CHAPTER 10

New-Type Urbanization and Green Transformation and Development

1 The Unsustainability of the Traditional Urbanization Model

Urbanization refers to the development of industrialization accompanying the development of society. It is a historical process in which non-agricultural industries continue to cluster in cities and towns, rural population continues to transfer to non-agricultural industries and towns, rural areas transform into urban areas, the number and scale of cities and towns increase, and urban production and lifestyle and urban civilization continue to spread and spread to rural areas. Urbanization plays a positive role in economic and social development. In the process of urbanization, it has realized three structural changes. First, the industrial structure has been transformed economically. The primary industry with low efficiency is gradually replaced by the secondary industry and the tertiary industry with high efficiency. Secondly, the spatial structure of settlements has been transformed. The scattered and sparse rural village structure has been replaced by the concentrated and compact modern urban structure, greatly improving the land use level. Thirdly, with the transformation of social demographic structure, as a large number of rural population turns into urban population, the urban production and lifestyle and urban civilization gradually replace the traditional rural production and lifestyle and rural civilization. However, modern and contemporary world history shows that the process of urbanization is

S. Gu et al., *Green Transformation and Development*,
The Great Transformation of China,
https://doi.org/10.1007/978-981-32-9495-0_10

not always a civilized, beautiful and good process. Improper urbanization will also cause a series of problems in economy, society, resources and environment, among which the problems in resources and environment are particularly prominent, which is the fundamental reason for the unsustainable urbanization.

1.1 Main Features of the Traditional Urbanization Model

One-Sided Emphasis on Single Economic Growth

Sound urbanization development is the comprehensive development of economy, society and ecology. However, China's urbanization development over the past decades only emphasizes quantifiable and measurable economic growth. Under the GDP-oriented performance appraisal system and the local government-led urban development model, the development of a city is often simply and roughly understood as the city's economic aggregate, growth rate, non-agricultural industries and foreign investment. However, the development of population itself and the protection of resources and environment are understood as a kind of "ornament" existence, which is placed in an insignificant and dispensable awkward position. For example, the housing problem in China's big cities is a typical manifestation. The government relies on a large number of land sales and the development of real estate industry to maintain the rapid economic development of the city. But a large number of residents are burdened with the heavy pressure of mortgage and plagued by haze. Such a mode of urbanization development puts the cart before the horse for people. The graduates' escape from the big cities of "Beijing, Shanghai and Guangzhou" can be seen as a rejection of the development mode of putting the cart before the horse and a sign of the unsustainability of this development mode. Taking the green space in urban environmental construction as an example, although the urban green space area of China has increased somewhat (see Fig. 1), compared with developed countries, China still has a lot of gaps. The per capita green space area of many developed countries is in the range of 20~40 square meters, up to 60 or 70 square meters. For example, the per capita green space in Washington, United States and Stockholm, Sweden has reached 50 and 80 square meters, respectively, while the per capita green space in Chinese cities is only 12.2 square meters. In terms of urban green coverage rate, the green coverage rate of major cities in the United States

is about 60%, while the average green coverage rate of built-up areas in China was 39.6% in 2012. In 19 provinces (autonomous regions and municipalities directly under the central government), the green coverage rate is lower than the average, with the highest in Beijing (46.2%) and the lowest in Gansu (30.0%) (see Fig. 2). It can be seen that China's urban construction in the green construction debt is serious, it is urgent to make up lessons.

Extensive and Wasteful Urban Space Expansion

In the process of urbanization, the spatial expansion of a city is a natural process. Many foreign cities emphasize a compact and efficient spatial layout and smart and comfortable urban growth based on limited urban land and time and resource conservation. However, many cities in China have extensive management of urban land expansion and pursue a kind of "spreading the cake" type space expansion and spread, which not only causes waste and strain of precious urban land, but also brings trouble to people's green travel. It is reflected in: (1) there is a serious mismatch between urban land expansion and population growth, and land urbanization is much faster than population urbanization. Statistics show that in the 10 years from 1990 to 2000, the urbanization rate of land was 1.71 times faster than that of population, and from 2000 to 2010 it was 1.85 times faster than that of population, far higher than the normal 1.12 times. In 2000, the urban built-up area of China was

