

Speed up Shanghai's Transportation System Developing into Low-Carbon Mode

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Abstract –The 21st century is the era of low-carbon economy. To improve influence in the global economy, Shanghai must seize opportunities to turn economy into low-carbon mode. Transport industry, as a vital power for Shanghai, is necessary to develop in a low-carbon way. Start with knowing current situation and problems of Shanghai's transportation system, this paper discussed the necessity for Shanghai to build a low-carbon transportation system from international, national and Shanghai's perspectives. Based on analyzing challenges, this paper put forward some suggestions to reach this aim.

Keywords –low-carbon economy; Shanghai; low-carbon transportation system

1. Introduction

In 2007, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) showed that climate change had become a common problem restricting the global economy development, and developing low-carbon economy had been recognized by most governments in the world [1]. In the era of low-carbon economy, to take up a stronger position in the global environment and enjoy a higher initiative, Shanghai must seize the opportunity to speed up strengthening its competition and building international shipping center of the fourth generation with the feature of "low-carbon and intelligent mode". Key points of the fourth-generation international shipping center the energy-conserving and environment-protective. At the same time, the transportation system which is a vital part of the industries of energy consumption and greenhouse gas emissions, is established as the key area in development low-carbon economy along with the industry and building industry.

As an economic center, Shanghai has experienced years of sustained and rapid development, achieved significant economic and social achievements, but also accumulated a lot of structural contradictions, faced with increasingly resources and environmental pressures. To meet the challenge of economy transition and solve problems about low energy efficiency and unreasonable energy structure, Shanghai is necessary to develop low-carbon transportation system.

2. The connotation of low-carbon transportation system

Low-carbon transportation system is considered to be one mode with features of energy-efficient, low energy-consumption, low pollution, low emission. It's engaged in reducing traditional energy's consumption, improving the energy efficiency of the transportation, improving the transportation energy structure, and optimizing the transportation system's developing mode.

3. Problems of Shanghai transportation system

3.1 The status quo of Shanghai's transportation system

At present, Shanghai's transportation system is consist of Pudong and Hongqiao two international airport, three main and three secondary railway stations and eight port areas. In "Eleventh Five-Year" period, Shanghai government paid more attention to the strategy of giving top priority to developing public transport. Finally, Shanghai achieved in rapid and healthy development of urban public transport, especially in track traffic whose length has leapt to the forefront of the world. In addition, Shanghai is actively promoting the port and shipping center's construction. As a result, both shipping hard and soft power are strengthened and Shanghai is getting close to be a real international shipping center.

3.2 Problems of Shanghai transportation system

Shanghai Comprehensive Transportation Development "12th Five-Year Plan" indicated that Shanghai is in the critical period of accelerating the realization of the "four lead", the construction of "four centers", also at the critical stage of enhancing the urban functions and the development's transition. To be one member of world-class cities with strong international competitiveness, Shanghai should put forward higher requirements to its integrated transportation system, which is made up of railways, highways, aviation, water transport and pipeline. Now, Shanghai has the four urgent problems.

3.2.1. Proportion of the various modes of transport is not reasonable. The effect of division of work and complement advantages is not obvious.

The proportion of cargo of rail, water, road and air transport in 2011 is 2.5:138.7:119.83:1. In various modes of transport, rail and waterway transport, which have less pollution and low-cost advantages are at high proportion. On the contrary, road freight accounts for a high proportion. This not only brings city residents traffic jams, but also causes a great deal of pressure on the environment. This is inconsistent with the concept of sustainable development, as well as principles of cost-effectiveness. Additionally, these various transport modes, such as railways, highways, waterways and aviation, are lack of division of work and cooperation (such as railway and port area, there is no direct docking). Factors of the transportation system haven't been integrated effectively, which is difficult to make the most of the advantage.

3.2.2. The transportation system is difficult to effectively support changes of urban consumers' behavior and consumption pattern.

Urban and peripheral area residents' traffic demand is increasing, with the expansion of the urban area and the continuous expansion of the urban population. The enhancement of the quality of life make the residents gradually expect more convenient, safe and comfort city traffic. Shanghai, give a top priority to public traffic, is faced with a challenge of meeting millions of urban residents' transport consumption need.

3.2.3. The transportation system is along with high energy consumption and low efficiency.

At this stage, the level of energy consumption of Shanghai people is much higher than the developed countries. The unit GDP energy consumption is much higher than Hong Kong's. Transportation energy consumption covers nearly 30% in the total energy consumption, Transportation energy efficiency is higher than other industries in Shanghai [4]. In "Eleventh Five-Year" period, unit GDP's energy consumption, power consumption, and transportation, storage and postal services' energy consumption are showed in Table 1.

Table1 Shanghai unit GDP's energy consumption in "Eleventh Five-Year Plan" period

Indicators	Units of measurement	2010	Cumulative rise or fall
Unit GDP's energy consumption	Tons of standard coal/ thousand Yuan	7.12	-20%
Unit GDP's power consumption	KWH/ thousand Yuan	8262	-17.13%
Transportation, storage and post services' energy consumption	Tons of standard coal/ thousand Yuan	30.95	+25.75%

Data source: Shanghai Statistics Bureau.

