The Analysis of Innovation Policies for New Energy Vehicle Technology

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Abstract
Based on Liu Yuling’s innovation policy analysis framework, this paper sorted the introduction of innovation policies for new energy vehicles in various periods in China and comparatively analyzes the domestic and foreign policy, which led to the discovery of “three similarities and three differences”. Also, it raised the idea of strategic adjustment for new energy vehicle technology innovation, providing a reference for decision-making to further promote the new energy vehicle technology progress and industrialization.

Kew words: New energy vehicles; Innovation policy; Sort; Evaluation

INTRODUCTION
With the energy drain and deterioration of ecological environment, new energy vehicle has become an absolute choice for the development of automobile industries all over the world. Developed countries such as the United States, Japan and EU also attaches great importance to the development of new energy vehicles and thus introduced favorable policies. China has also introduced a number of new energy vehicle innovation policies. Encouraged by these policies, China’s made some progress in developing new energy vehicles (Liu, 2010). However, some critics think that these innovation policies are ineffective and didn’t play a real role in promoting the development of new energy vehicles (Zhang, 2010, June 30), or even hindered the innovation process of new energy vehicles. How to evaluate these innovation policies? What is the difference between China’s innovation policies and those in other countries? These are two major concerns of this paper.

According to Liu Xieling (1993), innovation policies could be divided into three categories: One is supply policy, it includes providing financial, human resource and technical assistance, the establishment of infrastructure for science and technology. Second, the demand policy, it includes government purchases, contracts. This demand is the demand for innovative products, processes and services. Third, environmental policy, it includes tax policy, patent policy, government regulation and so on, which could provide a good environment for innovation activities. In this paper, the author used Liu Xieling’s analytical framework to analyzed our new energy vehicle technology innovation policies raised in the “fifth five-year plan”, “the eleventh five-year plan”, “the twelfth five-year plan” and compared with the new energy vehicle innovation policies in other countries so as to put forward a strategic and adjustment for China’s new energy vehicle technology innovation strategic policy.

1. THE SORTING OF CHINA’S NEW ENERGY VEHICLE INNOVATION POLICIES

China has adopted supportive policies for new energy vehicle development, which has been increasing year by year. Periodically, the “tenth five-year plan” period is the initial stage for the development of new energy vehicles, government issued a limited number of policies. In the “eleventh five-year plan” period, new energy vehicles enjoyed an integrated development, during that time, a
large number of policies emerged, which amounted to as much as 16 pieces. In the “twelfth five-year plan” period, the planning for new energy automobile industry has been introduced, and great importance has been attached to the development of new energy vehicles, especially the safety management and the promotion of technology in the whole industry. New energy vehicles industry welcomed so far largest scale policy support. These new energy vehicle technology innovation policies are as follows (Figure 1).

**Figure 1**
New Energy Vehicle Technology Innovation Policies

### Table 1
New Energy Vehicle Innovation Policies in the Twelfth Five-Year Plan Period

<table>
<thead>
<tr>
<th>Time</th>
<th>Policy Name</th>
<th>Release Organization</th>
<th>Content</th>
<th>Purpose</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>863 major projects for electric vehicles</td>
<td>Department of science and technology</td>
<td>Proposed “three vertical and three horizontal” layout for research, direct state investment totaling 880 million yuan</td>
<td>Reduce dependence on oil resources to keep up with the United States, Japan and EU.</td>
<td>Develop new energy vehicle at the same starting line as developed countries making a precedent for the development of new energy vehicle</td>
</tr>
<tr>
<td>2004</td>
<td>Automotive industry development policy</td>
<td>NDRC</td>
<td>Develop energy saving and sustainable technology for new energy vehicle determine</td>
<td>Guide the industry to the road of healthy and sustainable development</td>
<td>Provide policy support for the development of new energy vehicle</td>
</tr>
<tr>
<td>2005</td>
<td>Optimize the structure of the automotive industry</td>
<td>Ministry of development and reform commission</td>
<td>Ownership of electrical automobiles reached 5%-10% in 2010; 50%+ in 2030</td>
<td>Expanding the market for electrical automobiles and making people to understand the new energy vehicles</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Source: gathered by the author.

### 1.2 The “Eleventh Five-Year” Period (2006-2010)

“Eleventh Five-Year” period is a culmination of the development of new energy vehicles. 2008 international oil prices continued to rise, in July 2008 the oil price reached $ 147.27. Influenced by the rising oil prices, some customers began to consider buying less petroleum fuel consuming vehicles—the new energy vehicles. Car companies also saw the enormous potential of new energy vehicles, and began to increase R & D and promotion. The Government also began to introduce a large number of policies to promote the development of new energy vehicles.

