

Example Business Models of Electric Vehicle Startups in China and the US

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Abstract. In the modern era, electric vehicles are developing at a rapid speed, and technology and sales have made breakthroughs. Among them, in recent years, many mature brands have been established in the electric vehicle markets of China and the United States, such as Tesla in the United States and BYD in China, and many new brands have emerged. This article mainly studies the political, economic, social, technological, environmental and legal differences between the China and the United States in the development of electric vehicles, and conducts a detailed market analysis of a single brand to better understand the development of electric vehicles.

Keywords: Electric vehicle, policy, development, consumer preference.

1. Introduction

Electric energy is a necessary auxiliary energy in every car, and the first car that needs electric energy was invented in 1834 by a Scotsman Robert Anderson, It had a boxy, open-top design with large wooden wheels, similar to those found on horse-drawn carriages. The vehicle was powered by non-rechargeable primary cells, which were quite large and inefficient by today's standards. These batteries would have been visible, likely taking up significant space. In 1837, Thomas Davenport obtained the first patent in the United States motor industry. The technology of the internal combustion engine and the development of petroleum in the 1920s led to the oil car becoming the dominant vehicle of the era. There are no direct subsidies for petrol stations, but the rapid expansion of road networks and increased car ownership have spurred private investment in petrol stations, The increase in the number of filling stations makes it easier to replenish energy Until 1990, the development of battery energy storage units, as well as concerns about mineral energy reserves and rising oil prices, major automobile manufacturers began to try in the field of new energy vehicles. The progress of science and technology has made electricity no longer just an auxiliary energy source, but a dominant one. Through the support of the government and the change of people's ideas, the number of electric vehicles has increased gradual since 2015, from half million electric vehicles in the world in 2015 to more than 17 million electric vehicles in 2024. (not including hybrid car) [1].

2. Literature review

An electric vehicle (EV) is a type of vehicle that runs on electricity, usually one that does not use any other source of power .

China's first electric car brand is BYD (Build Your Dreams). BYD was founded in 1995 and initially focused on battery production, but entered automobile manufacturing in 2003 through the acquisition of Qinchuan Automobile. BYD launched China's first mass-produced plug-in hybrid vehicle, the F3DM, in 2008. BYD's market share in China is 17%, Other emerging industries such as NIO, Ideal, GAAian, Great Wall, AITO are gradually occupying a place in the market. What cannot be ignored is that AION is now developing rapidly and the competition with BYD make up 5.2% of China EV market [2].

America's first electric car brands date back to the late 19th century. At that time, electric vehicle technology had just begun to develop, and multiple brands were involved in the manufacturing and promotion of electric vehicles. One of the earliest and most famous electric vehicle brands is The Electric Vehicle Company, founded in 1899. Tesla's market share in the United states is 51.3%, Other emerging industries such as Ford, Rivian, lucid motors, CANOO are gradually occupying a place in the market make up 3.5% of the US market contribution.

In this article, we will study the business models of mainstream brands and their competitive advantages, and propose solutions for some electric vehicles companies to win market share. So we introduced the following two concepts:

Market leader: Refers to a product, brand, company, organization, or group that holds the largest share of total sales revenue within a specific market. By commanding a significant portion of the market, a market leader can shape customer loyalty, distribution channels, and pricing strategies. (The Economic Times)

Market follower: A company that isn't the leader in a particular market but opts to maintain its position rather than aggressively trying to increase its market share. Market followers must understand how to retain their current customers (Cambridge dictionary).

3. Overview in global market

3.1. Overview of the global electric vehicle market

Figure1 shows over the past ten years, the global electric vehicle (EV) market has grown significantly, and this growth is expected to continue. As environmental sustainability and climate change become more pressing issues, the move to electric vehicles has become a major trend in the global automotive industry. Significant technological advancements, encouraging government policies, and growing demand are the driving forces behind this expansion.

