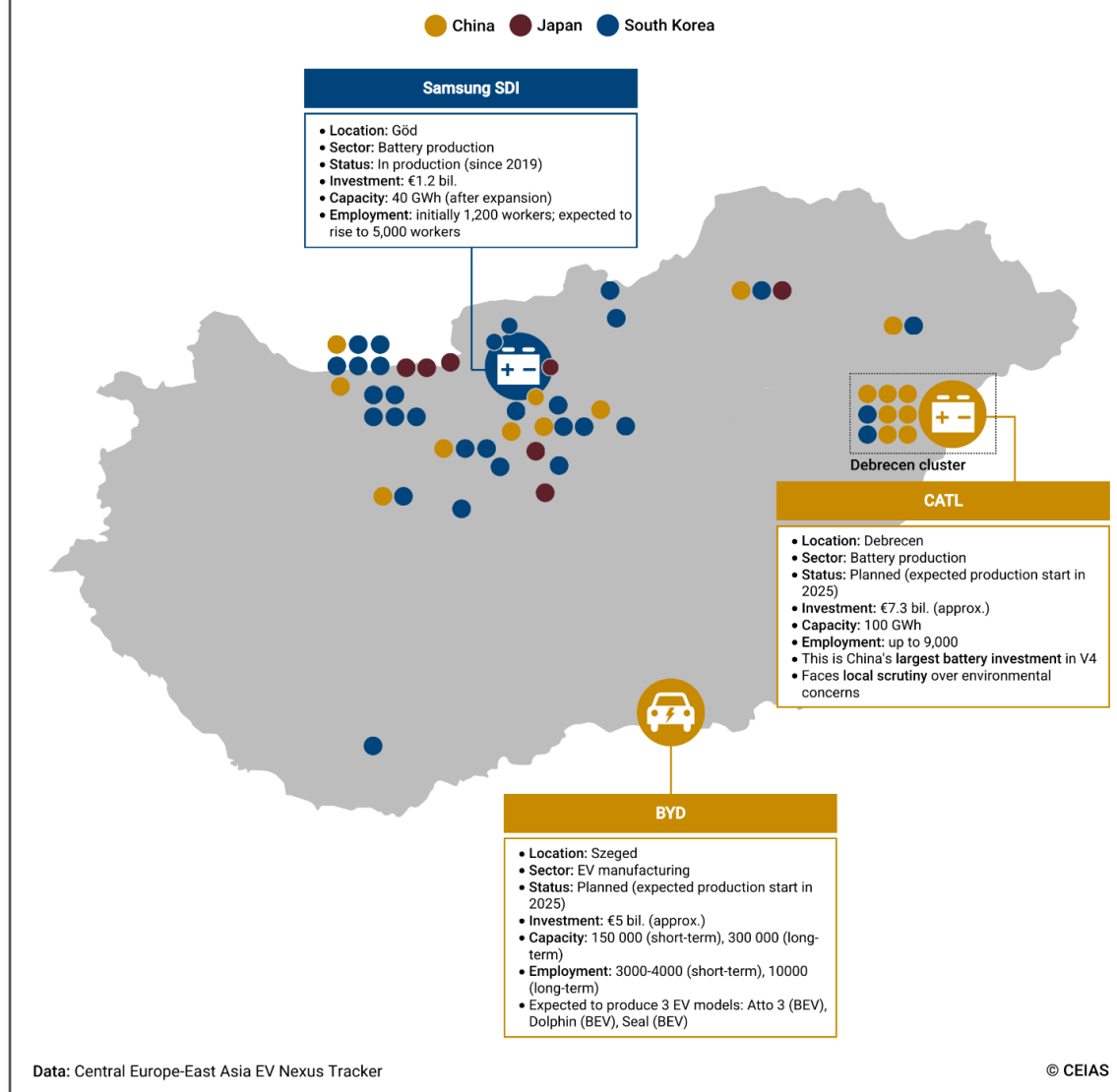
As regards attracting East Asian EV investment, besides the high level of openness of the Hungarian government towards East Asian investors, two important government measures contributed to the incoming EV-related investment: the financial incentives to the automotive industry, including state aid for investors; and the 2030 National Battery Industry Strategy, which aims at turning Hungary into a global EV battery hub.

Eastern opening policy and Sino-Hungarian “friendship”

The Hungarian government's openness to the East is not a novel development; it has been a characteristic of policies and governments since the early 2000s. Following several China-friendly socialist governments, the right-wing populist and national-conservative Prime Minister Viktor Orbán also emphasized the importance of the East, saying that although Hungary's “ship is sailing in Western waters, the wind blows from the East.”¹⁰³ Against this background, Hungary launched a new foreign economic policy in the spring of 2012, aiming to diversify Hungary's foreign economic relations through the “Eastern Opening Policy.” Although the Orbán government has emphasized its desire to maintain Hungary's strong economic relations with its traditional Western European partners, the primary objective of this policy has been to reduce Hungary's economic dependence on the West by enhancing economic relations with the East, particularly with China. In the following years, more investment from East Asia arrived, including investments in the automotive sector. These projects were linked, among others, to traditional automotive supply chains rather than EV supply chains. The only exception was BYD's electric bus factory in the northern Hungarian city of Komárom, which was established in 2017, marking the first EV-related investment in Hungary. The strong government commitment to East Asian (automotive) investment is attractive to all East Asian companies, which is an important factor in addition to other factors available in other V4 countries, such as lower taxes and proximity to partners and customers. Although South Korean and Japanese automotive investment has also arrived in

East Asian EV and battery investors in Hungary

Most significant projects highlighted



Hungary since the Eastern opening policy was announced, the most striking increase has been in Chinese investment, especially in recent years.

The Hungarian-Chinese relationship is exceptional at the European level, extending beyond automotive investments. Political factors, especially the quality of the political relations, are crucial in investment decisions for Chinese companies.¹⁰⁴ The relationship's political significance has increased in the past decade as the Hungarian government has supported China on many sensitive issues, including blocking EU statements on the South China Sea tribunal, human rights, and Hong Kong, as well as the explicit flouting of EU frameworks on 5G security in its cooperation with Huawei.

The economic implications of such a strong political commitment include, among others, that China's share in Hungarian imports exceeds the EU average, making it Hungary's second-largest import partner, after Germany. Actively investing in Hungary since the early 2000s, China had become the 8th largest investor in the country by 2022, with investments concentrated in the manufacturing sectors of food, chemicals, rubber and plastics, electrical equipment, machinery,

and the automotive industry.¹⁰⁵ Due to the surge in Chinese EV investments, Hungary also became the primary European destination for Chinese investments in 2023, retaining the position in 2024 as well as it accounted for almost one third of all Chinese investment in the EU.¹⁰⁶

The role of Hungary as a hub for Chinese EV investments is underscored by the case of BYD. After opening its electric bus factory in Komárom in 2017, BYD has chosen Hungary's Szeged as the location for its first EV plant in the EU, with planned production set to start by the end of 2025. The company has also opened a battery assembly factory in Fót and a distribution center in Páty. Moreover, in May 2025, BYD announced its plan to establish its European headquarters in Budapest. The center, which aims to employ 2,000 people, will have three key roles: sales and after-sales services, testing, and the development of localized versions of the company's electric vehicle models.¹⁰⁷

The role of government

Similar to other Visegrad countries, the Hungarian government is also trying to attract foreign investment, and as global investment flows have declined, competition for it has intensified. Since V4 countries offer similar pull factors in terms of market access and labor costs and quality, as well as a favorable legal and tax environment, governments often provide additional financial incentives. In Hungary, state aid plays a key role in attracting foreign investors. This has been particularly notable in recent years, with significant Chinese investments in the EV industry. For many years, European, South Korean, and other companies have been receiving state aid, constituting 10-12% of the total investment value.¹⁰⁸ Recently, with substantial Chinese investments in the EV industry, state aid has been allocated to these entities.

