

# Policy evaluation of electric vehicle promotion in China and Europe

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**Abstract.** In order to meet the goals for carbon neutrality, China and Europe are both adopting a variety of strategies to encourage electric vehicles as an alternative to gasoline vehicles. However, government incentives have changed in 2022, and the factors influencing the expansion of the electric vehicle market have changed. This paper provides a comparative analysis of European and Chinese policies on the promotion of electric vehicles over the last decade and makes predictions and recommendations for future developments based on the current market situation. Although the market for electric vehicles in China and Europe is slow to expand in the short term, in the long term, the market for these vehicles, which are very beneficial in reducing carbon emissions, will continue to expand. This paper hopes to provide a state-of-the-art understanding of the policies regarding the promotion of renewable energy cars, thus facilitating the worldwide goals of achieving carbon neutrality.

**Keywords:** Europe, China, Electric Vehicles, Policy analysis.

## 1. Introduction

The global emission of CO<sub>2</sub> reached a record high of 33.1 Gt in 2018 and leveled out at 33 Gt in 2019. A quarter of the world's carbon emissions in 2019 were caused by the almost 8.5 Gt of CO<sub>2</sub> emissions from the transportation sector [1]. Be that as it may, the Net Zero Emanations situation by the mid-century requires emanations from the transport segment to drop to 5.7 GT by 2030 [2]. Electric vehicles (EVs) have important priorities in reducing nursery gas, unfair carbon emanation, and using fossil energy sources compared to internal combustion motor vehicles (ICEVs) [3, 4]. Since electric vehicles (EVs) do not produce exhaust when they are operating, the power generating stage is where most well-to-wheels (WTW) carbon emissions are produced [5]. Many nations have developed promotion strategies in the last ten years as a result of the significant potential for electric cars to reduce carbon emissions. China (53%), Europe (20%), and the United States (18%) now account for the majority of the world's battery electric vehicle (BEV) stock [6]. As current research on the relationship between the electric vehicle market and policy is still in the early stages of market development, it is important to analyse the policy and situation in the context of the last two years, which provides strategies for future policy developments relevant to countries with similar development situations and different ideologies. The article will assess the impact of the policies introduced in China and Europe to promote electric vehicles in terms of financial assistance, policy benefits and infrastructure.

## 2. Background Analysis

Global energy-related CO<sub>2</sub> emissions are 31.5 Gt, and the epidemic pandemic's global closure reduces global CO<sub>2</sub> emissions by nearly 5.8% in 2020 (or nearly 2 Gt CO<sub>2</sub>). As a result, the annual average CO<sub>2</sub> concentration in the atmosphere in 2020 will be 150 percent higher than it was before the start of the industrial revolution, reaching the current historical extreme of 413 ppm. As governments relax curbs on the pandemic and economies rebound in demand for coal, oil, and gas, global CO<sub>2</sub> emissions, which are partly related to energy, are predicted to bounce back and climb by 4.8% in 2021, close to their 2018–19 peak [7].

Some researchers contend that while emissions from industrialised economies are structurally declining, emissions from emerging nations currently make up more than two-thirds of global CO<sub>2</sub> emissions. However, CO<sub>2</sub> emissions in the EU are still expected to increase by 80 million tonnes in 2021, with around 240 million tonnes of emissions. 2020 will see a 90 million tonne CO<sub>2</sub> reduction in emissions from the power sector, while 2021 will likely see a minor rise in coal and gas-fired power output, reaching around 10% of the 2020 emissions reduction. From 2019 to 2021, the share of coal-fired power generation in the EU will fall below 14%. At the same time, the growth in energy demand and emissions in 2020 will result in China's CO<sub>2</sub> emissions being around 6% higher than 2019 levels by 2021, mainly due to the increased use of coal in the power sector. Despite the rapid growth in renewable energy generation in China, coal-fired power plants have increased their generation by almost 7% in the last three years.

In addition to emissions from the power generation sector, the transport sector, which is still largely made up of fossil-fuelled vehicles, also contributes a significant amount of CO<sub>2</sub> emissions. According to the Report of the Intergovernmental Panel on Climate Change (IPCC) [8], the transport sector will be the fourth largest source of greenhouse gas emissions (15 percent of emissions) in 2019, with 8.9 billion tonnes of carbon dioxide equivalent globally. The top three sources of emissions are the power sector, industry, agriculture, forestry, and other land use. Of these, the transport sector accounted for 23% of total GHG emissions in the EU as of 2015, while in China, transport sector GHG emissions were 830 million tonnes of CO<sub>2</sub> equivalent, accounting for 6.7% of total national emissions [9, 10]. In addition to carbon emissions from the transport sector, the growth in energy demand and emissions in 2020 results in China's CO<sub>2</sub> emissions is around 6% higher than 2019 levels by 2021, mainly due to the increased use of coal in the power sector. Despite the rapid growth in renewable energy generation in China, electricity generation from coal-fired power plants has increased by almost 7% in the last three years.