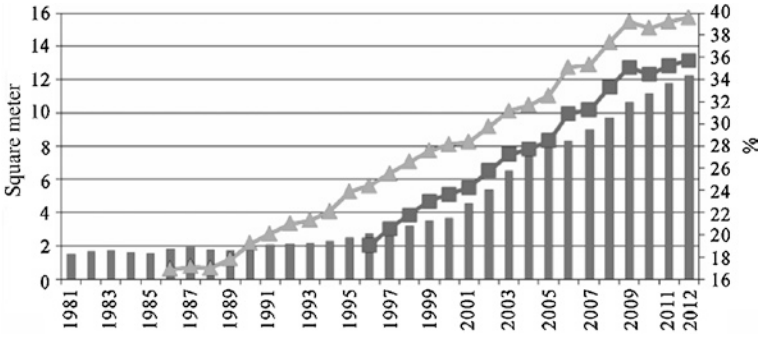

Fig. 1 Per capita green area of parks and green coverage rate of built-up areas in Chinese cities from 1981 to 2012 (*Data source* China urban construction statistical yearbook 2013)

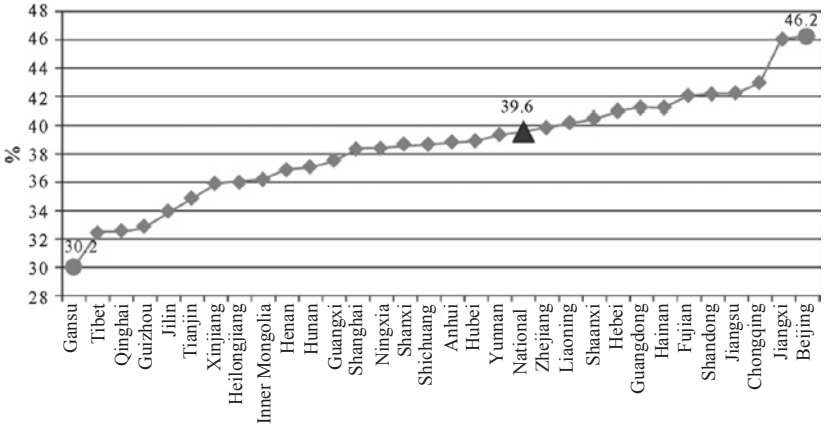

Fig. 2 Green coverage rate of built-up areas in all provinces (autonomous regions and municipalities directly under the central government) in 2012 (*Source* China regional economic statistics yearbook 2013)

22,439.28 square kilometers, which expanded to 38,107.30 square kilometers in 2009. From 2001 to 2009, the average annual growth rate was 7.76%, while the average annual growth rate of urban population was only 3.94%. (2) The average size of cities expands rapidly and grows extensively. From 1996 to 2008, the average built-up area of each city in China increased from 30.4 square kilometers to 55.4 square kilometers, and the average construction area of each city increased from 28.5 square kilometers to 59.8 square kilometers, an increase of 82.2 and 109.8%, respectively. (3) The one-sided emphasis on quantitative expansion in the development of new cities seems that the bigger the better. Many new areas in big cities cover hundreds of square kilometers, and some even cover thousands of square kilometers. It seems that the bigger the better, there is no smart growth concept. The same is true for all kinds of park construction. Under the background of accelerating catch-up and leapfrogging development, all levels of cities in our country, whether it is the construction of new industrial parks or the expansion of old industrial parks, are making efforts on the planning area, emphasizing on the of "number" and "size". Some are even as high as hundreds of square kilometers. There is little concept of resource conservation, especially land resource conservation. For example, in 2005,

the planned area of various types of development zones in China reached 38,600 hectares, 1.5 times the area of urban built-up areas in China. After clearing and rectification, the total area is still over 10,000 hectares.

Extensive Growth with High Consumption and High Emission

Urbanization inevitably consumes resources, but China's urbanization is an extensive growth process, which is characterized by high resource consumption, high waste discharge and high environmental load. Since 1978, China's energy consumption has increased dramatically (see Fig. 3), and it has always accounted for a large proportion in the world.

