

Review

Analysis of Legislative, Infrastructural, and Economic Determinants of Electromobility Development in the Slovak Republic with a Comparison of Visegrad Group (V4) Countries in the Context of EU Regulations

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Abstract

The transition to electromobility represents one of the most significant transformational challenges for the automotive sector in the Slovak Republic. This article analyzes the key determinants of this process—from the development of charging infrastructure and industrial transformation to government measures and the economic and legislative factors influencing the adoption of electric vehicles. The research draws on current statistics, European regulations, and a comparative analysis of the Visegrad Group (V4) countries and the European Union. The results highlight structural inequalities in charging availability, insufficient state support, and, at the same time, the strong potential of Slovakia to become a regional leader in electromobility. The article provides a practical framework for public policy design, investment decision-making, and further research in sustainable transport.

Keywords: electromobility; Slovak Republic; charging infrastructure; AFIR (Alternative Fuels Infrastructure Regulation); fit for 55; public policy; industrial transformation; battery technologies; distribution grid; Recovery and Resilience Plan; sustainable transport; Slovak and EU legislation; environmental regulation

1. Introduction

Over the past decade, electromobility has evolved from a marginal topic into a strategic pillar of modern sustainable mobility concepts and the broader energy transition. What initially appeared as a visionary concept has become an economic and environmental necessity, driven by the ambitious climate and decarbonization objectives of the European Union. In this context, the Slovak Republic—one of Europe's most significant automotive economies per capita—plays a key role in the regional transformation of the automotive industry. For the Slovak economy, the transition to electric mobility is therefore not a matter of choice but an essential condition for maintaining competitiveness, technological relevance, and long-term economic stability.

However, the transformation toward electromobility extends beyond technological innovation in individual vehicles. It represents a multidimensional systemic process requiring the simultaneous integration of infrastructural, legislative, energy, and industrial measures. Key elements include the development of a robust charging infrastructure, the implementation of targeted state support and regulatory incentives, innova-



Academic Editor: Antonio Caggiano

Received: 31 December 2025

Revised: 30 January 2026

Accepted: 5 February 2026

Published: 10 February 2026

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tions in battery technologies and energy management, and the restructuring of industrial and supply chains, which will inevitably affect a large number of jobs and regional economic structures.

This article focuses on a comprehensive analysis of the interrelated determinants of the transition to electromobility in the Slovak Republic and V4 countries, with the aim of identifying critical infrastructural, legislative, and economic factors shaping the pace and character of this transformation. The analysis also considers regulatory pressure, financial incentives, and political support from the European Union, which significantly influence national strategies in sustainable transport and decarbonization.

2. Charging Infrastructure in Slovakia

In recent years, the Slovak Republic has experienced a significant expansion of its network of charging stations for electric vehicles (EVs), reflecting the growing demand for low-carbon mobility and the implementation of European environmental policies. However, this development remains uneven and structurally unbalanced, with notable regional disparities in the spatial distribution of infrastructure [1,2].

Major transport corridors, particularly the D1 and R1 highways, are relatively well covered by ultrafast DC charging stations, enabling rapid range replenishment during long-distance travel. These high-performance stations are typically the result of investments by key market players (e.g., ZSE Drive, GreenWay, Ionity), often co-financed through European funds such as the Connecting Europe Facility (CEF) or the Recovery and Resilience Plan (RRP) [2,3].

Conversely, smaller towns, rural regions, and especially residential housing estates remain insufficiently equipped—particularly in terms of AC charging points suitable for long-duration overnight charging. This segment is essential for mass and inclusive electromobility adoption, especially for households without the option to install private wall-boxes [4,5].

Administrative, legislative, and technical barriers remain significant limiting factors. Complex permitting procedures, unclear ownership relations within apartment buildings, and insufficient distribution grid capacity often delay or prevent the deployment of public and semi-public charging infrastructure. Without systematic solutions, infrastructure development will remain socially selective, making electromobility disproportionately accessible to residents of detached homes [5–7].

From a European perspective, these challenges are clearly framed by Regulation (EU) 2023/1804 on Alternative Fuels Infrastructure (AFIR), which establishes binding minimum standards for Member States, including the obligation to ensure fast-charging stations every 60 km along the TEN-T core network. Slovakia has access to substantial funds from the Recovery and Resilience Plan, which should be prioritized for reducing regional disparities and supporting urban and residential charging deployment [1,8].

Strategically, Slovakia's charging infrastructure is in a quantitative growth phase but requires qualitative optimization and spatial balancing. Without targeted measures in spatial planning, regulatory incentives, and coordinated integration with the energy sector, mass EV adoption—crucial for meeting EU climate goals—cannot be achieved. The requirements for establishing a charging station in Slovakia are presented in Table 1 [9].

Table 1. Requirements for Building a Charging Station in Slovakia.

