

# On the Strategy Mode of Suzhou's Low-Carbon Urban Transportation

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**Abstract**—Low-carbon transportation is a key area of low-carbon economic strategy. By the framework of low-carbon economy--- low-carbon logistics---low-carbon transportation, and using the data of Suzhou city, we made an empirical analysis of Suzhou urban transportation strategy mode. Firstly, we have studied the existing urban traffic problems in Suzhou. On these bases, we put forward the strategy mode of urban transportation development model transformation; transportation resource allocation optimization; public transport development; and low-carbon transport implementation. We have clarified the methods and techniques of the transformation of extensive, high pollution and carbon emissions transportation development mode to sustainable, intensive, low-carbon, resource-saving oriented transportation development mode. At last, we put forward some relevant policy suggestions.

**Keywords**- *Low-carbon Transportation; Low-carbon Logistics; Low-carbon Economy; Urban Transportation*

## I. INTRODUCTION

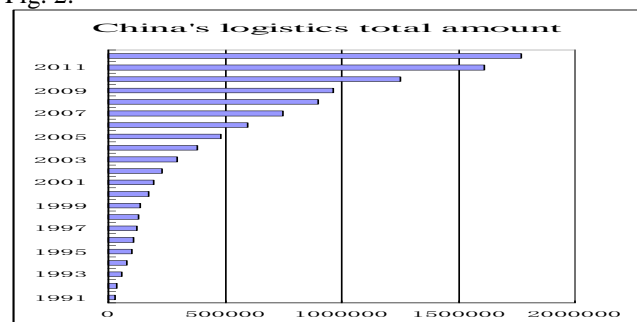
Since the new century, developing low-carbon economy has become a hot issue worldwide. The core content of it covers the concepts, technology and industry, and gradually rise to the level of the legal system. At the same time, a series of new ideas have emerged, such as "low-carbon economy", "low-carbon development", "low-carbon society", "low-carbon logistics" and "low-carbon transportation". In this background, Suzhou city, as one of the four key environmental protection cities in China, the way of creating low-carbon logistics, developing low-carbon transportation is imperative. By the framework of low-carbon economy--- low-carbon logistics---low-carbon transportation, and using the data of Suzhou city, we made an empirical analysis of Suzhou urban transportation strategy mode. Firstly, we have studied the existing urban traffic problems in Suzhou. On these bases, we put forward the strategy mode of urban transportation development model transformation; transportation resource allocation optimization; public transport development; and low-carbon transport implementation. We have clarified the methods and techniques of the transformation of extensive, high pollution and carbon emissions transportation development mode to sustainable, intensive, low-carbon, resource-saving

oriented transportation development mode. At last, we put forward some relevant policy suggestions.

## II. LOW-CARBON ECONOMY, LOW-CARBON LOGISTICS AND LOW-CARBON TRANSPORTATION

Low-carbon economy refers to "make more economic output, create higher standards of living and make better quality of life by fewer resources consuming and less pollution; and create new business opportunities and more jobs for the development, application and export of advanced technology" [1]. The main concern of low-carbon economy is reducing greenhouse gas emissions in economic development, while accessing to the maximum economic output of whole society. It is a economic mode based on the low energy consumption, low pollution and low emission, and is an another leaping progress of human society after the agricultural civilization and industrial civilization.

One of the key aspects of a low-carbon economy is low- carbon logistics. The most apparent appearance of the wasting of resources and energy existing in China's economy currently is the high costs of China's national logistics. According to the latest accounting of the China Logistics Information Center, China's logistics total amount is of 182.2 trillion RMB yuan in January to November of 2013. Calculated at constant prices, there is an increase of 9.4%[2]. The overall China's logistics total amount and its annual growth rate since the 1990s are show in Fig. 1 and Fig. 2:



**Data Source:** Our calculation according to data of China Federation of Logistics & Purchasing in 1991-2013. (2014-1-27)

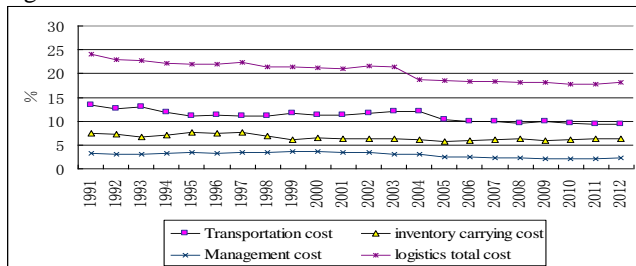
Figure 1. China's Logistics Total Amount in 1991-2012