In 2010, China's cement consumption nearly tripled to 1.851 billion tons in 2004, accounting for 56.2% of the global total. Steel consumption accounted for 44.9% of global consumption. In terms of energy consumption, China's primary energy consumption accounted for 19.5% of the global total in 2009, including 46.9% for coal and 10.4% for oil. China's energy intensity was three times that of the United States and five times that of Japan in 2010, according to data released by the China energy research association. On the other hand, high consumption of resources is accompanied by high discharge of pollution, garbage and harmful substances. In the process of urbanization in China, urban sewage and urban garbage grow rapidly (see Figs. 4 and 5), which far exceeds the load range of urban environment and leads to serious deterioration of urban ecological environment. China's carbon

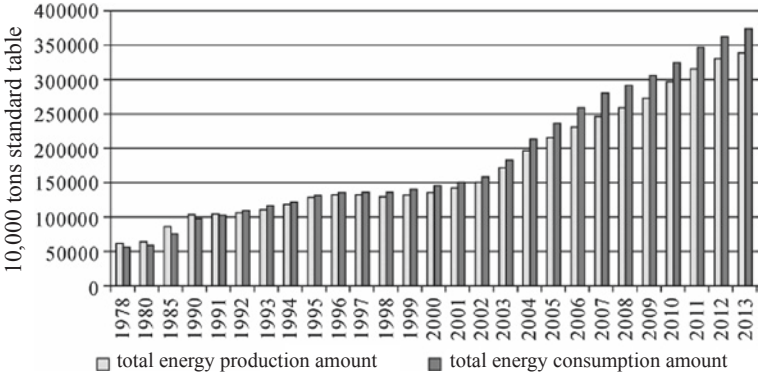

Fig. 3 Total energy production and consumption in China from 1978 to 2013 (*Source* China statistical yearbook 2014)

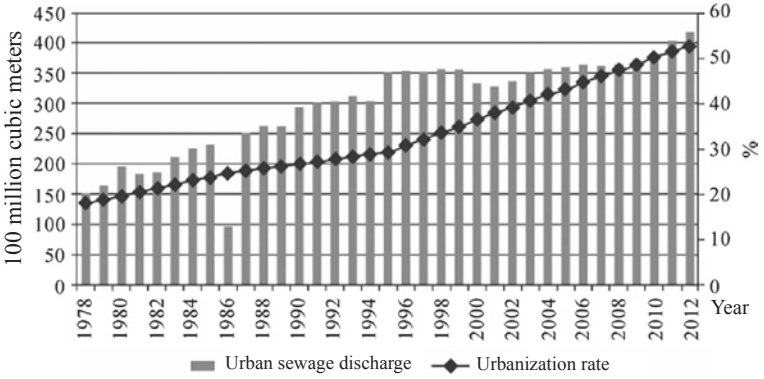

Fig. 4 China's urbanization and urban sewage discharge from 1978 to 2012 (*Data source* China urban construction statistical yearbook 2013)

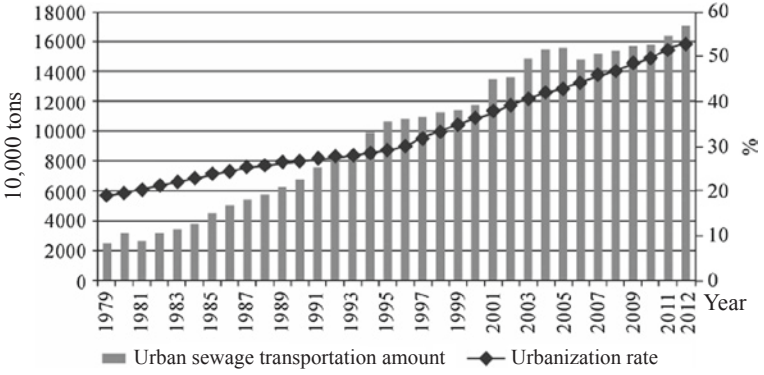

Fig. 5 China's urbanization and urban garbage clearance volume from 1979 to 2012 (*Data source* China urban construction statistical yearbook 2013)

dioxide emissions accounted for 21% of the world's total emissions in 2007, according to a report released by the international energy agency. Carbon dioxide emissions per unit of GDP were 3.16 times the world average and 5.37 times that of OECD countries. China's resources and energy consumption are mainly concentrated in urban areas. In 2009, among China's terminal energy consumption, public transportation industry and urban living consumption accounted for 85.2%. In the domestic energy consumption, urban areas accounted for 61%, and the

per capita energy consumption in urban areas was 1.83 times that in rural areas. According to the data provided by the international energy agency (IEA), in 2005, 41% of the urban population in China generated 75% of the primary energy demand, which is in contrast to the developed countries. On the one hand, it reflects the huge gap between urban and rural areas in China. On the other hand, it also shows the extensive characteristics of high consumption and high emission in Chinese cities.