Step/Area	What to Prepare/Do	Key Requirements and Notes	Legal Basis (SK/EU)
Location and Property Rights	Owner's consent, lease agreement, easement (cable routes)	Land registry verification, route specification, lease duration	Civil Code; Act No. 162/1995 Coll. (Cadastral Act) [10]
Zoning Plan	Verify compliance with land-use designation	Retail/fuel station/rest area vs. residential zones	Act No. 50/1976 Coll.; Act No. 200/2022 Coll. [10]
Connection to Distribution System (DS)	Connection request (number and power of DC chargers, required capacity)	DS conditions, reserved capacity, metering, TS/reinforcement	Act No. 251/2012 Coll.; Act No. 250/2012 Coll.; PPDS [10]
Technical Concept	Technology design (layout, schematics, grounding)	30–400 kW, selectivity, EMC, protection	STN EN IEC 61851, 62196; [11] STN 33 2000; STN EN 61439 [11]
Fire Safety (PBZ)	Fire safety project, distances, zoning, intervention routes	Gara ges/parking areas, ventilation, signaling	Act No. 314/2001 Coll. [10]
Traffic and Signage	Traffic design, “charging only” parking spaces	Vertical/horizontal signs, accessibility, road management	Act No. 8/2009 Coll.; Act No. 135/1961 Coll.; [10] STN/TP
Utility Network Statements	Statements from utility managers	Conflicts with HV/MV/LV, water, gas, telecom; trench coordination	Construction and sector regulations [11]
EIA Screening	Screening request	For large hubs or protected areas	Act No. 24/2006 Coll. [10]
Permitting	Zoning decision, building permit/notification	Project docs, land rights, statements, PBZ, DS	Act No. 50/1976 Coll.; Act No. 201/2022 Coll. [10]
Buildings (EPBD)	Cable pre-installation for new construction/renovation	Min. number of spaces, ducts, shafts	Act No. 555/2005 Coll. [10]
Metering and Billing	MID-certified meters	Accuracy, metrological verification	Act No. 142/2000 Coll.; MID [10]
Payments and Pricing	Ad hoc payment, transparent pricing	€/kWh display, open data, contract-free access	Regulation (EU) 2023/1804 (AFIR) [1]
GDPR/Consumer Protection	Terms, data processing	Minimisation, legal basis, user information	GDPR; Act No. 18/2018 Coll.; Act No. 250/2007 Coll. [10]
OHS & Technical Equipment	Qualified installers, training	Work on MV/LV, hazard marking, records	Act No. 124/2006 Coll. [10]
Inspections	Initial electrical + fire inspection	Before commissioning; periodic checks	STN 33 1500; STN 33 2000-6 [11]
Commissioning	Price list, payments, roaming/interoperability	Info disclosure, customer support, service	AFIR; URSO; CPO/MSP contracts [1]
Waste & Batteries	E-waste & battery procedures	Take-back, collection targets, emergency plans	Waste & battery legislation

3. Impact of the European Union on the Development of Alternative Fuels Infrastructure (AFIR)

Within the field of electromobility, the European Union represents the most significant systemic actor whose regulatory and financial instruments fundamentally shape national policies across Member States. Regulation (EU) 2023/1804 on the Deployment of Alternative Fuels Infrastructure (AFIR) constitutes the key legislative framework guiding Europe's transport and energy transition. The regulation, which entered into force on 12 October 2023 and became applicable from 13 April 2024, forms an integral part of the Fit for 55 climate package aimed at reducing greenhouse gas emissions by 55% by 2030 [1,8].

AFIR introduces binding minimum requirements (Table 2) for all Member States regarding the availability, performance, and coverage of charging and refueling stations for alternative fuels. Among its central provisions is the obligation to ensure that, by 2026, fast-charging stations for passenger vehicles are located at intervals of no more than 60 km along the TEN-T core network [1,8]. There is also a strengthening proposal within Fit for 55, namely to install at least 1 charging station for every 10 parking spaces for all non-residential buildings with more than 20 parking spaces, independently of any renovation (instead of Member States setting a minimum number) by 2027 [4]. These stations must also meet specified performance thresholds and transparency requirements for pricing [1,8].

Table 2. Requirements of the regulation for individual categories of transport and infrastructure.

Category	Target Year	Technical Requirement	Note
Passenger Vehicles (TEN-T)	2025	400 kW total power, min. 1 × 150 kW	Every 60 km on the core network
Passenger Vehicles (TEN-T)	2027	600 kW total power, min. 2 × 150 kW	Every 60 km on the core network
Passenger Vehicles (TEN-T)	2030	600 kW total power, min. 2 × 150 kW	Extension to the comprehensive network
Heavy-Duty Vehicles	2025	1400 kW total power, min. 1 × 350 kW	Coverage of 15% of the TEN-T network
Heavy-Duty Vehicles	2027	2800 kW total power, min. 2 × 350 kW	Coverage of 50% of the TEN-T network
Heavy-Duty Vehicles	2030	3600 kW every 60 km	TEN-T core network
Urban Nodes	2025	900 kW total power	For freight vehicles
Urban Nodes	2030	1800 kW total power	For freight vehicles
Safe Parking Areas	2027	Min. 2 stations at 100 kW	For electric freight vehicles
Safe Parking Areas	2030	Min. 4 stations at 100 kW	For electric freight vehicles
Hydrogen Stations	2030	Min. 1 tonne/day	Every 200 km on TEN-T + one in each urban node
Airports	2024	Electricity supply for parked aircraft	At contact stands
Airports	2029	Electricity supply for parked aircraft	Also at remote stands
Ports	2029	Shore-side electricity for ships	For 90% of passenger and container ships

Implementation of AFIR is supported financially through multiple European mechanisms, particularly the Recovery and Resilience Facility (RRF), which enables co-financing of projects aimed at the construction and modernization of charging points. In this respect, the EU acts not only as a regulatory authority but also as a financial facilitator of technological transformation.