The transportation industry needs to switch from fossil fuel-dependent transportation systems to alternative, fuel-less transportation systems in order to reach the Net Zero Emissions scenario by 2050. The EC White Paper on Transport set a target to reduce road traffic emissions by 60% by 2050 compared to 1990 emissions, which includes "halving the use of 'conventional fuel' vehicles (internal combustion engine vehicles) in urban transport by 2030 and eliminating the use of ICEVs in cities by 2050" [11]. Although there are currently no plans to completely replace ICEVs in China as there are in Europe, the government has enacted a series of corresponding measures to promote electric vehicles as an alternative to internal combustion engine vehicles to achieve the ambitious goal of becoming carbon neutral by 2060 completely.

### **3. Current measures analysis**

#### **3.1. China's measures**

In spite of being the largest EV market, China's initial efforts to promote electric vehicles did not have the anticipated impact. EV sales were extremely low before 2013, even with significant subsidies from the Chinese government (more than 6800 pounds) [12]. In order to encourage the use of private EVs, the Chinese government established a comprehensive package of incentives in 2014 and 2015. These incentives comprised both monetary and non-monetary measures. In addition to normal infrastructure improvements, tax incentives, and subsidies like those in Europe, a key policy was especially appropriate for China: free permission to buy a car. Restrictions on the purchase of cars and the implementation of vehicle limitation regulations have long been in place due to the fast rise of automobile ownership in China, particularly in several large cities like Shanghai, Beijing, and Shenzhen [13]. Although the procedure differs from city to city, the success rate was often very low or expensive [14]. These incentives are especially crucial in major cities like Beijing. Even if using public transportation was incredibly handy, it is nonetheless uncomfortable to be too huge and congested. At the same time, Beijing's implied promotion strategy offers the benefit of not being limited to motor vehicles [15], which limits the traffic flow in a city by limiting the odd or even number

of the last number licenses plate. Sales of electric cars have increased significantly in China as a result of more extensive legislative incentives. Only 17,600 EVs were sold in China in 2013, while 331,000 vehicles, or a 343 percent increase, were sold there in 2015 [15].

Although the Chinese EVs industry has introduced several new models and significantly increased customer choice in the past five years, there was little question that the Chinese electric vehicle market would struggle to take off without significant government financial backing for businesses and the market. In addition to subsidies for consumers, the Chinese government has created favourable conditions for electric vehicle stakeholders, including investors, by prioritising them on the supply side. In terms of components, for example, 25% of the world's lithium-ion battery suppliers are from China, which is a great advantage for local Chinese EV manufacturers. At the same time, Hertzke, Müller, and Schenk report that Chinese consumers have more choices than those in other countries, and in 2016, around 25 new electric vehicle models were introduced to the Chinese market, which has significantly widened consumer choice. In terms of improving the infrastructure supporting electric vehicles, China expanded its EV charging infrastructure to 107,000 public charging posts in 2016, an increase of 118% over 2015, and to stimulate investment in charging infrastructure, and the Chinese government has also asked local governments to introduce tax breaks and provide cheap land for private companies to build new charging stations. Therefore, the Chinese government's marketing strategy has been effective, as seen by the swift expansion of the contemporary vehicle market [16].

Despite the fact that China now has extremely high sales of electric vehicles, the penetration of electric vehicles in China is relatively low. For example, the penetration of electric vehicles in the light vehicle market in China was 1.4 percent in 2016; and around 24 percent in Norway [16]. Direct financial subsidies and indirect privileges have had significant driving benefits in the consumer market, and the short-term effects are clear. In the long term, however, direct financial subsidies are unlikely to be sustainable, and as the number of electric vehicles proliferates, privileges such as the right to purchase a vehicle and unrestricted license plate numbers will be removed. For example, the Chinese government's policy shows that financial subsidies for renewable energy vehicles in China are scheduled to end at the end of 2022 [17]. On a market level, the official abolition of EV subsidies after 2022 may indicate that China's renewable energy vehicle industry has gradually matured and that policy support and assistance cannot be more effective. It may also indicate that China's renewable energy companies have developed a complete industrial layout and supply chain system and have some control over costs and product development. For consumers, the maturity of renewable energy companies may enable them to better control production and sales costs, and there may not be much difference in the end market price. However, the loss of direct government subsidies will reduce consumer interest in purchasing. If the other incentives offered by the government are also removed, electric vehicles will not currently hold a higher appeal to consumers than fuel vehicles, and it is likely that sales of electric vehicles in China will not grow as rapidly as they have in previous years.