1.2 Resource and Environmental Crisis of Traditional Urbanization Mode

Increasing Resource and Environmental Constraints

The rapid urbanization in China is based on a large amount of consumption of land, water resources, energy, raw materials and other resources. As a result, the contradiction between supply and demand of resources is increasingly intensified, which has become a hard constraint for the development of urbanization. For example, China's total water consumption and per capita water consumption have remained high in recent years (see Fig. 6), and the domestic water consumption in cities is in a rigid demand state, but the total water supply and water supply capacity of cities are stagnant in terms of the supply of urban water resources (see Fig. 7). According to the statistics of water conservancy department, among more than 660 cities in China, there are more than 400 cities that are short of water, among which 114 are seriously short of water. There are 71 cities in the north and 43 in the south with severe water shortage. Even in the water-rich Yangtze River basin, there are 59 water-deficient cities and 155 water-deficient counties. There are only 10 provinces and cities in China that are not short of water, accounting for less than 16% of the country's land area. Severe and extreme water scarcity areas accounted for more than 60% of the country's land area. If divided by the number of cities, the number of cities lacking water accounted for 2/3 of the total number of cities in China, which restricts the sustainable development of Chinese cities. For another example, in terms of energy supply, China's energy gap continues to expand (see Fig. 8). In 2013, the gap between energy supply and demand reached 350 million tons of standard coal, and the energy abundance was −9.3%. As a result, China's energy external dependence continued to rise: In 2009, crude oil imports exceeded the 200 million tons mark, breaking

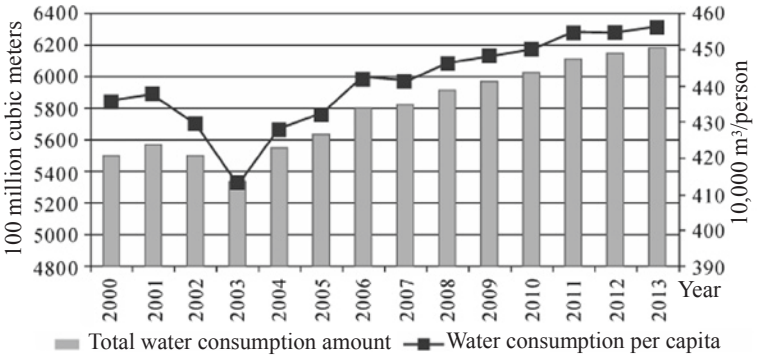

Fig. 6 Total and per capita water consumption in China from 2000 to 2013 (*Data source* China statistical yearbook of relevant years)

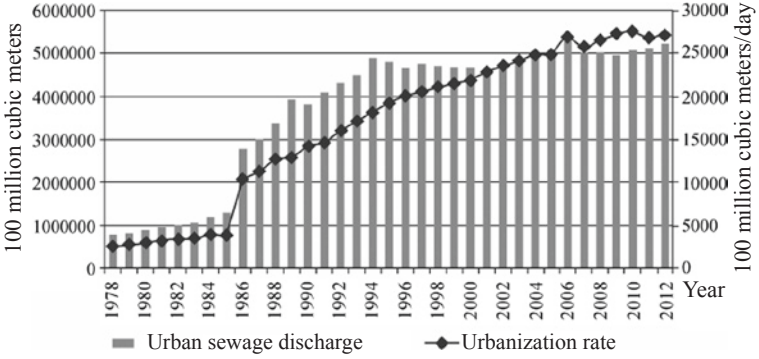

Fig. 7 Urban water supply in China from 1978 to 2012 (*Data source* China urban construction statistical yearbook 2013)

the 50% warning line for the first time. In 2011, it exceeded 250 million tons, but by 2013, it had exceeded 280 million tons, reaching 282 million tons, and its dependence on crude oil reached 58%. Not only that, it also paid a huge price in the economy, increased the cost of our country's development and weakened the international competitiveness of our industry. For example, China's crude oil import amount was less than 100 billion US dollars in 2009, rising to 196.66 billion US dollars in 2011, and reached 219.65 billion US dollars in 2013. There is also a crisis in the supply of urban land. Due to extensive land use, the quality of cultivated land in China has been sharply reduced, and the quality