4. Restructuring of Slovakia's Automotive Sector Under the Influence of European Electromobility Policy

The Slovak automotive industry—represented by major production plants such as Volkswagen, Stellantis, Kia, and Jaguar Land Rover—is undergoing a profound structural transformation towards electromobility. This transition extends far beyond incremental adjustments to existing production lines; instead, it entails a comprehensive reconfiguration of supply chains, production logistics, and technological competencies across the sector.

One of the most significant challenges, and simultaneously one of the greatest development opportunities, is the localization of battery production, which has become a strategic pillar of the new industrial policy. A symbolic milestone of this shift is the investment by Volvo near Košice, where a planned gigafactory will be fully dedicated to the production of electric vehicles and associated components [4,12,13].

At the European level, they wanted to strongly support this industrial transformation within the framework of the Fit for 55 legislative package, which essentially introduced a ban on the sale of new vehicles with combustion engines after 2035. However, this ban was lifted in December 2025 [2,3,14].

Simultaneously, the European Union is implementing initiatives such as the European Battery Alliance (EBA) and the Just Transition Fund, aimed at reducing Europe's dependency on Asian suppliers, strengthening regional self-sufficiency, and cre-

ating new employment opportunities in regions affected by the decline of traditional automotive production.

Slovakia's policy approach to supporting electromobility in recent years has been characterized by discontinuity and insufficient systemic coordination. Subsidy schemes for the purchase of electric vehicles have typically been short-term, with limited budget allocations and rapid depletion of available funds. Although the current direction—supported by the Recovery and Resilience Plan (RRP)—indicates a shift toward more systematic support for corporate fleets, public infrastructure, and technological innovation, the overall framework remains unstable.

For long-term effectiveness, direct financial subsidies must be complemented with stable indirect incentives such as tax benefits, motorway toll exemptions, and simplified permitting processes for the construction of charging stations. While the European Union does not prescribe national subsidy models, it provides a favorable economic environment through financial instruments (RRF, CEF, EIB) that can significantly facilitate the implementation of national measures aligned with transport decarbonization goals [5–7].

A coherent and predictable policy framework is crucial for stimulating market demand, strengthening investor confidence, and ensuring harmonized development across infrastructure, industry, and consumer adoption. Without such stability, Slovakia risks lagging behind its regional counterparts despite having strong industrial potential.

The future development of electromobility in the Slovak Republic will be determined by a complex interplay of technological, economic, and energy-related factors. The key challenges include the cost accessibility of electric vehicles, the rapid evolution of battery technologies, and the readiness of the electricity distribution grid for increased loads [5–7].

Despite the long-term cost advantages of electric vehicles, their initial purchase price remains significantly higher than that of internal combustion engine (ICE) vehicles. The Total Cost of Ownership (TCO) analysis, however, confirms that EVs are cost-competitive over time due to lower operating and maintenance costs. Households and corporate fleets with high annual mileage benefit the most, achieving economic parity within a few years. Nonetheless, the lack of awareness regarding TCO and the insufficient motivational framework hinder wider adoption among consumers [2,3].

Battery development is rapidly advancing, with research increasingly focusing on alternative chemistries such as sodium-ion and solid-state batteries. These technologies promise greater energy density, improved safety, and reduced dependency on critical raw materials. The EU's Regulation 2023/1542 on batteries and waste batteries introduces mandatory collection targets and minimum recycled material content, reinforcing the circularity of battery supply chains. Efficient recycling and second-life applications will play a vital role in reducing environmental impacts and securing material availability.

The electrification of transport will impose significant pressures on the electricity distribution grid, necessitating modernization and smart management. Smart charging and Vehicle-to-Grid (V2G) solutions are among the most promising strategies for enhancing grid flexibility. Smart charging enables controlled distribution of load across peak and off-peak hours, while V2G allows bidirectional energy exchange, effectively turning EVs into distributed energy resources that can stabilize the grid.

The presented analysis, based on European and national strategic documents, statistical data, and specialized studies of the automotive sector, provides a holistic view of the development of electromobility in Slovakia. This is a process that represents not only a technological transformation of the transport sector, but also a historic opportunity to modernize the economy and strengthen the country's innovation capacity within the European industrial landscape.

