Policy Evolution of Chinese New Energy Vehicle Industry

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The Chinese new energy vehicle industry policy is divided into three development periods: 2004–2008—promotion policy and technological policy; 2009–2013—financial policy; and 2014–2020—charging infrastructure policy.

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1. Introduction

China is the world's largest energy consumer, releasing large amounts greenhouse gases (GHG) into the atmosphere [1][2][3][4]. Carbon emissions related to transportation have increased to 10% of Chinese total carbon emissions [5]. The decarbonization of the transportation sector is imperative [6]. Electric vehicle technology has high hopes [7]. China, as the largest automobile production country in the world, is constantly exploring and adjusting its own NEV policies to facilitate the diffusion of NEVs.

NEV-related work began decades ago, in the 1990s [8]. The Ministry of Science and Technology established an Electric Vehicle Key Project under the National High-tech Research and Development Program (the 863 Program) in the 10th FYP (2001–2005). EVs, HEVs, and FCVs were included in these projects. The policy encourages enterprises to research and develop new energy vehicles. The "Automobile Industry Development Policy" was promulgated in 2004 to promote the coordinated development of the automobile industry. The development of the automobile industry into a pillar industry of the national economy by 2010 was the policy goal. After 2009, the number of policies increased rapidly. "Interim Measures for the Management of Financial Incentive Funds for Technological Innovation in the New Energy Vehicle Industry" was promulgated in 2012. Financial subsidies have promoted the development of the new energy vehicle industry.

The "Measures for the Parallel Management of Average Fuel Consumption and EV Credits for Passenger Car Companies (Dual-Credit Policy, DCP)" was introduced in 2017 to nurture the growth of new energy vehicles and effectively alleviate the government's financial subsidy pressure [9]. The DCP included two related parts: corporate average fuel consumption (CAFC) credit regulations, and NEV credit regulations. CAFC regulation aims to research and apply energy-saving technologies, and NEV regulation aims to promote new energy vehicles. The effects on energy saving and emission reduction by the DCP have been confirmed [10][11]. A new DCP was introduced in 2020; according to the new DCP regulations, the peak time of the whole fleet's greenhouse gas emissions will be 2026 [12].

China's auto industry is going through a transformation period from traditional vehicles to new energy vehicles, and the vitality of industrial policies has been highlighted [13]. The policy encourages the adoption of electric vehicles and the development of electric technology. Shao et al. [14] divide the government's financial subsidies into two stages: research and development (R&D) subsidies, and production subsidies. The R&D subsidy is for the design of new energy vehicle products, and the production subsidy is for the sales stage. The results show that R&D and the production of enterprises are highly dependent on policies. The main reason is the lack of market demand. It is difficult for enterprises to make profits.

However, neither the tax subsidy policy, the license plate restriction, nor the electric vehicle purchase subsidy policy can achieve the full popularity of electric vehicles [15][16]. The market adoption of NEVs still faces obstacles [4]. In particular, insufficient charging infrastructure is an issue [17]. There is an interaction between the market penetration of electric vehicles and charging infrastructures. The Chinese government has issued a series of policies to promote the construction of the national charging network, including charging pricing policies, charging infrastructure standardization, power system transformation, and incentives for the adoption of electric vehicles [18]. The "Thirteenth Five-Year Plan for Energy Development" promulgated and implemented in 2016 proposed to build electric vehicle charging facilities moderately ahead of schedule and build a "four vertical and four horizontal" inter-city electric vehicle fast-charging network.

2. The Evolution of the Chinese New Energy Vehicle Industrial Policy

NEV-related work began in the 1990s [19]. The Ministry of Science and Technology (MOST) established an Electric Vehicle Key Project under the National High-tech Research and Development Program (the 863 Program) in the 10th FYP (2001–2005) in 2001 [20]. EVs, HEVs, and FCVs were included in these projects [21]. Electric vehicles have low greenhouse gas emissions [22]. They have become an important direction of the transformation of the global automotive industry.

