



The Rise of China's New Energy Vehicle Industry: History, Status Quo and Challenges

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Abstract. This paper discusses the rise of China's new energy vehicle industry, including its history, current status and challenges. Firstly, the background and historical development of the industry are analysed, alongside a discussion of the role of government policies in promoting the popularisation of new energy vehicle technology and market. Secondly, the article outlines the current state of the Chinese NEV market, including key market participants, technological progress and market share. Finally, the article lists the main challenges facing the industry, such as technical bottlenecks, market competition and trade barriers.

Keywords: new energy vehicles, China, the rise of industry, challenge

1 Introduction

Economic development and population growth are driving rising energy consumption in the transport sector, which now accounts for a quarter of global carbon dioxide emissions [1]. At the same time, energy shortages are worsening, prompting some countries to ban the sale of fuel vehicles. Consequently, the development of new energy vehicles (NEVs) is increasingly recognised as a crucial strategy for addressing climate change and improving energy diversity, particularly in countries like China.

NEV refers to all vehicles powered by energy from sources other than gasoline and diesel engines, which can reduce air pollution and ease energy shortages. Data from the National Bureau of Statistics of China shows a growth rate of domestic 'new trio' products such as electric vehicles, lithium batteries and solar cells of 30.3%, 54.0% and 22.8%, respectively, in 2023 compared with the previous year; this is accompanied by an export growth rate of 'new trio' products up to 29.9% and an export value of above RMB one trillion Yuan (US Dollar 137.8 billion) for the first time [2]. China has led the world's NEV sales for 9 consecutive years since 2015 and in 2023 exported the world's largest volume of automobiles, ahead of Japan [3]. The rapid expansion of the Chinese new energy industry represented by NEV has shown a sound advancement of China's scientific and technological expertise.

Vigorously developing NEV is inevitable for China as it seeks to effectively deal with energy and environmental challenges and attain sustainable development of the automobile industry; this development also offers a significant opportunity to seize the

strategic initiative and narrow the gap with developed countries in Europe and the United States. This study aims to understand the history, development status and challenges of the new energy vehicles in China through the previous policy documents on the new energy industry issued by the Chinese government, the development of the domestic new energy industry and the expert evaluation of the industry.

2 Development History

The NEV industry is one of China’s seven strategically important emerging industries and is an important national industry; with this in mind, it is important for the domestic automobile industry to overtake competitors. The development history of NEVs in China can be divided into three main stages, as shown in Figure 1.

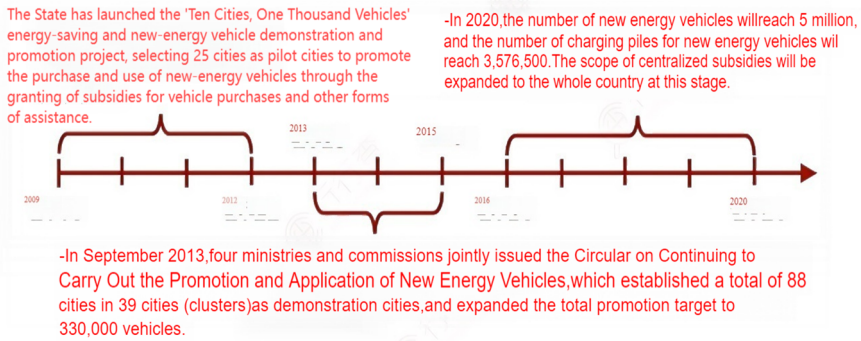


Fig. 1. Three stages in the development of China’s new energy vehicles.

The first stage is before 2008, mainly the strategic planning period of the new energy vehicle industry. At the beginning of the 21st century, the ‘863 program’ was initiated and a ‘three-longitudinal and three-transverse’ electric vehicle development pattern was formed. ‘Three longitudinal’ referred to BEVs, hybrid cars and fuel cell vehicles; while ‘three-transverse’ referred to common technologies such as power storage batteries, drive motors and power assembly control systems [4].

