

Research on the Development Strategies of New Energy Automotive Industry Based on Car Charging Stations and Battery Management

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Abstract

With the continuous development of economy and progress of social, people for energy use more and more widely in the direction of new energy. In the use of new energy, automobile industry has continued to explore, new energy automobile industry mainly refers to the use of new fuel and power energy, now advanced technology on making the new energy automotive industry can get greater development. The automotive industry is an important pillar industry of the national economy and plays an important role in the national economic and social development. With China's sustained and rapid economic development and urbanization accelerate, the future demand for the car will maintain the growth momentum for a longer period of time, the resulting that energy shortage and environmental pollution problems will become more prominent. The emergence of new energy vehicles can effectively alleviate the energy and environmental pressures, and to promote the sustainable development of the automobile industry, how to solve large-scale electric vehicle charging is a key factor. This paper analyzed definition and classification of new energy vehicles, the development of automobile industry and its impact on the environment, analysis of vehicle charging station, to maintain stable economic growth and improve people's living standards have an important strategic meaningful conclusions.

Keywords: *new energy, automobile industry, environmental pressures, strategic*

1. Introduction

Challenges the current energy, environmental issues, in response to the increasingly prominent contradiction between supply and demand of fuel and environmental pollution problems, major car producing countries in the world regard the development of new energy vehicles as improving industrial competitiveness, major strategic initiatives to maintain sustainable economic and social development, accelerate technology development and industrialization, while vigorously develop and promote the use of energy-saving technologies cars. Development and application of new energy vehicles have become the overall trend of the world automobile industry; the automobile industry has become a new growth point. New energy vehicles represent the future direction of the automotive industry over the next decade will usher in the global automotive industry transformation and upgrading of important strategic opportunities. Our current car production scale ranks first in the world, is expected to continue growing in the coming period, we must seize the opportunity, seize the deployment, accelerating the cultivation and development of energy-saving and new energy automotive industry, promote the optimization and upgrading the automobile industry, the automotive industry to achieve by country changes to the automotive industry powerhouse [1].

The significance of the development of new energy vehicles are:

First of all, the development of new energy vehicles is an important measure to alleviate the shortage of oil. In recent years, the rapid development of China's automobile industry has become the world's fourth largest car producer and the third largest auto consumer. According to data provided by the State Council Development Research Center, in 2013 China's car ownership is close to 60 million units in 2020 is expected to reach 140 million, respectively, motor vehicle fuel demand for 138 million tons and 256 million tons, the country for the year 43% and 57% of total oil demand. Shortage of oil resources in China, the current oil imports as a percentage of annual double-digit growth in 2013 is close to 50% import dependence. Therefore, the development of new energy vehicles, power generation oil, is to ensure the safety of China's energy strategy measures; are needed to achieve our environmental and Chinese automobile industry by leaps and bounds, and sustainable development. While promoting new energy vehicle technology innovation and rapid development, maintaining stable economic growth and improve people's living standards have important strategic significance [2].

Second, the development of new energy vehicles is an effective way to reduce environmental pollution. According to the U.S. Energy Information Administration EIA published international energy outlook; the world energy market consumption in 2005 to 2030 is expected to increase 50 percent. With the increase in energy consumption each year, carbon dioxide emissions will also increase. The current global carbon dioxide emissions, 25% comes from the car. 2030 will be 28.1 billion tons in 2005 to \$ 42.3 billion tons. In China, pollution emissions from motor vehicles has become an important factor in urban air pollution, China's carbon dioxide emissions currently ranks second in the world, the pressure of carbon dioxide emissions will increase.

The third point, the development of new energy vehicles is the only way the automotive industry development[3]. Development of new energy vehicles is to reduce vehicle fuel consumption, ease of fuel supply and demand, reduce emissions, improve the atmospheric environment, to promote the automobile industry and technological progress and upgrading of important initiatives. With the depletion of oil resources, increase awareness of environmental protection, hybrid vehicles and electric vehicles will become the mainstream for decades before the new century automobile development, and has become the consensus of all of China's auto industry insiders. Chinese government has also been in the National High Technology Research and Development Program (863 Program) specifically listed, including hybrid vehicles, including electric vehicles of major projects.

