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Electromobility in Sweden: Navigating the Phases of Change and Global Influence

Frances Sprei[1], Hans Fogelberg[2], Magnus Karlström[1, 3], Stefan Pettersson[1, 4], Hans Pohl[1],[3], Johan Wedlin[5]

[1]*Chalmers University of Technology, Space, Earth and Environment, frances.sprei@chalmers.se*
[2]*Västra Götalandsregionen,*
[3]*Lindholmen Science Park,*
[4]*IVL Swedish Environmental Research Institute,* [5]*Tångudden Konsult*

Executive Summary

Sweden, a nation of just over 10 million people, has a strong reliance on its automotive industry and has begun its journey towards electromobility. This paper employs a comprehensive literature review, incorporating grey literature, industry documents, media reports, and authors' industry and research insights to analyse Sweden's electromobility transition across four key phases: early exploration (1990–2000), national strategy (2001–2010), expansion and infrastructure (2011–2020), and mainstream adoption (2021–2025). Triple helix collaborations between government, industry, and academia have been a hallmark of Swedish electromobility and innovation policy and have clearly advanced national competence in key automotive technologies, including electrification. Sweden's journey offers valuable lessons: the transition to electromobility is lengthy and complex, and effective policies must focus on long-term, foundational elements, such as competence development and a robust innovation ecosystem, regardless of market timing.

Keywords: Public Policy & Promotion; Electric Vehicles: Heavy Duty Electric Vehicles & Buses; Trends & Forecasting of e-mobility

1 Introduction

The transition to electromobility has important implications for industrial and environmental development. This transition has and will differ between countries depending on context, such as political orientation and the presence of an automotive industry. It can thus be of interest to understand how this transition has taken place so far in specific contexts. Figenbaum (2017 & 2024) studied the development in Norway. Altenburg et al (2015) compared the development in France and Germany with the development in China and India, and Haluch et al (2021) studied the impacts of electromobility on the automotive chain in the USA, Germany, and Japan. To our knowledge, there has been no analysis of the development in Sweden so far.

Sweden is a small European country with just over 10 million inhabitants and is highly dependent on the automotive industry. It is the home of both heavy-duty OEMs such as Volvo Group and Scania, as well as passenger car manufacturers Volvo Cars (Chinese-owned now but still with headquarters, R&D, and major manufacturing in Sweden) and Polestar (Swedish car brand originating from Volvo Cars' performance subsidiary brand). Historically, the Swedish automotive industry has been dominated by three companies: Scania, SAAB, and Volvo. The first vehicle manufacturer was Scania, founded in 1900 and the first vehicle was made in 1901, followed by Volvo, founded in 1915 with the first Volvo car rolling from the factory in 1927. Airplane manufacturer SAAB presented its first passenger car in 1947. In 1968 SAAB car division and Scania merged into one company, which was dissolved in the nineties when SAAB Automobile was founded and became a part of General Motors, while Scania became an independent company. SAAB Automobile was later, in 2010, sold to Spyker, went bankrupt in 2011, and was then bought by NEVS. Today, Scania is owned by Volkswagen AG through its subsidiary Traton SE. In 1999, Volvo's passenger car business was sold to Ford Motor Company, and in 2010 re-sold to Zhejiang Geely Holding Group. The remaining Volvo Group today manufactures, among other things, heavy trucks, construction equipment, buses, and marine engines.

Sweden has an electrification policy situated between Norway and Germany when it comes to market and industrial support. Until the end of 2022 there has been quite generous support for the purchase of electric vehicles, especially in the company car segment, even if this support has not been nearly as generous as in Norway Germany, on the other hand, has supported its automotive industry to a larger extent than Sweden. At first glance, Sweden has managed the transition to electromobility fairly well. 57% of new cars sold in 2024 were electrified[1], and about 13.5% of the fleet is now either battery electric or plug-in hybrid[2]. Electric truck sales are still modest but rising, and public transport fleets are being electrified. From the production side, both passenger car and truck OEMs have ambitious electrification targets, and Volvo Cars is one of the few OEMs in line to manage the original 2025 CO2 emissions targets set by the EU.

It can thus be of interest to understand how a smaller country with relatively large actors in the automotive industry has approached the transition. The aim of the paper is thus to study the development over the last 35 years, looking at the contributions from policy, industry, and research. The questions that we have tried to answer have been:

- Which have been the key events within electromobility policy, innovation, and commercialization in Sweden, and, to some extent, the world?
- From a policy perspective, which initiatives have had a substantial positive or negative impact on Swedish electromobility development?
- What are the main limitations of the Swedish national electromobility policy?
- Which lessons can be learned from the Swedish electromobility case during 1990 – 2025?

We end by looking forward and seeing what challenges lie ahead, especially given the recent geopolitical developments. Given that the shift is ongoing and our contribution can only study the early phases of the transition, the longer-term successes or failures of Swedish policies, OEMs, and innovation systems remain to be seen.

2 Methodology

Similarly to Figenbaum (2017), we adopt an analytical framework based on the concept of socio-technical systems of the transport system. Key to both the maintenance and transformation of the system are its various actors and elements. We focus specifically on the triple helix of government, industry, and academia. We combine ideas from socio-technical systems with the theory of multilevel-perspectives (MLP), where the idea is that socio-technical transitions occur through an interplay of niches (e.g. demonstration programs), regimes (configurations of actors such as industry, government, academia, etc..), and landscapes (often exogenous factors such as international development, oil prices, etc.) (Geels, 2012).