Data Source: Ditto

Figure 2. Annual Growth Rate of China's Logistics Total Amount in 1991-2012

From the point of view of logistics value added, China's logistics value added amounted to 3.5 trillion RMB yuan in 2012. Calculated at constant prices, there is an increase of 9.4%. Among it, transportation logistics value added made a growth of 8.7%, warehousing logistics value added made a growth of 6.8%, wholesale and retail logistics value added made a growth of 9.8%, post logistics value added made a growth of 26.7%[3]. Logistics value added accounts for 6.8% of total GDP in 2012, and accounted for 15.3% of value added of services industry[3]. From the point of view of logistics costs, for a long time, China's logistics costs not only hold a huge absolute numbers, but also account for high percentage of total GDP. The various logistics costs-to-GDP ratio since the 1990s is shown in Fig.3:



Data Source: Our calculation according to data of China Federation of Logistics & Purchasing, in 1991-2013. (2014-1-21)

Figure 3. China's Logistics Total Cost and Various Costs-to-GDP Ratio in 1991-2012

Fig.3 shows, in a long time, the ratio of China's Logistics costs to GDP was around 20%. Since 2004, there is a slight decline, but is still much higher than the level of developed countries which about 10%. The total cost of China's logistics is 9.4 trillion RMB yuan in 2012, increased 11.4% over the previous year, accounted for 18.1% of total GDP[3], higher than that in developed countries nearly doubled. This indicates that China's logistics costs much higher, the consumption of resources and energy is enormous, and the associated carbon emissions are great. The modern logistics and supply chain management as a means of achieving low-carbon economy function is not yet realized in China, still remains to be digged deeply.

Specifically, from the perspective of transportation, in 2012, affected by the impact of rising fuel prices and rapid growth in road traffic, the road transport costs increased by 12.6%, higher than the growth rate of total social logistics costs by 1.2 percentage points[3]. Thus, because of the continuous rising of road transport costs and its accelerating rate of increase, building intelligent traffic has to be put on the agenda as soon as possible.

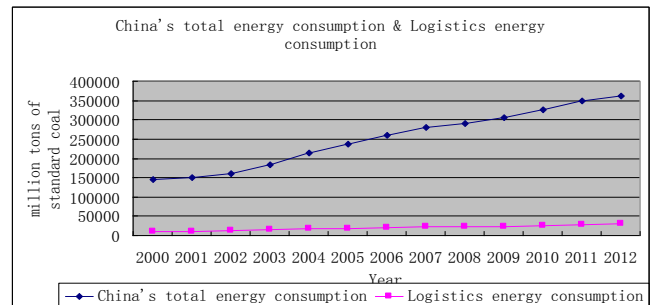
Similarly, the key to low-carbon logistics is the low-carbon transportation. From the perspective of total energy consumption, after thirty years reformation and opening up of China, China's economy has experienced leaps and bounds. Transport sector has also been a tremendous progress. China's transportation energy consumption accounts for a great proportion of the entire national economy, and shows an upward trend, as shown in Tab.1, Fig.4 and Fig.5:

TABLE 1. CHINA'S TOTAL ENERGY CONSUMPTION & LOGISTICS PROPORTION OF TOTAL ENERGY CONSUMPTION

(Unit: million tons of standard coal)

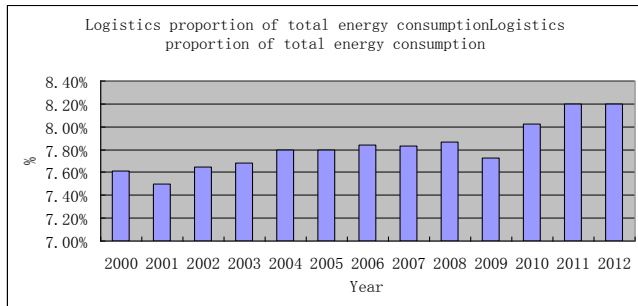
Year	China's Total Energy Consumption	Logistics Energy Consumption	Logistics Proportion of Total Energy Consumption
2000	145531	11074	7.61%
2001	150406	11283	7.50%
2002	159431	12196	7.65%
2003	183792	14116	7.68%
2004	213456	16642	7.80%
2005	235997	18391	7.79%
2006	258676	20284	7.84%
2007	280508	21959	7.83%
2008	291448	22917	7.86%
2009	306647	23691	7.73%
2010	324939	26068	8.02%
2011	348001	28536	8.20%
2012	361732	29663	8.20%