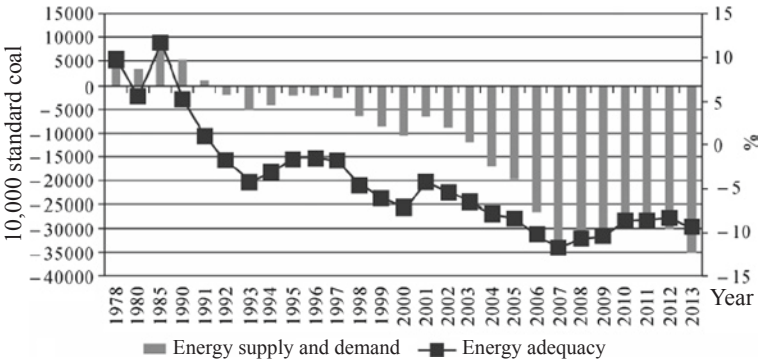

Fig. 8 China's energy supply and demand gap from 1978 to 2013 (*Data source* China statistical yearbook 1979–2014)

of cultivated land has been reduced. In order to ensure food security and other basic land needs, the supply of urban construction land has been limited. In short, extensive economic growth and irrational use of resources have wasted a large amount of precious natural resources, severely weakened China's ability to guarantee resources and environment for subsequent urbanization, and become an important prerequisite for the development of urbanization.

The Ecological Living Environment in Urban and Rural Areas Continues to Deteriorate

The traditional urbanization mode of extensive utilization of resources not only consumes a large amount of precious natural resources, but also produces a large amount of waste, pollutes the ecological environment and aggravates the deterioration of the ecological environment. It not only directly leads to the deterioration of urban ecological environment, but also damages the ecological environment of the vast rural areas with the increase and transfer of pollutants. The overall ecological and living environment in urban and rural areas continues to deteriorate, which is not optimistic. (1) The city is filled with a large amount of waste and harmful and toxic substances. In 2010, China's annual urban waste production reached 158 million tons, and the annual growth rate of 8~10%, per capita annual output reached 440~500 kg, some big cities increased by 15~20%. At present, China has accumulated nearly 8 billion tons of municipal solid waste, occupying 800,000 mu of land. About 2/3 of large and medium-sized cities in China are surrounded by garbage, and

about 1/4 of them have developed into the predicament of no suitable place for stacking garbage. The "garbage siege" trend has become, and will become more and more intense. Urban air quality is poor, PM2.5 concentration is generally high, and haze weather is becoming more and more frequent. According to the newly revised *Environmental Air Quality Standards* in February 2012, two-thirds of the cities in China have substandard air quality. The pollution in big cities is worse than that in small cities. At the end of 2008, the country's 113 key environmental protection cities alone accounted for 59.3% of the country's wastewater emissions, 47.5% of chemical oxygen demand emissions, 49.4% of sulfur dioxide emissions, 55% of nitrogen oxide emissions and 44.8% of soot emissions. (2) The ecological regulation system of the city itself is constantly damaged. Wetlands and groundwater are important ecological regulation systems of cities, and they are the "immune system" to maintain the healthy development of urban resources and environment. However, China's urbanization does not pay much attention to the protection of these "immune systems". In the process of urbanization, the area of urban wetlands in China decreases sharply and the biodiversity continues to decrease. Especially, due to excessive artificial intervention, urban wetlands are often divided into small areas, broken habitats and isolated patches, and the wetland habitats are often damaged. However, due to the over-exploitation of urban groundwater, the ground subsidence accelerates, and the ground water level in many cities and towns in north China, northwest China and east China continues to decline. Some areas have already seen regional geological disasters such as ground subsidence, cracks and seawater intrusion and other ecological and environmental problems. More than 50 cities across China have suffered from land subsidence disasters (see Table 1), especially in the north China plain, with land subsidence exceeding 200 mm reaching 64,000 km^2, accounting for about 46% of the whole north China. On the other hand, the discharge of waste water also pollutes the groundwater and threatens the safety of drinking water. From 1991 to 2011, the discharge of urban sewage increased by 37.4%, while the discharge of county sewage increased by 84.1% from 2001 to 2011. At present, nearly 20% of urban sewage, 30% of county sewage, and most of the sewage in the established towns were not effectively treated and directly discharged into rivers, lakes and seas, resulting in serious water pollution and threats to the safety of urban drinking water. According to statistics, 54% of the water quality in functional areas nationwide is

