

The Current Status, Barriers and Development Strategy of New Energy Vehicle Industry in China

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Abstract—Developing new energy vehicle industry is critical for China to cope with the energy and environmental challenges, and to promote the technological innovation, transformation and upgrading of the automotive industry. In this study, the current status, achievements and barriers of China’s local new energy vehicle industry are comprehensively reviewed. Details are explored in terms of regional protectionism, infrastructure deployment, business model innovation, and “subsidy-cheating” phenomena during the development process. Based on the analysis, the strategy for accelerating the development of China’s local new energy vehicle industry is proposed.

Keywords—component; new energy vehicle; electric vehicle; automotive industry; development strategy

I. INTRODUCTION

As the energy and environmental challenges are increasingly severe, many countries have formulated strategy for the development of new energy vehicles (NEV). Global automotive industry has entered into the energy-efficient and low-carbon development stage [1], [2]. Simultaneously, China has reached consensus on developing new energy vehicle and takes it as the national strategy. For China, developing new energy vehicles is not only significant for the construction of a stronger automotive nation [3], [4], but also crucial for dealing with issues of energy security, excessive carbon emissions and air pollutions [5]. Meanwhile, in the automotive field planning of China Industry 2025, energy-efficient vehicles and NEVs are listed as one of the key fields. It was clearly proposed that the development goal of NEVs is to account for about 20% of total Chinese automotive market by 2025 [6].

In 2015, China’s NEV production and sales volumes were 379,000 and 331,000 respectively, up by 3.8 times and 3.4 times year on year. The market share of NEVs historically broke 1%, topping the world [7]. During the rapid development course of China’s NEV industry, both national and local governments have played significant roles in guiding and supporting the NEV industry [8]. From the perspective of industrial development, NEV industry cannot entirely depend on the support by the central government. As the regional management authorities, local governments shall play an indispensable role likewise. From the perspective of transformation and upgrading of local industries, developing NEVs is a crucial strategic opportunity for focusing on green

transportation and establishing low-carbon cities during the course of new-round urbanization construction [9]. Currently, Chinese government adopts the two-pronged approach for promoting NEVs supported by both central and local governments. In 2015, Chinese government introduced over 20 policies in top-level design, NEV promotion and application, and purchase subsidies. Meanwhile, local governments also introduced relevant documents to increasingly support and fuel the development of NEV industry, including NEV purchase subsidy infrastructure supporting deployment and so on [10]. However, favorable and unfavorable performance is intermingled in the process of promoting the NEV development. Some prominent problems exist, such as regional protectionism, slow development of infrastructure setup, unitary business model, and “subsidy-cheating” phenomena, which hinders the NEV development to some extent.

In this paper, the current status of local NEV industry is comprehensively illustrated. The issues existing in the development process are deeply analyzed. And the targeted coping strategies and specific suggestions in promoting the sound development of local NEV industry are put forward.

II. CURRENT STATUS

China’s NEV industry has achieved a considerable development in recent years and many local governments have introduced NEV policies to accelerate the progress. Despite the NEV promotion task in the first period between 2009 and 2012 is far from the expected goal, it is just the precisely continuous support by the central and local governments that lays a foundation for NEV industry achieving breakthrough development, thereby over fulfilling the NEV promotion task in the second promotion period between 2013 and 2015.

A. Government Incentives

The central government has introduced policies to support the NEV promotion and application for three consecutive stages since 2009. In the meanwhile, the NEV pilot cities gradually increase, and some local governments introduced the preferential policies with distinctive features.

In January 2009, four ministries and commissions jointly launched the “Ten Cities One Thousand Energy-Efficient and NEV Demonstration and Promotion & Application Project”. As the first time for implementing promotion and demonstration work of energy-efficient and NEVs, the

Project plays a positive role in increasing public awareness of NEVs and enlarging the market shares. The various supportive policies issued by local governments provided powerful safeguard for the promotion work between 2009 and 2012.