Compared China, Japan and U.S with the transportation energy consumption, showed in Table 2, we can recognize the general status of China's transportation system. China's energy consumption in railway and road transport is higher than the United States and Japan. Energy efficient is low.

Table 2 Energy consumption of China, Japan and the United States in 2008

State	Consumption units: kg of standard coal/ kiloton km				
	railway	highway	waterway	aviation	pipeline
Japan	8.600	31.000	34.000	679.000	--
United States	7.000	31.000	11.400	682.000	7.500
China	8.870	43.170	8.930	482.340	7.470

3.2.4. The transportation system has high emission and serious pollution.

During a quite long period of time, the urban transport developed at the cost of serious resource destruction and environmental pollution. Yang Zhi(2011) disclosed that: in 2005-2009, Shanghai people's carbon dioxide emissions is much higher than other people's in other regions. The average emissions of one person per year is 13 tons, in which the traffic generated almost 30% [5], and individual vehicles became the principle resource of energy consumption and the greenhouse gas emissions [6].

4. The necessity for Shanghai to build a low-carbon transportation system

4.1 In international aspect

Copenhagen Conference (the fifteenth UN climate framework agreement Conference) was held in 2009. While countries still have many differences to settle in the impacts of carbon emission reduction targets, responsibility, funding and technical support, but development of low-carbon economy has become the world's common sense. The era of low-carbon economy has arrived and become an irreversible trend.

4.1.1. Initiatively response to the energy saving call

In global perspective, transportation is one of the main areas of greenhouse gas emissions. According to the 2007 European Transport Ministers' meeting, transportation accounted for 28% in the whole fuel consumption and carbon dioxide emission, in which highway occupied 18%, waterway 2%, aviation 5%, and other 3% [7]. Furthermore, the development of the transport industry needs a strong support of energy. Effective conservation and rational use of energy will reduce greenhouse gas emissions and realize sustainable development of the transportation system.

4.1.2. Under international pressure

According to the report of the greenhouse gas emissions released in the UK Maplecroft, China releases more than six billion tons of carbon dioxide to the atmosphere every year, ranked the first place in the world. In 2009, Premier Wen Jiabao promised at the Copenhagen conference: Our carbon dioxide emissions per unit GDP will reduce 40% -45% in 2020, compared with the level in 2005. The "12th Five-Year Plan" clearly indicated that in five years, the target is 17% reduction in energy conservation. China will establish carbon market and put low-carbon pilot in a very prominent position. However, western countries continue to exert enormous pressure on China to accept international supervision, and require our actions to achieve "measurable, reportable, and verifiable".

4.2 In national aspect

4.2.1. Shanghai's strategic position

As one of the national central cities in China, Shanghai is positioned to be an economic, technological, industrial, financial, trade, exhibition and shipping center. Considering Shanghai's strategic position in the whole development of the country, Shanghai must lead in changing economic development mode and adjusting economic structure. Its transportation industry must lead to meet the challenges and opportunities, low-carbon economy will bring to China."

4.2.2. Rigid task from the state

Promoting transportation to save energy and to reduce greenhouse gas emission is a rigid task. In "12th Five-Year" period, the state asks Shanghai to decrease unit GDP's energy consumption by 18%, decline carbon dioxide emission by 19%, and continue to reach the energy-saving target.

4.3 In Shanghai's aspect

4.3.1. Shanghai ranks in China's high-carbon regions

Yang (2011) pointed out that, in Shanghai, carbon dioxide emissions is much higher than other regions, with emission of 13 tons per resident. In 2009, electricity consumption is relatively high, with a record of 6004.06. Since there are low-carbon competitiveness rankings,

Shanghai has been ranked in high-carbon cities (shown in Figure 1). The traffic contributed about 30 percent of the energy consumption and carbon emissions. Shanghai's newest low-carbon economic competitiveness score is 56.21, which is much lower than Hainan's 80.48 points.



Figure 1 Low-carbon competitiveness level of the provinces in 2009
Note: Black -the high-carbon regions, gray- the medium lever, white- low-carbon region; high, medium and low-carbon region is divided in accordance with their relative low-carbon competitiveness ranking.

4.3.2. Low-carbon economy brings a major chance to Shanghai's transportation system

The development of low-carbon economy is complete accord with Shanghai's strategy target, which contains adjusting economic structure, promoting the transformation, developing service economy, and enhancing the urban functions. Opportunities are listed in following aspects. First, the low-carbon economy brings opportunities for the development of new-style energy and new industries to the transportation system. New-style energy includes solar, wind, and nuclear energy. New industries include new transportation equipment manufacturing, new energy vehicles, energy-efficient transportation tools etc. Second, the low-carbon economy promotes the development of carbon finance market, and injects new life into Shanghai's building into an international shipping center and international financial center. New Energy Finance forecast: with the invention of carbon funds, carbon currency and carbon index, the scale of the global carbon trading market will reach \$ 3.5 trillion in 2020. Third, the concept of low-carbon economy guides Shanghai to stress public traffic strategy and encourage people to use low-carbon traffic tools in their daily life. Industry experts said that, under certain conditions, the proportion of public transport trips increased by 1%, urban transport energy consumption decreased by 1.5%. Fourth, based on the close association with developed countries, Shanghai can learn more advanced low-carbon technologies and accelerate the construction of the international shipping center.