China energetically implemented the Automobile Industry Development Policy released by the Chinese National Development and Reform Commission in 2004; this policy motivated automobile enterprises to develop and produce NEVs, carry out research and conduct the industrialised restructuring of new power such as electric vehicle and power battery for vehicles. Furthermore, in 2007, China issued Management Regulation on Production Admittance of New Energy Vehicles, which enabled volume production of NEV.

The second phase lasted from 2009 to 2013, in which the NEV strategy was presented. In 2009, the Chinese government strongly backed the development of NEV to realise industrial upgrading and transformation in the automobile industry. In January 2009, the Chinese Ministry of Science and Technology, the Ministry of Finance, the

National Development and Reform Commission and the Ministry of Industry and Information Technology jointly initiated ‘a thousand cars in ten cities’ by giving fiscal subsidies and carrying out a pilot run of 1000 NEVs in one over 10 cities/year in the coming three years covering buses, taxis, service cars and municipal traffic and postal vehicles, with the aim of taking up 10% of automobile market shares by 2012 [5]. Since this point, the NEV industry has boomed.

The Energy-saving and New Energy Automobile Industry Development Plan (2012-2022) released in 2012 identified BEV as the main development target of the Chinese new energy vehicle industry. Moreover, in 2015, the total production and sales of new energy vehicles in China reached 670,000 units, over 500,000 units more than expected and a tenfold increase of 2015 by 2022. Sales of NEVs will rapidly increase to 300,000 in 2023, with year-on-year growth rate of 40%, as shown in Figure 2. This symbolises the industrialised and commercialised stage of the NEV industry [6, 7].

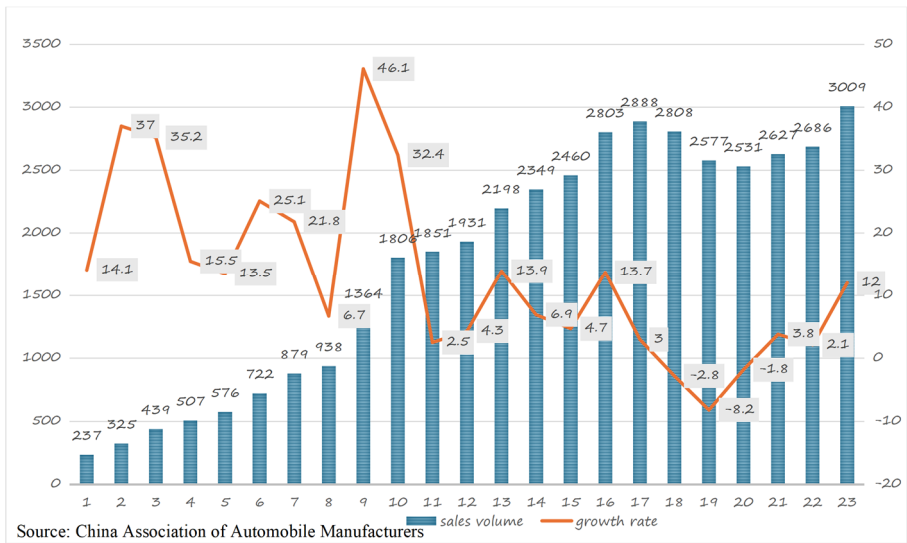


Fig. 2. 2001-2023 China’s car sales and growth rate.

The third phase lasted from 2014 until now. In this phase, the Chinese Government adjusted relevant subsidy policies and continue to introduce numerous subsidy policies to encourage people to buy new energy vehicles and promote the NEV industry, as shown in Table 1. Additionally, the Chinese Ministry of Finance and the Chinese Ministry of Industry and Information Technology issued ‘A Notice about Rewards on the Construction of New Energy Vehicle Charging Facilities’ in November 2014, the policy of rapid charging facilities with high construction costs will be tilted and the subsidy standards would be appropriately raised. In the second half of 2015, the National Development and Reform Commission released ‘Guiding Ideas about Strengthening Urban Parking Facilities Construction’, with a total of 16 strategies, stressing ‘encouraging building intensive parking facilities such as parking garage, basement parking and

mechanical parking system and building NEV chargers in a certain proportion together with main works' [8].