The list of "individual government decisions" on state aid for companies has been publicly available since 2004 and shows the names and countries of the companies as well as the number of jobs created.¹⁰⁹ Between 2004 and June 2022, East Asian firms (comprising more than 50 Japanese, South Korean, or Chinese firms in total) received more than 35% of the state aid allocated to foreign companies. 60% of the state aid to East Asian firms went to battery manufacturing or battery component manufacturing companies. The leading recipient of state aid is China's CATL, which is investing in a €7.3 billion battery plant in Debrecen with a planned capacity of 100 GWh, marking the company's second manufacturing base in Europe, following the plant in Germany.

State aid granted to selected battery and EV investments in Hungary



Company	State aid (EUR)
CATL	845 million
SK On (previously SK Battery)	299 million
Huayou Cobalt	132 million
Samsung SDI	89.6 million
EVE Power	37 million
SEMCORP Hungary	34 million
Nio Power Europe Kft	4.5 million
Halms Hungary Kft	4 million
Shenzhen Kedali Industry	3.4 million
BYD (Komárom)	2.4 million
BYD (Szeged)	unknown

Data: Author's own compilation based on press releases and government reports

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Furthermore, the government is allocating substantial financial resources to build the required infrastructure, as battery manufacturing necessitates significant energy and water use. The enhancements, which are only for factory operations, are, however, not accounted for in the state aid but are funded by Hungarian taxpayers. The state's commitment is also reflected in the fact that building a battery plant is considered a priority investment, which means the authorization process is considerably shorter and simplified. At the same time, the battery investments are also creating considerable local pushback.¹¹⁰

The 2030 National Battery Industry Strategy

Published in 2022, the Hungarian government's 2030 National Battery Industry Strategy¹¹¹ runs in parallel but is partly isolated from the EU's industrial policy: the EU's priority is to develop European batteries and create a genuine European value chain, whereas the Hungarian strategy is based mainly on investments from East Asian companies.¹¹² According to the Hungarian strategy, the battery value chain to be created in Hungary serves multiple purposes: promotes the development of a competitive industry, increases economic value creation, creates new jobs, and makes Hungary a center of the European battery value chain. The battery manufacturing activities and investments of East Asian firms align effectively with the National Battery Strategy. This strategy, combined with the state aid mentioned above, has attracted investment from numerous Chinese and East Asian battery companies, thereby strengthening Hungary's position as a major global battery and EV hub.

However, the challenge is that these investments are essentially low-value-added activities, without the possibility of technological spillover effects. Besides hosting foreign companies, Czechia, Poland, and Slovakia also aim to strengthen their position in the EV supply chains through domestic R&D spending and try to leverage this transition for upgrading. Hungary relies heavily on external investors, mainly from China and South Korea, and engages in labor-intensive, low-value-added activities. Currently, it is also uncertain how the EU's attempt to develop European innovation and battery manufacturing capabilities will contrast with the R&D activities of East Asian investors, predominantly located in Asia. Most battery investments are still ongoing or have just started production, but a hopeful example is that Samsung SDI recently announced that it would establish a small R&D unit in Hungary.¹¹³

Poland: Battery juggernaut

An acceleration in the manufacturing of EVs and batteries began in 2015, when a center-right government took power in Poland, experimenting with a more proactive industrial policy aimed at attracting higher-value-added investments. This led to the creation of the so-called "Strategy of Responsible Development" in 2017.¹¹⁴ At that stage, the government was open to all investors who could bring innovative activities and did not pose a security threat due to connections with Russia. Investments from East Asian countries aligned well with this policy.

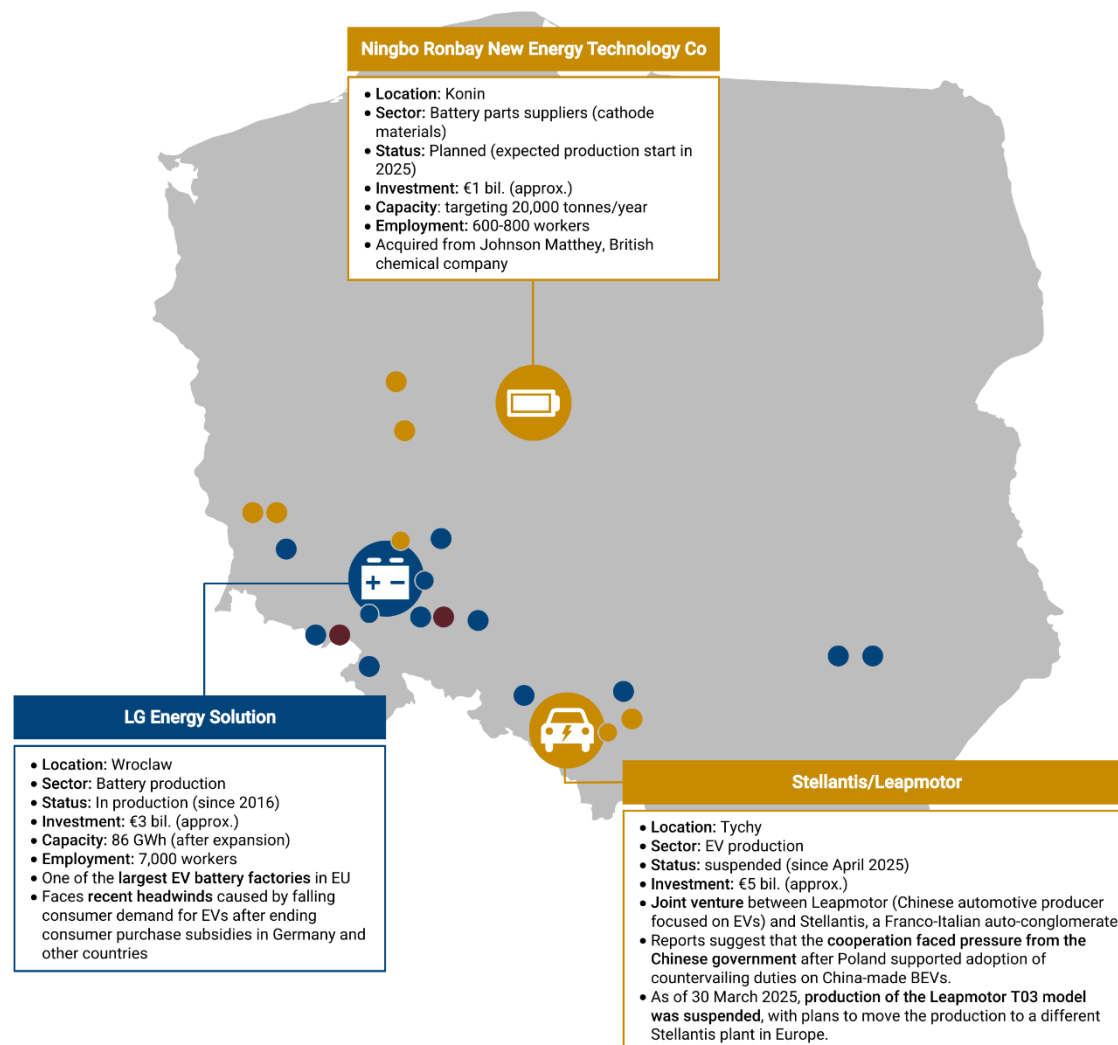
South Korea, in particular, was viewed as a role model of industrial policy, being a mid-sized country comparable to Poland that achieved economic success through bold industrial strategies. China was also considered an interesting partner due to its financial capabilities, although it was not seen as an innovation powerhouse at that time. However, with its notable

East Asian EV and battery investors in Poland

Most significant projects highlighted



● China ● Japan ● South Korea



Data: Central Europe-East Asia EV Nexus Tracker

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success in the EV sector, the government began to regard China's EV maker Geely as an attractive partner for upgrading Polish suppliers in the automotive value chain (see below).

The government has declared the promotion of electromobility as one of its economic priorities, focusing public resources, state institutions, and state banks on stimulating the production and market for EVs.¹¹⁵ Attracting foreign investments in the sector has become a key goal to demonstrate the effectiveness of the new policy. According to the Polish Agency for Investment and Trade, the electromobility sector was the leading beneficiary of government assistance between 2014 and 2023.¹¹⁶ Seven of the largest investments during this period were in this sector. Leading the charge was Intel, which planned to build a chip factory in Poland, followed by LG Energy Solution and other South Korean companies connected to the battery supply chain, namely SKC, SK Hi-Tech, and SK Nexilis.