2.1. First Step: 2004–2008: Promotion Policies and Technical Policies

The Chinese government encourages and guides the development of energy-saving and environmental vehicles. The technical policy for hybrid energy vehicles and fuel engines is a vital development direction in this stage. The government encourages the research and development of new energy vehicles. However, there are fewer typical policies to support new energy vehicles in the early stages. Most industry policies focus on the improvement of fuel economy. China started the standard formulation of the automobile fuel economy measures in 2001, including "Fuel consumption limits for passenger cars", "Measurement methods of fuel consumption for light-duty vehicles", and "Automobile Vehicle Fuel Consumption labels". These standards have built a relatively complete system of fuel economy standards. In addition, the government introduces technical standards for the vehicles industry. By 2010, the average fuel consumption of new passenger cars was more than 15% lower than the level in 2003. However, there is still heavy pressure to achieve the expected goals.

Some development problems have appeared in China's automobile industry at this stage. The research and development (R&D) of the car is not prominent. There are fewer well-known car brands. The market-for-technology model is hard to maintain. Higher R&D costs fail to attract more auto manufacturers to develop energy-saving vehicles. New energy vehicles are still in the stage of technical reserves. The transformation of vehicle electrification is coming. There are no typical policies to support the research activity of corporations at this stage.

Before 2008, the Chinese auto-industrial policy had no policy preference for new energy vehicles. New energy vehicles require huge preparation expenditures, and investors must face huge market uncertainty. In addition, the government must keep the health of market rules under the policy. The uncertain market is a negative factor for decision-makers. Thus, the research and development of new energy vehicles are blocked. The growth of car ownership is the primary goal at this stage, and new energy vehicles have not yet received attention.

2.2. Second Step: 2009–2013: Financial Policies

Since 2000, the gasoline consumption percentage of transport, storage, and post has contributed to more than 40% of total industrial gasoline consumption. With the rapid development of the Chinese economy and the acceleration of the urbanization process, demand for cars will continue to grow. Energy stress and environmental pollution will become more prominent. Before 2009, the Chinese government issued many promotion policies and fuel standards, but the expected goals were not achieved. To expand the national promotion of new energy vehicles, at the beginning of 2009, the Chinese government launched a demonstration program for 10 cities, including a thousand vehicle deployments in 13 Chinese cities. The central government provides one-off subsidies for hybrid, electric, and fuel cell vehicle purchases [21]. By 2012, the total number of electric vehicles on the road had reached more than 10,000. At the same time, the "Interim Measures for the Administration of Financial Subsidy Funds for the Demonstration and Promotion of Energy-saving and New Energy Vehicles" was launched to ensure the success of the demonstration program. However, the subsidy for the demonstration program only covered the public service fields, such as buses, taxis, governmental fleets, sanitation, and postal service vehicles; the private vehicle market was excluded. Moreover, the subsidies were lower than the market expectation [23].

The "Consumer subsidies for individual purchase of new energy vehicles" was launched in 2010. The policy encourages the individual purchase of new energy vehicles. The local government allocates special funds to support the construction of infrastructures such as charging stations, the purchase of new energy vehicles, and the recycling of batteries [24]. The financial subsidy can stimulate investments to drive industry growth, and reduce the initiation period. The rapid growth of EV adoption occurs in this phase [4][16][25]. The industrialization and commercialization of Chinese electric vehicles nationwide are gradually realized [9].

The "Development plan of energy-saving and new energy automobile industry (2012–2020)" was launched in 2012. This policy had two key targets: to reach 500,000 units in the production and sales of electric vehicles and plug-in hybrid vehicles by 2015, and to produce 2 million electric vehicles and plug-in hybrid vehicles by 2020, with a cumulative production and sales volume of more than 5 million units. By 2015, the average fuel consumption of passenger cars decreased to 6.9 L/100 km and the fuel consumption of saving energy passenger cars was less

than 5.9 L/100 km. By 2020, the average fuel consumption of passenger cars decreased to 5.0 L/100 km. The fuel consumption of energy-saving passenger cars was less than 4.5 L/100 km. The research and development of energy-saving vehicles and new energy vehicles were conditioned to release the pressure on energy and the environment and quicken the transformation of the vehicle industry. “Management methods of fuel consumption labels for light-duty vehicles” and “Fuel consumption evaluation methods and targets for passenger cars” were introduced to improve the development and application of advanced energy-saving technology and make sure the fuel consumption target’s came true.

