# Low Carbon Economy and the Transformation of Economic Development Mode of Wuhan of China

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**Abstract** After retrospecting related references on low carbon economy, the paper considers low carbon economy as a new economic development mode, which has been gradually becoming a global consensus. On basis, by analyzing the advent challenges, from three aspects including the stages of development, industrial structure, the status of resources and environmental, Wuhan (of China) intends to develop low carbon economy. Moreover, to quicken the paces of transforming the low carbon economy of Wuhan, the paper provides some suggestions from developing the industrials with the characteristics of low carbon, optimizing the energy structure, drawing up more approaches which contribute to the development of industrial policies of low carbon economy as well as shift the ways of production, living, and consumption.
**Key word** Low carbon economy; Wuhan of China; Economic development mode; Transformation

## 1 Introduction

The conception of 'low carbon economy' was initially mentioned in the government report of UK Our Energy Future: Creating a Low Carbon Economy. After the eighty of 20 century, the economist Grossman and Krueger (1995) institute 'environmental Kuznets Curve', they think environmental quality grows up with the same reverse 'U' curve relation like the economic growth. Subsequently, centering on the emission of carbon dioxide of greenhouses gases, the Japanese experts Kaya Yoyichi came up with the famous formula Kaya, namely, the emission load of carbon dioxide in a country or regions is dependent on four factors including the population, per capital of GDP, energy intensity and energy structure. In the Stern's report, Stern (2006) indicates that the annually investment of GDP 1% could avoid the annual loss of GDP 5-20%, meanwhile, appealing for the global transformation of low carbon economy.

In China, the theoretical research about low carbon economy has already turned into a hot topic. Zhuang Guiyang (2009) indicated that only if the indexes of carbon productivity achieves on the higher level economic form with the people's living standard, the low carbon economy could be finally realized. Zhang Kunmin (2009) indicated low carbon economy should be one part of resource-conserving and environmental friendly style society. Pan Jiahua (2008) indicated that carbon has nothing to do with living quality; it's the responsibility of developed country setting an example for developing the low carbon. Qian Zhixin (2009) predicted, following the waves of agriculture, industrialization, information, the world will ring in the fourth wave, namely the wave of low carbon, walking toward low carbon age.

With the transition to a global consensus on low-carbon economy, as the main country on carbon dioxide emissions, China confronts dual pressure referring to international commitments to reduce emissions and constrained resources and environments came from the economic development. The Chinese Government clearly stated its determination to develop a low carbon economy and take a series of initiatives to promote low-carbon economy. Low-carbon economy is considered to be as a kind of low power consumption, low pollution, low emissions and high performance, high efficiency, high benefits as the main feature, with less greenhouse gas emissions for a larger output of the new economic development model, it will significantly impact on the development of economic transition of China.

## 2 Restraining Factors of Developing Low-carbon Economy in Wuhan

At the end of 2007, to accelerate regional economic development in central, Chinese government approved the Wuhan city circle as the reform experimental area of building up 'resource-saving and environment-friendly society' (referred to as 'Two –oriented society'). The construction of two-oriented society and development of low-carbon economy possess a high degree of solidarity, developing low-carbon economy is regarded as vital path to construct two-oriented society. To construct 'Two-oriented society' as the target of Development of Wuhan city circle in Hubei Province is becoming the engine of developing economy rapidly, this leads to unprecedented opportunities for

Wuhan being as the growth pole. Meanwhile, the two types of community-building goals of the restructuring of Wuhan Economic Development put forward new demands. Wuhan is currently in the stage of accelerated industrialization, how to make good use of advantages, at the same time, dealing with relations well between economic development and development and utilization of resources and environmental protection of the relations to achieve the transition to a low carbon economy, facing a number of challenges.

### 2.1 Stages of development and the hypothesis of Environmental Kuznets Curve

Environmental Kuznets Curve considers that the growth of economy have influences on environment. Initially, with the development of economy, the per capital GDP will be increased with the deterioration of ecological environment, but when the per capital GDP achieve on certain level, the damage of ecological environment will be decreased with its increase, the amelioration of ecological environment, so that the relation between economic development and environment appears to a reverse U curve.

As far as concerned Wuhan is in the middle stage of industrialization, while benefiting from the national regional economic development strategy and industrial gradient transfer, the industrialization of Wuhan is in the stage of developing rapidly, compared with 10 years ago, in Wuhan, the main energy consumption has already increased by 1 times. Although the level of unit GDP energy consumption decreased in Wuhan, but rapid economic growth leads to increased carbon emissions, increasing pressure on ecological environment, Wuhan is still on the rising stage of Kuznets inverted U- Curve . Obviously, if we do not change the traditional model of economic development, the contradictions between economic development and resources and the environment will be more prominent.

### 2.2 Industrial structure and locked-in effect

The so-called locking effect (Locked-in effect) refers to the infrastructure, equipment, personal and other large consumer durables, once put into their useful, they could be used for 15 years to 50 years or more, technology and capital investment has a payback period, immediate replacement amounts to a huge economic losses. In comparison, due to locking effect caused by switching costs of developed countries costs is less than in the process of industrialization of developing countries.