The transformation of transport in Slovakia towards electric mobility represents a complex and multilayered process, characterized by strong industrial development dynamics and a relative stagnation in domestic demand. While investment activity in the automotive sector—driven by European policies and technological innovation—has reached a historic peak, public adoption of electric vehicles remains limited and socially uneven. To understand this contrast, it is essential to analyze three key areas: charging infrastructure, market purchasing power, and the regulatory environment.

From a quantitative perspective, Slovakia has recorded a significant increase in the number of public charging points. By mid-2025, approximately 2200 active stations were in operation, with year-on-year growth in double-digit percentages. Despite this progress, the analysis identifies substantial structural disparities in the network's composition and spatial distribution.

The majority of the national network consists of roughly 1600 AC (alternating current) chargers, which are suitable for long-duration “destination charging” in locations such as shopping centers, hotels, or office complexes. In contrast, only around 600 DC (direct current) fast-charging stations provide sufficient capacity for replenishing energy within 20–30 min. Although their number is increasing, their placement remains uneven.

Charging infrastructure is heavily concentrated along the primary transport corridors (D1 and R1, D1—label for highway of the highest importance, R1—label for expressway of the highest importance) and within metropolitan areas such as Bratislava and Košice. Regions including Rimavská Sobota, Poltár, or Svidník remain significantly underserved, creating disparities in access and limiting the willingness of residents in peripheral regions to adopt electric vehicles.

A major obstacle to mass EV adoption is the insufficient availability of AC charging points in dense residential zones, especially large housing estates. The absence of affordable and accessible overnight charging creates a socio-economic divide—electromobility is significantly more accessible to residents of family homes who can install private wallboxes.

A crucial influence on infrastructure development is Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure (AFIR), which introduces binding standards for EU Member States. By 2026, fast-charging stations with a minimum required power must be installed every 60 km along the main TEN-T corridors (TEN-T- Trans-European Transport Network—the official network of the most important transport corridors in the EU, planned and financed by the European Union). This legislative framework is designed to eliminate so-called range anxiety and remove “white spots” in the trans-European transport network. The implementation of AFIR is supported by Slovakia's Recovery and Resilience Plan (RRF), which allocates more than €50 million for the construction and modernization of charging points. In this way, the EU combines regulatory pressure with financial incentives, creating a synergistic model that supports both public and private investments (ZSE Drive, GreenWay, ejoin, and others). Figure 1 shows the location and number of charging stations across Slovakia from all the aforementioned providers, which were built thanks to financial injections from the EU [15].

Although Slovakia is an export leader in electric vehicle manufacturing, the domestic market remains characterized by a low penetration of battery electric vehicles (BEVs). Several economic, structural, and policy-related factors contribute to this stagnation [1,8].

The share of BEVs in new vehicle registrations stands at only 3–4%, significantly below the European average of 15–17%. Slovakia lags far behind countries such as Germany, France, and the Netherlands, where BEV market shares reach 20–25% [16].

The primary obstacle is the high upfront purchase price. The cost difference between an electric vehicle and an internal combustion engine (ICE) equivalent ranges from EUR 10,000 to 15,000, representing a significant financial barrier for the average Slovak household [6,7].