Taking a stance from these frameworks, each author separately outlined historical developments and key events. The events were identified in line with the theories to capture both more long-term changes in regime and landscape (niches that build up momentum) as well as niches and events that could initiate more rapid development (destabilization of the regime that creates windows of opportunity). The authors have together a longstanding involvement in industry, innovation, policy, and research on electromobility. The

[1] https://www.trafa.se/globalassets/rapporter/2024/rapport-2024-10-elektrifierade-fordon-i-sverige---en-analys-av-laddbara-fordon-over-tid-och-geografi.pdf and https://e-fordon.se/stark-start-for-bilaret-2025/
[2] https://powercircle.org/elbilsstatistik/

common denominator of the authors is innovation policy research and senior roles in innovation and strategy development. The experience of the authors has been an advantage when using MLP as a framework given its heuristic nature requiring substantial empirical knowledge (Geels, 2012). Their own experiences and expertise are complemented by document analysis of research papers, industry, and government reports and documents, newspapers, and media articles. The different individual timelines were analysed and combined through workshops. Since experts and authors are in this case the same group of people, a certain degree of reflexive scrutiny has been an important part of the analysis work. In the analysis, four different phases were identified representing different stages in the MLP transition. We also differentiate between the Swedish and the global development, where the global development is seen more as the landscape given its more exogenous nature.

3 Four phases of global and Swedish development

We have divided the electromobility development into four different phases based on the main type of activities being carried out in each phase. In this section, we present these phases of development. For each phase, we also present a timeline with global events to the left (black for policy and grey for industry) and to the right, Swedish events (light grey for policy, white for research and dark grey for industry).

3.1 Phase 1 (1990 - 2000): Early Exploration and Small-Scale Adoption

Global development

The California Zero Emission Mandate had a considerable impact, being the first larger policy scheme that in effect suggested battery electric vehicles. Automakers invested considerable efforts in protesting against it, but also in developing vehicles more or less in line with the regulation. One of the reasons why the mandate caused such strong reactions was the success of earlier regulations leading to the global introduction of the three-way catalyst.

Several battery electric vehicles were developed and introduced in limited quantities by all major automakers, with GM EV1 receiving the most attention. Toyota and Honda also developed hybrid electric vehicles, which were not zero emission but, as the mandate lost its traction, became the solution produced in large volumes with the Toyota Prius as the main vehicle model.

The ZEV Mandate was revised and weakened in 1998.

Swedish development

Volvo, which at this time included both light and heavy vehicles, had good relations with the Californian regulators. Pre-development of several electrified vehicles started, and the concept that was probably attracting the most attention was the Volvo ECC, a series hybrid with a very clean gas turbine propelling a high-speed generator charging the battery[3]. Less futuristic Volvo-internal projects resulted in a power-split hybrid powertrain, a solution industrialized by Ford Motor Company, and start-stop hybrids, which remained with Volvo Cars but were not commercialized.

The Swedish government supported the development in several ways. In the early 1990s, the state, in close collaboration with the automotive industry, invested in a vehicle research program, FFP. It mainly sponsored PhD student projects. Another public initiative involved large demonstration projects, on the car side mainly encompassing French vehicles, as those were the only modern BEVs available on the market. Some heavy vehicles from domestic suppliers were also developed and tested. A series of technology procurement projects gathering several municipalities and other customers behind common specifications were also carried out. The emphasis in the strategy lay on plug-in hybrids, which were considered most suitable for the long distances driven in Sweden, but in practice, most of the vehicles employed on the streets were battery-electric ones only.

[3] https://www.media.volvocars.com/ch/de-ch/media/pressreleases/5023/volvo-ecc-the-car-that-gave-the-world-a-preview-of-volvos-future-already-back-in-1992