5. Challenges and suggestions for Shanghai to build a low-carbon transport system

5.1 Challenges

5.1.1. The system challenges

Low-carbon economy requires Shanghai transportation system to transfer from adaptive innovation mode to transformational innovation mode. Low-carbon economy requires transportation to speed up innovation and change in order to adapt to the requirements of the development of low-carbon. Low-carbon system innovation includes change of law, policy, government management [8]. To weigh the short-term and long-term goals, the transportation should take advantage of strategic opportunities to achieve low-carbon transition, with consideration of synergies of carbon emission and energy.

5.1.2. The economic challenges

Low-carbon transportation system will bring both positive and negative aspects to the urban economy. On one hand, it will attract urban residents' consumption of new-style energy transport, but also attract foreign capital, which will bring unexpected opportunities to the Shanghai. On the other hand, in view of the immature status quo of low-carbon technologies, the promotion of low-carbon transportation will reduce residents' consumption in the traditional transport. However, high-emission vehicles limit and traditional vehicles elimination will increase city economic load.

5.1.3. The social challenges

Low-carbon transportation system is the formation of a new government, transportation enterprises and the public [9]. The enterprises are important nodes of the system. They should establish correct sense of worth, and scientifically weigh the costs and interests. The government plays as a leader, supervisor. The public is the core of low-carbon transportation system. Their low-carbon concept plays a central role.

4. The technical challenges

In accordance with the requirements of low-carbon development, on one hand, the transportation system must make efforts to adjust the energy structure, accelerate the pace of construction of new-style energy, increase the proportion of clean energy, use new technologies to promote fossil energy used in low-carbon mode, and improve the energy efficiency. On the other hand, Shanghai should establish logistics information network with high intelligence.

5.2 Suggestions

5.2.1. Strengthen the government's leadership

The government plays a vital role of leading and controlling the overall situation in the construction of low-carbon transportation system. It's a planner, standard-setter, and manager. Shanghai's transport, energy, environmental protection, science and technology and taxation departments should work together to make policies, industry standards and supervision mechanism. Finally, the stable and legal system will help to promote the industry's low-carbon development.

5.2.2. Adjust the structure of transportation

The reality is that the road freight takes up a large proportion, it's lack of division of work. There're some recommends. First, Shanghai should make the infrastructure intensive and develop in low-carbon mode, reduce land occupation, and make aviation highway and waterway docked effectively. Second, constantly optimize operating structure, improve the quality of public transport service to meet demands of passengers and freight. Make the most advantages, such as punctual, low-pollution, comfort and safe. Third, in reference of Tun Men's container terminal, Hong Kong's practice in 90s, Shanghai could develop "the Yangtze River Strategy" to ease the pressure on road transport and form the Yangtze River logistics chain [10].

5.2.3. Cultivate low-carbon technologies and industries, and develop new-style energy

Suggestions on the development of low-carbon technologies and new-style energy are as follows. First, Shanghai should adopt new methods in the construction of infrastructure, and reduce the consumption of raw materials. For example, the abandoned steel slag can be reused in filling roadbed and the goudron can be recycled. Second, speed up transferring solar, wind, nuclear power and other new energy to transport energy, and increase the proportion of clean-energy vehicles. Third, publish catalog about low-carbon transport technology and product regularly. Promote a timely introduction of new low-carbon energy and new technologies to the transportation system, for example, the promotion of marine shore power technology at the Port of Shanghai. Fourth, increase capital investment, establish low-carbon transport laboratory, technology research and development center.

5.2.4. Establish a transportation information platform

Timely and punctual information can improve the efficiency of the transportation system and reduce operation costs. Shanghai should promote the application of the Internet of Things in the transportation system and establish an intelligent information platform. This is not only helpful to coordinated transport, but also helpful to reduction of the waste of resources and environmental pollution. Furthermore, the public traffic travel information system can make residents feel the system's

convenience and timeliness. Finally, it will increase their satisfaction and dependence.

5.2.5. Publicize the low-carbon concept, and establish the public guide system

Public's low-carbon concept is the core of Shanghai's building a low-carbon transportation system. On one hand, we can publicize the atmosphere by government's action, some social activities or advertisement. Introduce advantages of the public traffic, such as large volume, low price etc. On the other hand, use the legal, economic, technical measures and even moral pressure to standardize and guide the public's transport consumption.

6. Conclusions

Shanghai's development of low-carbon transportation system is imperative. Shanghai must considerate the global background of low-carbon economy and the construction of the fourth-generation international shipping center, take full account of the government, transport companies and the public, establish their low-carbon concept, promote low-carbon technologies and new-style energy, and succeed to develop a low-carbon transportation system in the end.

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Vitae

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