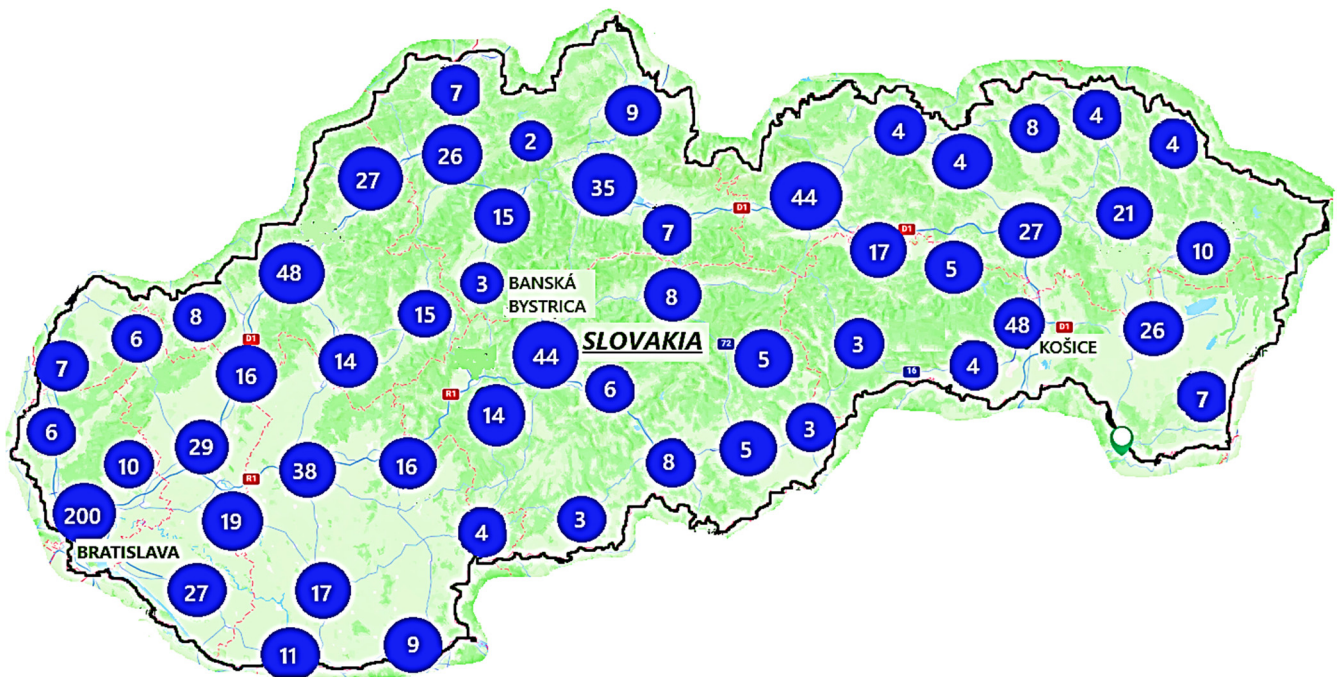


Figure 1. Map of charging stations across Slovakia. (own processing according to [15]).

Despite the high initial cost, EVs show clear long-term economic advantages:

- Home charging costs are approximately 3–4 EUR per 100 km, compared to 9–10 EUR per 100 km for petrol vehicles.
- Maintenance costs are 30–40% lower due to the absence of oil changes, filters, timing belts, and exhaust systems.
- Corporate fleets and high-mileage users (over 25,000 km/year) often achieve payback within 3–4 years, even without subsidies.

However, public awareness of TCO advantages remains low, and the national incentive framework has not sufficiently targeted this issue. Slovakia's subsidy programs for EV purchases have historically been episodic and poorly coordinated. Short-term subsidy rounds with limited budgets create uncertainty and discourage consumers from committing to an EV purchase. This cyclical pattern leads to market paralysis, where potential buyers delay purchases in anticipation of future subsidies.

Indirect EU Influence:

The European Union indirectly influences demand through:

- CO₂ fleet emission limits that require automakers to increase BEV sales to avoid penalties.
- Financial instruments such as the Recovery and Resilience Facility (RRF), which supports new subsidy schemes for corporate and utility fleets. These vehicles later enter the second-hand market, increasing the availability of more affordable used EVs for households.

Overall, the Slovak EV market is constrained by a mismatch between industrial readiness and limited consumer adoption. While manufacturers and infrastructure operators are rapidly expanding capacity, domestic demand is slowed by high upfront costs, insufficient policy support, and persistent uncertainties in the incentive system [5–7]. The only known available questionnaire dealing with the perception of EV by Slovaks was conducted by the Ipsos agency in 2017, the results are shown below in Figure 2 [17].

The current state of electromobility in Slovakia can be described as an imbalanced development between infrastructure readiness and actual market adoption. While infras-

tructure and industry have advanced rapidly—driven by European legislation, financial mechanisms, and strong industrial capacity—domestic consumer uptake lags behind [5–7].

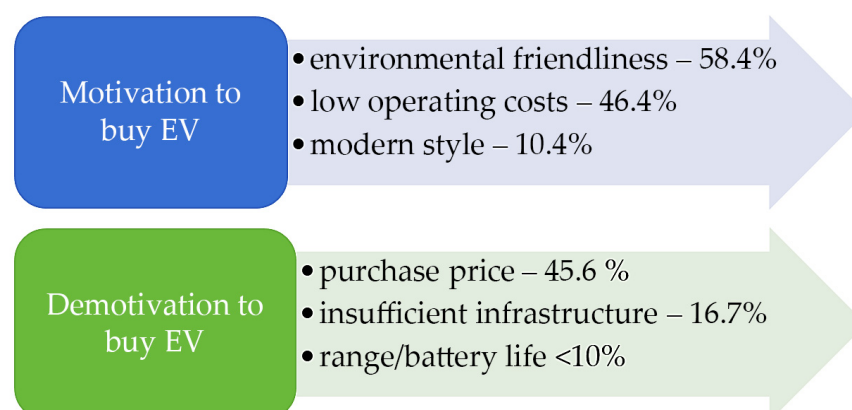


Figure 2. Results of the Ipsos questionnaire focused on the perception of EV by Slovaks.

Current Charging Infrastructure and Statistics in Slovakia and Comparison with Neighboring Countries

The growth of charging infrastructure in Slovakia has been dynamic, reflecting both increasing market interest and the influence of European regulatory frameworks. However, infrastructure quality is defined not only by the absolute number of charging points but also by their type, power level, spatial distribution, and overall accessibility. Table 3 provides an overview of the current charging network in Slovakia and compares it with neighboring V4 countries (Czech Republic, Poland, and Hungary) [5–7].

Table 3. Overview of the current charging network in Slovakia and compares it with neighboring V4 countries (Czech Republic, Poland, and Hungary).