According to the “Development plan of energy-saving and new energy automobile industry (2012–2020)” and “Fuel consumption evaluation methods and targets for passenger cars”, the corporate average fuel consumption (CAFC) target evaluation system for passenger cars was implemented in 2012. The “Measures for the Accounting and Management of Corporate Average Fuel Consumption of Passenger Car (CAFC-Draft)” was announced to obtain advice from all sectors of society. In 2013, the “Measures for the Accounting and Management of Corporate Average Fuel Consumption (CAFC) of Passenger Car was published by the MIIT together with NDRC, the Ministry of Commerce, the General Administration of Customs, and the State Administration for Market Regulation.

2.3. Third Step: 2014–2020: Infrastructure Policies

In the first step and second steps of the NEV industry policies, most demonstration cities focused on public service fields for NEV applications, and the private-passenger car market was less involved. Thus, it was much easier to establish and manage the recharging infrastructure to meet the NEV fleet applications. However, with the penetration of energy-saving and new energy vehicles into private purchases, developing an extensive charging station network is becoming more and more urgent. Subsidy policies widen the deployment of new energy vehicles, but the subsidy incentive policies for new energy vehicles also bring extra financial burdens to the government and cause some problems with subsidy cheating. Subsidy cheating is harmful to the equal competition of the market and hinders the healthy development of the vehicle industry. Therefore, the Chinese government intends to transition plug-in electric vehicle support into a more supply–push approach, indicated by the reduction in purchase subsidies, the enforcement of restrictions on the corporate average fuel consumption (CAFC) rate, and the implementation of the plug-in electric vehicle quota policy [26].

In the third step, the special guide policy for recharging infrastructure is promulgated. The “Notice on Rewards for the Construction of New Energy Vehicle Charging Facilities” suggests that the reward funds must be used for the construction and operation of charging stations, the upgrading and transformation of charging infrastructure, and the operation supervision system of charge and replacement. It shall not be used for subsidies for the new energy vehicles purchase, etc. According to the “Development plan of energy-saving and new energy automobile industry (2012–2020)” and “Guiding opinions on accelerating the promotion and application of the new energy vehicles”, guiding the charging infrastructure construction of electric vehicles is integral. The “Guidelines for the Development of Electric Vehicle Charging Infrastructure (2015–2020)” were enacted by NDRC in 2015 [27]. The charging infrastructure is key for the promotion and application of electric vehicles (EV), and it also is a significant strategic measure in energy consumption reform.

However, financial subsidies were withdrawn from 2016 onwards, step by step, and because of the exposure of several “subsidy fraudulent” incidents in 2015, subsidies reduced. The subsidy standard of new energy vehicles declined by 20% in 2017 and 2018 compared to 2016, and by 40% from 2019 to 2020. After 2020, the subsidy policy was withdrawn [28]. To advance the new energy vehicle technology and reduce the fuel consumption of traditional vehicles, the “Measures for the Parallel Management of Average Fuel Consumption and EV Credits for Passenger Car Companies (Dual-Credit Policy)” was introduced in 2017. The introduction of a dual-credit policy regime, reflecting the development of the electric vehicle policy, changed the initial design stage into the stage of early response and urged corrective actions to assess the policy’s effectiveness [9]. Chinese new energy vehicle credit regulations are a development of California’s zero-emission vehicle (ZEV) regulations. The policy requires that the numbers of the NEV credits to the conventional vehicle numbers from auto companies must be no smaller than the government’s requirement for the new energy vehicle credit ratio. However, there are significant differences between these schemes in policy design and implementation [3], as shown in **Table 1**.

Table 1. Comparison between China’s NEV and California’s ZEV credit regulations.

Features	China’s NEV Credit Regulation	California’s ZEV Credit Regulation
Associated with CAFC/CAFE	Yes	NO
Scope	Nationwide	California and 9 other states
Applicable manufacturer	Production of traditional cars per year > 30,000	Average sales of traditional cars in the previous 3 years > 4500
Credit proportion requirement	2021: 14%; 2022: 16%; 2023: 18%	2018: 4.5%; 2019: 7%; 2020: 9.5%; 2025: 22%
Encouraging vehicle	BEV/PHEV/FCV	PHEV/BEV/FCV
Credit trading	Free trading	Free trading
Expiry date	Allowed to be carried over annually	Allowed to be carried over annually
Punishment	Administrative punishment: suspension of production	Financial punishment

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