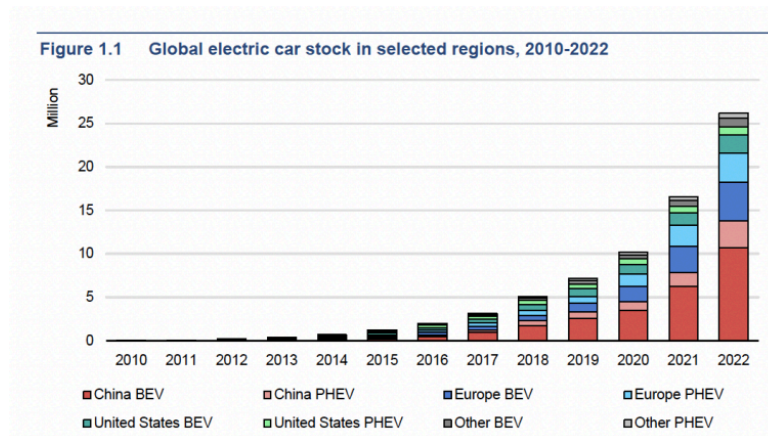


Figure 1. Global electric car stock in selected regions, 2010-2022
 (<https://evmarketsreports.com/global-ev-outlook-2023-2/>)

3.2. Rising demand

The demand for electric vehicles has increased significantly during the last one to three years. Global EV sales have more than doubled since 2020, with over 10 million units sold in 2022 alone, according to recent data. A number of factors, in figure2, such as growing consumer awareness of environmental issues, rising fuel prices, and advancements in EV infrastructure, like the development of charging networks, are driving this upward trend. EVs are starting to appeal to a wider variety of customers as more automakers release electric models and battery prices continue to fall.

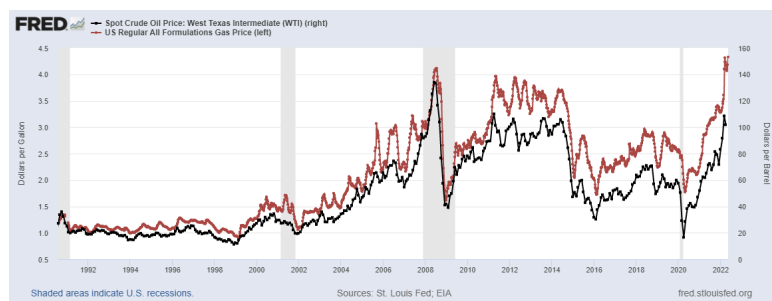


Figure 2. UK department for business, energy & industrial strategy

3.3. Government policies

Governments around the world have been instrumental in driving the uptake of electric vehicles. Many nations have implemented strict policies aimed at curbing pollution as a result of the dire need to reduce greenhouse gas output and the rising CO2 emissions that characterize the global environmental situation. Governments have enacted a number of laws to encourage the use of electric vehicles because they understand the inherent advantages of these vehicles, which include safety, health, green energy, and environmental friendliness.

For example, some nations provide tax breaks and subsidies to people who buy and manufacture electric cars, one of the most significant incentives for EV buyers is the federal tax credit, which can be as high as \$7,500 (in the united states), another factor in the united states is the federal tax credit. The federal tax credit begins to phase out for manufacturers once they have sold 200,000 qualifying

vehicles. This has already occurred for some companies, like Tesla and General Motors, which have sold enough EVs to trigger the phase-out. For the purchase of a new electric vehicle. This credit is designed to offset the higher upfront cost of EVs compared to conventional vehicles. The amount of the credit depends on the size of the vehicle's battery. Because of these incentives, EVs are now more affordable overall and more accessible to the general public. Furthermore, some governments have set aggressive deadlines for phase-outs of internal combustion engine vehicles.