While political factors have not been a key consideration for the Polish government in attracting foreign investment, economic linkages with South Korea in the battery and EV sectors, as well as the nuclear energy sector, have also had a spillover effect on political ties. The relations between the two countries have further deepened after the invasion of Ukraine by Russia, as Poland signed numerous arms sales contracts with South Korea, which has become a major non-EU security partner for Warsaw. The growing intensity of political ties might also spur further cooperation in the EV and battery supply chains. While Poland has been largely open to Chinese investments, its approach towards China has remained cautious, as many of the earlier expectations about Chinese investments have not materialized.

Battery sector

The support of the Polish government for localizing battery supply chains has significantly influenced Poland's trade, making it the second-largest battery producer and exporter in the world, after China.¹¹⁷ Between 2017 and 2022, the value of battery exports increased from €200 million to €9 billion, resulting in a 2.6% share of total exports. This made batteries the largest export category in the Polish automotive sector, followed by personal cars (€7 billion) and delivery vans and trucks (€6.5 billion). However, the last two years have been more challenging due to the reduction of subsidies for purchasing EVs in some EU countries. As a result, the value of battery exports in 2023 decreased to €7.66 billion. The data for 2024 suggests a continuation of the trend, with only €3.2 billion in exports for the first half of the year. This situation highlights the ongoing volatility in the EV battery market.

South Korean companies have had a leading role in Poland's battery sector. A flagship initiative was an investment by LG Energy Solution (formerly LG Chem), which has since expanded to become one of the world's largest battery factories. This process involved several stages, with the company receiving state aid at each step. LG has been present in the special economic zone in Biskupice Podgórze since 2006, producing LCD displays, white goods, and LED lighting. In 2016, the company announced plans to construct a medium-sized factory in the zone, aiming to follow similar ventures in the US and China. Initially, the project required an investment of €300 million and was expected to employ 700 people; it was completed in 2017. As demand for the factory's production rose, partly due to contracts with Volkswagen, the company started planning subsequent phases. In 2017, LG invested €1.1 billion in the second stage, creating 800 jobs. The Polish government supported these two phases with a total public aid of €57 million. At that time, the South Korean company aimed to reach an employment level of 6,000 and a total investment value of €1.4 billion.

Due to the growing demand for batteries and the introduction of the Green Deal, LG Energy Solution planned further expansion. In 2019, the third stage was initiated, and LG Energy Solutions received €100 million in state aid. In 2020, LG acquired a nearby factory from the Turkish company Vestel, which produced RTV and household appliances, for \$31 million to use it for its own manufacturing purposes. In 2021, LG Energy Solution began implementing the fourth stage of the project, increasing the total investment value to €3.1 billion and employing an additional 500 workers, including 250 with higher education, such as 200 engineers, bringing the total employment to 10,000. The planned production capacity was 100 GWh, sufficient to supply around 100,000 cars annually for companies such as Audi, BMW, Fiat, Ford, and Volkswagen. This time, the company received €18 million in state aid. LG Energy Solution also announced its cooperation with Polish academic institutions, investing €2.6 million in scholarships and research at the Technical University in Wrocław. A direct flight was established between Wrocław (location of the factory site) and Seoul in November 2003.

However, this success story encountered obstacles in 2024. Following the German government's withdrawal of subsidies for EVs and a rapid rise in energy prices, a sharp decline in LG orders

occurred. The company estimated in August 2024 that, due to lower demand for EVs, production would decrease by approximately 38%.¹¹⁸ In 2023, EV batteries accounted for 20% of the total exports of the Polish automotive sector. However, by the first three quarters of 2024, this share had dropped to 12.6%.¹¹⁹ The decline in 2024 reached 58.2%, causing anxiety within the sector. Consequently, LG Energy Solution decided to shift some of its production of lithium-ion batteries for Ford from Poland to the US, specifically to Michigan, to take advantage of the benefits offered by the Inflation Reduction Act.¹²⁰ Consequently, employment at the factory decreased from 10,000 in 2022 to 6,600 in 2024.

LG Energy Solution is now pursuing a strategy of product diversification and is reorienting itself toward energy storage specialization. The company is counting on subsidies for such investments from the National Fund for Environmental Protection and Water Management. At that time, the fund offered €850 million in non-repayable grants and €94 million in credits to support the development of 2.5 GW and 5 MWh of energy storage systems between 2024 and 2028. Ultimately, LG Energy Solution decided to modify its strategy and broaden its product portfolio by initiating the production of cylindrical and solar batteries, as well as introducing new materials. With tax breaks, LG Energy Solution could expect approximately €200 million in state aid for the development of its factory.

The LG Energy Solution factory has attracted more suppliers from Europe and Asia. In 2021, the South Korean SK High-Tech Battery Materials' battery factory in Dąbrowa Górnicza was opened. Construction began in 2020, with the company investing €1.34 billion, and the plant's capacity is sufficient to meet the demand for 300,000 cars.¹²¹ A loan of \$300 million for this investment was provided to a consortium of three banks, two of which are banks (PKO BP and Pekao SA) in which the Polish government holds shares. Although the loan was not offered on preferential terms, the involvement of public banks in priority government investments likely expedited credit preparation and investment risk assessment processes. For SK High-Tech, Poland became the third production location for EV battery separators, following its home market and China. Another South Korean company, SK Nexilis, started building a factory for copper foil lithium-ion batteries in Stalowa Wola in 2022.¹²²

In addition to South Korean investments, the LG Energy Solution factory has attracted investments from other parts of the world. In 2020, Belgian company Umicore decided to build a factory in Nysa to produce cathode materials. The company openly stated that its main customer would be LG Energy Solution. Another example is the Chinese company Guotai-Huarong, which built a plant in Prusice (its first outside China) for electrolytes, planning to supply LG Energy Solution's factory. The largest Chinese investment so far in Poland is by Ningbo Ronbay New Energy Technology in Konin, central Poland, where the company acquired a previously unfinished cathode materials factory owned by the British multinational Johnson Matthey in 2024.¹²³ The investment is estimated at around €1 billion.

EV manufacturing

Poland is significantly less competitive in the production of finished cars compared to the production of car parts and batteries. Before 2015, it did not aggressively compete to attract car manufacturing factories. As a result, it is now more beneficial for car manufacturers to install EV production lines in existing plants in other V4 countries. Poland has only specialized in certain segments, such as delivery vans, trucks, and buses.

For example, Volkswagen decided to launch a production line for the e-Crafter model at its factory in Września.¹²⁴ Poland has also become a hub for electric buses, with the local brand Solaris emerging as one of the leading producers in this segment. Additionally, MAN operates bus plants in Poland. Although this is a specific segment, it has facilitated the development of Polish

suppliers for battery components, such as Impact Clean Power Technology, which produces battery systems for buses, and Ekoenergetyka, which manufactures charging stations for buses.

Generally, Asian EV producers have not shown much interest in investing in the bus or delivery van segments; however, cooperation with established Polish suppliers has occurred. For instance, LG Energy Solution signed a contract to deliver 200,000 battery modules for buses to Impact Clean Power Technology, a leading global supplier of heavy-duty battery systems for public transportation, which assembles them in its factory.¹²⁵ Representatives from the Polish automotive sector, interviewed for the study, emphasize that recent years have made Asian producers more interested in collaborating with Polish suppliers. Due to distortions in the global automotive supply chain, they are more open to new partnerships and are eager to explore local sourcing options.

Cooperation with China in the sector has encountered several substances. In 2016, a company named ElectroMobility Poland was established by state-owned enterprises from the energy sector, including PGE, Energa, Enea, and Tauron. Initially, each held a 25% stake, but over the following years, the state increased its ownership to 90.8% through a new stock issue. The company's goal was to establish a Polish brand of EVs (Izera) in collaboration with a more experienced partner. Facing difficulties in attracting established brands, ElectroMobility Poland began negotiations with Chinese firms. In 2022, after extensive discussions, the company signed a contract with Geely, securing access to 60% of the components from the Chinese producer. The Polish company planned to utilize Geely's platform while sourcing the remaining 40% of parts from Polish suppliers, aiming to increase their share in future versions of the produced EVs. Geely had committed to helping build a factory in Jaworzno, which would have employed approximately 7,000 employees directly and an additional 30,000 indirectly¹²⁶. The Polish government intended to finance this initiative with €1.4 billion in non-refundable grants¹²⁷ from the EU Recovery and Resilience Fund¹²⁸, created to help member states mitigate the consequences of the COVID-19 pandemic. However, the plan became unviable due to legal disputes between Poland and the European Commission.