There are also reports that the current market for electric vehicles in China is mainly in first-tier cities such as Shanghai, Beijing, and Shenzhen, while there is still plenty of room for development in smaller cities in the second tier and below. At the same time, the range of direct and indirect incentives for the "use phase" could be increased, such as reduced charging costs, parking fees, road tolls, etc. On the other hand, some regions in China, such as Hainan Province, have already piloted the process of electrification of public transport services, controlling the increase in the number of combustion engine vehicles and gradually banning their sale, similar to the current approach in the EU. The Chinese government also has a sound regulatory system for the safety of renewable energy vehicles, which guarantees increased electric vehicle sales. If these policies are fully promoted and implemented, sales of electric vehicles will increase significantly in the coming years.

### 3.2. European measures

In Europe, the Member States (MS) have raised the most significant measures, such as tax measures, infrastructure-focused measures, fiscal incentives to assist R&D initiatives, and programs to improve consumer awareness. According to these metrics, the number of EV owners in Europe rose from less

than 0.01 million to 1.75 million [6]. In response to the EU's proposal to achieve zero emissions from urban passenger transport by 2050 and zero emissions from urban freight transport by 2030, some European countries have first targeted the electrification of urban freight transport systems, enacting policy measures to incentivise and support this. For example, in Oslo and Newcastle-upon-Tyne, electric freight vehicles can share dedicated roads with public transport; in Paris, electric vehicles can enter low-noise areas or visit at night; in London, Stockholm, etc., electric vehicles do not pay city tolls, etc. [18]. In addition to the freight car wash, private electric car sales have also soared as a result of the agreement by EU countries to completely ban fuel cars by 2035, as various countries, including the UK, have made significant direct financial subsidies to consumers over the past few years to reach this target. The component of financial incentives is mostly conveyed via tax reductions. Some countries, like France, allow the use of electric vehicles without requiring them to pay registration costs. Vehicle Ownership Tax wasn't levied on private VEs in the Czech Republic nor in three other nations. At the same time, buying an electric vehicle may qualify for a tax benefit in Portugal and five other MS. In Belgium, the tax relief is lowered by 15% up to €4940, and in Portugal, it is cut by 30% up to €796. Additionally, most MS created direct assistance. The maximum incentive was roughly €5600 in the UK and €5000 in France [19].

They are still more worried about the supporting facilities, and the monetary incentive has a limited impact on encouraging people to buy. As a result, in addition to monetary policies, governments also developed programs to support the infrastructure for electric vehicles. To facilitate the phase-out of petrol and diesel vehicles and vans, the UK government will create the Rapid Charging Fund, a new £950 million fund. Its goal is to guarantee future assurance for the power capacity of the key A-road service areas. [20]. The Czech Republic started constructing a network of free parking areas and public charging stations for electric vehicles. Meanwhile, governments invested heavily in research and mandated that dealers display passenger car energy labels, making it simple for prospective purchasers to evaluate each vehicle's various CO<sub>2</sub> emission and fuel consumption levels [19]. Despite the limited impact of certain awareness programs, this statistic is nonetheless crucial for dispelling myths about the price and range of EVs. Providing financial assistance for electric vehicles is definitely appealing, but even the best subsidy cannot sustainably increase usage in the absence of ideal supporting infrastructure. The first step in promoting EVs is to install public charging stations. At the same time, the various nations should develop incentive programs that cater to their individual demands [20].

Just as direct economic subsidies for electric vehicles have been decreasing in China in the last two years, subsidy policies have been tightening in some European countries [21]. For example, the German Ministry of Economy wants to end subsidies for plug-in hybrids early at the end of 2022 and reduce cash subsidies for electric vehicles by a third from 2023; in June 2022, the UK government scrapped its policy of providing a £1,500 subsidy (PiCG) for electric vehicles, etc. Countries such as Norway also have plans to reduce incentives for electric vehicles in urban areas, for example, by removing road toll discounts, privileges to use bus lanes, and parking concessions. This could also go a long way to swaying consumer enthusiasm for electric vehicles, slowing the growth of electric vehicle sales. These countries that have cut car purchases and subsequent benefits have often relied on steady market share growth from incentives such as subsidies offered in past years.

