Business Models for Electric Vehicles in China

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Keywords: Electric vehicles; Business models; Fast-charging model in Shenzhen; Battery-exchange model in Hangzhou.

Abstract. The problem of global warming and energy shortage is becoming more and more serious in recent years, especially in China. So China attaches great importance to the development of electric vehicles, which are considered as an effective way to deal with the global energy crisis and environmental pollution. And years of the electric vehicles demonstration practices show that, business models play important roles in promoting the industrialization of electric vehicles. Therefore, the paper chooses electric vehicles as its research object, adopts the classic business model analysis framework, tries to analyze two typical business models in China, fast-charging model in Shenzhen and battery-exchange model in Hangzhou, then discusses the obstacles and policy suggestions in the process of business model promotion. The paper concluded that, different business models have different strengths and weaknesses, and feasible business models for electric vehicles that can be promoted to the whole country should be further explored.

Introduction

Electric Vehicles

Electric vehicles refer to cars that are powered by the vehicle power supply system, driven by the electric motor, and in line with the requirements of road traffic regulations and safety regulations [1]. Electric vehicles include blade electric vehicles (BEV), hybrid electric vehicles (HEV) and fuel cell electric vehicles (FCEV).

Policy

In 2009, China launched the Ten Cities and Thousands of New Energy Vehicles project. The main content of the project is that, by providing financial subsidies, it needs to develop 10 cities and each of these cities needs to promote 1000 new energy vehicles each year, to carry out demonstration in about three years [2].

In September, 2013, the state issued a policy called "the notice of continuing promoting new energy vehicles," that means the subsidy policy of new energy vehicles was promulgated and the specific amount of subsidies was implemented. In April 2015, the Ministry of Finance in China had modified the subsidies in 2016 and the specific amount is shown in Table 1.
In 2014, the State Council issued a notice about exempting the new energy vehicles from vehicle purchase tax. Its content is that, from September 1, 2014 to the end of 2017, blade electric vehicles, qualified plug-in hybrid electric vehicles and fuel cell electric vehicles, that obtained licenses to sale in China (including imports), can exempt from vehicle purchase tax.

**Status Quo**

China began to research and develop major science and technology projects in electric vehicle field since 2001. After ten years of hard working, we have made major breakthroughs in some key technologies, and established an electric car industry chain technology system [3] with independent intellectual property. Coupled with the demonstration and policy support in 2009, the Olympic Games and the World Expo, China's electric vehicle industry is developing rapidly in recent years, mainly reflected in the following aspects:

(1) The production and sales of electric cars continued to increase. According to the latest data released by China Association of Automobile Manufacturers, in 2015, the production of new energy automobiles was 340,471 and the sale was 33,102, and compared to the production and sale in 2014, there respectively have 3.3 times and 3.4 times increase. Among them, the production and sales of the pure electric car were respectively 254,633 and 247,482.

(2) The exploration of business models for electric vehicles have made some achievements. Now we have formed a number of business models for reference in major demonstration cities, such as fast-charging and Putian model in Shenzhen, battery-exchange and Micro bus model in Hangzhou and Targeted Buy model in Hefei (see Table 2).

**Business Model Analysis Framework for Electric Vehicles**

A business model is the set of which activities a firm performs, how it performs them, and when it performs them as it uses its resources to perform activities, given its industry, to create superior customer value (low-cost or differentiated products) and put itself in a position to appropriate the value [4].

A structured approach which implicitly follows the above definition and includes a
methodical procedure differentiates business models into three elements [5]:

(1) Value proposition: Defines the promised value of a product offered by the manufacturer to the client beforehand. When looking at the classical business model for internal combustion engine vehicles, the car manufacturer promises to deliver the customer a high quality vehicle with the individual features the customer wanted.

(2) Value chain configuration: Describes the potential possibilities to design the product offered with regard to the different shareholders involved in a business model. These shareholders include electricity suppliers, vehicle and battery suppliers, users, third-party players and so on.

(3) Revenue model: Fixes the type of payment the customer makes to the supplying shareholder as part of the offer. The overall value of the value network will eventually revert to the value of the enterprise and customer related [6].