In 2023, a center-left government took power, initially showing little interest in continuing the Izera project. However, it later became more involved, resuming negotiations with the Chinese. The Ministry of State Assets, responsible for overseeing the project, decided to abandon the initial concept and instead focus on building an electromobility cluster in Jaworzno, rather than developing a separate Polish brand.¹²⁹ Currently, the details of this new concept are not publicly available; however, discussions with Geely are ongoing, and preparatory work on the construction site in Jaworzno is in progress.

The case of the Stellantis-Leapmotor cooperation presents an interesting example of cooperation between Chinese and European carmakers, as well as the political implications of cooperation with China in the sector. In 2024, Stellantis began the production of Leapmotor's T03 model at its factory in Tychy, Poland, following the formation of a JV in May.¹³⁰ However, production stopped in April 2025, following media reports that the Chinese government had exerted pressure after Poland supported the introduction of EU countervailing import tariffs on BEVs from China.¹³¹ Similarly, the plans to manufacture another model, B10, in Tychy have been suspended, and a plant in Zaragoza, Spain, is under serious consideration.¹³² It is difficult to determine whether the Chinese government has influenced the decision or if it is the result of negotiations between Stellantis and Leapmotor; the anti-dumping duties may have been used as an excuse. It is also worth noting that Leapmotor models are produced using a semi-knockdown technique, meaning the vehicles are assembled from partially completed kits sourced from China, which limits the value added by the factory.¹³³ Whether the cooperation on production in Poland is set to resume remains unclear.

Another notable case is the R&D centre by Volvo (owned by China's Geely) in Krakow, which opened in 2023, employing around 200 people, with plans to expand to 500. According to the company, the Volvo Tech Hub has played a key role in the development of software and technology for the company's ES90 BEV.¹³⁴ The Tech Hub is the fourth such centre for Volvo worldwide and the second in Europe, following one in Stockholm.

Slovakia: Stuck in overdrive?

Slovakia boasts the highest car output per capita in the world, however, this statistic belies the severe dependency of the country's economy on the automotive sector, which accounts for 13% of GDP, 54% of industrial production (compared to 33% in Hungary 31% in Czechia) and 33% of industrial exports.¹³⁵ This economic structure has developed over the past 35 years as a result of the country's traditional strength in machinery and heavy industries, successive governments' policies targeted at attracting foreign car producers, the country's geographical proximity to major car markets and car manufacturing centers.¹³⁶

Slovakia received its first major foreign investment in the sector almost immediately after the transition to a market economy when Germany's Volkswagen acquired a former state-owned enterprise in 1991. In the mid-2000s, following the country's integration into European structures and trade liberalization, French Peugeot Citroën (later multinational Stellantis) and South Korean Kia opened their production lines in 2006. The carmakers became the largest taxpayers in Slovakia, and their factories in the country attracted hundreds of suppliers, predominantly of European provenance. In 2018, the emerging industrial cluster attracted an Indian-owned company, Jaguar, which built its fourth car manufacturing plant in southwestern Slovakia.

The transition to electromobility in Slovakia began in the late 2010s, marked by the arrival of the first suppliers in the EV battery supply chain and the founding of InoBat in 2019. The established car manufacturers, spearheaded by Volkswagen, announced plans to transition to EV production in the early 2020s. While exact figures are unavailable, Volkswagen is said to have spent over €1 billion on redeveloping its production lines, while Kia's production upgrades exceeded €100 million.¹³⁷

Yet, the most significant development in terms of electromobility is the entry of a new car manufacturer focused purely on the production of EVs, Volvo Cars, and the rise of an EV battery manufacturer, InoBat. Coincidentally, both projects have significant Chinese involvement. Volvo is a subsidiary of the Chinese car producer Geely. InoBat is partially (25%) owned by Chinese battery producer Gotion Tech, and the two companies have formed a joint venture, Gotion-InoBat Batteries (GIB), with 80% Chinese and 20% Slovak ownership. While Volvo Cars is an established car manufacturer, InoBat is an example of a home-grown EV battery startup that has reportedly attracted the second-largest FDI in Slovak history.¹³⁸ Neither Volvo nor the GIB JV has started manufacturing; both projects are scheduled to initiate production in 2026. However, while Volvo's factory is currently under construction, popular protests and fears of environmental impact threaten to delay the construction of the GIB plant. To facilitate the construction, the Slovak Prime Minister, Robert Fico, declared GIB a strategic investment, which extricates it from certain regulatory requirements and accelerates the approval processes.¹³⁹ The government also built a dedicated industrial park for the battery factory and provided substantial state aid.

Sino-Korean dominance

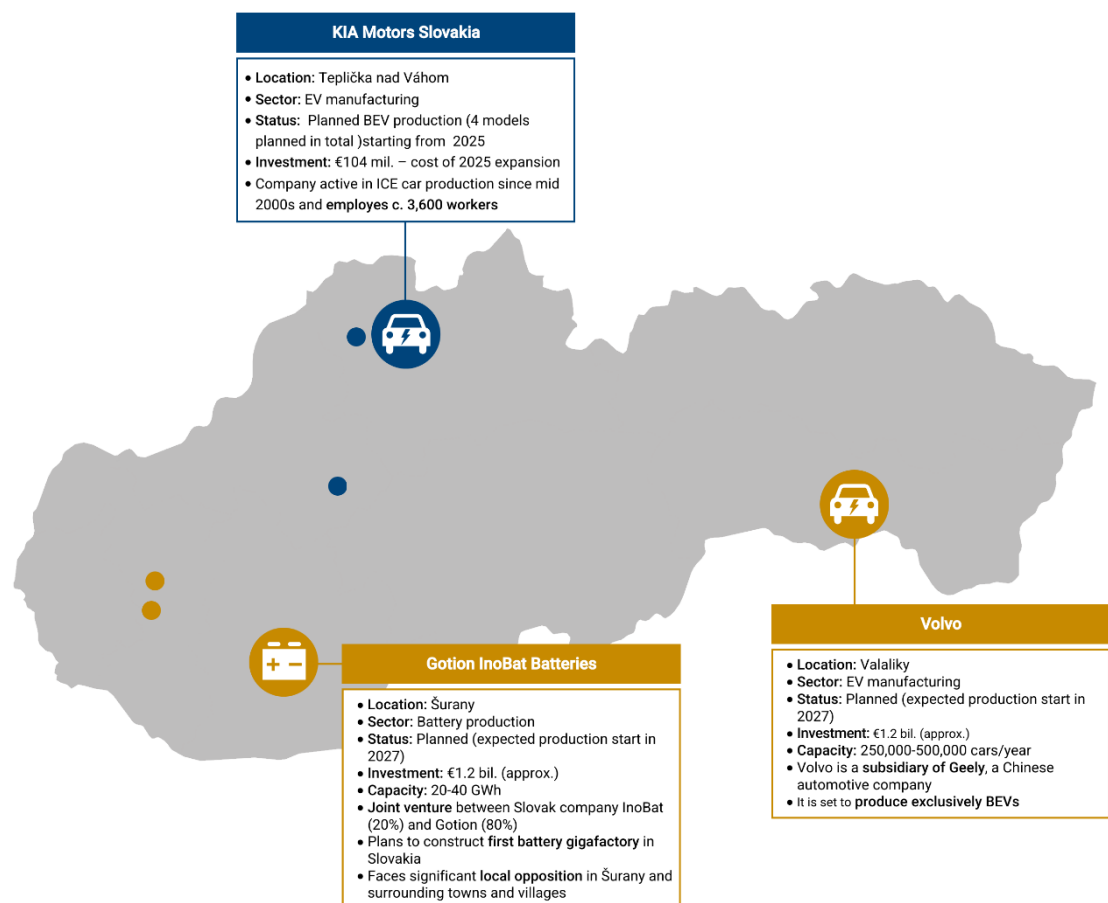
Over the past two decades, dozens of East Asian automotive suppliers established production facilities in Slovakia. The South Korean suppliers dominate. However, Japanese, Chinese, and

East Asian EV and battery investors in Slovakia

Most significant projects highlighted



● China ● South Korea



Data: Central Europe-East Asia EV Nexus Tracker

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Taiwanese firms are also embedded in local supply chains. Nevertheless, when it comes to EV manufacturing, the two Chinese-owned companies have garnered significant attention, as each of the announced investments exceeds €1 billion and is likely to create hundreds of jobs. This is in stark contrast to the investment in electromobility by South Korean carmakers, who focused on redeveloping their existing plants, which cost them about one-tenth of the price. Furthermore, South Korean investments in electromobility tend to create a smaller number of new jobs, as existing employees are retrained and moved to operate EV production lines.