To help NEV enterprises lower costs, elevate technical R&D levels and eliminate high-consumption high-pollution fuel cars as soon as possible, the 'dual integral' policy was put forward. Firstly, oil consumption of fuel cars would be minimised; secondly, production of cost-effective NEVs would be raised to maximise the new energy integral [9]. The policy support for the new energy vehicle industry has tended to be market-oriented. Presently, some NEV enterprises have gradually been separated from subsidy policy and gained an endogenous power for independent development.

Table 1. China's NEV subsidy laws in recent years (Source: Author).

Date of enactment	Name of the law
January 2008	Notice on Pilot Work on Demonstration and Promotion of Energy-saving and New Energy Vehicles
September 2013	Notice on Continuing Work on the Promotion and Application of New Energy Vehicles
January 2014	Notice on Further Improving the Promotion and Application of New Energy Vehicles
July 2014	Guiding Opinions on Accelerating the Promotion and Application of New Energy Vehicles
April 2015	Circular on Financial Support Policies for the Promotion and Application of New Energy Vehicles for the Period 2016-2020
December 2016	Adjusting and Improving Subsidy Policies to Promote the Healthy Development of the New Energy Vehicle Industry.
December 2016	Circular on Matters Relating to the Responsibility for Approving the Promotion and Application of New Energy Vehicles
October 2017	The Motor Vehicle Loan Regulations
January 2018	Notice on Adjusting and Improving Financial Subsidy Policies for the Promotion and Application of New Energy Vehicles
July 2018	Opinions on Innovating and Improving Price Mechanisms for Green Development

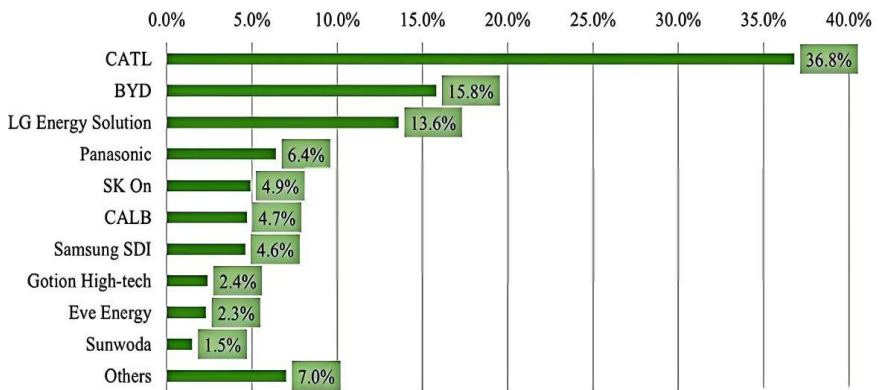
3 Status Quo

The Chinese NEV industry shows a growing trend in the following four aspects:

Firstly, with respect to technological innovation and breakthrough, Chinese NEV enterprises have made a remarkable breakthrough in battery, drive and charge technologies. For example, they continue to improve the endurance and safety of NEVs through studying and applying new battery technologies such as solid state batteries and Lithium-air batteries. Moreover, they greatly improve the driving performance and

comfort of NEVs through independent innovation and breakthroughs in core components such as the motor and electric control systems. Vehicle batteries, electric motors and vehicle electric control systems are the most important points of the new energy vehicle industry chain and they account for 60% of the total costs of NEVs; among these, the cost of the new energy vehicle battery is as high as 40% of the total cost of the car. At present, the power battery industry is dominated by ternary lithium batteries and LFP batteries [10].

Propelled by the NEV industry, the vehicle power battery industry is also experiencing explosive growth and domestic power battery enterprises play an increasingly important role. Data from SNE Research shows that CATL and BYD ranked 1st and 2nd with power battery capacity in 2023. Furthermore, CATL has topped the list for 7 consecutive years and has been the only battery manufacturer with more than 30% of global market shares [11], as shown in Figure 3. Chinese NEV enterprises have gradually popularised and applied quick charge technology to greatly improve charging efficiency and lower the use cost.