Category	Slovakia	Czech Republic	Poland	Hungary	Description and Significance
Total number of public charging points	2380	4464	6102	3319	Includes all AC and DC points. Represents the total network capacity.
Slow AC points (up to 22 kW)	1750	3168	4339	2397	Core of the network. Ideal for ‘destination charging’ (shopping centers, hotels, offices) where the car stays for several hours.
Fast DC points (25–149 kW)	470	1008	1288	738	Key for travel and quick top-ups (30–90 min). Located mainly on highways and in cities.
Ultra-fast UFC points (150+ kW)	160	288	475	184	Top-tier technology. Allows compatible cars to charge in 15–30 min. Essential for future transit.
Total number of locations	950	1728	2441	1383	Shows how many places offer charging. One charging station at a location may have multiple points (e.g., 2× DC and 1× AC).

Central Europe is entering a stage in which public charging infrastructure is transforming from a developmental bottleneck into a competitive advantage. Although the V4 countries differ in absolute numbers, their structural characteristics are converging due to shared European goals.

Poland currently leads in absolute numbers of public charging points, while the Czech Republic and Hungary show accelerated development of high-performance corridors.

Slovakia is significantly catching up with the regional leaders thanks to the growing number of ultra-fast (UFC) charging hubs. Although the parameter values differ from country to country (see Figure 3), the structural differences are not substantial. Slow AC points account for 70–74% of all public points in the compared countries. Fast DC points represent 20–23%, and ultra-fast UFC points make up 6–8%.

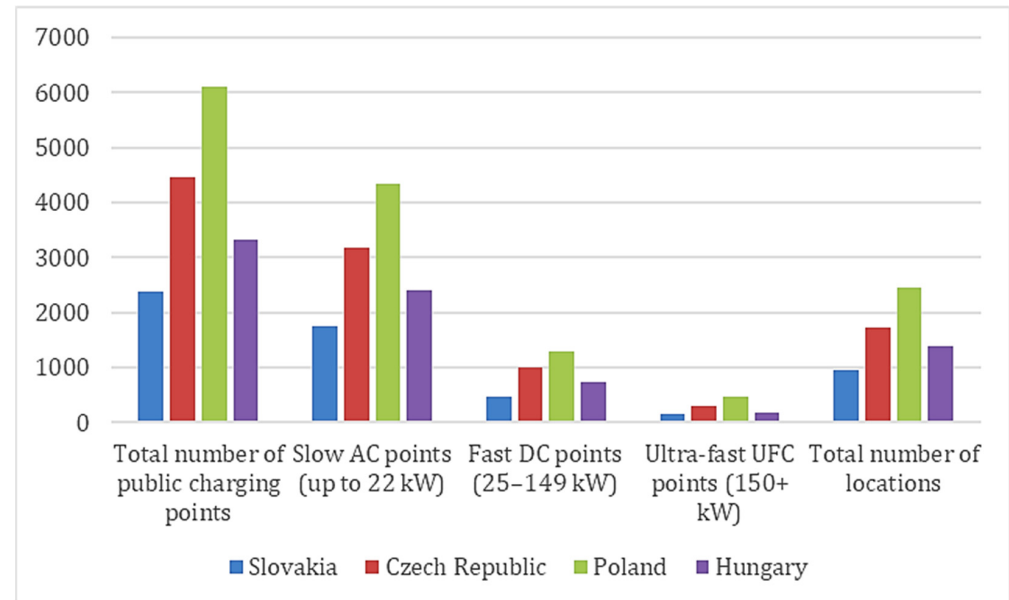


Figure 3. Public charging infrastructure of Visegrad Group Countries.

The ratio of total public charging points to total locations is nearly identical across all countries, at approximately 1:2.5.

There is, however, a clear pressure to reduce charging time, and for investors this means that the demand for high-performance charging has become not only real but also a strategically expanding market segment—one that will continue to be strengthened by the AFIR (Alternative Fuels Infrastructure Regulation) and the rapid growth of battery-electric vehicle (BEV) fleets across the region.

Compared to the Visegrad Group (V4) countries and the European Union as a whole, Slovakia ranks as follows: Although Slovakia has the lowest number of public charging points among the V4 countries, it performs the best within the V4 when calculated per capita (points per 100,000 inhabitants)—see Table 4—reaching 31.3% of the EU average [4].

In terms of the number of electric vehicles in operation, Slovakia reaches only a 0.3% share and ranks among the countries with the lowest EV fleet, both in comparison with the V4 and the entire EU. Relative to the EU average, it achieves 15.3% of the share of electric vehicles.

Slovakia has a comprehensively prepared legal and technical framework, covering energy regulation, metrology, occupational health and safety (OHS), fire protection, as well as payment and metering standards (MID, transparent pricing). Currently, the decisive success factor is shifting toward implementation and permitting processes, especially the transition to a digitalized construction-permit system [4].

Table 4. Pricing Models in Slovakia.