Data Source: China Energy Statistical Yearbook(2001)[M]--- China Energy Statistical Yearbook (2013) [M]. China Statistics Press. 2001.9---2013.9; China Statistical Yearbook[M] (2001)--- China Statistical Yearbook (2013) [M]. China Statistics Press. 2001.9---2013.9



Data Source: TABLE.1

Figure 4. China's Total Energy Consumption & Logistics Energy Consumption in 2000-2012



Data Source: TABLE.1

Figure 5. Logistics' Proportion of Total Energy Consumption in 2000-2012

Seen from the above data, the energy consumption and associated carbon emissions in transportation is one of the most important areas in total carbon emissions. Especially since 2009, the proportion of transportation energy consumption accounts for the total energy consumption has shown an increasing trend. With the highlights of energy crisis, environmental pollution and climate crisis, reducing carbon emissions and developing low-carbon transportation has caught people's growing attention. Therefore, construction of low-carbon transport must be put on the agenda as soon as possible.

### III. THE TRANSPORTATION STATUS AND NECESSITY TO IMPLEMENT LOW-CARBON TRANSPORTATION STRATEGY IN SUZHOU CITY

The so-called low-carbon transportation refers to that, under the guidance of the concept of low-carbon economy and sustainable development, through technological innovation, system innovation, industrial restructuring, new energy development and other means, to develop a new transportation modes to minimize greenhouse gas emissions[4]. It includes efficient, low-carbon energy transportation, bus travel mode and etc. Low-carbon urban traffic system is a specific performance of low-carbon transportation in cities.

Recent years, the study of low-carbon transportation international[5][6] and domestic[7][8] is increasingly deepening. China's major cities are all engaged in developing low-carbon transportation. For examples, Beijing Municipal Committee will work together with the World Resources Institute (WRI), draw the International experience of transportation management which combine the pollution control with rule blocking, and vigorously to build a low-carbon transportation[9]. Xi'an is also being vigorously to build a new transportation system in order to reduce carbon emissions, thereby reducing haze, and protect the environment[10].

Suzhou city is one of the economy and logistics centers in Jiangsu Province. It locates in the heartland of Yangtze River Delta. Its geomorphic features is mainly plain, low-lying, and densely populated. Its energy and resources is dependent on external. Suzhou is a type city scarce of resources. This decides that Suzhou city must go the low-

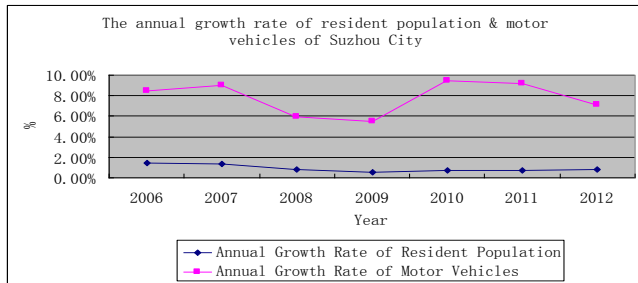
carbon logistics and low-carbon transportation way to achieve sustainable economic and social development.

#### A. The Transportation Status of Suzhou City

With the rapid economic growth of Suzhou, its traffic is showing a picture of prosperity and development. Suzhou's Traffic infrastructure construction is advanced steadily. The urban public transportation has significantly speeded its development. Currently, the rail transit of Suzhou city is speeding up its construction; Changzhou-Kunshan expressway, Suzhou-Wuxi expressway, Suzhou section of Beijing-Shanghai high-speed railway, Suzhou section of Shanghai- Nanjing intercity railway also have been completed and opened to traffic. At the end of 2012, Suzhou railway passenger volume was of 26.2798 million person time. Railway freight volume and reach volume was 937.8 thousand tons and 3,114.3 thousand tons. Highway passenger volume was 30,762.63 million person kilometers. Cargo turnover reached 13,572.55 million ton kilometers. At the end of 2012, Suzhou highway mileage is of 13,089.5 km. Inland waterway navigable mileage is of 2,760 km. The city bus route network length is of 11,624 km[11]. Suzhou urban bus operation vehicles is of 6,306 vehicles. Bus passenger volume reached 912.46 million person times. The taxi vehicles is total of 8,132 units. Total length of the light rail line is 25.2 km. Total operating mileage is of 1.433 million km. The light rail passenger volume has reached 25.948 million person times[11]. The above data are among the best in the prefecture-level city throughout the country. Suzhou also toke the lead in the country to launch ESC taxi. Suzhou newly added 300 ESC taxis, has greatly facilitate the Suzhou city's public traffic.