Although the distinction between greenfield investment by Chinese companies and brownfield investment by South Koreans indicates that Chinese investors contribute more to the economy by creating new jobs and building new factories, a comparison from an operational perspective provides a different picture. Kia already employs a large workforce and produces 300,000 cars a year, despite only a fraction of these being EVs and weak demand for EVs leading to a scaling back of production plans.¹⁴⁰ Volvo plans to produce 250,000 cars a year. However, current sales of their EVs in Europe indicate that the factory would be redundant as their existing capacities exceed demand. Volvo sold only 75,000 EVs in Europe in 2023, casting doubt on the need to build an additional factory.¹⁴¹

Unlike in the first wave of automotive buildup in the 2000s, EV OEMs and battery manufacturers have not been followed in the country by many suppliers. A few South Korean manufacturers of automotive and battery components have announced relatively modest investments, mostly in the vicinity of Kia's plant. The two large Chinese-owned plants currently under construction have only been followed in Slovakia by two of their domestic suppliers. Additionally, the factories utilize Chinese contractors for the installation of technical equipment in their plants, as evidenced by Wuxi Lead's provision of production lines for InoBat's R&D center.¹⁴² While in Hungary, the Chinese EV and battery investors will likely rely on the import of inputs from China, due to their ownership structure, Volvo and GIB are more likely to source inputs from regional supply chains, predominantly those in Hungary and Poland, which saw the arrival of dozens of suppliers in EV battery supply chains.

GIB's legal form of a joint venture is becoming increasingly common in the industry, particularly as countries seek to attract technologically advanced investors and acquire a stake in their technology. However, InoBat is the sole regional example of a domestic company able to enter into a joint venture with an advanced partner, especially after the Polish EV project, ElectroMobility, has been put on hold. Additionally, another Slovak technological project, the roadable airplane AeroMobil, was acquired by a Chinese investor, who decided to move production to China.¹⁴³

Role of government

Slovak governments have a long history of attracting FDI into the country's automotive sector. While undoubtedly active in pursuing this goal, the set of tools they used to woo potential investors has been limited to tax holidays, direct subsidies, and streamlining regulatory approvals. While these are certainly of interest to potential investors, as evidenced by the number of OEMs and automotive suppliers relocating to Slovakia, the new investments primarily focus on the assembly stage of manufacturing, which generates the lowest value added throughout the entire production cycle.

The government's first policy on electromobility development, adopted in 2015, focused on increasing FDI in the sector, particularly by expanding production facilities and enhancing R&D intensity.¹⁴⁴ Nevertheless, governments have been slow to extend support to the sector, and in the early 2020s, the focus was primarily on nurturing the green hydrogen industry at the expense of EVs. The current government's position exhibits a curious tension, as it supports the consumption of combustion engine vehicles, while actively encouraging firms to invest in the EV sector in Slovakia for manufacturing.¹⁴⁵

To move production higher up the value chain, governments would need to either increase support for education and R&D to make the country more attractive for firms active in higher-value-added production or enact policies to facilitate technology transfer by established investors. However, Slovakia is the country with the lowest amount of R&D funding in the V4 region, measured both in absolute and per capita terms, which translates into the country filing the lowest number of patents, again in per capita terms.¹⁴⁶ In this context, the rise of InoBat initially occurred despite the government's approach,¹⁴⁷ even though the government eventually provided substantial support and subsidies.

When it comes to technology transfer, the established OEMs have, over time, increased their R&D spending in Slovakia and moved some of their more advanced technological processes to the country. Most notably, VW relocated the production of some of its premium SUVs to its Slovak plant, while Kia also added larger models to its portfolio of cars manufactured in Slovakia over time. Nevertheless, the country does not pursue policies or implement processes that would enable it to fully leverage the benefits of technology transfer. While some policies may be limited

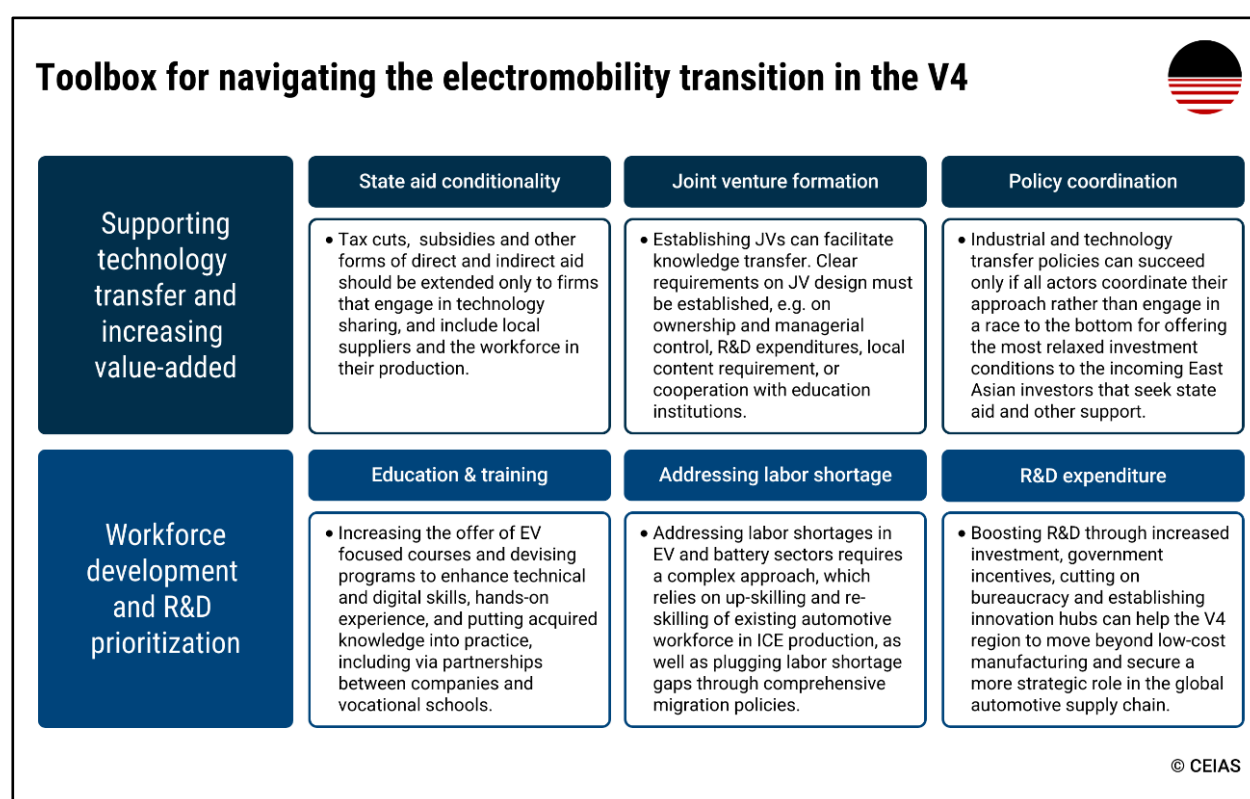
by EU-wide regulations—for instance, local content requirements would need to define “local” as European, rather than Slovak—others would be easier to enact, such as requirements to employ a local workforce or foster collaboration with educational institutions.