During the second NEV promotion period (2012-2015), local governments issued policies in development planning, financial subsidy, promotion plan, and infrastructure setup in line with their own fiscal capacity, which played an active driving role in the development of local NEV industry.

During the third NEV promotion period (2016-2020), combined with *Notice on NEV Promotion and Application Financial Support Policy from 2016 to 2020*, local governments accelerate the layout of NEV industry. Multiple provinces and cities have clearly defined the NEV development directives and relevant subsidy standards in 2016, and others are speeding up the formulation of their regional policies. Local governments introduce multiple preferential policies to intensify the NEV promotion, such as without implementing traffic restriction and purchase quota, electricity price discount, free parking, releasing new energy freight car traffic permit, and vehicle license for free [11].

B. NEV Market Development

From 2009 to 2012, 25 demonstration cities promote 27,432 energy-efficient vehicles and NEVs, including 23,032 units in public service domain, and 4,400 units in private domain. There is a certain gap for achieving the fixed goal of 10% of automotive market share.

From 2013 to 2015, the promotion areas are extended to 39 demonstration areas, 88 cities, with promoted NEVs 383,285 units, completion rate reached 114% [7]. The areas with high promotion rate of NEVs are concentrated in the Beijing-Tianjin-Hebei Region, Yangtze River Delta and Pearl River Delta, with concentration ratio up to 63%.

In terms of NEV promotion purpose, NEV mostly promoted in the public service domain accounted for the majority. The private and public service area accounted for 35.78% and 64.22% respectively. Among the promoted vehicles, passenger cars were dominant. The promotion amount of battery electric passenger cars and plug-in hybrid electric passenger cars were 168,100 units and 71,207 units respectively; the promotion amount of battery electric buses (including battery electric special-purposed vehicles) and plug-in hybrid electric buses were 118,388 units and 25,587 units respectively, as indicated in Fig. 1. Besides, fuel cell vehicles were being in the starting stage of product development at present, merely promoted for 6 units in 2015.

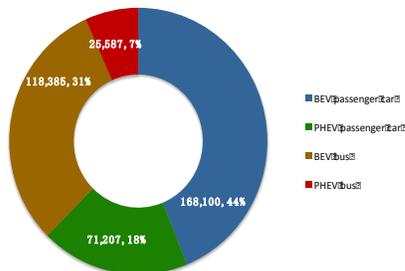


Figure 1. Proportion of NEV promotion models from 2013 to 2015.

During the NEV promotion process, Beijing, Shanghai, Guangdong, Zhejiang and Jiangsu set an example for other cities nationwide in creating new models, and innovation by combining with their own distinctive urban features, thus forming unique promotion highlights [12], [13].

III. BARRIERS

The production and sales volumes of NEVs grow rapidly in China, which is the achievement reflection of supportive policies issued by the central and local governments. The local governments play a government-dominated role in the promotion and application process according to the state will of gradually improving supporting policies. However, some prominent problems still be exposed during the development process of local NEV industry.

A. Regional Protectionism

As the national strategy emerging industry, NEV industry obtains a large quantity of capital subsidies from the central government. However, regional protectionism tendency exists in the NEV promotion and application process at present. The major reason is that local governments are driven by their own interests and they expect to help local enterprises obtain subsidies from the central through introducing various local policies, thus making enterprises create more tax revenue and profits for the local governments. Regional protectionism modes are various which mainly include local enterprise restrictions, technological standard restrictions, and miscellaneous procedure restrictions.

Regional protectionism separates the NEV market, which is against the market operating rule, and imposes restrictions on the regular development of enterprises. Moreover, it even damages the consumers' interests, and deviates from the national strategic directions of developing NEVs, severely hindering the development and promotion of NEV industry in China [14]. Meanwhile, some local governments have many excuses in fulfilling their subsidy promises to the automotive enterprises, which impedes the promotion of NEVs and poses negative effects on the credit standing of local governments.