Finally, the development of new energy vehicles is an important part of smart grid construction. Electric vehicles and smart grids by combining a win-win model. Once the national grid with charging stations, will open up the car, "rations" on the downstream supply future industrial space will be greater. The current controversy about the direction of development is that while energy companies hope to take the Japanese model, that is, in the original construction of charging stations plus the road, but the distribution chain perspective to assess, the European model is more in line with the new charging station market in China needs.

2. Definition and Classification of New Energy Vehicles

New energy vehicles refers to the use of non conventional fuels (gasoline, diesel outside) as a source of power (or the use of conventional fuels, but using a new type of vehicle power unit), advanced technology and power control and drive the overall vehicle, the technical principle, the formation of the new structure and new technology has advanced, the car, which is completely or mainly rely on new energy to drive the car.

New energy vehicles according to the power source to divide the different, mainly has three kinds: Hybrid Electric Vehicle, Electric Vehicle and Fuel Cell Electric Vehicle. According to the different types of batteries, and can be divided into the nickel metal

hydride battery powered cars, lithium battery powered vehicle and fuel cell electric vehicle. New energy automobile current types are: hybrid electric vehicle (HEV), a pure electric vehicle (BEV), fuel cell vehicle (FCEV), hydrogen engine vehicle and gas, alcohol vehicle and so on.

2.1. Hybrid Electric Vehicle

Hybrid refers to those using the conventional fuel, at the same time with the motor generator to improve the low speed power output and fuel consumption models. According to the different fuel types, mainly can be divided into gasoline and diesel hybrid two. The current domestic market, the mainstream of the hybrid vehicle is gasoline hybrid, and the international market diesel hybrid vehicle development is also very fast [4].

2.2. Electric Vehicle

As the name implies, is mainly used in electric vehicle electric drive cars, the majority of vehicles directly driven by the motor, a part of the vehicle to electric motor installed in the engine compartment, is also part of the rotor of the motor directly to the wheels as, its difficulty lies in the electric power storage technology. The harmful gas of pure electric vehicle itself does not discharge of atmospheric pollution, even according to the consumption of electricity for the conversion of emissions from power plants, in addition to sulfur and particulate pollutants, other also significantly reduced, due to power plants are mostly built in from the densely populated city, the less harm to human being, but also the power plant is fixed, concentrated discharge, removal all kinds of harmful emissions is relatively easy, have been related technology. Also because of the power can be obtained from a variety of primary energy, such as coal, nuclear, hydro, wind, light, heat, relieve people worry about the exhaustion of the oil. Electric cars can make full use of the evening low power surplus electric charge, the power generation equipment and can make full use of, greatly improving the economic benefit.

Research shows that, the same after crude oil refining, sent to the power plant, the charging battery, then the battery driven vehicles, the energy utilization efficiency than refined into gasoline, and then by the gasoline engine driven vehicle is high, so it is in favor of saving energy and reducing the amount of carbon dioxide, it is these advantages, make research and application of electric cars become a "hotspot of automobile industry". For the electric car, the biggest obstacle is the infrastructure construction and the price impact of the industrialization process, compared with the hybrid, electric cars need more infrastructure, but this is not a business can solve, need to work together to build together with local government departments in various enterprises, there will be a large-scale promotion opportunities [5].

2.3. Fuel Cell Electric Vehicle

Fuel cell vehicles refer to the hydrogen, methanol as the fuel, produces electricity by chemical reaction, rely on motor driven car. The battery power is through the chemical reaction of hydrogen and oxygen, rather than through the combustion transformation to. The process of chemical reaction of the fuel cell will not produce harmful products, so the fuel cell vehicle is a car without pollution, energy conversion efficiency of the fuel cell is 2~3 times higher than the internal combustion engine, so from the aspect of energy utilization and environmental protection, fuel cell vehicle is an ideal vehicle.

Fuel cell must be combined into a single fuel cell group, in order to obtain the necessary power, meet the requirements of the use of vehicles. In recent years, the fuel cell technology has made great progress. The world famous automobile manufacturer, such as Daimler Chrysler, Ford, Toyota and general motors have announced plans in 2014, before the fuel cell cars into the market. At present, the prototype fuel cell cars are

tested, to fuel cell demonstration projects are several city transport bus power in North America in the. But there was still a technical challenge in the development of fuel cell vehicles, such as the integration of a fuel cell, improve the efficiency of commercial electric vehicle fuel processor and auxiliary parts, automobile factory towards integrated components and reduces component cost direction, and has made remarkable progress [6].