Source: SNE Research

Fig. 3. Market share of the world's top EV battery makers (2023).

Secondly, domestic sales and market share have increased. Since 2022, domestic production, sales and export volume of NEVs have grown steadily. According to statistical data from the China Automotive Industry Association, production and sales of Chinese NEVs reached 7.058 million and 6.887 million in 2022, with a high year-on-year growth rate. In 2023, production and sales of Chinese NEVs kept increasing to 9.587 million and 9.495 million and the domestic market share reached 31.6%, indicating a sound growth trend [12]. Production and sales of domestic NEVs are predicted to reach 13 million by 2024, with a market penetration rate of above 40%, with the potential for further increases [13], as shown in Figure 4.

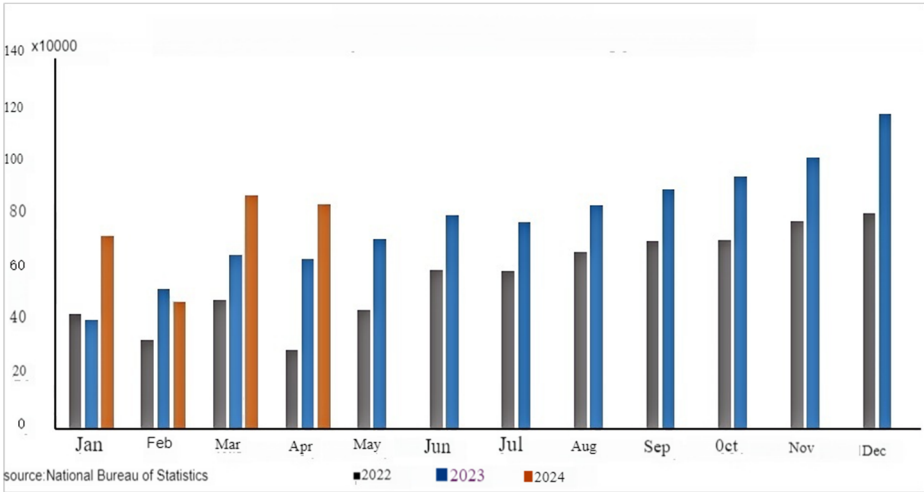


Fig. 4. Monthly sales of new energy vehicles.

Thirdly, regarding export growth and international competitiveness enhancement, domestic NEVs have a rapid growth trend. According to the data, by May 2024, China’s exports of new energy vehicles reached 519,000 units, up 13.7 per cent from the previous year, according to China’s customs authorities [14]. The export volume is predicted to reach 5.50 million in 2024, indicating the increasingly strong international competitiveness of Chinese NEVs, as shown in Figure 5.

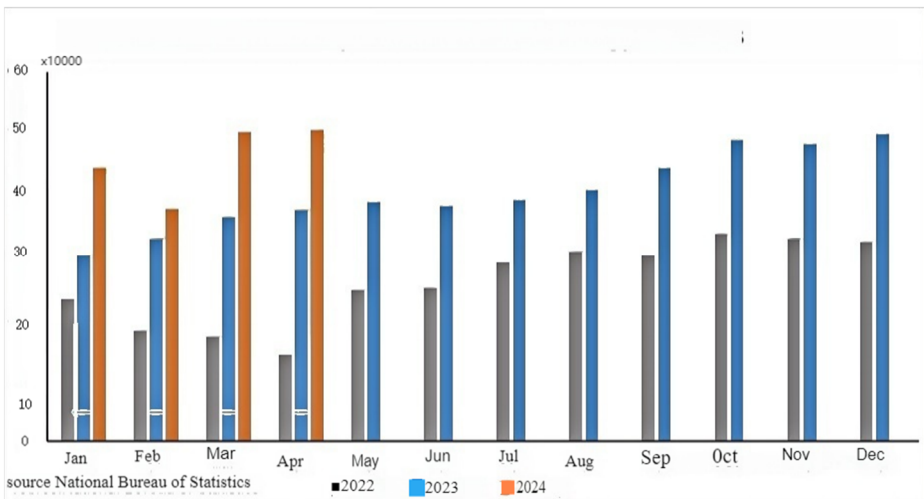


Fig. 5. China’s monthly exports of new energy vehicles.