B. "Subsidy-Cheating" Phenomenon

To promote the development of NEV industry, the central and local governments introduce plenty of supportive policies, especially in financial support. Although the subsidy policies play a crucial role in the development of excellent enterprises with quality technologies and products, some enterprises seize the chance seeking unjust benefits, which poses negative effects on the sound development of NEV industry.

Tempted by the high subsidies, some manufactures overlook the product quality and performance, causing inferior reliability of some NEV products in the market. The local governments are lack of strict examination in product parameters and quality inspection while allocating subsidies. Meanwhile, systematic regulation mechanisms are also lack in the application and allocation of NEV subsidies, which indirectly increases the possibility for "subsidy-cheating"

enterprises. The “subsidy-cheating” phenomena result in confusion to some extent, and affect the development of NEV industry to some extent.

C. Infrastructures

One of the main bottlenecks for constraining NEV promotion and application is insufficient charging infrastructure setup, and lack of regional construction planning. By the end of 2015, NEV ownership in China reached 583,200 units, while merely matching 49,000 various AC and DC chargers, and 3,600 charging stations, as indicated in Fig. 2. The proportion of vehicles compare with chargers is far less than the actual demands, difficult to meet the daily operating requirements of NEVs effectively.

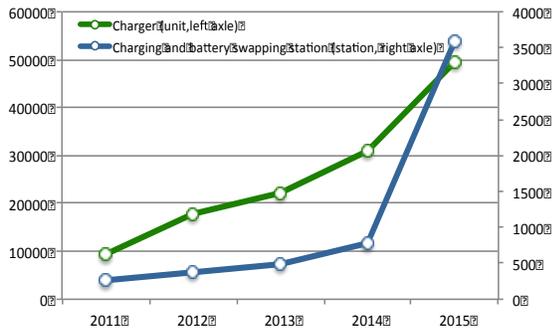


Figure 2. Quantity of NEV chargers and stations.

There are four major problems in infrastructure setup. Firstly, some local governments are lack of attention to the development of charging infrastructure, without a clear development path, deficient in supporting policies and insufficient promotion of advanced patterns in some regions, like Wanbang charging mode [15], [16]. Secondly, do not properly deal with the relationship among right, responsibility and benefit. Inadequately consider the charging infrastructure setup in the relevant planning of urban construction. Insufficiently promote the coordination of sites that are difficult to install charging infrastructure, like residential areas and social parking lots. Charging infrastructure financial and taxation policies mismatch with electric vehicle supportive policies, causing inadequately attracting social capital [17]. Furthermore, charging network is not sufficiently connected. The established chargers are mainly used to meet the enterprises’ own needs and they are “isolated islands”, lack of effective mutual communication, and wasting a lot of public resources. Meanwhile, charging network and power grid is lack of effective combination. The out-of-order charging infrastructure setup will increase the burden of power grid, and enlarge differences between peak and valley, and even may threaten the safety of power grid in server cases [18]. At last, use ratio of chargers needs to be improved, and local governments are lack of effective management and protection mechanisms for charging infrastructure. Numerous public charging parking lots are occupied by non-electric vehicles, and charging lots are occasionally considered as common parking lots, reducing the efficiency of resource allocation of charging

infrastructure, and even increasing the burden of NEV consumers.

D. Innovation and Business Models

As the “newly-born” products, NEVs are still in weak status compared with traditional vehicles, and need more development impetus by business model innovation, which is far from satisfied [19]. In 2015, traditional passenger cars accounted for 85.9%, while NEVs only took 45.4%. It follows that NEVs have great potentialities in passenger car field compared with traditional vehicles, as indicated in Fig. 3.