Table 1 List of cities with serious land subsidence in China

City	*Tianjin*	*Shanghai*	*Cangzhou*	*Suzhou*	*Changzhou*	*Wuxi*	*Tangshan*	*Jiaxing*	*Fuzhou*	*Ningbo*	*Zhanjiang*	*Nantong*
Sedimentation/m	2.78	2.7	1.131	1.056	1.05	1.0	0.801	0.75	0.679	0.45	0.413	0.3
Area/km^2	1300	850	–	150	200	100	1100	600	–	120	–	–

Source Fang Wujun, Ding Feng, Ge Pingtao, et al. Land Subsidence Caused by Groundwater Overdraft and Its Solution. *Science and Technology Information Development and Economy*, 2008, 18 (26): 205–206, 208

substandard, 90% of the groundwater is polluted, 64% is seriously polluted and 67.8% of the rivers are polluted, accounting for about two-thirds of the monitored river length. (3) Urban garbage and pollution tend to spread to the countryside. Taking urban solid waste as an example, data analysis shows that before the mid-1980s, the unit emission of urban solid waste in China was generally greater than 0.1 m^2/t. Since then, due to strict occupation of farmland and increased investment in comprehensive recycling and utilization, the area of waste per unit emission has been reduced to 0.09 m^2/t. In spite of this, the land occupation of solid waste in cities and towns still exceeds 60,000 hm^2. Most of these solid wastes are distributed around large- and medium-sized cities, which, together with other household wastes, continuously erode the farmland around the cities and threaten the local landscape ecology and water environment. (4) The health of urban and rural residents is seriously threatened. Severe weather such as smog aggravates the outbreak of lung cancer and other diseases in big cities. According to the monitoring data released by Beijing municipal health bureau in November 2012, the incidence of lung cancer in Beijing increased from 40.29 in 2001 to 62.68 in 2010, with an average annual growth rate of 2.4%. However, some small- and medium-sized cities, especially some industrial, mining and heavy industry cities, have neglected pollution control and environmental protection in the process of urbanization, leading to the emergence of "cancer villages" and other terrible phenomena in some towns and villages. It is estimated that there are about 459 "cancer villages" in China, and the phenomenon is gradually spreading to the Central and Western regions. In a word, the traditional urbanization model has produced various problems in terms of resources and environment. The next 20 to 30 years will be the period of rapid urbanization in China. If the urbanization model still follows the past thinking, it will bring more serious problems and the traditional urbanization model must be changed.

2 The Connotation of Green Development of New-Type Urbanization

New-type urbanization is an open concept, which is defined differently by different scholars and research perspectives. However, no matter which definition is used, it is believed that the new urbanization is the reflection and transcendence of the traditional urbanization model, the overcoming of its various disadvantages and a relatively advanced urbanization model. In terms of resource and environmental protection, it is

reflected in resource conservation, environmental friendliness, ecological civilization and the improvement of human survival and development environment. Because of this, the new urbanization is also a kind of green urbanization. For example, Chinese scholar Zhang Zhanbin believes that the connotation and characteristics of the new urbanization path are mainly summarized in four main aspects: First, industrialization, informatization, urbanization and agricultural modernization should coordinate and interact, promote the integration of industry and city through industrial development and scientific and technological progress, and realize the urban-rural development driven by green urbanization has the basic cities and towns as well as the urbanization of the continuation of rural civilization. Second, we should coordinate population, economy, resources and environment, advocate an intensive, smart, green and low-carbon development mode, build a beautiful China with ecological civilization and realize the sustainable urbanization of the Chinese nation. Third, build a city pattern that is closely connected with regional economic development and industrial layout. Take urban agglomeration as the main form, coordinate the development of large, medium and small cities and small towns, improve the carrying capacity of cities and show the urbanization of Chinese culture, civilization and confidence. Fourth, achieve all-round development of the people, build inclusive and harmonious cities and towns, reflect the orderly citizenization of the migrant agricultural population and the coordinated development of public services and commit to the urbanization of a harmonious society and a happy China. There are four aspects in the second aspect: First, the population, economy, resources and environment should be coordinated to highlight the overall and balanced development. Second, it needs to fully integrate the concept and principles of ecological civilization into the whole process of urbanization, highlight resource conservation and ecological environment friendliness, and demonstrate intensive, smart, green and low-carbon urbanization. Third, build a beautiful China with ecological civilization, realize the harmonious coexistence between man and nature, develop ecological economy and ecological products, and contribute to global ecological security. Fourth, achieve sustainable development of the Chinese nation, highlighting intergenerational equity and sustainable development. Green urbanization has the basic characteristics of low consumption, low emission, efficient and orderly. It is a new type of urbanization model that combines intensive urban development with green development, coordinates