3. The Development of Automobile Industry and Its Impact on the Environment

The automobile industry is a pillar industry of the national economy, plays an important role in the national economy and social development. With the rapid development of China's sustained and rapid economic development and urbanization process, in a long period of time in auto demand will still maintain the growth momentum, energy shortage and environmental pollution caused by the more prominent. Speeding up the cultivation and development of new energy vehicles, is effective to alleviate the pressure on energy and the environment, the urgent task of promoting the sustainable development of the auto industry, but also speed up the strategic measure of transformation and upgrading of the automotive industry, foster new economic point of growth and international competition advantage. The development of China's automobile industry is faced with many challenges from energy security, environmental protection and climate change to the requirement of sustainable development. With the rapid increase in car ownership in recent years, the automobile energy consumption growth has accelerated the trend, intensified the contradiction between China's oil supply and demand. In the current oil resources increasingly tense, prices continued to rise in the international situation, the development of electric vehicles especially hybrids is an effective way to alleviate the situation of shortage of oil resources in China, but also enhance the core competitiveness of important strategic initiatives of our automobile industry.

Status of energy, natural resources is China advantageous to the development of new energy automotive industry. Since entering the new century, new energy electric vehicle technology make a spurt of progress. Oil into the industrialization of hybrid power technology, the technology of lithium power battery has made a major breakthrough, vehicle fuel cell technology progress. A series of this technology is very suitable for popularization and application in our country under the condition of energy resources.

Carbon dioxide emissions are shown in Figure 1.

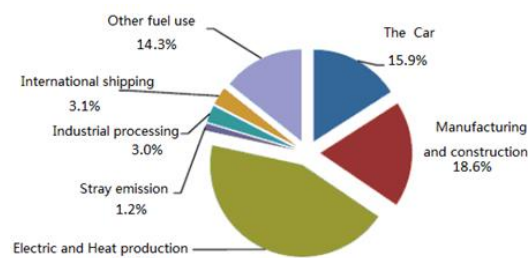


Figure 1. Carbon Dioxide Emissions

From the energy situation, compared with up to 50% foreign oil dependence, adequate power supply in China, electric power installed capacity of nearly 800000000 kilowatts, a day of low power consumption is about 10000000000 kwh, can be used for 40000000 to 50000000 electric vehicles charging, this figure will increase. At the same time, China's power source is wide, can make full use of various renewable energy and clean energy, including wind power, nuclear power and other clean energy, the proportion of more and more will be also big, the power energy with high conversion efficiency, emission is

relatively centralized, convenient transportation, widely distributed terminals and other advantages, fast enough to support the development of China's automobile society to provide adequate energy security of these conditions for the development of new energy vehicle in china.

The impact of recent large-scale haze, making from the government to the general public are aware of the necessity and urgency of new energy vehicles in use [7]. Various levels of government introduced subsidies to encourage policies to pilot a private purchase of new energy vehicles, to encourage consumers to buy new energy vehicles. Local Government to implement the new energy vehicle parking fee waiver, charging fee concessions and other support policies implemented in some places limited number of travel, license quota auction, when the car quota system and other measures, new energy vehicles treated differently. It has promoted the new energy vehicles to enter our field of vision as soon as possible.

Solar car is shown in Figure 2.