The United States Department of Energy (DOE) funds a range of research initiatives aimed at advancing EV technologies, including battery development, electric drivetrains, and lightweight materials. These efforts are designed to improve the range, performance, and affordability of EVs. the DOE's Advanced Technology Vehicles Manufacturing (ATVM) Loan Program has provided over 10 billion in loans to companies like Tesla, Ford, and Nissan to help them develop and manufacture electric vehicles [3].

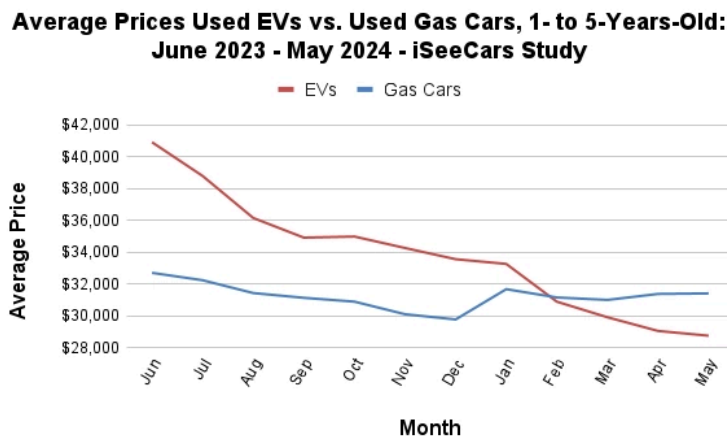


Figure 3. Comparison between electric vehicles and fuel vehicles

Norway serves as an anecdote for China and the US, it's path representing potential risks and experimental outcomes that other nations may follow in the future. Norway is a major oil producer, but it also leads the way in promoting electric cars. With incentives like zero import taxes, lowered tolls, and exemptions from road tax, the nation's legislative framework is very conducive to the adoption of EVs. Incredibly, over 80% of new cars sold in Norway are electric. Norway has set rather "ambitious" climate goals, one of which being becoming carbon-neutral by 2050. Supporting EVs is a vital part of this strategy, as the transportation sector is a significant source of greenhouse gas emissions, accounting for over 16% of all emissions. There is a wide political consensus in Norway on the need to address climate change and promote sustainable development. This has allowed the government to implement and maintain robust pro-EV policies over the long term, regardless of changes in political leadership, hoping to take a leadership role in EV adoption, being a risk/liability to the US and Chines Markets [4].

While oil has been a significant revenue source, Norway understands the need to reduce its reliance on a volatile commodity, the Norwegian Ministry of Trade, Industry and Fisheries has established an official roadmap to plan and achieve its goals, by becoming an early adopter of EVs, Norway can position itself as a global leader in EV technology and related industries. They aim to become carbon neutral by 2050 and have utilised many tax breaks to achieve this goal.

- No purchase/import tax on EVs (1990-2022)
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-Maximum 50% of the total amount on ferry fares for electric vehicles (2018)
 (https://elbil.no/english/norwegian-ev-policy/, Norsk elbilforening, 2022)

3.4. Technological advancements

Another major factor contributing to the industry's growth has been the EV technology's rapid advancement. Table 1 shows the development of solid-state batteries and other advancements in battery technology have greatly expanded the operating range and efficiency of electric vehicles.

Table 1. The development of solid-state batteries

Year	Price (approximate)	Tech
2010	\$1,200 per kilowatt-hour (kWh)	Battery costs were extremely high, thus making EVs expensive and limiting their market penetration and potential. E.G: The Nissan Leaf, one of the earliest mass-market EVs, was priced around \$56,000, with the battery pack being a significant portion of the cost.
2015	\$350 per kWh.	Battery costs had dropped substantially, thanks to advancements in battery chemistry, economies of scale, and increased investment in research and development. This reduction in cost helped manufacturers like Tesla introduce more affordable and advanced models like the Model S.
2018	\$176 per kWh.	The cost continued to decline as production ramped up and new technologies, such as improved lithium-ion batteries, were developed. This was a time of exponential time for the EV market growing by up to 4% within 2 years, leading the launch of more affordable models like the Tesla Model 3, which started at \$40,630.
2020	\$137 per kWh.	Battery costs dropped further, with industry reports indicating that the \$100 per kWh threshold (considered the point where EVs would reach price parity with internal combustion engine vehicles) was within reach (5-10 years)