Provider	Charging Type/Program	Price (€/kWh)	Notes
ZSE Drive	Without monthly fee (One-time charging)	0.39 €	
ZSE Drive	Partner Program (€12.90/month)	0.29 €	
ZSE Drive	Partner Program 100 (€24.90/month)	0.29 €	After exceeding 100 kWh (AC only)
OMV eMotion	Without program	from 0.44 €	
OMV eMotion	With program (€3.99/month)	Discounted rate	
GreenWay	AC (slow)	from 0.25 €	Price depends on power and charging duration
GreenWay	DC (fast)	up to 0.59 €	Price depends on power and charging duration
ejoin	AC (slow)	from 0.25 €	Prices vary by location and charger
ejoin	DC (fast)	Higher rates	Prices vary by location and charger

Digitalization of permitting shortens administrative procedures and favors projects with complete technical documentation and timely reservation of grid capacity. In an environment where the share of 150+ kW charging stations is rapidly increasing, the key competitive parameters include:

- strategic placement within a transport corridor,
- guaranteed availability of grid capacity,
- seamless customer experience (easy payments, roaming, transparent pricing).

From the perspective of spatial organization, a clear asymmetry can be observed between transit locations and destination locations:

- Transit corridors: The network of ultra-fast (UFC) stations along the D1 motorway and parts of the R1 already meets European standards thanks to investments by Ionity, ZSE Drive, GreenWay, and OMV eMotion.
- Destination locations: Once outside the main traffic routes, however, infrastructure availability decreases significantly.

The biggest challenge remains charging for residents of apartment buildings:

- Installing a private wallbox is administratively, legally, and technically demanding (complex ownership structures, grid capacity, construction permits).
- Public AC charging points in residential zones are insufficiently deployed, creating social inequality in access to electromobility—EVs are realistically accessible primarily to residents of family houses.

Another barrier is insufficient interoperability among charging service providers. Users frequently need multiple apps and RFID cards from different operators (ZSE Drive, GreenWay, ejoin). Although roaming solutions (e.g., Hubject, GIREVE) are gradually improving this situation, user convenience still does not match the level of fuel stations with instant payment.

The following table summarizes the pricing models and programs of selected public charging providers in Slovakia. It lists basic tariffs, optional monthly plans, and notes on how the final price may vary depending on station power, charging duration, or location [18–21].

We also provide in Table 5 an indicative overview of electric vehicle charging prices at public stations in the V4 countries (Slovakia, Czechia, Hungary, Poland), broken down by providers, charging types, and pricing programs. Prices are listed in €/kWh [19–21].

Table 5. Overview of public charging providers in V4 countries.

Country	Provider	Program/Charging Type	Price (€/kWh)
Slovakia	ZSE Drive	Without monthly fee	0.39
Slovakia	ZSE Drive	Partner (€12.90/month)	0.29
Slovakia	ZSE Drive	Partner 100 (€24.90/month)	0.29
Slovakia	OMV eMotion	Without program	0.44
Slovakia	OMV eMotion	With program (€3.99/month)	
Slovakia	GreenWay	AC (slow)	0.25
Slovakia	GreenWay	DC (fast)	0.59
Slovakia	ejoin	AC (slow)	0.25
Slovakia	ejoin	DC (fast)	
Czechia	ČEZ Futurego	Basic AC	0.328
Czechia	ČEZ Futurego	Basic DC	0.533
Czechia	ČEZ Futurego	Basic HPC	0.738
Czechia	PRE Point	Start AC	0.369
Czechia	PRE Point	Start DC	0.492
Czechia	PRE Point	Start UFC	0.574
Czechia	E.ON Drive	AC	0.328
Czechia	E.ON Drive	DC/UFC	0.5125
Hungary	Tesla Supercharger	Standard	0.5954
Hungary	Tesla Supercharger	Max	0.6266
Hungary	IONITY	Standard	0.728
Hungary	Mobiliti	DC (50–150 kW)	
Hungary	MOL Plugee	Standard	0.8034
Poland	Budimex Mobility	AC (up to 22 kW)	0.6302
Poland	Budimex Mobility	DC (up to 150 kW)	0.5934
Poland	Tesla Supercharger	Gliwice	0.368
Poland	Tesla Supercharger	Other locations	0.437
Poland	Ekoen	Dynamic pricing	0.3657

Table 6 presents statistical indicators of prices for the V4 countries: the average price, minimum and maximum values, as well as price variability expressed by the standard deviation. The values are given in €/kWh, and the interpretation assumes a comparable methodology across the countries [19–21].

Table 6. Overview of public charging prices in V4 countries.

Country	Average	Minimum	Maximum	Standard Deviation
Hungary	0.69	0.60	0.80	0.10
Poland	0.48	0.37	0.63	0.13
Slovakia	0.36	0.25	0.59	0.13
Czechia	0.48	0.33	0.74	0.14

A comparison of the average public EV charging prices in 2025 shows the following.

These data show that Slovakia has the cheapest public charging in the region, which may positively influence demand for electric vehicles if accessibility barriers in urban areas can be removed.

5. Summary

The research confirms that electromobility in the Slovak Republic is entering a phase of accelerated development, yet its full potential remains limited by several structural

challenges. Based on the analysis of infrastructure, legislation, industrial transformation, and economic parameters, the following conclusions can be formulated:

Slovakia offers the lowest average public charging prices in the V4 region, providing a competitive advantage for consumers and corporate fleets. This factor could significantly boost EV adoption if paired with improved access to residential charging and stable national support schemes.