According to the analytical framework Liu Xieling, China’s new energy vehicle technology innovation policies in the “Eleventh Five-Year plan” period showed the following characteristics: as for the supply, in 2006 nearly 20 billion yuan was invested for the development of new energy vehicles; in January 2009, 10 billion yuan was invested to support the industrialization of new energy vehicles and its key spare parts = in industrial production, in April, 60,000 yuan subsidies were provided to pure electric vehicle purchasers, in May 20 billion yuan fund was allocated to support the technical innovation. Supports to the supply aspect contributed greatly to the...
industrial development of new energy vehicles; as for the demand: in 2008 the government purchased more than 500 new energy vehicles, which were put into use during the Olympic Games, in 2010 a total of 1,017 pure electric vehicles, hybrid and fuel cell and other types of new energy vehicles were put into use in Shanghai World Expo. Government procurement on the one hand played an exemplary role in the use of new energy vehicles, and on the other hand, brought economic benefits to new energy vehicle enterprises, ensuring the sustainable development of new energy vehicles; as for the environment: in 2006 a new excise tax policy was introduced; in 2007 the new energy automobile production and access management rules was issued ; the Sino-US cooperation to jointly build US-China Clean Energy Research Center and a series of other new energy vehicles policies provided a good environment for the development of new energy vehicles.

China’s new energy vehicles innovation policies in the 11th five-year plan period (see Table 2).

### Table 2
Major Innovation Policies in the “Eleventh Five-Year Plan” Period

<table>
<thead>
<tr>
<th>Time</th>
<th>Policy</th>
<th>Release organization</th>
<th>Content</th>
<th>Purpose</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 6</td>
<td>New consumption tax policy</td>
<td>Ministry of finance</td>
<td>Tax break for energy-saving vehicle</td>
<td>Tax relief to support the development of new energy vehicles</td>
<td>Tax breaks encouraged more companies to develop new energy vehicles</td>
</tr>
<tr>
<td>November 7</td>
<td>Regulations for the production and management of new energy vehicles</td>
<td>MIIT</td>
<td>Set 15 thresholds for companies to launch new energy vehicle projects (Luo, 2008)</td>
<td>Raise up the thresholds for producing new energy vehicles and regulate its development</td>
<td>Standardize the new energy automobile products</td>
</tr>
<tr>
<td>December 7</td>
<td>Guiding catalogue of industrial structure adjustment ,2007 edition</td>
<td>NDRC</td>
<td>Development and Reform Commission officially listed new energy vehicles to the favored industry directory</td>
<td>Promote the industrialization and large scale production</td>
<td>Point out the direction of development in the new era for the automobile industry</td>
</tr>
<tr>
<td>January 9</td>
<td>“Notice on the extension of demonstration of new energy and energy-saving vehicles”</td>
<td>Ministry of science and technology</td>
<td>Identified 13 cities as the new energy vehicle demonstrative pilot cities</td>
<td>Promote the sustainable development in a large scale and industrialization</td>
<td>Expanded the market from public service area and eased the price disadvantage of new energy vehicle</td>
</tr>
<tr>
<td>February 9</td>
<td>“Demonstrative project 100 hybrid buses put into use”</td>
<td>Ministry of science and technology, ministry of finance</td>
<td>Each city launched 1,000 new energy vehicle to do the pilot running.</td>
<td>Expanded the market for the new energy vehicle</td>
<td>More people are beginning to know the new energy vehicle</td>
</tr>
<tr>
<td>March 9</td>
<td>The restructuring and revitalization plan for the automobile industry</td>
<td>State council</td>
<td>Proposed the implementation of new energy vehicle strategy</td>
<td>Promote the use of energy-saving and new energy vehicles</td>
<td>New energy vehicles were promoted to be used in the public domain and thus accelerated the construction of public charging facilities</td>
</tr>
<tr>
<td>May 10</td>
<td>“Notice on the expansion and promotion of the use of energy-saving and new energy vehicle in the public service domain and ”</td>
<td>Ministry of finance, ministry of science, the ministry of industry, development and reform commission</td>
<td>Energy-saving and new energy vehicle expanded to as many as 25 cities</td>
<td>Expand the market of the new energy vehicles</td>
<td>By the end of 2010, the ownerships in 25 pioneer cities reached a total of 10,000</td>
</tr>
<tr>
<td>June 1, 2010</td>
<td>“Subsidies for the private purchase of new energy vehicles”</td>
<td>Ministry of finance</td>
<td>Subsidies for infrastructure to private purchasers</td>
<td>Promote the personal purchase of new energy vehicles</td>
<td>By the end of 2010, private purchases of new energy vehicles reached over 1,000</td>
</tr>
</tbody>
</table>