Fourthly, with NEV market expansion, domestic NEV brands are rising and competing fiercely with international brands. Domestic NEV enterprises continue to launch

numerous competitive products to meet diversified consumer needs by virtue of deep insights into the local market and the ability to innovate. In view of great varieties and high-cost performance, self-owned NEV brands constantly enhance their strength and gradually enter the global market. For instance, BYD, Great Wall Automobile and Chery Automobile enjoy a good reputation abroad. In 2021, 8 Chinese self-owned brands came out top 20 global NEVs, and domestic brands enjoyed certain international influence, as shown in Table 2. In the meantime, growing consumer need for an environmentally-friendly, low-carbon and healthy life also raises the market demand for NEVs.

Table 2. Top EV brands in the world.

1	BYD	226,531
2	Tesla	156,100
3	Volkswagen	45,085
4	BMW	41,361
5	SGMW	38,528
6	Changan	29,831
7	Mercedes	29,567
8	GAC	28,788
9	SAIC	26,316
10	VOLVE	23,364
11	Geely	22,111
12	Hyundai	20,977
13	Audi	20,425
14	Ford	15,992
15	Kia	15,793
16	Hozon	15,097
17	Li Auto	15,034
18	Dongfeng	14,586
19	NIO	14,338
20	Chery	12,285
source:CleanTechnica		

4 Challenges

From an international perspective, high-end Chinese NEV brands have a poor reputation and limited market influence. Relative to the traditional fuel car market, domestic NEV enterprises change the situation from joint venture's dominant position into self-owned brands. Nevertheless, the market share of self-owned brands decreased in 2021

as domestic joint ventures launched NEVs successively, which heavily reduced the market share of self-owned brands. Furthermore, domestic high-end brands still have a reputation inferior to European and American high-end brands. For example, Tesla has a better brand awareness than BYD and Beijing Automotive. In the future, NEV market competition will become increasingly fierce. Not only will high-end NEV enterprises constantly launch new brands, foreign-funded enterprises and joint ventures also will advance the development of NEVs, resulting in increasingly keen competition [15]. Thus, enterprises that do not yet have high-end brand advantages in the NEV field should attach greater importance to enhancing brand awareness.

Moreover, external market risk and challenge intensify pressure on exports. In early 2024, the American government declared restrictions on Chinese NEV imports to obstruct their access to the American market [16]. On June 12, 2024, the European Commission, after 8 months of anti-subsidy investigation, declared an additional tariff based on a 10% tariff on NEVs imported from China since July 4 [17]. An additional tariff on Chinese NEVs of all states will have a serious impact on export of Chinese NEVs and pose a challenge to China's automobile industry.

From a domestic perspective, the new energy vehicle industry has a low production capacity of auto parts and it is hard to tackle core technologies. Although the domestic new energy vehicle industry is expanding, it is difficult to make a breakthrough in core technology, so the market is large but remains stronger. China's automobile industry started late, its foundations are poor and the level of the whole automobile industry is uneven. Compared to countries with developed automobile industries, China still has a big gap in product quality control and cost control [18]. Domestic NEV enterprises were inferior to international advanced enterprises in production technology and highly dependent on imported batteries and electric control systems. For instance, a power battery, a critical component of electric vehicle, still has the disadvantages of short endurance, short life, high maintenance and replacement costs and long charge times.

Additionally, the product service system needs improvement and the hedge ratio of vehicles is low. With the continuous increase of consumers, the requirements for new energy vehicles are not limited to the car itself, but also put forward the requirements for the service system of the whole industry, prompting the new energy manufacturers to constantly improve the industrial chain [3]. At present, it is cheaper to purchase NEVs than fuel-powered cars due to subsidy policies and driving an NEV can save 20,000-30,000 Yuan compared to driving a traditional internal combustion engine vehicle in the first few years due to lower power consumption and maintenance costs [19]. However, in consideration of residual value, the total cost of most NEVs is about 10% higher than that of fuel cars due to a high depreciation rate. Since automobiles are not FMCG, consumers worry about the cost of NEVs [20]. Moreover, quality assurance of used NEVs is negligible and there are no detection and evaluation criteria, especially power battery detection and evaluation [21]. This has an adverse effect on the recycling and sale of used NEVs and has resulted in a low hedge ratio of NEVs.