The inability and unwillingness to encourage technology transfer run counter to the European objective of attracting Chinese car producers, as stated when the European Commission announced the imposition of countervailing duties on the import of Chinese-made BEVs.

Governments not only attract investors by courting them directly, but also by engaging with politicians in the countries where investors are based. Here, Slovakia’s experience has been rather paradoxical. Slovak relations with South Korea improved significantly only after Kia and South Korean suppliers invested in Slovakia. In the Chinese case, the trajectory was more complicated. Slovakia was a founding participant of the 16+1 initiative and an early participant of the Belt and Road Initiative; however, despite all the diplomatic activity, little Chinese investment arrived in Slovakia, leading to premature declarations of its failure.¹⁴⁸ The two large Chinese investments arrived in Slovakia at a time when the Slovak government pursued a relatively cold policy towards China. Despite the current government’s enthusiastic embrace of China and its EV manufacturers, as seen in Slovakia’s vote against the countervailing duties on the imports of Chinese BEVs¹⁴⁹ and in the Prime Minister Robert Fico’s high-profile trip to the country with a large entourage, followed by multiple ministerial visits within a few months, no new Chinese investment in Slovakia has been announced, despite other European countries successfully attracting EV investments during the same period.¹⁵⁰ Both the South Korean and Chinese experiences raise questions about the value added of diplomatic outreach, indicating that Slovakia should focus on improving its domestic environment, particularly in research and development, infrastructure, and labor force issues.

Shifting gears: Finding the right playbook for electromobility transition

The electromobility transition is presenting a serious challenge to the competitiveness of Central European economies. This section outlines how Central European countries might leverage the transition, including the investments of East Asian companies, by focusing on policies that facilitate technology transfer, increase value-added, boost workforce development, and enhance R&D in the automotive sector.



Supporting technology transfer and increasing value-added

As presented in the pages above, most East Asian EV-related investments in the V4 countries are directed toward manufacturing activities, mostly assembly. At the same time, these EV companies possess leading technology and innovation skills, that is, they could facilitate technology and knowledge transfer, establishing an ecosystem where not only the investors gain access to the necessary manufacturing capacity and supply chains but also host countries can reap benefits (either directly or indirectly) from their advanced technology.

Access to EV technologies could help the V4 countries upgrade their automotive supply chains and provide a solid foundation for indigenous innovations. This is not only in V4's long-term interest but is also crucial for a genuine European transition to electromobility. Speaking about

competitiveness at the Strategic Dialogue on the Future of the Automotive Industry in March 2025, European Commission President von der Leyen stated that European automotive supply chains must become more resilient and adaptable, particularly in batteries.¹⁵¹ This is, however, challenging as European production is just about to scale up, while East Asian batteries remain cheaper. Neither making EVs more expensive nor creating new dependencies is a solution here, which is why von der Leyen added that direct support for EU battery manufacturers will be explored, and European content requirements for battery cells and components will be phased in. That is, in the short and medium term, Chinese batteries will certainly be needed to meet European climate targets. In the longer term, however, as European innovation advances and local content policies grow stricter, East Asian-owned or invested factories in Europe may become a liability.

V4 state aid with strings attached

As detailed in the pages above, given their dependence on the automotive industry, the V4 countries cannot afford to miss out on the EV transition. As the necessary funds and resources for the transition are lacking locally, foreign investment is needed. To attract such investments, the V4 countries are also offering generous incentives to invest in EV companies. These incentives typically go beyond simple tax incentives and include direct and indirect state subsidies, such as for infrastructure development. In this regard, Hungary is at the forefront, drawing the most from East Asian EV investments; nevertheless, other V4 nations have also employed this strategy, providing hundreds of millions of euros to investing companies. For instance, Slovakia supported the Geely/Volvo car manufacturing plant, Czechia provided financial support for Hyundai's factory, and Poland sponsored LG Chem's EV battery plant.

The details of the agreements behind these state subsidies are typically not publicly available; however, they are likely to contain few provisions for technology and knowledge transfer.¹⁵² When granting state aid to East Asian companies investing in the V4, governments should be more aware of the scope of the activities they support and demonstrate greater courage in their demands for reciprocity.

These agreements may stipulate the involvement of several local companies in manufacturing activities. A percentage may be established to determine the proportion of these enterprises engaged in higher-value-added activities. Moreover, knowledge transfer may be enhanced if a portion of the state subsidies were explicitly contingent upon R&D collaboration, such as mandating the participation of local universities and knowledge centers to guarantee technological spillover benefits. In the case of battery production, in addition to manufacturing technology, technology transfer related to battery life extension or recycling would be particularly beneficial to the V4 countries.

Joint ventures

Forming JVs with V4 partners, which many Chinese producers are already accustomed to from their operations in China, would be one approach to expedite and lower the cost of building factories in the EU. In addition to speeding up the procedure, this would provide East Asian EV manufacturers with the same benefits—distribution network development, local supplier procurement, regulatory compliance, and adaptation to local preferences—as the wholly owned format. At the same time, technology and knowledge transfer in the V4 host countries would increase significantly. Most Chinese EV manufacturers have so far opted for direct investment and a wholly owned format over joint ventures. However, in later stages, they often seek assistance from local automotive players in navigating new markets.

Joint ventures and licensing by East Asian companies in V4



Country	Investor country	Entity	Location	Amount (€ mil.)	Category	Production status	Start of production	Note
Hungary	South Korea	LG Magna	Miskolc	51.6	EV parts suppliers	planned	2026	JV between LG Electronics (South Korea) and Magna International (Canada)
Hungary	Japan/ South Korea	LG Chem/Toray	Nyergesújfalu	680	battery parts suppliers	operational	2022	JV between LG Chem (South Korea) and Toray (Japan)
Hungary	South Korea	EcoPro/SK Ecoplant/TES	Debrecen	748	battery recycling	planned	2025	JV between EcoPro (South Korea), SK Ecoplant (South Korea), and TES (South Korea)
Hungary	China	Ikarus/CRRC	Székesfehérvár	unknown	EV manufacturing	operational	2019	JV between CRRC (China) and Ikarus (Hungary)
Poland	South Korea	POSCO/SungEel Hitech	Bukowice	unknown	battery recycling	planned	2022	cooperation between POSCO (South Korea) and SungEel Hitech (South Korea)
Poland	China	Electromobility Poland/Geely	Jaworzno	unknown	EV manufacturing	planned	2025	licensing of the pure electric SEA architecture by Geely (China) for the Izera brand
Poland	China	Leapmotor International	Tychy	unknown	EV manufacturing	suspended*	2024	JV between Stellantis and Leapmotor (China)
Slovakia	China	Gotion InoBat Batteries	Šurany	1,200	battery manufacturing	planned	2027	JV between Gotion (China, 80%) and InoBat (Slovakia, 20%)
Slovakia	China	InoBat/Gotion	Voderady	140	battery manufacturing	operational	2024	Gotion (China) has 25% ownership of InoBat (Slovakia)

*The production in Tychy was suspended in March 2025, with Stellantis looking to move the T03 model production to Zaragoza, Spain.

Data: Bloomberg and authors' compilation from open sources

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In the new wave of automotive investment ushered in by the EV transition, East Asian manufacturers are increasingly embracing JVs as the go-to format for market entry in the V4 countries. Nine JV and other cooperation projects that are currently operational or under construction are worth more than €2 billion, a significant portion of the total sectoral investment by East Asian companies in the region. This demonstrates that the private sector appreciates and largely embraces this format, in stark contrast to the FDI strategies in ICE sectors in the 1990s and 2000s.

The EV industry JVs in the V4 countries can be split into two categories. On the one hand, Chinese companies partner with local firms to facilitate production, sales, and distribution in Europe. On the other hand, South Korean companies tend to partner with firms from like-minded countries, which strengthens the market position of South Korean firms, especially in comparison to their Chinese competitors.