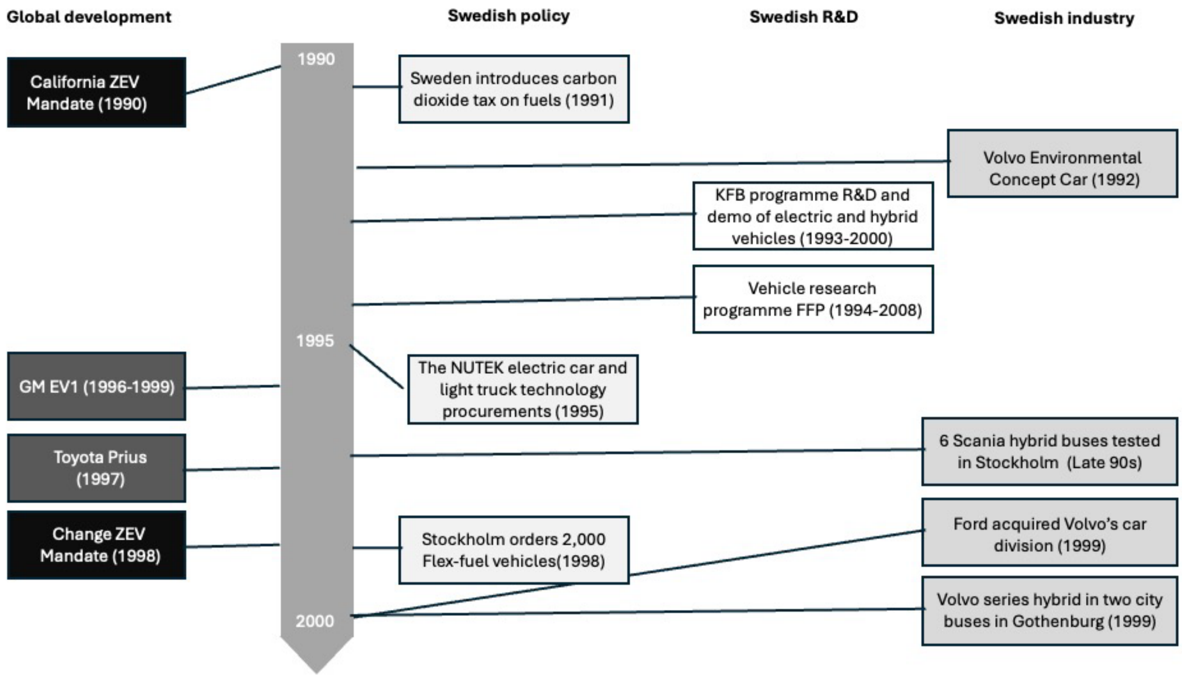

Figure 1: Major electromobility events Phase 1 (1990 - 2000)

3.2 Phase 2 (2001-2010): National Strategy and Technological Advancements

Global development

Climate initiatives at the beginning of the 2000s were driven by the Kyoto Protocol, which, while adopted in 1997, entered into force first in 2005 after the ratification of Russia and Canada.

On the passenger vehicle side, battery development and the push from the first ZEV mandate in California led to hybrid vehicles entering the market, with the Toyota Prius dominating. It is also in this period that we see the appearance of commercial battery electric vehicles of different character. These were often targeted to smaller markets, i.e., niches in the MLP terminology (Geels 2012). On one hand the Think City and Buddy, smaller low-performance cars mainly sold in Norway, where the initial reason for Norway to subsidize the market was to support a potential domestic car manufacturing market; and on the other hand the high-end Tesla Roadster, the latter signalling a shift towards the high-cost market and high-performance EVs. Nissan Leaf became the first BEV targeting a broader market.

Swedish development

From a policy point of view, Sweden, rather than focusing on electromobility, aimed to achieve independence from fossil oil and maintain - at least on paper - technological neutrality. In reality, the policy was influenced by political ambitions for bioenergy. This led to the introduction of flex-fuel vehicles, i.e. vehicles that could be driven on a blend of gasoline and renewable fuels, being produced and sold in the country. In 2008, almost 25% of the sold cars were flex-fuel vehicles and by 2014 about 250 000 flex-fuel vehicles were rolling on the streets. However, Sweden was unique in Europe in aiming for this technology (Brazil and the US also supported flex-fuel vehicles), and when the Swedish Government ended the subsidies, the market died (Sprei, 2018). Toward the end of the period, incentives for electrified vehicles, or rather vehicles with low tailpipe CO_2 emissions, were introduced.

There were some nascent projects related to electromobility and towards the end of the period, Volvo launched hybrid-electric city buses. For public transport, electric buses and electric public transport systems were launched. Volvo Cars partnered with Vattenfall to make plug-in hybrid cars.

The Green Vehicle (Gröna Bilen) Program started in 2000 as a more applied and larger complement to FFP. Both were, at this point in time, primarily internal combustion engine (ICE) and biofuel focused initiatives. One important impact of the research programs was that they enabled the industry to employ people with research qualifications, thus contributing to strengthening both the automotive industry's research competence as well as the interest and ability to incorporate research results into the OEMs' own development activities. It also contributed to strengthening the cooperation with universities and research institutes and the internal competitiveness of passenger car manufacturers within the foreign-owned groups[4].