Last but not least, charging facilities still require improvement and cannot meet current needs. Charging infrastructure is characterised by large investment and a long chain. Whether the charging facilities are perfect or not is a point that every potential user of new energy will inevitably consider. It is also the foundation of the development

of new energy vehicles. Without perfect charging facilities, the development of new energy vehicles is useless. Presently, Chinese NEV enterprises focus on production and sale. They quickly build OEMs and energetically demonstrate the popularisation and application of NEVs but they ignore charging facilities construction; consequently, 'there are no charging piles for NEVs' in many places. *New Energy Vehicle Charging Facilities Construction Guide* released in 2015 specified the ratio of NEV and charging pile of 1:1 [22]. In reality, the target is far from expectations. As of 2023, China had 20.41 million NEVs and a NEV-charging pile ratio of 2.4:1, far less than the 1:1 desired ration [23]. It is obvious that to fulfil the national NEV planning target, the construction of charging facilities will need to be emphasised in the coming years.

5 Summary

From the above discussion, it can be concluded that China's NEV industry has firmly established itself in the automobile sector and has gone through three phases: national strategic planning before 2008, strategy implementation from 2009 to 2013 and a transformation from government policy-oriented to market-oriented after 2014. Presently, China's NEV industry accounts for more than 60% of global production and sales and has taken the first place for 9 consecutive years.

Even so, the industry is still confronted with significant challenges, such as poor brand influence, lagging core technology, an imperfect product service system, inadequate infrastructure and increasing export pressure. Addressing these issues requires overcoming technical bottlenecks, fully understanding the status quo of NEV technology and identifying the development trends and directions. Actively tackling technical difficulties of NEV and increasing R&D input will accelerate the development process and greatly promote the development of NEV technology.

Moreover, strengthening government support and fostering government-enterprise cooperation is essential to further promote the development and popularisation of NEVs. Through the continuous development of new energy vehicles, it can contribute to the protection of the natural environment and reduce carbon emissions.

References

1. Schafer, A. (2000). Carbon dioxide emissions from world passenger transport: Reduction options. *Transportation research record*, 1738(1), 20-29.
2. National Bureau of Statistics. (2024). *Statistical Bulletin of the People's Republic of China on National Economic and Social Development 2023*. National Bureau of Statistics. Retrieved 29 Feb 2024 from https://www.stats.gov.cn/sj/zxfb/202402/t20240228_1947915.html
3. Gao, T., Dong, B., & Zhu, Q. (2024). Current Situation, Trend Prediction and Development Suggestions for the Export of Chinese Automobiles. *International Journal of Global Economics and Management*, 2(1), 155-159.
4. Chinese Ministry of Science and Technology. (2012). Interpretation of the 'Twelfth Five-Year Plan for the Scientific and Technological Development of Electric Vehicles'. Chinese Ministry of Science and Technology. Retrieved 4 April 2012 from https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgnr/fgzc/zcjd/202106/t20210628_175505.html