Currently, conventional vehicles have achieved industrial development and formed its own business model. Traditional and electric vehicles are similar in their core values—providing travel services. So if we want to achieve further development of electric vehicles, it is necessary to make breakthroughs in battery technology, which in turn will bring higher costs, thus not conducive to the promotion of electric vehicles. Therefore, it is imperative to explore new business models that suitable to electric vehicles.

Case Analysis

Our exploration of business models for the electric vehicles began in 2009. These years there has emerged a variety of business models for reference, but the most important is the fast-charging model in Shenzhen and battery-exchange model in Hangzhou.

Fast-charging Model in Shenzhen

Fast-charging model in Shenzhen is mainly used in Shenzhen taxi areas. Its main features are: "fast charging, vehicle sales, third-party operators [7]."

Value Chain Configuration. Fast-charging model in Shenzhen is a mode of vehicle sales. Vehicle sales model needs to integrate the battery into the vehicle and the sell the car to the customer. In fast-charging model, BYD company, that has the qualification to product vehicles, carries out the work of integrating the battery and vehicle, then sells the cars to its customer—Pengcheng taxi company. Electricity operators mainly held by China Putian Corporation. In this value network, it mainly provides charging service through constructing the fast-charging station and its electricity is obtained from the China Southern Power Grid. On this basis, Pengcheng taxi company hires taxi drivers to operate and meet the needs of passengers (see Fig.1).
Revenue Model. In the fast-charging model in Shenzhen, Pengcheng taxi company stays in the core position. Its funding has two main sources: one is the fixed rent from taxi drivers, the second is the subsidies from the national and local governments. Its expenditures are the vehicle acquisition costs, wages paid to taxi drivers and charging fees. As a car manufacturer, in this model, BYD can get a one-time income by selling cars. As an electricity operator, Putian gets its revenues mainly from offering the charging service for the electric taxies, and its expenses include infrastructure construction costs and electricity purchasing costs. Currently, the consumers’ main spending is the cost of a taxi ride, and the standard of electric taxi fees is similar with the general taxi, but passengers do not need to pay fuel surcharges.

Evaluation

(1) Advantages: First, for automotive manufacturers, the adoption of this model can help them to get back the full amount of the cars at once, thereby reducing the risk. Second, since the battery is located in rear of the car and the back seat is relatively high, so the customers sitting in the back seat can have a good vision. And compared with the traditional cars, pure electric automobiles have little shock. Third, charging flexibility, thus can avoid the impact to the grid when a large number of electric vehicles charging at the same time.

(2) Disadvantage: Taxi companies should pay for the electric vehicles in one-time, so it is likely to cause a shortage of funds; the mileages of electric cars are shorter and charging time is longer, so it makes many taxi drivers spend a lot of time to wait in the charging station; in general, the life of battery is shorter than the vehicle, which makes the taxi company face the risk to spend much money on replacing the battery; this mode requires a lot of infrastructures, which needs a lot of investment to construct.

Battery-exchange Model in Hangzhou

As one of the country's new energy vehicle demonstration cities, Hangzhou has promoted the new energy vehicles for more than five years, and the application of new energy vehicles mainly gathered in the public sector, such as taxi personal leasing and buses, etc. So the business models Hangzhou explored still gather in the public domain, and the
battery-exchange model is the case, characterized as: "quick change power, naked car sales, battery lease" [7].

**Value Chain Configuration.** Battery-exchange model in Hangzhou is a kind of "naked car sales + battery lease", i.e. electric vehicles (without battery) and batteries are sold separately. In this model, in order to operate normally, the Hangzhou New Energy Taxi company needs to buy naked cars from car manufacturer Zotye and lease batteries from electricity operator—electric car service company in Hangzhou and the batteries will not be sold but only be rent. To provide battery rental services, the Electric car service company often needs to purchase a large number of standardized batteries from manufacturers, and cooperate with the National Grid to purchase electricity. In addition, it also needs to construct power plants to exchange batteries and offer maintenance (see Fig.2).