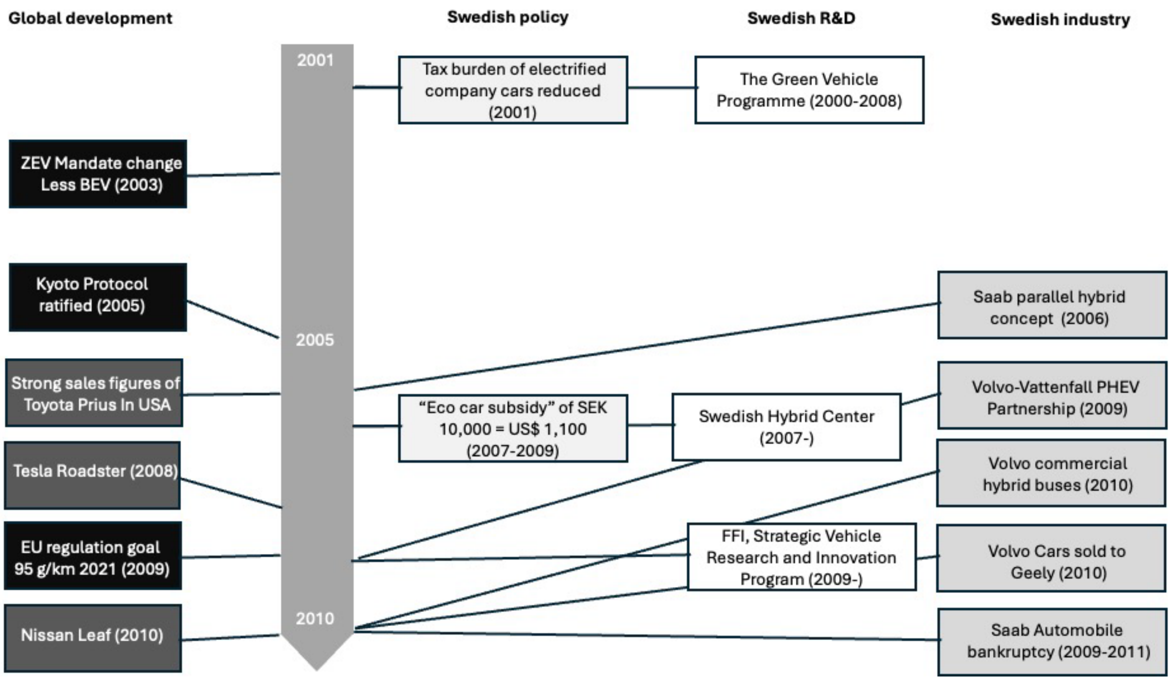

Figure 2: Major electromobility events Phase 2 (2001 - 2010)

3.3 Phase 3 (2011-2020): Expansion, Policy Integration, and Infrastructure Development

Global development

During this period, the sales of electric cars increased. The period started with a new generation of electric vehicles coming onto the market, such as the Nissan Leaf (2010) and Tesla Model S (2012), which demonstrated that electric cars could have performance. Almost all car companies invested heavily in electric vehicles and had ambitious roadmaps ahead. Among other things, the competitiveness of electric cars increased because battery prices fell drastically during the period.

Policies also supported the development. The Paris Agreement was adopted in 2015 to keep the global average temperature well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C. Battery electric vehicles were seen as a pathway consistent with the Paris Agreement. For example, the EU adopted a new regulation that sets CO2 emission performance standards for new passenger cars and vans in 2019. The EU also implemented the directive on the deployment of alternative fuels infrastructure to support the rollout of the EU's alternative fuels infrastructure.

China also invested heavily during the period to capture large parts of the electromobility value chain. An important strategy document was Made in China 2025, a national strategic plan and industrial policy to further develop the manufacturing sector. The EU tried to create its battery industry strategy to stand up to China by creating the European Battery Alliance in 2017. Another European initiative was Battery 2030+, a large-scale, long-term European research program for batteries created in 2018. The project coordinator of Battery 2030+ is Uppsala University.

[4] https://www.vinnova.se/contentassets/e44de009e8174c46b00dfac077eb0203/va-09-11.pdf

Swedish development

FFI, a Strategic Vehicle Research and Innovation joint program between the state and the automotive industry running since 2009, promoting and financing research and innovation for sustainable road transport, had a special subprogram focused on electromobility starting in 2011, spending 40 million SEK (around 4 million Euros). In this program, the Swedish OEMs (Volvo Cars, Volvo Group, Scania, and SAAB Automobile) together with universities and other research organizations collaborated on topics like batteries, range extenders, etc.

Sweden has, besides a strong OEM industry, also a strong telecom sector dominated by Ericsson[5], which paved the way for the fruitful Swedish collaboration between the different industries around electromobility. The Special Vehicles department at Volvo Cars in 2011 rebuilt 250 Volvo C30 to fully electric drive. In a joint project led by Viktoria Institute, Volvo Cars, Ericsson, and Göteborg Energi (the local energy company in Gothenburg), smart charging and payment solutions were elaborated from a user perspective. The project received much attention at the Mobile World Congress in Barcelona in 2012 since it was the first time an OEM, a telecom company, and a utility company collaborated around electric vehicles.[6]

During this period, both electric hybrid and battery electric buses were explored and tested in the city of Gothenburg as part of the project Electricity. It was decided that the main part of the bus fleet in the region should be electrified, and 157 full-electric buses were procured from Volvo Group in 2019. Sweden also introduced a purchase incentive för electric buses in 2016. During this phase, Volvo Group also experimented extensively with electric trucks, and they started producing and selling heavy-duty battery trucks in 2019.

Testing of charging technology while driving, so-called electric roads (Electric Road Systems test), was done during this period. Four different technologies were tested in Sweden from 2016 to 2024. All four trials showed that the technology worked on a vehicle and road level, but also that the challenges at the actual traffic level in full implementation were difficult to overcome. The tests were planned to have led to the construction of Sweden's first permanent electric road on the highway E20 between Hallsberg and Örebro[7]. Peripheral services such as payment and access systems would also be tested. However, in August 2023, the Swedish Road Authority stopped the procurement. Inflation and cost increases meant that the development had become too expensive.

Between 2015-2022, the Swedish government supported the expansion of charging infrastructure for electric vehicles with roughly 5 billion SEK (around 500 million Euros), including government incentives for private charging outlets (2018), but a support scheme also existed for public charging.

Several purchase incentives for electric cars have existed during this period. During 2011-2016 Sweden had a super green car premium. But this system was changed when the government introduced a bonus for vehicles with low carbon dioxide emissions, and a malus, i.e., higher vehicle taxation, for vehicles with higher carbon dioxide emissions in 2018. However, the government abruptly cancelled the bonus in 2022, with negative effects on sales as a result, while keeping the malus mechanism intact.

The period also saw the launch of several new Swedish companies, such as Northvolt (battery producer, 2015), Einride (Swedish transport company, 2016), and Polestar (premium electric cars, 2017). Lastly, a key industrial decision was when Volvo Cars decided to build electric machines in Sweden.