Although Slovakia's number of public charging points per capita is relatively high, infrastructure is disproportionately concentrated in urban centers and along major transit corridors. Peripheral regions and residential zones—particularly large apartment districts—remain underserved.

The distribution grid faces significant capacity and stability challenges due to the expected surge in electricity demand. Implementing smart charging and Vehicle-to-Grid (V2G) solutions will be essential to ensure grid flexibility and resilience.

Slovakia shows strong performance in the rollout of ultra-fast charging stations yet lags behind in absolute infrastructure volume compared to other V4 countries. Moreover, domestic EV adoption remains low despite rapid infrastructure development.

Although Slovakia has a robust legal and technical framework, practical implementation is hindered by complex permitting procedures and ownership challenges, especially in EU regulations—especially AFIR and Fit for 55—along with financial mechanisms such as the Recovery and Resilience Facility (RRF) and Connecting Europe Facility (CEF), provide essential regulatory pressure and financial support. Effective utilization of these tools will be critical for long-term stability.

Overall, Slovakia stands at a strategic crossroads: strong industrial capacity and favorable pricing create a solid foundation for electromobility, but structural constraints must be addressed to translate this potential into large-scale adoption.

6. Conclusions

The transition toward electromobility in the Slovak Republic represents a multidimensional transformation that extends far beyond technological innovation and encompasses economic, legislative, infrastructural, and societal dimensions. The analysis presented in this paper confirms that Slovakia possesses strong industrial foundations, increasing support from the European Union, and the most competitive charging prices in the Central European region. However, several structural barriers continue to limit the full realization of its electromobility potential.

Key determinants of success will include: the ability to efficiently leverage EU funding instruments (RRF, CEF) for expanding and modernizing charging infrastructure, the implementation of streamlined and fully digitalized permitting processes, the development of inclusive policies that ensure equitable access to charging infrastructure, including in residential apartment zones, long-term stability and predictability of national incentive programs, integration of smart charging, energy management, and V2G technologies to support grid flexibility.

Electromobility offers Slovakia a historic opportunity to modernize its transport sector, strengthen its industrial competitiveness, and contribute meaningfully to the EU's decarbonization objectives. Realizing this potential will require coordinated action across public administration, industry, grid operators, and local communities. With strategic planning and effective implementation, Slovakia can position itself not only as a producer of electric vehicles, but also as a mature and forward-looking electromobility market.

This study presents a multidisciplinary analysis of the key determinants shaping the development of electromobility in the Slovak Republic, integrating technical, legislative,

economic, and policy-oriented perspectives. The scientific contribution of the paper can be summarized in the following thematic areas:

The research consolidates current statistical indicators, infrastructure data, pricing models, and legislative frameworks, including major European regulations such as AFIR. This creates a unified and coherent overview of the electromobility landscape in Slovakia and across the V4 region.

The study offers an original comparative assessment of public charging infrastructure and charging price structures across the V4 countries. The analysis employs key indicators—such as charging points per 100,000 inhabitants and BEVs per charging point—to evaluate national preparedness for the electromobility transition.

The research highlights critical obstacles that hinder the widespread adoption of electromobility, including insufficient residential AC charging infrastructure, fragmented roaming and interoperability, and legislative complexities affecting charging station deployment. These findings hold relevance for policymakers and infrastructure planners.

The paper provides an in-depth interpretation of major EU regulations relevant to electromobility, particularly the deployment of alternative fuels infrastructure (AFIR). It translates EU-level policy requirements into national implementation challenges and practical implications for Slovakia.

The detailed overview of procedural requirements for constructing charging stations—covering legal, technical, spatial planning, and metrological conditions—provides a practical reference model for future infrastructure development, policy design, and methodological guidelines.

Overall, the study contributes to advancing knowledge on the strategic, infrastructural, and legislative aspects of electromobility, supports the EU's decarbonization goals, and offers a foundation for further research on the impacts of EV deployment on energy systems, regional development, and economic transformation.

Author Contributions: Conceptualization, D.K. and S.R.; methodology, D.K.; validation, D.K. and L.G.; investigation, S.R.; resources, D.K.; writing—original draft preparation, S.R.; writing—review and editing, D.K. and L.G.; visualization, L.G.; supervision, D.K.; project administration, L.B.; funding acquisition, L.B. All authors have read and agreed to the published version of the manuscript.

Funding: The article was supported by VEGA 1/0328/25, Strategy for the effective and sustainable use of Earth Resources within the Slovak Republic, with an emphasis on the Raw Materials Policy of the EU& by the Horizon 2020 project, No. 101180341 Interregional EU innovation Hubs for the circularity and green supply of Raw Materials to achieve the resilience of the main underdeveloped regions specializing in the critical industrial value chain. This research was also funded by KEGA: 056TUKÉ-4/2024, a platform for the effective creation, evaluation, and transfer of innovations and the efficient management of university research outputs with a practical orientation.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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