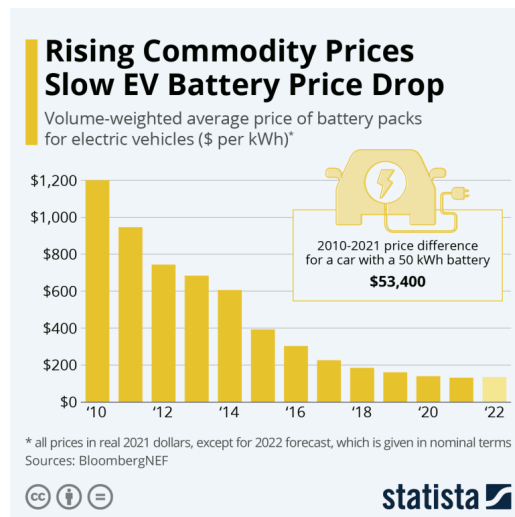


Figure 4. Rising commodity prices slow EV battery price drop

3.5. Major players

A few major companies control the majority of the electric vehicle market, and they all make unique contributions to the industry's expansion. Leading EV innovation and production companies include Tesla, BYD, and Volkswagen.

Tesla has been a leader in the electric vehicle (EV) industry, renowned for its high-performance cars and cutting-edge battery technology. Since 2003 Tesla has been researching and innovating in Full Self Drive, also known as Autopilot. Tesla's Autopilot system offers advanced driver assistance features like adaptive cruise control, lane-keeping, and traffic-aware cruise control. Over time, Tesla has continuously updated and improved these features through over-the-air software updates. Industry standards have been set by the company's core technologies, which include its electric drivetrains and battery packs that it developed on its own, such as the 4680 Battery Cells. Introduced in 2020, these new battery cells are larger and more efficient than previous designs. They promise to deliver higher energy density, lower cost per kWh, and greater range, while also reducing the complexity and cost of manufacturing, leading to more affordable Tesla EV models such as the Model 3 (\$40,630) and Y (\$44,630). Tesla also has renewable energy integration beyond the vehicles alone, such as solar panels and the Solar Roof. These products are designed to work seamlessly with Tesla's Powerwall battery storage system, allowing owners to generate and charge their vehicles themselves [5].

Founded in 1995, BYD (Build Your Dreams) is a significant player in the electric vehicle (EV) market, especially in China. BYD offers a broad portfolio of electric vehicles, from passenger cars like the BYD Han, Tang, and Dolphin, to commercial vehicles such as electric buses and trucks. The BYD Han, a luxury sedan, is notable for its high performance and range, with some versions of the sedan offering over 370 miles of range on a single charge. BYD's vehicles are also known for their energy efficiency, which is a result of the company's advanced battery technology and the integration of regenerative braking systems that capture energy during braking and feed it back into the battery. BYD has been working to expand the availability of charging infrastructure, particularly in China. The company has partnered with various entities to build over 100,000 charging stations with 16,000+ in shenzhen alone, BYD has invested in fast-charging technology to reduce the time required to recharge its vehicles by 32% [6].

Volkswagen (VW) is a competitor to the US and Chinese EV firms, as it has been a dominant part of the vehicle market, spending over 30 million in EV research, Volkswagen has made many ground breaking discoveries, such as the Modular Electric Drive Matrix (MEB) platform is a scalable, flexible platform designed specifically for EVs. It serves as the foundation for a wide range of electric vehicles across VW's brands, including but not limited to Audi, SEAT, Skoda, and VW itself. The MEB platform is designed to optimize battery placement and vehicle dynamics, enabling cost-effective production of multiple models with varying ranges. From this one could conclude that European competitors are also focusing on EV innovation, to quickly prevent imports from overwhelming their markets, and to dominate a significant part of future EV market percentages.