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[5] https://www.ericsson.com/en

[6] https://www.greencarcongress.com/2012/02/elviis-20120223.html

[7] https://bransch.trafikverket.se/en/startpage/projects/Road-construction-projects/electric-road-e20-hallsbergorebro/

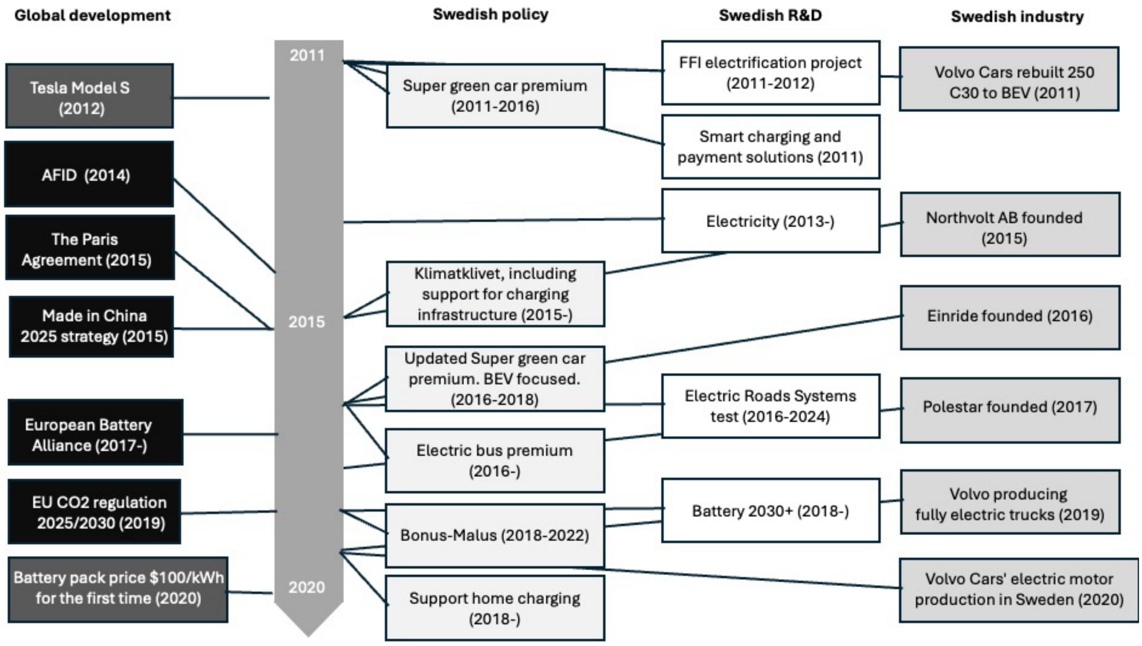

Figure 3: Major electromobility events Phase 3 (2011 - 2020)

3.4 Phase 4 (2021-2025): Mainstream Adoption and Value Chain Challenges

Global development

The rapid growth of manufacturing of electric cars and market demonstrations of electric trucks is manifest. Between 2020 and 2025, the electric vehicle landscape evolved dramatically both for light-duty and heavy-duty vehicles, driven by a mix of incentives, technological advancements, stringent regulations, and shifts in consumer behaviour. The European Union's Green Deal, announced in 2020, became a critical driver. It set out a vision for carbon neutrality by 2050, with legislation for the auto industry in principle to phase out internal combustion engine vehicles sales by 2035 to reach the target of zero-emission cars.

On 25 July 2023, the European Council adopted the new Alternative Fuels Infrastructure Regulation (AFIR). The regulation raises the ambition of the EU and will regulate how charging infrastructure will be expanded across the Union for a long time to come.

Since heavy-duty vehicles (HDVs) are responsible for more than 25% of greenhouse gas (GHG) emissions from road transport in the EU and account for over 6% of the total EU GHG emissions, revised CO2 emission standards for heavy-duty vehicles were decided in 2024[8]. Under the new regulation, ambitious targets are set to reduce CO2 emissions compared to 2019 levels by: 45% from 1 January 2030; 65% from 1 January 2035; 90% from 1 January 2040 onwards. In addition, 90% of new urban buses in the EU will have to be zero-emission as of 2030, and all of them by 2035. In 2027, the Commission will review the expansion of the scope also to small lorries.

Narrow profit margins, fluctuating battery raw metal prices, rising inflation, and the reduction of purchase incentives in some European countries raised concerns about the industry's growth rate, although global sales figures remained robust. China became the largest market for electric vehicles (45% xEV market share in 2024[9]) and also emerged as the dominant player in both EV production and battery manufacturing. Sufficient battery manufacturing capacity requires a final investment decision to meet the commitments announced by automakers and governments worldwide. Battery supply chains, dependent on critical raw materials like lithium, cobalt, and nickel, faced challenges, partly due to geopolitical factors, but also a need for more investments. By 2024, securing sustainable and ethically sourced materials had become a central issue for governments and manufacturers.

[8] https://data.consilium.europa.eu/doc/document/PE-29-2024-INIT/en/pdf
[9] https://volta.foundation/battery-report-2024

At the beginning of 2025, Donald Trump became US president, launching a period of high uncertainty, including taxes, and removing support for electric vehicles. The US president is constantly swinging from threatening tariffs one day to withdrawing them or at least reducing them a few days later. However, the tariffs against China have remained in place (145%), with the consequence that China has increased tariffs against the US (125%)[10]. China has also temporarily stopped all exports of rare earth metals and magnets to the US, a severe blow to American companies. It is no exaggeration to say that there is currently a show of force between the US and China. The volatility of the decisions is reflected in the world's stock markets. There are few winners in a world with trade wars, and the risk is that the world will be thrown into a deep recession and increased conflicts, which will hinder progress in general and the electromobility adoption in particular.