#### B. The Necessity to Implement Low-Carbon Transportation Strategy in Suzhou City

As transport developed, Suzhou's environmental pressures continue to increase. Transportation is one of the main reasons that cause global warming. In recent ten years, the global carbon dioxide emissions increased by 13%, carbon emissions growth rate of transportation is as high as 25%. Some experts expect, by 2050, the global transport carbon emissions will increase by 30% to 50% than the current. In this regard, we can find some questions from the contrasts of the following tables and figures of Suzhou city: the total number and their growth rates of resident population and motor vehicles (Fig.6); changes of the proportion of the automobiles to motor vehicles (Fig.7); the total number and their growth rates of resident population, motor vehicles and private cars (Fig.8).

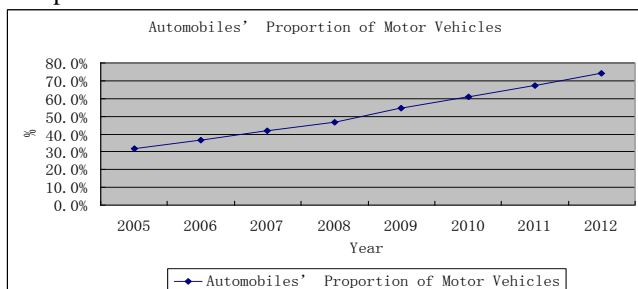


**Data Source:** Suzhou Statistical Yearbook (2001)[M]---Suzhou Statistical Yearbook(2013) [M]. Jiangsu Statistics Press.2001.9---2013.9

Figure 6. Annual Growth Rate of Resident Population & Motor Vehicles of Suzhou City in 2005-2012

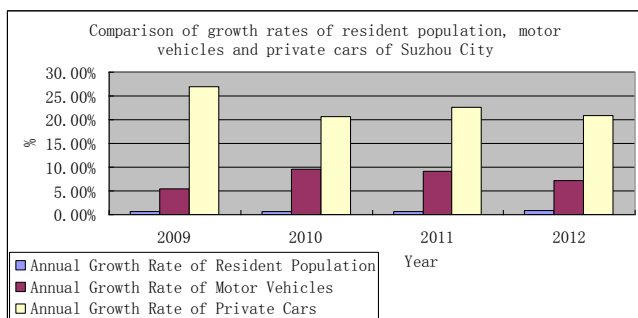
From the data above, we can find: the annual growth rate of motor vehicles of Suzhou in 2006-2012 is significantly higher than the rate of resident population of Suzhou (Fig.6). Therefore, the growth rate of motor vehicles of Suzhou and the resulting carbon emissions growth rate are considered high.

It can be found that the proportion of the automobiles to motor vehicles of Suzhou rose from 31.8% in year 2005 to 41.7% in 2007, reach 54.4% in 2009 when has exceeded the 50% level, and has since been developed to 74.4% in 2012 (Fig.7). The annual growth rate of private cars is even more astonishing, far more than the growth rate of resident population and motor vehicles in the same period (Fig.8). This runs counter to the target of developing low-carbon transportation of Suzhou.



**Data Source:** Suzhou Statistical Yearbook (2001)[M]---Suzhou statistical yearbook (2013) [M]. Jiangsu Statistics Press. 2001.9--- 2013.9

Figure 7. Proportion of the Automobiles to Motor Vehicles of Suzhou City in 2005-2012



**Data Source:** Ditto

Figure 8. Comparison of Growth Rates of Resident Population, Motor Vehicles and Private Cars of Suzhou City in 2009-2012