Wuhan, an old industrial base, is in the development stage of accelerating industry, the industry accounts for a larger part of total GDP of Wuhan City whose economy is growing by the manufacturing industry of cars, machine-based equipment, steel, petrochemical, building materials and other heavy industry as major powers. In the economic structure which put more emphasis on heavy industry, not only long-term industrial investment, put a huge amount of money, and energy-intensive industries and key enterprises, accounting for a large energy consumption, energy conservation and consumption reduction are difficult, the high cost of converting a low carbon economy, facing the pressure of huge amounts of money and technology, to achieve industrial restructuring by locking effect will pay a heavy price.

### 2.3 Resources and environments and Ecological footprint

Ecological Footprint (Ecological Footprint) is used to calculate and measure the extent people use the natural resources and the extent to which human nature by providing an analysis of ecosystem services methods. By calculating the individual, regional, national or global population consumption of resources and consumptive needs of waste generated by the biological production area, and making a comparison with the range of the biological carrying capacity, the regional sustainable development could be measured.

As the economic development of Wuhan mainly depends on the consumption of resources of traditional industries, and rapid industrial development demands more energy, while the effective utilization of energy is still at a lower level, the over-exploitation of ecosystem, serious depletion of natural resources beyond its capacity, resulting in ecological footprint over the ecological carrying capacity, serious ecological imbalances that affect sustainable economic development in Wuhan. According to statistics, from 2002 to 2007 period, per capita ecological carrying capacity in Wuhan suggest little changes, but ecological deficit grows from 1.909815 $hm^2$ in 2002 to 2007, 2.610107 $hm^2$, ecological footprint of per capita is14.6 times the per capita ecological carrying.

## 3 Ways of Realizing the Transition into Low-carbon Economy Mode of Wuhan

### 3.1 The adjustment of industrial structure

Both of Knowledge-intensive and technology-intensive industries belong to low-carbon industries such as finance, consulting, advertising, education, insurance, and other modern service industry,

namely, the low power consumption, low pollution, low-emission or zero-emission industries, but also their knowledge and technical content has a very high added value. Wuhan has more universities, abundant science and education resources, strong comprehensive strength of science and education. Therefore, Wuhan should play to our strengths, change the economic development model, adjust the tertiary industries structure, and take the knowledge-intensive and technology-intensive development path, reduce the dependence of economic development of heavy chemical industries such as high carbon dependence, to develop high-tech and modern service industry and other low-carbon industries.

**3.2 Optimize the energy structure**

On the one hand, Wuhan should actively develop and utilize renewable energy sources such as solar, wind, hydro, biomass, biogas, and many other low-carbon or carbon-free energy. On the other hand, the transition from high-carbon economy to a low carbon economy cannot be achieved in the short term; it should focus on improving the efficiency of the use of fossil energy. If the Government promulgated a number of preferential policies to attract foreign investment, strengthen international cooperation, use of foreign advanced technology to improve energy efficiency and curb the increase in total consumption of fossil energy. Currently, on the aspects of utilizing the natural gas , building up waste to energy projects, foster solar energy industry, construction of rural biogas project, Wuhan is taking effective ways to strengthen them.

**3.3 Exerting the guidance of government and market mechanism to develop the industrial policies**

Government can raise the threshold for carbon-intensive industries, increase the taxes to the high energy consumption, high pollution and high emission industries, and lay out preferential policies to encourage the development of low carbon industries, reduce taxes on low-carbon or giving governmental subsidies to low carbon industry to attract investors. Meanwhile, the government can establish carbon sequestration projects funded by Carbon Trust, or encourage beneficial commercial and public sector to reduce carbon dioxide emissions comprehensively to promote the building of low carbon city of Wuhan.

**3.4 Fostering the low carbon ideas of businesses and the public**

To change the model of city's economic development, we must foster the consciousness of participating, building up the ideas of low carbon development in industry, encourage enterprises to enhance energy efficiency and the development of low-carbon technology, guide them to produce more products to meet the requirements of low carbon economy. In people's daily lives, they are encouraged to live in a low carbon way by adding more elements of low carbon, promoting eco-eating and consumption, such as promotion of eco-eating, open green car, home energy conservation and etc. Only urban enterprises and public act together can it be possible for Wuhan to transit into a low carbon economy.

## 4 Conclusions

From the aspects of the stages of development, industrial structure and resources and environments, the paper analyzes the difficulties during the process of transition towards low carbon economy in Wuhan. There are lots of ways for Wuhan to realize the low carbon transformation. For example, considering, adjusting the industrial structure; vigorously developing industries with the characteristics of low carbon; optimizing energy structure, improving energy efficiency and reducing carbon dioxide emissions; exploiting the guidance of government and market mechanism, laying out industrial policies which are conducive to the development of low-carbon economy; cultivating the ideas of low-carbon to businesses and the public philosophy, changing the patterns of the production, living and consumption. Only when those are realized, can Wuhan be able to set a good example for building up a two-oriented society in the Wuhan city circle by realizing the coordinated development of economic and resources and environments.

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