![Figure 2. The structure of Battery-exchange model in Hangzhou.](image)

**Revenue Model.** In this model, the electricity operator—the Electric car service company is in the core position and its main source of income is the new energy battery rental fee charged from the taxi company and the battery-exchange fees. The expenditure includes construction costs for power plants, battery purchasing cost and the electricity fees paid to the National Grid. Besides, the New Energy Taxi company also plays an important role. Its expenses include the battery lease fee, naked car purchasing costs and other operating expenses, while its revenues mainly from operating income and government subsidies.

**Evaluation**

(1) Advantages: Naked car sales greatly reduce the purchase price. Plus the subsidies from the state and local, the price will be competitive; using battery exchange can greatly reduce the waiting time of the users and improve the efficiency; for scrapped batteries, power operators can achieve its secondary use as a short-term energy storage unit.

(2) Disadvantage: On one hand, this model requires different automakers to promote standard batteries, which in turn tends to touch the interests of them. On the other hand, it also requires the naked cars to achieve the function of quick release, which needs certain skill level
and still has some risks. Finally, naked car sales make the automobile companies lost the core components production, and thus do bad for the competition improvement[8].

Discussion

Problems

Although Shenzhen and Hangzhou has explored feasible business models for electric vehicles, but it still faces many difficulties to promote it to the whole country.

(1) It is difficult to make breakthroughs in battery technology in the short term. For electric vehicles, the battery is the core factor. But at the current level of technology, the short battery life cycle, long charging time and short mileage often limit the further development of electric vehicles.

(2) The consumer acceptance is low. If we want to achieve a large-scale promotion of the business models, the electric vehicles must have a certain consumer bases. That means, in the present circumstances, it must take the user acceptance into consideration. Now, many consumers have realized the energy saving and environmental protecting effect of the electric vehicles, but the high prices and short mileages make the consumers discouraged for electric vehicles.

(3) The interest allocation mechanism in the business model has not yet formed. The main purpose of stakeholders involved in the business model is to obtain benefits. But, which business models to choose and how to allocate the subsidies and profits are still not clear, which make the stakeholders unlikely to achieve any benefits, thus suppressing the initiative, thereby hindering the promotion of business models.

(4) The combination between business model and the promotion region is not enough, and different regions lack coordination. The promotion of business models is affected by cities’ size, function and field. But it is the different characteristics of different regions that make the choice of charging or exchange, bundling the vehicle and battery or not so difficult, thus increasing the difficulty to promote.

(5) Infrastructure issues. Few infrastructures may not meet the demand for charging or exchanging the battery of electric vehicles. But more infrastructures may spend excessive construction costs. Therefore, it is better for us to combine with the number of city-owned electric vehicles to maintain the appropriate number of charging or exchanging station.

Suggestions

(1) The government should develop a unified plan to promote business models, clear the objectives and directions, strengthen the guidance of investment, create a good environment, and then strengthen the publicity to raise consumer acceptance.

(2) Strengthen the policy support, further increase subsidies of electric vehicles from the state level and local level, implement relevant policies, effectively lower the price of the private car, and improve the competitiveness of electric vehicles, thus attract the targeted consumers; on the other hand, we also need to increase investment to the research of batteries and other key technologies, and encourage technological innovation, to achieve technological breakthroughs, and thus lay the foundation for the promotion of the business models.

(3) Form an interest distribution mechanism that can be accepted by all parties involved, and mobilize their involvement in business model innovation initiative and encourage all relevant parties to carry out research and development activities to form their the core competitive advantages.
(4) Continue to carry out demonstration activities in different regions, and combine with
different characteristics in different areas of the city to explore specific and feasible business
models and promote innovation; then identify and conclude the problems occurred in the
process of the demonstration to provide practical support.

Conclusion
Although the electric vehicle industry has been developed to some extent and the exploration
of business models has had some achievements, we still have many things to be solved. If we
do want to explore a business model that can be promoted to the whole country, we must pay
great attention to the existing problems, which include not only technical problems, such as
batteries and infrastructures, but also problems like consumer acceptance and interest
allocation mechanism and so on. At the same time, it is also important to combine
governments, stakeholders and consumers, strengthen the government's guidance and promote
the participation of stakeholders to improve consumer acceptance degrees, and continue
carrying out experimental work.

Acknowledgement
The research reported here was supported by the key project of China’s National Social
Science Foundation (Project no. 16AGL004).

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