In 2024, Elon Musk took a clear side with Trump, and is working closely with the president to cut US administrative costs. At the same time, Musk has taken a clear stance for extreme right-wing politics, which has led to a sharp drop in Tesla car sales, and Tesla shares have lost 44% of their value since hitting an all-time high in December[11].

Swedish development

On October 14, 2020, the government decided to establish an Electrification Commission to accelerate the electrification of the heavy road transport sector and the transport sector as a whole. The commission would be an advisory body for the ongoing exchange of experiences between the government and representatives of the business community, interest groups, research institutes, universities and colleges, municipalities and regions, etc[12]. During the two years that the Electrification Commission operated, the pace of electrification of the transport sector increased dramatically.

During the period from 2020 to 2025, the focus on battery-electric heavy trucks increased. Several initiatives were launched to build up the charging infrastructure in Sweden. The Volvo Group reached the largest market share for electric heavy trucks in Europe.

In 2022, the government assigned the Swedish Energy Agency a program about Regional Electrification Pilots for Heavy Transport program aimed at accelerating the electrification of freight transport in Sweden. The program is still ongoing, and now focused on the expansion of charging infrastructure and refuelling infrastructure for hydrogen in Sweden[13].

From 1 January 2020, municipalities can introduce environmental zones of class 1, 2, or 3. Environmental zone class 3 has the highest requirements. Only electric vehicles, fuel cell vehicles, and natural gas vehicles, both light and heavy, are allowed to drive there, with the addition that natural gas vehicles are subject to Euro VI emission requirements. In the case of heavy vehicles, plug-in hybrids are also allowed to drive if the vehicle meets the Euro VI emission requirements. First out to introduce environmental zone 3 is Stockholm, and it was planned to be introduced in Gamla Stan and another area in the City of Stockholm, starting on 31 December 2024. However, after several actors appealed the decision, the introduction is now paused.

Earlier, the Swedish politicians had high ambitions in the shift to a fossil-free society, and made an effort to shift out fossil fuelled cars by incentives and subsidies. However, there was a shift in the political government in 2022 to a right-winged one. As a consequence, the bonus incentive part in the bonus-malus system was taken away, the requirement of biofuel blending into the gasoline and diesel was lowered, taxes on gasoline and diesel were lowered, and the carbon dioxide emissions started to increase again. Plug-in light-duty vehicles had a high market share in Sweden, but when the purchase bonus for electric cars was removed, growth stalled in 2023 and 2024. The sales were mainly sustained by company cars that still had a tax subsidy (Schub et al 2025). There is no consensus among the Swedish parties that fossil-fuelled cars

[10] The figures from April 2025, but be aware of quick changes.
[11] https://edition.cnn.com/2025/04/02/business/tesla-sales/index.html
[12] https://regeringen.se/contentassets/2d116eb604404aa7b09a1a414c6a2e40/sammanfattning-av-tva-ar-med-elektrifieringskommissionen/
[13] https://www.energimyndigheten.se/klimat/transporter/laddinfrastruktur/stod-att-soka-inom-laddinfrastruktur/regionala-elektrifieringspiloter/

should be abandoned in the EU in 2035 anymore. The lack of political effort makes it harder for Volvo Cars to have ambitious targets of only selling EV in 2030, as they said in 2021, and therefore, they abandoned that in 2024.

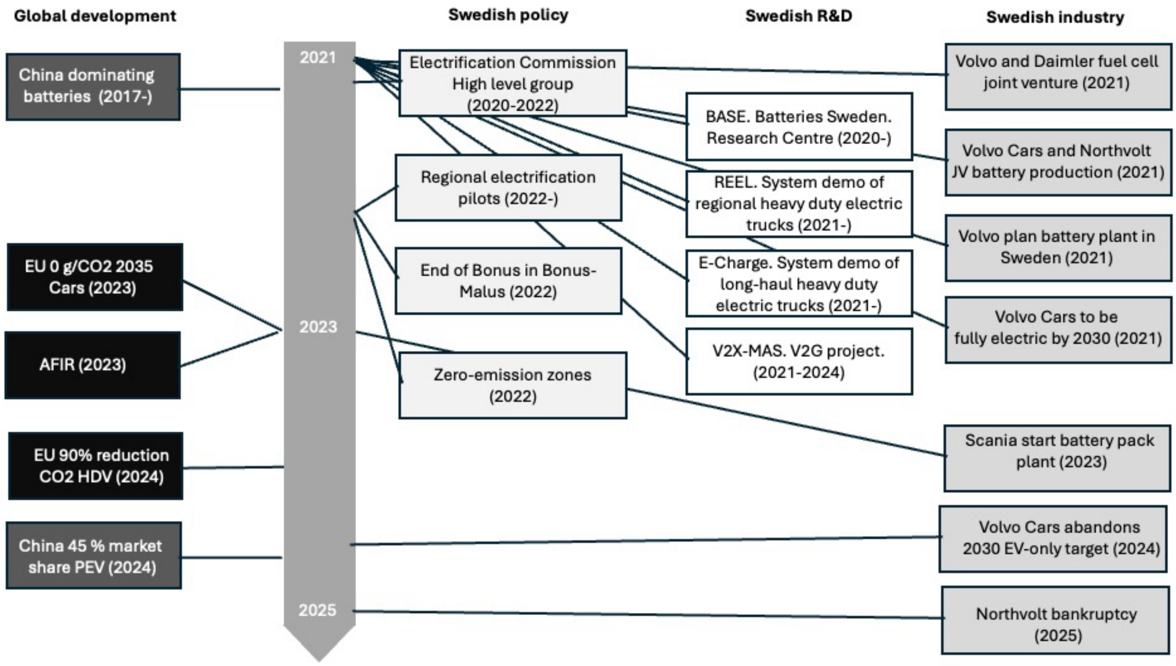

Figure 4: Major electromobility events Phase 4 (2021 - 2025)