Since JVs are more likely to enhance knowledge transfer, they may also be favored by European policymakers, which helps fulfill one of the objectives of implementing countervailing duties. However, merely anticipating that Chinese corporations will establish joint ventures with local producers will not be sufficient for knowledge transfer. Specific requirements, such as quotas for the proportion of European employees in technical and managerial roles, local content requirements, including purchasing from European suppliers, cooperation with regional research

Central Europe-East Asia EV nexus

Tracking Chinese, South Korean and Japanese electric vehicle and battery investment in the V4 countries

and educational institutions, and offering of apprenticeship and internship positions to local students, would be necessary for a targeted approach.

As most of the Chinese EV investment concentrates on V4 countries, it would be incumbent on the local politicians to impose such requirements. However, this does not seem to be the case, as Central European policymakers rely largely on the old, time-tested toolkit of enticing investors with tax incentives, direct state aid, and infrastructure development. Most of the Chinese EV investment is hosted by Hungary, which is on friendly terms with China and is unlikely to upset the Chinese government by imposing requirements that facilitate technology transfer. It is apparent from the type and structure of Chinese automotive investment in Hungary that the country is content with serving primarily as an assembly location. From the perspective of Chinese EV makers, this provides an ideal position, wherein they avoid countervailing duties while simultaneously preventing technology transfer.

Coordinated V4 approach?

Nonetheless, the aforementioned recommendations are ineffective if the V4 countries perceive one another primarily as rivals in the EV transition and compete for the various EV investments, which has happened in the case of almost all major investments in the sector. Under such circumstances, no one can impose stricter conditions on East Asian (and other foreign) investors than previously, as they may rightly fear that neighboring countries will readily accept investors without such conditions attached.

Joint action by the V4 countries is currently unrealistic, but at least a coordinated position and approach should be sought to achieve better investment conditions, such as mandating technology transfer. Minimum requirements should be defined, such as local content requirements, the proportion of suppliers to be involved, and the scope and nature of research cooperation. These would bind all V4 countries and thus constitute a common and inescapable expectation for East Asian investors.

Such coordination can take place at both the regional and EU levels. Certain policy frameworks support and encourage regional initiatives. However, their voluntary nature lowers the chances of their success. On the other hand, the EU needs to establish a robust regulatory framework that will shape the incentives not only for foreign investors, thereby preventing regulatory arbitrage, but also for member state governments, thereby preventing a race to the bottom in attracting investments and job creation. As many EU-level plans regarding local content requirements, such as those for batteries and components, are already underway, it is in the interest of both host countries and investing companies to proactively incorporate these provisions into investment deals.¹⁵³

Workforce development and R&D promotion

In this section, we outline policy responses that the V4 countries could adopt to increase benefits from EV investment in workforce development and R&D. We focus on targeted educational initiatives for young people, state-backed programs for reskilling and upskilling the sector's labor force, and the importance of a comprehensive, forward-looking strategy. We emphasize the need for a holistic approach that addresses the specific needs of the automotive sector and ensures an active role for key social partners, including labor unions, in shaping the transition.

The automotive industry plays a key role in the economies of all four Visegrad countries, serving as a major source of employment. However, as the EU prepares for the phase-out of ICE vehicles,

governments in the V4 face the task of strengthening labor market resilience amid the green transition. The countries in the region are well-positioned to become a hub for EV production. Nevertheless, the transition may also present challenges as a large part of local value-added relies on labor-intensive, low- to mid-skilled component assembly, leaving the region susceptible to negative impacts.

Individual V4 countries currently lack comprehensive national plans or strategies to ensure a just transition for automotive sector employees, while active labor market policies are in decline in Hungary, Slovakia, and Czechia.¹⁵⁴

The V4 countries face persistent labor shortages in the automotive manufacturing sector due to tight labor markets, demographic pressures, low willingness of workers to relocate, a lack of graduates from relevant technical fields, and broader challenges in retaining talent domestically.¹⁵⁵ To address these shortages and the need for greater workforce flexibility, companies have increasingly turned to temporary agency work and migrant labor.¹⁵⁶ This has contributed to the emergence of a two-tier workforce structure in the automotive industry, where core employees benefit from stable, well-compensated positions. At the same time, agency workers contend with precarious working conditions and irregular, lower-paid employment.¹⁵⁷

Hungary has been the most proactive in deregulating labor laws, lowering skill requirements for job entry, and facilitating the employment of migrant workers on temporary contracts. Czechia and Slovakia are also working to reduce bureaucratic barriers to streamline the hiring of foreign workers, reinforcing the shift toward a more flexible but less stable workforce.¹⁵⁸ A comprehensive migrant policy is essential for meeting the economy's future needs; however, it is insufficient on its own. Strengthening labor market resilience through state-led reskilling and upskilling efforts, as well as fostering domestic talent, will be crucial to addressing workforce challenges, supporting the transition to emerging industries and the green economy, and reaping the benefits of East Asian investment in the EV and battery sectors in the region.

Training the next generation of workers

As the automotive industry undergoes transformation and response times shorten, it is increasingly crucial for national authorities to collaborate closely with industry and education partners to adapt training and workforce development strategies. Establishing an education system and vocational training reflecting industry demands can help ensure a steady supply of skilled workers equipped to meet future labor market needs.¹⁵⁹ Workers entering the automotive sector over the next decade must be well-prepared for the shift from mechanical to electrochemical production processes. As the industry advances, technical and digital expertise will become increasingly essential, enabling workers to operate human-machine interfaces, analyze data, and apply specialized knowledge of vehicle technologies and systems.¹⁶⁰ Additionally, chemical and safety-focused skills, including the ability to handle hazardous EV components, are crucial.¹⁶¹ Competency with battery management software, testing and quality control, battery diagnostics, charging infrastructure installation, and software updates will all be in high demand.¹⁶²

The evolving demands of the automotive sector are highlighting gaps in existing educational offerings at both university and vocational levels. Training programs specifically focused on EV technologies, such as battery production, remain limited, highlighting a disconnect between current curricula and industry needs.¹⁶³ Addressing this gap involves not only developing educational programs in areas such as battery systems and EV technologies but also integrating humanities-oriented courses that examine the broader societal implications of the EV transition. However, preparing the economy for this shift requires a more comprehensive educational reform. Greater emphasis must be placed on technical and digital skills, hands-on laboratory

experience, and putting the acquired knowledge into practice.¹⁶⁴ Moreover, these reforms present an opportunity to address gender disparities in technical fields, thereby fostering more inclusive participation in the rapidly growing EV sector.¹⁶⁵

Apprenticeships and internships will be essential in bridging the gap between education and industry, offering students hands-on experience. Governments can encourage vocational schools and universities to establish partnerships with industry, facilitate student placements and integrate these programs into curricula. Companies like Hyundai in Czechia already offer paid internships in various departments, allowing students to gain experience while promoting the company as an attractive employer. Hyundai has also collaborated with schools by providing pre-production models, including PHEVs and BEVs.¹⁶⁶

In Hungary, dual education programs have been encouraged, with vocational schools receiving increased government funding and forming agreements with large employers to address the demand for specialized professions.¹⁶⁷ Universities have also introduced specialized engineering programs in collaboration with industry partners. For example, Széchenyi István University has established a comprehensive network of dual education partnerships, thereby enhancing vocational training.¹⁶⁸

In Slovakia, dual vocational education has been supported by fostering direct cooperation with employers, primarily in the automotive sector, and introducing new training modules for secondary students that focus on emerging fields, such as electric car diagnostics.¹⁶⁹ Additionally, as part of the Sector-Governed Innovations (SGI) initiative, 24 Sectoral Committees were established to monitor labor market developments and inform vocational training in line with sector-specific needs.¹⁷⁰

While these initiatives demonstrate a growing alignment between education and industry, they also reveal underlying structural dynamics that merit closer examination. The increasing role of corporations in shaping curricula and training pathways suggests a shift in the locus of skill formation from the public to the private sector. This trend often results in programs tailored to the short-term needs of individual firms, particularly large multinationals, potentially at the expense of broader educational objectives and reinforcing existing labor hierarchies rather than fostering adaptability, upward mobility, or innovation across the sector as a whole.¹⁷¹

This company-specific orientation may enhance students' immediate employability, but it raises concerns about their long-term labor market flexibility. Training designed to meet narrowly defined roles may not equip students with transferable skills or the capacity to transition across occupations or move up the production chain. Moreover, small and medium-sized enterprises (SMEs), which cannot often co-develop such programs, risk being left out of the emerging ecosystem of skills development.