**Note.** Source: gathered by the author

### 1.3 The 12th Five-Year Plan Period (2011-Present)
In the 12th five-year plan period, China’s automobile production capacity will be able to reach 40 million, and more than 50% of our oil relied on imports, if there is no alternative energy or new energy sources, it would be difficult for the development of China’s automobile industry, on the other hand, it is imminent to solve the environmental pollution caused by automobile exhaustions. In 2011, PM$_{2.5}$ density in many Chinese cities ranked the highest in the world, as a result of vehicle gas emissions. Together with lack of oil supplies, environmental pollution pressures force the government to accelerate the pace of developing new energy vehicles.
According to Liu Xieling’s analytical framework, China’s new energy vehicle technology innovation policies in the 12th five-year plan period represents the following characteristics— as for the supply, owing to the huge investment to support the development of new energy vehicles in the 11th five-year plan period, the government focuses on the independent innovation and development of new energy vehicles and safety management, this time with less direct monetary support. As for the demand part, although there are no explicit government procurement policies, in fact there are a number of government procurements in those demonstrative cities; as for the environment, the blueprint for the new energy vehicle industry has been constantly put forward, giving away a clear direction for the development of the whole industry, and also strengthened safety management, ensuing a good policy basis for the development of new energy vehicles in the long haul. New energy vehicle innovation policies in the 12th five-year plan period (Table 3).

<table>
<thead>
<tr>
<th>Time</th>
<th>Policies</th>
<th>Release organization</th>
<th>Content</th>
<th>Purpose</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 11</td>
<td>“The 12th five-year plan”</td>
<td>NPC</td>
<td>List the new energy vehicle as one of the strategic newly-emerged industries</td>
<td>Promote the application and industrialization of new energy vehicles</td>
<td>Many cities has begun to focus on the development of the new energy vehicles</td>
</tr>
<tr>
<td>August 17, 2011</td>
<td>“Notice on strengthening the safety management and demonstratively promotion of the new energy vehicle”</td>
<td>Ministry of science and technology</td>
<td>Required the pioneering cities to strengthen the safety management of new energy vehicles</td>
<td>Fully realize the importance of the demonstratively promotion and safety management of new energy vehicles</td>
<td>Accidents of new energy vehicles reduced</td>
</tr>
<tr>
<td>September 8, 2011</td>
<td>“Guidance on the industrial globalization of the newly-emerged industries”</td>
<td>Ministry of commerce, development and reform commission</td>
<td>Focusing on the lack of core technology, build the innovation system for the new energy vehicles to increase innovation capacities</td>
<td>Increase the innovation capacities</td>
<td>To be seen</td>
</tr>
<tr>
<td>April 18, 2011</td>
<td>Plan for energy-saving and new energy vehicle industry</td>
<td>State council</td>
<td>Focus on the promotion of electrical vehicles and plug-in hybrid vehicle industry</td>
<td>Enhance the overall technological level of China’s automobile industry</td>
<td>To be seen</td>
</tr>
</tbody>
</table>

Note: Source: gathered by the author

2. The Comparison of the New Energy Vehicle Innovation Policies with Other Those in Other Countries

2.1 Sorting and Evaluating of New Energy Vehicle Innovation Policies in China and Other Countries

a) U.S. the first electrical car was born in the United States, which has always been in the leading position in the development of new energy vehicles. The main feature of innovation policies in the United States is: Leaders in successive administrations have attached great importance to the development of new energy vehicles. In the Clinton administration (1993-2001) period, “next generation automobile partnership program” was developed, encouraging the development of pure electric vehicle. However, due to the deficiencies in technology, the short distance after charging, battery pollution, problem in recycling, there was a slow development in the pure electric vehicles. In the Bush administration (2009) period, policies began to support the development of fuel cell vehicles, not only developed incentives for the production of fuels, and for the purchasers of new energy vehicles, tax subsidies could be enjoyed. Also, a great amount of funding was put into the research of new energy vehicles. Under the encouragement of government policies, America’s technology and research of fuel cells are at the advanced level in the world.