Figure 2. Solar Car

4. Analysis of Vehicle Charging Station

4.1. Analysis of the Current Situation of China's Automobile Charging Station

Charging station is a harbinger of new energy automobile era. In the new energy policy support, as the infrastructure of new energy vehicles, station is expected to start in the new energy automotive market outbreak of electric vehicle charging. At the beginning of 2009, the national grids have done charging station ten years of long-term development planning. According to the plan, by 2015 China's charging stations will reach 1700. Pull this planning passenger electric bus and EV, is expected to become a reality. Electric bus is a short period of pulling the charging station development important factors. The construction of charging facilities in the pilot area, should according to the intensive use of land, the standardized construction, to meet consumer demand for the principle, charging facilities into the city comprehensive transportation system planning and city construction related industries planning, scientifically determine the construction scale and location distribution, appropriate building, actively try to personal and public parking dispersed slowly charge and the charge mode of technology. Charging facilities is an important guarantee for the development of new energy automotive industry. Scientific planning, to strengthen the technology development, explore the effective business model, and actively promote the construction of charging facilities, to meet the need of the development of new energy vehicles industrialization. Parking in the main commercial areas, residential areas and the government sector field special parking support electric vehicles and slow charging pile, in the city's main roads and train stations, airports and other places of building public fast charging station bus station, relying on the establishment of dedicated bus charging for electric system.

Electric vehicles, new energy and green products zero pollution, with good prospects for development, and the electric vehicle charging infrastructure energy supply is the premise and the foundation of its development, the electric vehicle charging station for electric vehicle important facilities as energy supply, whether it is novel, the commercial

operation mode with high efficiency is the key to the development of the industry. In 20 to 30 years, in the fuel cell electric vehicle age did not come before, to pure electric vehicles the rapid replacement of battery, extended range electric vehicle and matched with the charging infrastructure maintenance of batteries, charging service is the best way to achieve the commercialization of electric vehicles[8].

However, at present, pure electric vehicles in the technology, operation economy, and infrastructure still exist the bottleneck of industrialization development, the need for government policy support. The popularity of pure electric vehicles through the government encourage the support policies and measures, to create a pure electric vehicle market start-up phase of the policy environment, thus promoting the commercialization process of pure electric vehicle. Must solve two problems of pure electric vehicle commercialization, one of which is the purchase cost, the second is the energy supply. In the lithium ion battery is currently the most advanced as an example, the energy ratio of only 1/50 gasoline engine, the core technology is still the defect of electric vehicle development shackles. Experts pointed out that a new energy, now the battery theory has made the development of battery technology to reach a limit, we should have found "superconductor" thinking for battery technology, change a way of thinking to construct the new theory may break. Battery technology in this point, it can be said that domestic and foreign car companies are in the same starting line. Another problem of pure electric vehicles in the course of industrialization, the energy supply is the inconvenience. This mainly includes two aspects, one is the pure electric vehicle research and development the lack of a unified standard, two is the infrastructure is not perfect. At present, some pure electric vehicles using a "plug-in" (power depletion after looking for a charging socket); but some pure electric vehicles using the "battery" (power exhausted directly to replace the battery, do not need to socket). "The pure electric vehicles, plug-in" also Tastes differ all tastes. Manufacturers not only cell sizes vary, and some even charging interface is not the same. If the electric car is production, a few years after treatment of these used batteries will inevitably become a new environmental problem. Therefore, the solution of these problems relies on the national standard as soon as possible.

Because the infrastructure is not perfect, China current charging environment seriously restricted the development of pure electric vehicles. In Chinese, unless the live private villa, or more open spaces, no charging condition. In addition, the construction of infrastructure of pure electric vehicles also need to State Grid and the related department of energy support. However, when the China State Grid Corp at the beginning of this year proposed charging stations in the planning of the 27 City National start building electric car, industry experts also expressed concern: because of the lack of national standards, charging station of the actual application effect will be greatly reduced, electric cars may cause a lot of R & D enterprise cannot enter the charging station for charging two grid.

Schematic charging station is shown in Figure 3.



Figure 3. Schematic Charging Station

4.2. Analysis of the Investment Model of Charging Station in China

A. Government led mode

The government investment of electric vehicle charging stations, can the electric vehicle charging station construction and the organic coordination of city land use planning, city power grid planning and other aspects of the implementation, so as to promote orderly electric vehicle charging station construction.

B. Enterprises leading mode

Optimistic about earnings prospects of electric vehicle charging station is an important part of the new energy use, is the direction of the development of strategic emerging industries, and adapt to the development of electric vehicles, battery charging station will also along with the further development of electric vehicles and obtain the corresponding social benefit and enterprise benefit. Seize the emerging energy market charging stations in a particular region in a certain period of time exists as a scarce resource, in other words, in a specific period and the area of electric vehicle charging stations cannot construction and expansion, the enterprise without limit, advance construction of the charging station, in advance of possession of the corresponding resources and access to the relevant market. The realization of enterprise development mode change, such as the petrochemical (petroleum) electric vehicle charging station investment enterprises, can realize the traditional energy companies gradually to the new energy enterprises to change. Power grid enterprises will be electric vehicle charging station construction into the smart grid organic composition part, can the birth of energy storage technology, but also promote the development of clean energy, to achieve resource conservation and efficient use of electricity [9].