Manufacturing became key, but research policy efforts were slow, small, and remained primarily product-focused in publicly co-funded R&D programmes. R&D programmes focused on battery manufacturing were initiated regionally and large national efforts still remain to be seen. One initiative is BASE - Battery Sweden[14] established in 2020 and planned to end in 2025, is a competence centre where academia and companies collaborate. BASE creates a stable platform for excellent world-leading battery research in Sweden. The platform enables the implementation of new scientific breakthroughs in industrial applications, which strengthens Sweden's ability to compete in the future battery market.

Examples of large projects in Sweden are REEL, which is a national initiative where leading Swedish actors have joined forces to accelerate the transition to electrified, emission-free heavy transport on our roads[15]. E-charge, where 14 actors in collaboration develop, test, and demonstrate battery electric long-haul truck transports[16]. Another project is V2X-MAS, which aims to accelerate the transition towards electrification of the transport sector by supporting the electricity infrastructure and creating additional value for EV owners[17].

In April 2021, Volvo AB and Daimler Truck AG announced a joint venture Cellentric[18], focused on hydrogen-based fuel-cells[19]; fuel-cells are seen as having potential for heavy-duty long-haul transports.

Battery manufacturing is of special interest. The Swedish battery developer Northvolt commissioned its first manufacturing plant in the northern part of Sweden, in Skellefteå in 2021. Global battery supply chains became a major geopolitical issue, with Sweden at the centre of European initiatives. Volvo Cars and

[14] https://www.uu.se/en/research/strong-research-environments/national-competence-centres/batteries-sweden-base
[15] https://closer.lindholmen.se/en/project/reel
[16] https://www.lindholmen.se/en/project/e-charge
[17] V2X-MAS: V2G Hub | V2G Around the world
[18] cellcentric: Sustainable Fuel Cells for Mobility - cellcentric
[19] Volvo Group & Daimler Truck AG- Launches Cellcentric

battery specialist Northvolt AB also agreed in 2021 to build a new joint venture battery plant, under the name Novo Energy, in Gothenburg, and Scania issued plans to buy batteries from Northvolt. However, Northvolt began experiencing quality issues during the ramp up phase of volume manufacturing of battery cells, resulting in significant financial difficulties after the summer of 2024 followed by bankruptcy in the spring of 2025. Both cell manufacturing facilities in the manufacturing belt and on the west coast of Sweden have been postponed. Volvo Cars plant in Gothenburg, and the now solely owned battery manufacturer, Novo Energy, announced delays in manufacturing. Volvo Group also announced that their planned battery cell production plant in Mariestad would be delayed. Both companies have announced that they are fully committed to electrification, but their timeline has changed. Publicly co-funded R&D for battery manufacturing is still not in place that matches this new and important sector.

4 Discussion and conclusions

Sweden's transition to electromobility has evolved through four distinct phases. The first phase was marked by optimism and innovation, with various solutions being actively developed. In contrast, the second phase shifted focus toward other solutions such as biofuels and modified ICE technology. The third phase saw more industrial development activity, exemplified by strong support for Northvolt and its ambitious battery production plans in northern Sweden. The ongoing fourth phase has been characterized by significant momentum from the automotive industry, particularly with battery-electric trucks becoming central to the product strategies of AB Volvo and Scania; however, with decreasing political push.

Triple helix collaborations between government, industry, and academia, have been a hallmark of Swedish electromobility policy and innovation policy. These collaborations, while difficult to quantify in terms of direct impact, have clearly advanced national competence in key automotive technologies, including electrification. They have fostered domestic collaboration within the innovation system but may have inadvertently weakened international research networks. Furthermore, they likely helped retain automotive actors within Sweden, though their conservative nature may have had limited or even negative influence as direct drivers of the transition.

A key limitation of Swedish policy is its inability to support large-scale market shifts on its own, given Sweden's relatively small share of the global automotive market. National policy can effectively fund R&D and pilot projects, but lacks the scale to drive major technological change in vehicles. The flex fuel vehicle initiative demonstrated the effectiveness of targeted policy when minor vehicle modifications were sufficient. In contrast, electrification demands more extensive vehicle changes and, thus, access to larger markets. This underscores the importance of aligning with broader coalitions—such as the EU—when approaching market-driven initiatives.

Sweden's journey offers valuable lessons. The transition to electromobility is lengthy and complex. Effective policy must focus on long-term, foundational elements—such as competence development and a robust innovation ecosystem—regardless of market timing. However, Sweden underinvested in battery and fuel cell research until recently, largely because domestic industry actors have not prioritized it. Similar conclusions can be drawn about the European automotive industry in general. The high costs associated with late-stage innovation require strategic coordination and timing, which can be particularly challenging for smaller countries. Stability, predictability, and international collaboration are critical as the market evolves.