Not only is the global electric vehicle market growing in size, but its variety is also increasing. As a result of regional laws, financial incentives, and customer behavior, adoption and preference rates have varied widely.

China: See Figure 5, the biggest and most active market for electric vehicles, China accounts for more than 50% of worldwide EV sales. This dominance has been greatly aided by the government's strong support, establishing tax breaks which includes infrastructure development and subsidies. The EV incentive package, worth a total of \$72 billion, was first introduced in June by the Chinese government. and will run until 2028. EVs bought in 2024 and 2025 will be exempted from sales tax up to a maximum of 30,000 yuan (\$4,180) Cheap labor the country's robust reserves of key minerals such as Lithium and Cobalt are crucial to the appeal of the growing market [7].

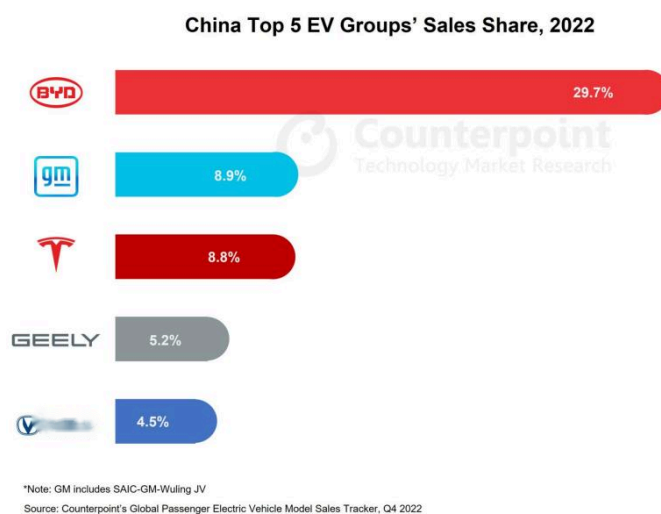


Figure 5. China Top5 EV groups'sales share, 2022

Europe: Europe holds a substantial share of the global EV market, second only to China. This is because of tight emission rules and alluring incentives are fuelling the EV market's rapid growth and that the European Commission committed to promote commercial use of zero-emission vehicles through a Greening Corporate Fleets initiative in 2023. The EU's Green Deal, CO2 reduction standards for trucks, vans and buses to 45% by 2030 and 90% by 2040, eventually aiming to make Europe the first climate-neutral continent by 2050, also encourages this growth [8].

-The growth trend in the share of electric car registrations continued in 2023, reaching 23.6% - according to preliminary data. This includes 15.5% full electric cars.

-In 2023, 8% of the new vans sold in Europe were fully electric (up from 6% in 2022).

-In 2022, the share of electric vehicles in new car registrations increased in almost all countries (EU-27, Iceland, Norway) compared with 2021. The highest shares were found in Norway (89%), Sweden (58%) and Iceland (56%).

(<https://www.eea.europa.eu/en/topics/in-depth/electric-vehicles>, European Environment Agency, 2024)

USA: Even though the country sold only 7.5% of all EVs worldwide in 2023, the rate of adoption within its border is rising, at 8.6% of the entire new vehicle retail market by the end of 2023. American consumers are finding electric vehicles (EVs) more accessible thanks to expanding networks of charging stations and increased federal and state support, as previously mentioned with the United States Department of Energy (DOE), and significant tax breaks.

4. Strategic/business model

The form of the table2 is used to analyse how AITO companies use different sales methods to satisfy different social groups. The following table will describe the different models of AITO company and their highlights, whether AITO has preferential treatment for customers, and how AITO after-sales service is. And how AITO auto cooperates with Huawei mobile phones, reflecting the advantages brought by cooperation in those aspects. By further analysing AITO automotive's business model, we can understand how AITO has gained a foothold in this highly competitive enterprise in a short period of time.