C. Electric vehicle user driven mode

Those electric cars users meet their vehicle operation, investment and construction of electric vehicle charging station. Electric vehicle charging station user investment, is regarded as an electric vehicle infrastructure, avoid the subject to external charging station and thus to the running of the electric vehicle bring adverse effect and inconvenient.

The advantage of this model is that the electric car users can accord their own needs the construction of charging facilities, realize the effective connection electric car charging facilities of its own.

D. The theoretical basis of mixed mode

China's electric vehicle charging station construction and operation model of best choice is mixed mode. The above analysis shows that, the three modes have their respective advantages and disadvantages. At this stage, not simply take a certain kind of model, the more ideal choice should be "mixed mode of government and enterprise", namely the government participation and support enterprise leading mode. The model not only has theoretical basis, but also can overcome the pure government leading mode and simple mode of enterprise leading the shortcomings, to better meet the present charging construction and operation station needs.

The theoretical basis of the model is the rise in the twentieth Century 90's in the western developed countries, and gradually spread to the world countries and regions, countries and regions to become widely used to promote the development of public utilities in the public private partnership (Public Private Partnerships, referred to as "PPP") theory, the core idea of the theory is that the government in order to provide infrastructure needs, through the mode of contract and private (enterprise) a partnership set up shared benefits and risks. "Mixed mode of government and enterprise" is the concrete application of theory in the station construction and operation of the electric vehicle charging.

Mixed mode adaptive, current, our country electric car is in the flourishing stage, and adapt to the charging station construction and operation, but also in the rapid development, at this stage, the enterprise is difficult to achieve profitability targets station business charge. At the same time, in the charging station construction and initial operation, such as the existence of charging station layout planning, construction standards, service price enterprises themselves can not solve, only after the government participation and support, enterprises have the power and ability of the construction and operation of charging station.

The complementary role of mixed mode, as mentioned earlier, the government leading mode and enterprise leading mode has its own advantages and disadvantages, but their complementarities is very strong also, as in the charging station construction fund, funded enterprise can better overcome the insufficient government funding problems; in the operation efficiency, enterprise management can overcome its inherent operation the problem of low efficiency. At the same time, government participation and support, to enable enterprises to overcome the blindness and disorder of the charging station construction in the development of charging stations, promote technological innovation; reduce investment and the operational risk charge station.

In a mixed mode, the government is more inclined to support the construction and operation of which types of firms are charging station requires careful consideration. At present, our country enterprise intends to invest approximately have three kinds of electric vehicle charging station: petrochemical, power grid enterprises (petroleum) enterprises, other social enterprises. In the power grid enterprises is the best candidate.

4.3. Vehicle Charging Station Cost Status

Charging station construction cost, maintenance cost. The first to talk about the "most popular" Tesla super charging pile, it is reported that each of the charging pile cost about \$100000 to \$175000, of which most of the money will be used in the foundation of the remodeling. In addition, Tesla super charging pile is also equipped with a solar panel, solar panel to an extra \$150000 Of course, if you just in the Tesla's guidance make the power company staff at a 220V in your garage in the wire, so the cost is lower!

Take charge of our station, according to expert estimates, in the calculation of land acquisition fee is not the case, charging station cost three main part of the infrastructure cost, distribution facilities cost, operation cost. There are 10 chargers hypothesis charging station, charger, battery maintenance equipment, charging station monitoring and security surveillance equipment costs were 2000000 Yuan, 200000 Yuan, 200000 Yuan, and 2400000 Yuan for the cost of infrastructure. Charging station distribution cost is relatively fixed, charging station distribution facilities generally includes 2 transformers, 1 sets of power distribution cabinet, 1 km, 2 km of 0.4KV cable, 10KV cable with above 700KVA capacity active filter is installed, charging station distribution costs in 1920000 Yuan. Charging station operating costs include staff costs, station equipment consumption costs, a total of 210000 Yuan, and distribution facilities maintenance cost is about distribution costs by 3%, about 60000 Yuan a year.