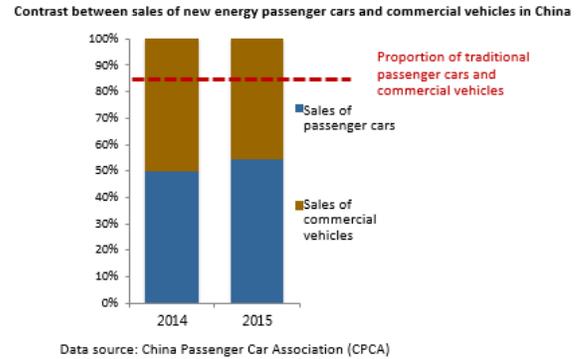


Figure 3. Contrast sales between new energy passenger cars and commercial vehicles in China.

Firstly, NEV industry still mainly adopts the traditional business model in various regions, namely outright purchase pattern, especially dominated by group clients (like bus companies). Group clients directly trade with NEV manufacturers, continuing the traditional model of “cash on delivery”. Secondly, some local governments are lack of support and guidance for the exploration and innovation of business models, and the application of new-type business models like time-sharing rental, vehicle leasing, sales replaced by rental, and battery leasing is limited. The gap in the business models possessing profitability and sustainable development remains to be filled. Thirdly, during the process of promotion and application of NEVs, local governments do not consider the particularity of NEV products, and frequently copy the traditional automotive business models, lack of making use of NEV product features sufficiently to innovate business models, thus promoting the marketization of NEVs.

IV. DEVELOPMENT STRATEGY

The sound development of NEV industry in China should be based on the effective interaction between the central government and local governments. The central government should make national top-level design, point out the strategic direction, and reform the assessment mechanisms of local governments, and clearly define the goal orientation of local NEV industry development, and give appropriate encouragement and incentives. Meanwhile, stepwise formulate more scientific and reasonable mechanisms, such as leading in NEV, CAFC (Corporate average fuel consumption), and carbon emission credits trading system, to

give full play to the regulatory role of market. In fact, the Chinese government is actively promoting it. Local governments should resolutely implement the national strategies, and safeguard the unified market of NEVs and reasonably formulate the local government plans combined with local conditions, and highlight local features, such as preferential policies of without carrying out traffic restriction and purchase quota for NEVs in megacities. The infrastructure advancement and model innovation are especially required to be facilitated by local governments.

A. *Top-Level Design*

Local governments should spare no effort to implement the strategic deployment of central government in regard to NEV development, strengthen understanding of market disciplines, opening orders, and innovation rules, and release vitality of local NEV industry.

Firstly, local governments should straighten up the management system of local NEV industry, formulate top-level design for the development of regional industry, and earnestly complete the organization and implementation tasks of technology plans. Secondly, local governments should formulate systematic, continuous, and transparent portfolio policies standing in the height of economic transformation and upgrading and building energy-efficient and low-carbon society. Actively implement the transformation of government functions, comprehensively arrange and deploy long-term and feasible promotion and application policies of local NEV industry, and accomplish government regulation work, and facilitate the sound and sustainable development of local NEV industry. At last, local governments should accelerate the setup of major supportive platforms, like popular entrepreneurship, crowd-sourcing, collective support and crowd-funding platforms, effectively give full play to the roles of innovative subjects including enterprises, universities, and scientific research institutions, optimize entrepreneurial innovation ecology, and coordinate innovation resources, and improve innovation efficiency, and set up complete NEV innovation systems and innovation value chains.

B. *Private Market*

Local governments should actively seek entry points of private consumption markets of NEVs from the perspective of customer demands, and explore the duplicable successful promotion models stepwise.