5. Central People's Government of the People's Republic of China. (2010). Decision of the State Council on Accelerating the Cultivation and Development of Strategic Emerging Industries. Central People's Government of the People's Republic of China. https://www.gov.cn/gongbao/content/2010/content_1730695.htm
6. Chinese National Development and Reform Commission. (2017). Review of the Development of the New Energy Vehicle Industry during the 12th Five-Year Plan Period (in Chinese). Chinese National Development and Reform Commission. Retrieved 6 August 2024 from https://www.ndrc.gov.cn/xwdt/gdzt/xyqqd/201712/t20171221_1197831.html
7. Long, X., Wang, S., & Dong, X. (2023). Overview of the Development Status of New Energy Commercial Vehicles in China (in Chinese). *Automotive Digest*, 2023(12), 27-37. <https://doi.org/10.19822/j.cnki.1671-6329.20230049>
8. National Development and Reform Commission. (2015). Guidance on Enhancing Urban Parking Facilities. National Development and Reform Commission. Retrieved 3 August 2015 from https://www.ndrc.gov.cn/fggz/zcssfz/zcgh/201508/t20150811_1145696.html
9. Yi, Y., Zhang, M., Zhang, A., & Li, Y. (2024). Can “dual credit” replace “subsidies” successfully?-based on analysis of vehicle supply chain decisions under the digital transformation of technology. *Energy Economics*, 130, 107303.
10. Tan, X., & Li, T. (2021). Analysis of challenges and opportunities in the development of new energy vehicle battery industry from the perspective of patents. IOP conference series: Earth and environmental science.
11. Gong, S., & Prawitz, S. (2024). The list of "Global TOP100 Auto Parts Suppliers" was released, with electrification and intelligence becoming the main growth engines (in Chinese). *Automobile Industry*, 4, 4-7.
12. China Association of Automobile Manufacturers. (2023). Brief analysis of new energy vehicle production and sales in July 2023. China Association of Automobile Manufacturers. Retrieved 18 July 2023 from http://www.caam.org.cn/chn/4/cate_32/con_5236133.html
13. Tian, J., Wang, P., & Zhu, D. (2024). Overview of Chinese New Energy Vehicle Industry and Policy Development. *Green Energy and Resources*, 100075.
14. General Administration of the People's Republic of China. (2024). Monthly statistical report 2024. General Administration of the People's Republic of China. Retrieved 18 July 2024 from <http://gdfs.customs.gov.cn/customs/302249/zfxxgk/2799825/302274/302277/5668662/index.html>
15. Lv, Z., Zhao, W., Liu, Y., Wu, J., & Hou, M. (2024). Impact of perceived value, positive emotion, product coolness and Mianzi on new energy vehicle purchase intention. *Journal of retailing and consumer services*, 76, 103564.
16. Alessandria, G. A., Khan, S. Y., Khederlarian, A., Ruhl, K. J., & Steinberg, J. B. (2024). Trade War and Peace: US-China Trade and Tariff Risk from 2015–2050.
17. European Commission. (2024). Commission imposes provisional countervailing duties on imports of battery electric vehicles from China while discussions with China continue. European Commission. Retrieved 4 July 2024 from https://ec.europa.eu/newsroom/europe_direct/items/839227/en
18. Dzienis, A. M., & McCaleb, A. (2024). Motives behind Sino-Japanese strategic alliances in the new energy vehicles sector in the age of the Belt and Road Initiative. *Asia Pacific Business Review*, 30(2), 274-299.
19. Xinhua Net. (2023). Starting from 2023, the subsidy policy for purchasing new energy vehicles has ended. With the withdrawal of subsidies, how will new energy vehicles "continue their journey"? (in Chinese). Xinhua Net. Retrieved 6 August 2024 from http://www.news.cn/fortune/2023-02/21/c_1129382110.htm

20. Lin, X., Teng, X., & Huang, G. (2023). Issues and Solutions for the Survey and Assessment of New Energy Vehicle Accidents (in Chinese). *Automobile Maintenance and Repair*, 24, 64-66. <https://doi.org/10.16613/j.cnki.1006-6489.2023.24.022>
21. Wu, B. (2023). New Standards for the Testing and Maintenance of New Energy Vehicle Power Batteries have been Established (in Chinese). *China Consumer Newspaper*. Retrieved 4 August 2024 from <https://www.ccn.com.cn/Content/2023/10-09/1513171507.html>
22. Central People's Government of the People's Republic of China. (2015). *New Energy Vehicle Charging Facilities Construction Guide*. Central People's Government of the People's Republic of China. https://www.gov.cn/zhengce/2015-10/09/content_5076250.htm
23. Sohu Automobile. (2024). The number of new energy vehicles has exceeded 20 million, leading to an increasing number of disputes over charging piles (in Chinese). *Sohu Automobile*. Retrieved 4 August 2024 from https://www.sohu.com/a/777429468_484936

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