According to the above calculation, point to a similar conclusion, a charging station average investment is 3000000 Yuan, a charging pile for the cost of 25000 Yuan. For large charging station, for example: a distribution of total charging capacity reached 3200000 volt ampere station, install 1600000 volt ampere transformer 2, charger, DC charging pile 30 Taiwan 30, can satisfy 30 electric buses non-stop charging. In addition to AC charging piles 15, can satisfy 15 car electric car charging society. The project is total investment of about 22000000 Yuan.

According to the country's network planning, the first phase of the main equipment for charging stations will reach a total investment of 300000000 Yuan, the second phase of 1400000000 Yuan, 1800000000 Yuan in 2020 to third stage, charging station main equipment total investment will reach 3200000000 Yuan. The main equipment in the

charger, charging station for electric power monitoring system, the active power filter of the scale of investment in 2010 will reach 150000000 Yuan, 20000000 Yuan, 63000000 Yuan, second stages of the annual average investment size will rapidly grew to 1440000000 Yuan, 160000000 Yuan, 672000000 Yuan.

One can also charge for the two hundred or three hundred car electric car charging, covers an area of about four thousand or five thousand square meters of the station investment cost in 3 ten million Yuan, the charge size gas station investment in remortgage million. However, charging stations in addition to the money also need to land, a charging station general area of several hundred square meters, in the developed city to build a large number of charging stations will be met with difficulties.

Cars of the future business will contain rations hundreds of billions of market. Electric cars the same mileage consumes electricity price is 1/3 of the oil, then according to the finished product oil terminal year over year trillion business scale, charging station business scale is expected to reach 100 billion per year.

4.4. The Car Battery Management

The charging power load monitoring station into unified power monitoring network will make full use of the power of integrated scheduling network advantage, to improve management efficiency and peak valley electricity peak load capacity.

The power grid enterprise investment charging station for charging facilities construction and operation of the legitimacy and rationality:

(A) conducive to the realization of the charging station construction and power transmission and distribution network organic cohesion power grid enterprises and construction of the charging station, can realize the organic unity of transmission distribution network planning and the development of charging station planning, transmission and distribution network construction in synchronization with the charging station construction, which can not only ensure the charging station power supply reliability and the power supply structure optimization, you can also avoid charging station construction and the development of transport and distribution network caused by the lack of coordination of waste of resources.

(B) favor of the charging station construction into the smart grid planning, promote the technical innovation of our country will be charging stations in the "Twelfth Five Year Plan" period to the development of smart grid, smart grid technology research to increase. Charging station as an organic part of smart grid, if the power grid enterprise investment and operation, power grid enterprises can be charging station will be incorporated into the smart grid energy storage for scientific research technology, thereby greatly improving the charging station and improve the technology content of energy storage technology level [10].

(C) A strong professional and technical advantages. Since the charging station and the power system of professional and technical knowledge are closely linked, by the power grid enterprise investment and operation of electric vehicle charging station, can give full play to the professional technical advantages of power grid enterprises, increase the charging station of the ability and level of service.

(D) lead the electric power grid enterprise resource optimization by charging station through investment and operation, through the power peak, use efficiency maximizing power resources, to achieve the national goals of energy saving and emission reduction. Combined with the development of distributed is energy and new energy vehicle.

(E) conducive to the maintenance of power system security and stability of electric vehicle will produce a large number of harmonics in the charging process, and the harmonic of power quality and the safety of the power grid will have a significant adverse

impact. Compared with other enterprises is more capable of charging station harmonic of power grid enterprises. Not only that, the power grid enterprises can make full use of the charging station peak, which helps to ensure the safe and economic operation of power grid.

5. Conclusion

The emergence of new energy vehicles can effectively alleviate the energy and environmental pressures, and to promote the sustainable development of the automobile industry, how to solve large-scale electric vehicle charging is a key factor, This paper analyzed definition and classification of new energy vehicles, the development of automobile industry and its impact on the environment, analysis of vehicle charging station, to maintain stable economic growth and improve people's living standards have an important strategic meaningful conclusions.

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