Firstly, local governments should formulate clear promotion planning, policies and programs, including the promotion and application amount of NEVs, supporting infrastructure setup, relevant supportive policies, and operation management models, and strengthen the supervision over law enforcement. Meanwhile, based on the requirements of long-term and sustainable development, break away from the awareness of “regional protectionism”, and ensure the unified market during incubation period for NEVs, and resolutely prevent the occurrence of “subsidy-cheating” phenomena. Secondly, local governments should further increase the purchasing in public field, and strengthen extension in public sector such as bus, taxi, environmental

sanitation and logistics, improve the utility rate of NEVs in the state-financed vehicles. Actively conform to the requirements of Implementation Plan for Purchasing NEVs by Governments and Public Institutions, namely the proportion of NEVs in state-financed vehicles no less than 30%, and vigorously promote in the rental field. Furthermore, compared with traditional passenger cars, new energy passenger cars still possess huge market size. Local governments should actively exploit private consumption market, and provide convenient conditions for private consumption in vehicle loan, insurance, parking, traffic, and service, and prioritize to promote for the conditional areas, and form scale effects as soon as possible. Finally, strengthen format innovation of business models. Local governments should promote the innovation and application of business models in NEV field, and effectively improve the cognition degree of NEVs for consumers.

C. *Infrastructure Deployment*

Local governments should vigorously promote the implementation of new national charging standards, and old charger transformation project, and connect the charging infrastructure, and deal with three key problems, namely standardization of charging port, upload data, and settlement system. Oriented to the setup of future electric smart cities, expand multiple business models by attracting the social capitals, and accelerate the development of charger networks and hydrogen fueling stations in medium and large cities, and sufficiently encourage the local governments to play a due role.

Firstly, local governments should practically strengthen organization leadership and compile NEV promotion and application implementation plans between 2016 and 2020 combined with regional actual conditions. According to the principle of “chargers and stations before vehicles”, local should accelerate the formation of charging infrastructure system featuring appropriate advance, reasonable layout, and scientific and high-efficiency. Secondly, local governments should positively introduce special encouragement measures in old charger upgrading in line with the new national standards, and complete the upgrading as soon as possible. Thirdly, local government should innovate the charging infrastructure setup, and operation models, and actively learn the advanced promotion experience from other areas, like “crowd-funding” model in Changzhou. Fourthly, local governments should strive to promote the connectivity of charger data in the region, and its smart connectivity with power grid, further improving charging efficiency. Positively build national advanced smart charging service demonstration areas, and lay a foundation for the nationwide connectivity. Fifthly, the trend of ecology remodeling and industrial transfer make new-round urbanization face a crucial opportunity. Under the synergy effects of urban agglomeration, the middle and lower reaches of Yangtze River, Northeast urban agglomeration, and Chengyu urban agglomeration may establish a unified charging infrastructure standard system by optimizing resource allocation, which will promote the development of local NEV industry.

D. Government Role

The development of China's NEV industry is shifting from being driven by policy to driven by both market and policy. More scientific and complete supervision mechanisms and guiding functions will be introduced. The NEV subsidy will diminish stepwise in 2020, and the direct financial subsidy era is about to be terminated.

During the critical period, local governments should even make use of supply-side reform to prevent negative impacts on NEVs in case of subsidy diminishing. On one hand, force enterprises to realize breakthrough in core technologies by increasing investment of technology-oriented R&D. On the other hand, local governments should even improve supervisory efficiency, thus promoting the stable transition of NEV industry to market development. Otherwise the previous policy and subsidy support will lose its significance.

V. CONCLUSIONS

NEV industry, as the national strategy of China, is not only an effective approach for relieving the energy pinch and environment pollution, but also a crucial part of establishing a harmonious automotive society, or even a crucial support for China become a stronger automotive country. Developing NEV industry requires the effective cooperation and coordination between the central government and local governments, thus the nation strategic goal can be smoothly reached. Meanwhile, developing NEVs provides a great strategy opportunity for regional transformation and upgrading, and building harmonious green cities. Therefore, this paper suggests local governments should actively give play to initiative spirit, impelling action, coordinating ability and regulating function, and specifically deal with bottleneck problems like regional protectionism, infrastructure setup, business model innovation, and "subsidy-cheating" phenomena by making use of different regional advantages. Effectively advance the smooth transition of NEV industry from policy-oriented to market-oriented, and promote the rapid and sustainable development of NEV industry are the significant task for local governments.

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