At the same time, It must be aware of that the carbon emissions in the area of traffic is belongs to rigid emission, and is difficult to significantly reduce in short term. Rigid emission refers to that, with the development of the times, most industry's energy consumption will be reduced gradually. But the transport energy consumption will not reduce, but also increase. According to CICERO, over the past 10 years, most of the EU industries have done successful in emission reduction. But the transport carbon emissions grew 21% in the past 10 years[12]. Transport carbon dioxide emissions in China accounted for 7.5% of the whole society emissions in 2012. Energy consumption accounted for 8.20% of energy consumption of the whole society. Among it, the road transport accounted for 52.1%. (The truck accounted for 18.8%, private cars accounted for 12.2%, agricultural vehicles accounted for 6.1%, and motorcycle accounted for 3.5%). Railway transport accounted for 17.3%. Water transport accounted for 16.5%, Air transport accounted for 9.8%. Pipeline transport and port transport accounted for 4.3%[13]. For a city as Suzhou which is resources scarce, at the same time, the number of cars is big, because the proportion of the automobiles to motor vehicles increased year by year, and private cars grow rapidly, to improve this situation has been of great urgency.

Through the above data analysis, it can be seen that the pressure of environmental pollution, greenhouse gas emissions and energy shortage of Suzhou caused by road traffic is enormous. This pressure mainly comes from the automobile of Suzhou, especially the rapid growth of private cars. Therefore, it is not only necessary, but also is urgent to realize low- carbon transport in Suzhou.

#### IV. SUGGESTIONS FOR IMPLEMENTING LOW-CARBON TRANSPORTATION STRATEGY IN SUZHOU CITY

Based on the above analysis, we believe that Suzhou must vigorously develop low-carbon transport, vigorously make use of low-carbon energy, improve the traffic environment, improve the efficiency of transportation, develop public transport, and achieve low-carbon public travel. To this end, we put forward the following concrete suggestions about the implementation of the low-carbon transportation development strategy in Suzhou city:

##### A. Vigorously Promote the Technical Progress of Low-Carbon Logistics and Low-Carbon Transportation

With the development of the times, car as the main road transport mode will not be changed. Therefore, which can be changed is the power source for vehicles. Greenhouse gas emissions of the vehicles is mainly derived from the use of oil and other high carbon materials. So, an effective measure to reduce carbon dioxide greenhouse gas emissions is the use of low - or no carbon clean energy as alternative energy for vehicles. The alternative energy sources including natural gas, ethanol, mixed or synthetic fuel, bio diesel, liquefied petroleum gas, electricity and solar energy etc. However, the use of these alternative energies not only has to do with its technical structure, supply cost,

degree of commercialization, but also has to do with the alternate process of old and new vehicles. It will be a long-term process. But just because of the long-term, it must be carried out as soon as possible.

#### B. *Improve the Traffic Environment and the Efficiency in the Use of Vehicle Energy*

Chinese passenger car's average fuel consumption is of 8.07 liter /100 km in 2012, which is 1.02 liter higher than the European standard and 2.67 liter higher than that of Japan. Low efficiency mainly because of the traffic jam, America wasted fuel is close to 3 billion gallons every year due to traffic congestion. Traffic congestion in China is more serious. Especially in the rush hour, the traffic congestion situation in the old city is extremely serious. The amount of fuel consumption and greenhouse gas emissions each year due to traffic jams is very considerable.

To improve the efficiency in the use of vehicle energy is mainly reflected in improving the traffic efficiency. Such as reasonable layout of traffic lights, employ vehicle intelligent traffic management system, increase three-dimensional road construction. Especially in the planning stage of road construction, to improve traffic efficiency, we should do our best to pay attention to the road capacity. At the same time, drivers must get rid of the bad driving habits, improve the quality of vehicle maintenance, strengthen the awareness of energy conservation, and thus improve the efficiency in the use of vehicle energy.

#### V. CONCLUSIONS

Based on the above analysis, Suzhou city government should increase public transport infrastructure construction, optimize the site layout of public transportation, facilitate various modes of transport interchange, implement the integration of rural and urban traffic, and increase the use of low-carbon, clean energy, reduce greenhouse gas emissions.

To sum up, in order to realize the sustainable development of urban traffic, to achieve energy-saving, emission-reducing targets, Suzhou must implement low-carbon transport strategy, optimize traffic resources allocation, and change traffic development mode. Suzhou should do its best to change the transportation development mode from the economic development oriented mode to the resource-saving oriented mode; shift from extensive, high pollution, high emission mode of transportation development to intensive, low energy consumption, low carbon transportation development mode, actively advocated the concept of recycling economy, and thus realize the low-carbonized and ecological development of urban transportation.

#### ACKNOWLEDGEMENT

Thanks for the Philosophy and Social Sciences Foundation of Jiangsu, China (04EYB022).

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