Table 2. AITO

AITO	
	The AITO M5's interior design focuses on simplicity and a sense of technology. The overall layout is relatively clean and tidy, and a lot of soft materials and leather wrap are used to enhance the texture of the interior.
Design style	AITO M7 is positioned as a medium and large SUV with a luxurious interior style suitable for family use while taking into account business needs The AITO M9 interior features a generous use of high-end materials such as leather, solid wood trim and metal trim, adding to the overall luxury. The details are very exquisite, the stitching process is exquisite, and the touch is excellent.
After-sales service	AITO provides road rescue services to car owners, including emergency towing, battery power, tire replacement, etc., to respond to emergencies. For some simple repair and replacement services, some AITO outlets offer fast repair lanes to reduce waiting time for owners. AITO provides a 24/7 customer service hotline, and users can call customer service at any time for help, whether it is emergency troubleshooting or general consultation.
Prefere ntial policy	Cash discount: directly reduce the sales price of the vehicle and give consumers a certain amount of cash discount. Limited-time specials: Offer special rates during specific promotional periods, such as holidays or brand anniversaries. Replacement subsidy: An additional cash subsidy or discount is provided when consumers trade in their old car to buy a new AITO car. Provide additional cash subsidies or discounts of approximately 33,000 to 35,000yuan. Free maintenance: Provide a certain number or period of free maintenance services, including replacement of oil, filters and other routine maintenance items.
Huawei coopera tion	Driver assistance system (ADAS), including full-speed domain adaptive cruise, lane keeping assist, automatic parking and other functions. Huawei's sensor technologies such as Lidar, millimeter-wave radar, and cameras have been applied in AITO models to enhance the vehicle's intelligent driving capabilities. 5G technology: As the world's leading 5G technology supplier, Huawei provides advanced 5G communication modules for AITO vehicles, enabling vehicles to achieve high-speed and stable vehicle networking functions, supporting real-time navigation, remote monitoring, OTA updates, etc. Brand synergies: AITO, as a joint brand of Huawei and Celex, has rapidly increased brand awareness with the help of Huawei's influence in the field of consumer electronics. Huawei's brand image and marketing experience have also provided strong support for AITO's foothold in the automotive market.

5. PESTle analysis

Using the PESTEL format to analyse the differences between electric vehicles in the United States and China, using the PESTEL analysis reader can understand how countries view the development of electric vehicles, and how to promote people to choose electric vehicles through the establishment of legislation, how to invest in the technological change of cars, whether electric vehicles are more suitable for this era of calling for environmental protection. By referring to the article published by EESI, reader can learn about the comparison of electric vehicle policies between China and the United States, and by reading the article about the effectiveness of electric vehicle subsidies in China, reader can learn about the development of subsidies for electric vehicles in China [9,10].