In the Obama administration (2009-present), Obama’s new energy policy in the policy agenda occupied an important position, after Obama took office, a series of new energy vehicle innovation policies has been adopted to promote the development of new energy vehicle; large amounts of money has been invested to battery research, development and production of core spare parts, the construction of charging infrastructure, purchase subsidies and government procurement. With the support of a range of policies, new energy vehicles in the U.S. have developed with remarkable achievements.

b) Japan. Owing to the oil drain and a huge number of car ownerships, Japan is one of the first countries to start the development of electric vehicles. According to Liu Xieling’s analytical framework, Japan’s new energy vehicle innovation policies presents the following characteristics: as for the supply, first, nearly 500 yen were invested for the development and construction of new
energy vehicles, second is to build infrastructure, according
to a 1993 plan, 2,000 alternative fuel supply stations were to
be build, including 1,000 pure electric vehicle fast charging
stations, the number of which could reach 5,000 from 2010
to 2020. Besides, 2,000,000 home-use charging equipment
would be completed. Third is to provide technological
support; as for the demand, the Japanese government
launched priority procurement of low-pollution cars; as for
the environment, “special measures law on the promotion
of new energy utilization” and “energy strategy 2030” were
issued, a variety of tax incentives for the development of
new energy vehicles t were introduced to provide a good
environment for its development.

c) E.U. Europe is the origin of new energy source,
also in the leading position in the development of the low
carbon economy. For the development of new energy
vehicles, the European Commission and European
countries have developed a number of policies and
measures to promote its development and consumption,
but due to the different economic and social level, the
degree of support to support new energy vehicles varied.

According to the research on innovation policies in
EU countries, new energy vehicle innovation policies has the following features: a) in Britain, apart from the
subsidies, loans rather than direct fund were provided,
modification of ownership tax, taxation according to the
amount of carbon dioxide emissions per unit distance are
all to encourage the development of new energy vehicles;
b) in France, supports include not only direct investment,
subsidies, loans but also cash “reward or punishment”
according to newly bought car’s emission. c) in Germany,
great importance is attached to the development of new
energy vehicle technology, the lithium battery technology
is listed in the “high-tech strategy”, large amounts of
money were invested to researches concerned, and also,
strategically, “National electric vehicle development plan”
was issued to promote the development of new energy
vehicles; d) in Sweden and Nethelands, subsidies and
reduced tax were adopted to support the development of
new energy vehicles.

2.2 The Comparison of New Energy Vehicle
Innovation Policies
2.2.1 Three Similarities in the Innovation Policies in
China and Other Countries
a) invested a lot on R&D and consumption areas, b) put
new energy vehicles on the government procurement list,
c) increased investment in infrastructure.

According to the national “automobile and new energy
vehicle industry development plan” (2011-2020), only the
central government would invest 10 million Yuan in R&D
and consumption area to support the development of new
energy vehicle. In Japan, more than 200 billion yen has
been invested for the R&D of fuel cells. The U.S., Germany
etc. also invested heavily in support of new energy vehicles.

For the government procurement, China purchased a
large number of new energy vehicles during the Olympic
Games and the Shanghai World Expo. The United States
set up a special fund for new energy vehicles, and Japan,
EU has launched the plan to purchase new energy vehicles
using public funds.

As for the infrastructure, China has provided subsidies
for the charging stations from 2009, Germany, the United
States and Britain have taken similar measures.

2.2.2 Three Differences in Innovation Policies
Tree aspects: a) different paths to develop new energy
vehicles. Path of development means different routes to
support new energy vehicle technology, and new energy
vehicles include hybrid, pure electric vehicle, fuel cell
vehicle, hydrogen engine vehicle and gas burning vehicle
and glycol ethers. China mainly develops electric vehicles
while other countries have focus. b) different way to guide
consumers. There are different ways to guide consumers,
like financial subsidies, tax incentives and punish-reward
policy. China focused on consumer guidance while other
countries varied. c) different thinking paths. Supports to
new energy vehicles include supports to the production,
the infrastructure and the key spare parts. China focused
on the production of the whole vehicle, while other
countries worked on core technologies.

CONCLUSION
New energy vehicle is the tread for the automobile
industry, while the direct impetus of it comes from the
country’s supporting policies. through sorting and
evaluating innovation policies for new energy vehicles at
home and abroad, we can find there are three similarities
and three differences. Three similarities mean substantial
investment in R&D and consumption; procurements of
new energy vehicles; emphasis on the investment in the
infrastructure. Three differences refer to: different path
of development; different way of consumers guide; different
policies to support the idea.

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