Navigating the impact of EVs on jobs in the automotive sector

The shift from ICE vehicles to EV production will require substantial reskilling and upskilling of the workforce. While some jobs in automotive manufacturing will remain relevant, many others will become redundant. EVs require only a third of the parts used in ICE vehicles, resulting in a reduction in jobs, particularly among suppliers specializing in ICE components.¹⁷² Vehicle production itself will also be affected, as BEV assembly is less labor-intensive than ICE manufacturing.¹⁷³ Although new investments in battery and cell production may offset some job losses, the assembly of EV batteries is not a high-value-added activity,¹⁷⁴ and battery cell production is highly automated.¹⁷⁵ Furthermore, some trade union representatives fear that the losses in traditional automotive will be compensated by employment in hazardous working conditions at companies with hostile attitudes toward labor unions, relying on more vulnerable

labor.¹⁷⁶ However, the growing demand for EVs will also create new employment opportunities, for example, in software-based services and sales.

Over the next decade, there will be significant movement between sectors and jobs. Some workers will need to move into entirely different industries, while others will require reskilling. Companies like Kia, Hyundai, Toyota, and Stellantis, which are transitioning to EV production, are already facing skill shifts. Currently, most of the reskilling is taking place in-house on an ad hoc basis, often without long-term planning. Alternatively, employers hire new workers with the required skills.¹⁷⁷ There is a limited infrastructure in place for reskilling on the labor market, state institutions mostly support in-house reskilling efforts by providing financial assistance to automotive companies.¹⁷⁸ This support can take the form of direct funding, co-funding, or tax incentives for companies that retrain their employees in-house. While Czechia and Slovakia prioritize retraining programs for the manufacturing workforce with limited focus on high-skilled talent, Hungary places greater emphasis on supporting R&D in high-value segments of the traditional automotive industry.¹⁷⁹

Due to scarce national funding for employment policies, Visegrad countries largely rely on European programs, with most financial resources drawn from the Recovery and Resilience Facility and the Just Transition Fund.¹⁸⁰ Additionally, state institutions offer their own reskilling courses, but on a limited scale, with the Czech Employment Office currently providing over 88 courses in the fields of Engineering, Welding, and Automotive.¹⁸¹

Legislative measures could further encourage companies to invest in employee education, for instance, by requiring businesses to allocate a percentage of wages to workforce training.¹⁸² Alternatively, governments could impose training quotas, mandating companies to dedicate a set number of hours annually to employee education. Additionally, policies that gradually increase local workforce participation in management and technical roles, particularly in foreign-owned multinational companies, could support long-term workforce development. While this transition often occurs naturally as companies establish a local presence, targeted regulations could accelerate the process.

Furthermore, employment in the broader EV industry could be stimulated by setting local content requirements, encouraging companies to source materials and components from domestic suppliers. This would not only support local businesses but also boost job creation. Lastly, companies should be encouraged to report on their workforce development initiatives, fostering transparency and embedding continuous training as a standard business practice.

In addition to retraining workers already in the automotive sector, the transition to EV production will also require upskilling employees from related industries that already have similar skill sets necessary for EV production. Finally, continuous education of the entire workforce will be crucial, as digital proficiency will be a fundamental requirement for most jobs. Currently, 30% of the workforce lacks digital skills, yet at least 90% of future jobs are expected to demand them.¹⁸³ Labor markets in Central Europe often struggle with low worker mobility, largely due to a fear of leaving stable employment and high homeownership rates.¹⁸⁴ To address this, workers should be encouraged to advance their careers, consider switching jobs, and take advantage of opportunities for lifelong learning.¹⁸⁵

A just transition to EV production cannot be fully achieved without the inclusion of social partners, particularly trade unions. Trade unions have focused more on wage-related benefits in collective bargaining than on reskilling the workforce.¹⁸⁶ They could help reskill the sector by anticipating skill shifts and evolving into learning platforms that support workers in adapting to industry changes.¹⁸⁷

Labor shortages and an aging workforce pose ongoing challenges in the context of industrial transformation in the automotive manufacturing sector. In this context, the role of labor market monitoring and intelligence sharing has become increasingly prominent. Enhanced data flows between institutions, industries, and policymakers can support more responsive planning and facilitate adaptation to shifting skill demands.

Despite the scale of transformation in the automotive sector, many governments have yet to establish dedicated platforms, working groups, or strategic frameworks specifically focused on workforce-related dimensions.¹⁸⁸ The absence of a coordinated, cross-sectoral approach may limit the ability to anticipate and manage the social and employment implications of the shift toward EV production. While individual initiatives exist, a more integrated focus on the interplay between technological change, workforce dynamics, and industrial policy remains underdeveloped in many national contexts.

Supporting R&D

Increasing investment in R&D is crucial for maximizing the benefits of foreign investment in the automotive sector, as it also supports the development of a skilled workforce and encourages knowledge spillovers from foreign investors. While a significant share of automotive manufacturing jobs is in the V4 countries, their role in R&D remains minimal. Even if R&D operations are present, they tend to focus on non-core supporting activities, rather than core technologies, and the local spillover has been limited. This reflects the structural position of the V4 countries within the established hierarchies of the global automotive value chains.¹⁸⁹ In 2020, Eastern Europe accounted for 32% of EU automotive jobs, but only 8.7% of R&D positions, and represented 3.6% of R&D business expenditures in 2019.¹⁹⁰ This imbalance hinders the region's ability to capture high-value-added activities, as evidenced by its significantly lower patent output compared to Western Europe.¹⁹¹ In the decisions of automotive companies regarding the establishment of their R&D activities, the main factors are the ability to provide a sufficient supply of highly qualified researchers, favorable government R&D policies, and strong institutional support for R&D.¹⁹²

The new wave of foreign investment in the sector, focusing on innovative technologies and processes, should be leveraged to strengthen the currently weak R&D footprint of the four countries. Some indications, such as Volvo's R&D center in Krakow and BYD's announced hub in Budapest, suggest the potential for a strengthened R&D focus with the shift to electromobility. However, their overall impact on the localization of core R&D will require further scrutiny.

Government action is crucial. Boosting R&D through increased investment, state financial incentives, and the establishment of innovation hubs could help the region move beyond low-cost manufacturing and secure a more strategic role in the global automotive supply chain. National-level legislation and schemes to support the localization of R&D in the regional supply chains should be developed, making it an attractive proposition for foreign investors to integrate R&D as a core component of their investment strategies in the region.¹⁹³ The governments should also support the involvement of local entities in relevant EU financing schemes to promote the development of R&D activities, particularly with a focus on higher-complexity core technologies.

The establishment of specific industrial platforms with government support should facilitate cooperation, knowledge sharing, and networking among local companies across countries. Moreover, governments should ensure that any existing and upcoming financing schemes minimize the bureaucratic burden, which may pose obstacles, especially for SMEs, to taking advantage of the available financing opportunities.¹⁹⁴

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Central Europe-East Asia EV nexus

Tracking Chinese, South Korean and Japanese electric vehicle and battery investment in the V4 countries

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Design: Veronika Blablová, Matej Šimalčík

Copyediting: David Hutt

Research assistance: Chen Wei-Chung

Cite as: Šebeňa, Martin et al. Central Europe-East Asia EV nexus: Tracking Chinese, South Korean and Japanese electric vehicle and battery investment in the V4 countries. CEIAS, May 2025.

Published by:

Central European Institute of Asian Studies
Murgašova 2, 811 04 Bratislava, Slovakia
www.ceias.eu
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ISBN 978-80-8239-029-5

The publication is one of the results of the project “East Asian electric vehicle makers in the V4 countries’ electric vehicle transition” coordinated by CEIAS and implemented in cooperation with OSW Centre for Eastern Studies (Poland), Palacký University Olomouc (Czech Republic), Corvinus University of Budapest (Hungary).



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The project is co-financed by the governments of Czechia, Hungary, Poland and Slovakia through Visegrad Grants from the International Visegrad Fund. The mission of the fund is to advance ideas for sustainable regional cooperation in Central Europe.

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