Table 3. PESTEL analysis

	CHINA	USA
Political	<p>government support/Centralized infrastructural and regulation/environmental regulations.</p> <p>Electric vehicles will be subsidized by the government after 300,000 yuan, such as a range of 300-400 kilometers will have a subsidy of 9,100 yuan, more than 400 will have a subsidy of 12,600 yuan, but this is only for pure trams, hybrid is only 4,800 yuan subsidies, no matter how long the endurance, but this policy will be terminated on December 31, 2022.</p>	<p>Incentives (tax credit), Unlike in China, U.S. tax credits can be used in different ways, such as cash grants, property and sales/use tax deductions, while in China they are only reflected in price changes at the time of purchase</p> <p>Significant investment in EV infrastructure through the Bipartisan Infrastructure Law</p>
Economic	<p>Largest EV market globally</p> <p>Extensive domestic manufacturing base with major players</p> <p>Government investment in battery technology and EV infrastructure, reducing costs and fostering industry growth.</p>	<p>Growing EV market with increasing consumer interest and investment from traditional automakers</p> <p>Federal funding aimed at expanding charging infrastructure and promoting domestic battery production.</p>
Social	<p>High urban population density, driving demand for cleaner transportation to reduce urban pollution.</p> <p>Government campaigns to raise awareness about the benefits of EVs.</p>	<p>Diverse consumer attitudes towards EVs, with increasing acceptance and awareness of environmental benefits.</p> <p>Social trends towards sustainability and green living are encouraging EV adoption.</p>
Technology	<p>Rapid advancements in battery technology and electric drivetrains, supported by significant government and private sector R&D investment.</p> <p>Leading in the development and deployment of fast-charging networks.</p> <p>Integration of smart grid technology and renewable energy sources with EV infrastructure.</p>	<p>advances in autonomous driving technology and integration with EV platforms.</p>
Legal	<p>Comprehensive regulations promoting EV production and adoption, including mandates for automakers and subsidies for consumers.</p> <p>Strict emission standards and targets for phasing out internal combustion engine vehicles.</p>	<p>Varying legal landscape across states, with some states having more aggressive EV mandates and incentives.</p>
Environmental	<p>Severe air pollution issues in urban areas drive the push for cleaner transportation solutions.</p> <p>Government targets for reducing carbon emissions and achieving carbon neutrality by 2060.</p> <p>Policies promoting the use of renewable energy sources for EV charging.</p>	<p>Federal and state policies aimed at reducing greenhouse gas emissions and promoting sustainable transportation.</p> <p>/Increasing investment in renewable energy to support a sustainable EV ecosystem.</p>

6. COMPARIsons between markts

The electric vehicle market has a very large market share, resulting in a lot of leading brands in this industry, such as Tesla in the United States and BYD in China, the two brands each have their unique advantages. With the development of new energy, many new automobile brands have been born. The table4 shows CANOO and AITO.

Table 4. CANNO&AITO

	CANNO	AITO
Technology Integration	The interior of CANOO vehicles is designed to be highly customizable and tech-forward, featuring large touchscreens, intuitive user interfaces, and seamless integration with personal smart devices.	AITO's vehicles are deeply integrated with Huawei's HarmonyOS, providing seamless connectivity and smart features that enhance user experience. This includes advanced driver assistance systems and high-end audio provided by Huawei Sound
Versatility and Utility	CANOO aims to appeal to both personal and commercial users by offering vehicles that can adapt to various needs. Features such as expandable truck beds, built-in power outlets, and flexible seating arrangements highlight their focus on utility and versatility	AITO offers both range-extended (EREV) and battery-electric (BEV) vehicles, catering to different customer needs. The EREV models provide extended range through a combination of a petrol engine and electric motors, while the BEV models focus on pure electric driving
Strategic Partnership	CANOO collaborates with various technology and manufacturing partners to enhance its product offerings and operational capabilities. This includes partnerships for EV infrastructure and component manufacturing	Collaboration with Seres and leveraging Huawei's technology and distribution channels are crucial to AITO's strategy. These partnerships help in achieving economies of scale, innovation, and efficient market entry

7. Conclusion

This paper mainly reveal the development of new energy vehicles in China and the United States, and through PESTEL analysis of the two countries, further differences between the two countries in the new energy market were discovered BYD is a relatively representative electric car brand in the Chinese market. The reason for its success comes from its diversified product lines and strong government support. AS for US market, Tesla is the most successful electric car brand. The reason for its success is probably its cutting-edge battery technology and America’s stringent emissions rules and attractive incentives are driving rapid growth in electric vehicle market. Although the current electric vehicle market seems to be growing at an extremely fast rate, there are still some potential problems. For example, CANNO and AITO are new brands. How to gain a foothold in the market requires thinking about their drawbacks. In the future, new brands like CANOO and AITO should pay more attention to technology research and development, pay attention to customer needs, and find more reliable partners. In this way, they can develop better in the market [11].

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