In a global context, Sweden's progress is notable, especially in heavy-duty vehicles, where it has moved relatively early compared to international peers. The country leveraged its strong automotive sector - Volvo Group, Volvo Cars, and Scania - to advance electrification. Nonetheless, the removal of government incentives in 2022, combined with economic pressures, has slowed momentum in light-duty vehicle adoption. Sweden's policy position has often been between Norway's strong market incentives and Germany's industrial backing. It has also been characterized with support for specific technologies such as biofuels and modified ICE, which had a delaying effect on the investment into electromobility.

Europe as a whole faces increasing pressure. It lags behind Asia - particularly China and South Korea - in battery manufacturing and automation. China's early and extensive support for green technologies has positioned it as a global leader. In contrast, Europe has focused more on regulation than on direct industrial support, often constrained by its own rules limiting national-level action. Northvolt's initial promise as Europe's battery manufacturing flagship was dashed by its bankruptcy in 2025, raising broader concerns about Europe's true standing in battery know-how and capacity.

Despite these challenges, Sweden's experience underscores the importance of strong industrial competence and consistent, long-term policy. Its culture of collaboration - between government, industry, and academia - has been a key enabler. Swedish institutions excel in fostering innovation through informal, cross-sector relationships and a non-hierarchical working style that accelerates progress. The long-standing collaboration programs, such as the FFI, have anchored OEMs in Sweden, strengthened ties with academia, and built a resilient national automotive ecosystem. However, these programs have also reduced incentives for international collaboration, particularly with the EU.

The broader geopolitical landscape is shifting. China now leads in both production capacity and the battery value chain, with a high level of manufacturing automation. Asia continues to dominate in electric drivetrain technologies. The U.S. has also moved aggressively, particularly through the now-ended IRA, to boost its heavy vehicle and green technology sectors. In contrast, Europe's approach has been cautious and fragmented. Structural funds have attracted new manufacturing to Eastern Europe, but overall, regulatory inconsistency has undermined policy effectiveness - particularly in the car segment, where European strategies have yet to fully acknowledge the scale and pace of Chinese competition.

Nevertheless, heavy trucks present a different picture. Europe, and Sweden in particular, remains strong in this segment. The presence of two globally significant truck manufacturers and a supporting component supplier ecosystem focused on heavy vehicles provides a foundation for leadership.

In conclusion, Sweden's electromobility strategy has achieved notable progress, especially considering its size. The country maintains a relatively high share of electrified vehicles and continues to position itself strongly - especially in heavy-duty transportation - within the global automotive transition. Still, the paradigm shift is only just beginning. Continued leadership will require sustained investment, international alignment, and the political will to adapt to fast-evolving global dynamics.

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Presenter Biography

	Frances Sprei is a professor in Sustainable mobility at Chalmers University of Technology from which she also received her PhD. She has been a postdoc at Stanford. She has a long experience in research on electromobility looking at consumer perspectives, charging infrastructure, incentives, and driving behavior. She is active in outreach and policy support. She is the Chair of the research council of West Sweden's climate transition, has been an expert for reports on charging infrastructure for the Swedish Parliament and is a board member of Transport and Environment.
	Hans Fogelberg is a regional developer at Region Västra Götaland, leading the regional industry and electrification portfolio. He has a PhD in the area of innovation policy studies, focusing on historical studies of the electrification of transportation and the role of innovation policy and research policy for industrialisation. He is a board member of several Swedish public-private initiatives in the area of electrification of transport, transport efficiency and fossil free transportation.
	Magnus Karlström (PhD) is Project Manager at Lindholmen Science Park and researcher at Chalmers University of Technology. Karlström's research interests are fuel cell vehicles, electromobility, strategy, life cycle assessment, and business intelligence. He is also the editor-in-chief of omEV, which is a newsletter about electric vehicles that has existed since 1997. EVS-25 in Stavanger was Karlström's first.
	Stefan Pettersson is the Head of Research at IVL Swedish Environmental Research Institute, and an adjunct Professor in Systems and Control at Chalmers University of Technology where he also received his MSc and PhD. Stefan has a long experience of research on electromobility both at Volvo Technology where he earlier worked on control algorithms for hybrid powertrains, and in his earlier position as Director of Electromobility at RISE being responsible for hundreds of research projects involving technology, business, behaviour and policies. Stefan attended the first EVS conference in 2010 in Shenzen (EVS25), and has joined most EVS conferences since then. Stefan was one of the initiators for EVS38 in Gothenburg.
	Hans Pohl (PhD) is Project Manager and researcher at Lindholmen Science Park. Pohl's research interests are vehicle electrification, innovation and scientometrics. Previous positions include Analyst at Sweden's Innovation Agency, and Area Manager at ABB Switchgear. EVS13 in Osaka was Pohl's first.
	Johan Wedlin has a M.Sc. in Mechanical Engineering from Chalmers University of Technology. He has over 30 years of experience from the automotive industry, where he mainly focused on concept development, advanced engineering and research. He then worked close to a decade at the Swedish research institute RISE Viktoria as Senior Project Manager, with projects within electromobility, vehicle automation, mobility sharing and open innovation processes. He now splits his time between non-profit activities and consultancy work at Tångudden Konsult AB. Wedlin has participated in several EVS conferences since EVS29 in Montreal 2016. Johan was one of the initiators for EVS38 in Gothenburg.