On the other hand, the war in Russia and Ukraine has put pressure on the European economy, with rising prices for energy and other raw materials as well as supply chain disruptions, rising inflation in various countries, increasing the cost of living for the population and a contraction in the car sales market already in the first half of the year [22]. The situation has not changed, and it is unrealistic to expect Europe to break its dependency on Russian energy in the near future. It is also challenging for other nations to rapidly satisfy the market's energy demands in Europe. The recent decisions by many European nations to rebuild coal power facilities or promote coal power might conflict with the actions taken by the EU to tackle climate change and negatively affect the growth of the market for electric vehicles.

#### **4. Future EV promotion measures in China and Europe**

By the end of 2020, there will be a total of 2.24 million electric vehicles in the EU-27, which is a significant increase from the EU's earlier goal of having at least 30 million electric vehicles on the road by the end of the century. Of these, passenger cars will make up 94.3 percent, light-duty commercial vehicles 5.4 percent, buses and trucks 0.3 percent, and trucks and buses will make up 0.03 percent and 0.03 percent, respectively. Currently, the EU supports the growth of electric cars in various ways, including by pressuring automakers to create low-emission vehicles and encouraging the creation of integrated charging infrastructure. The EU's unique €750 billion stimulus package has led to a huge increase in electric vehicle sales, but the growth rate of electric vehicle sales will slow in the coming years as direct financial support for them decreases in several of the countries mentioned earlier. However, some other factors influence the expansion of the European electric vehicle market. Based on EV sales in the first half of 2022, it is clear that, in addition to consumer interest, the main factors limiting the increase in market share for EVs in European countries are productivity shortages and supply chain constraints. According to the European Automobile Manufacturers Association [23, 24], sales of renewable energy vehicles in Europe were 1.134 million in the first half of 2022, down by around 30,000 units compared to the same period in 2021, with Tesla currently the top-selling electric vehicle in Europe. However, Tesla's deliveries have also suffered greatly due to the spread of the COVID-19 epidemic causing Tesla to ship fewer vehicles to Europe. Despite opening its Berlin plant in late March, Tesla is still in a slow product ramp-up phase and will take time to reach the capacity of Tesla's Shanghai plant. Therefore, it can be assumed that if European EV production capacity can be increased and supply chain constraints can be addressed, this will help to boost the European EV market.

China's electric vehicle market, while unaffected by the Russian-Ukrainian war, is expected to experience a significant slowdown in real GDP growth in 2022 due to the massive outbreak of a new coronavirus epidemic in the first half of the year [25], which disrupted the normalisation of economic growth, although price increases in China have been limited and the decline in consumption has caused a decline in new vehicle sales. At the same time, despite further reductions in China's direct economic subsidies for renewable energy vehicle sales, sales have increased significantly, which can be attributed to the stimulus from the impending end of economic subsidies.

In this context, the continued expansion of the market share of electric vehicles must focus on continuing to improve the competitiveness of electric vehicles, enabling the clean vehicle industry to flourish through differentiated taxation of vehicles and fuels based on environmental performance and enhanced regulatory measures. Beyond this, Europe, achieving energy independence and developing sustainable energy sources to fully replace fossil-based power generation. For China, the next step could be to extend policy attention and action needs to other modes of transport, especially commercial vehicles - light commercial vehicles, medium and heavy trucks - which have increased and emissions disproportionately.

#### **5. Conclusion**

Addressing transport emissions is critical to the GHG mitigation strategies of many countries, as the sector is the largest energy consumer in 40 percent of countries worldwide. Both China and Europe have largely used direct economic subsidies, infrastructure promotion, and favourable regulations to increase the market share of electric vehicles. With the changing economic situation in both regions and the gradual fading of economic subsidies, without sound equipment support, good market supply, and a change in consumer attitudes, sustained growth in EV sales will be difficult to achieve, and complete replacement of ICEVs will be even more difficult. Under the current situation where governments attach great importance to the use of electric vehicles to replace internal combustion engine vehicles, the trend of sustained growth in electric vehicle sales will not change, but the growth rate may be reduced. Significant replacement of ICEVs by electric vehicles will only be possible if buying and using electric vehicles offers users more ease and advantages compared to ICEVs.

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