urban population, economy, resources and environment, saves resources, reduces carbon emissions, is environmentally friendly and is economically efficient, and embodies the scientific concept of comprehensive, coordinated and sustainable development.

The author believes that the green development of new-type urbanization is not only reflected in the above aspects, such as resource conservation, low-carbon emission reduction, environmental friendliness and economic efficiency, but also in the harmonious ecological livable environment and life support. To be specific, in terms of resource conservation, it is embodied in saving water, land and ore, etc. The use of resources no longer focuses on the quantity of input, but on the connotation and repeated use. In terms of low-carbon emission reduction, the city layout is compact, the energy structure is reasonable, environmental protection materials are widely used, and the emission of toxic and harmful substances is greatly reduced. In terms of environmental friendliness, the concept of environmental protection is prevalent, and the environmental protection industry is developed. Industrial development and human behavior reflect the protection of the environment. In terms of economic efficiency, resources can support economic and social development. However, resources are used to the best of their ability, which is reflected in less waste and more efficiency. In terms of ecological livability, urban construction is no longer targeted at GDP growth, but a people-centered urban construction mode with people's own development as the goal. In the urban construction, people's health, comfort, convenience, safety and other aspects are reflected everywhere. In terms of life support, people are not only regarded as the core and the main body, but also as a whole between people and various creatures in nature. Cities are not only regarded as an economic carrier, but also as an important organism of nature. We should actively open up various channels for communication and contact between cities and natural ecological organisms, build ecological cities, and turn cities into a new and important ecological organism.

3 Foreign Practical Experience in Green Urbanization

3.1 The Development Process of Green Urbanization in Foreign Countries

The international research on the development of green urbanization has a long history, which can be divided into three periods.

First, the green urbanization theory was in its infancy (before 1920s).

As early as ancient Greece and Egypt, the important idea of urban construction is to consider the location, form and layout of a city according to its environmental factors. In 1898, the British scholar Ebenezer Howard proposed the idea of building Garden Cities in *Tomorrow: A Peaceful Path to Reform* and *Garden Cities of Tomorrow*. The core idea was: The layered design of the city, centered on the central park and supporting public buildings, radiates around and builds garden houses. The outermost part of the city is the industrial zone, which is separated by more than 1 m of avenue between the industrial zone and the residential zone to ensure the environmental quality of the residential zone. This idea of urban construction played an important enlightening role in the later ecological planning of urbanization, which can be regarded as the beginning of modern green urbanization. Later, Patrick Geddes developed Howard's idea in *Cities in Evolution* that urbanization should follow natural environmental conditions and plan and build cities according to ecological principles.

Second, the development and improvement period of green urbanization theory (1920s–1970s).

This period was characterized by the introduction of ecological thoughts into urbanization, the formation and development of urban ecological theories, and the widespread influence of urbanization. Under the influence of Howard's idyllic city thought, the urbanization development planning began to introduce ecological thought and gradually systematize it, and urban ecology was established and developed. In 1933, the *Outline of Urban Planning* (hereinafter referred to as the outline) formulated by the Congrès International d'Architecture Modern (CIAM), namely the Charter of Athens, began to introduce ecological thinking into the urbanization process. According to the outline, urban expansion devours the scenic green zones around it, alienates people from nature, further threatens public health and deprives people of the right to be nourished physically and mentally. Therefore, the primary responsibility of urban planning is to meet the most basic physiological and psychological needs of human beings. Starting from the four major activities of human's residence, leisure, work and transportation, "introducing nature into the city" should be considered in the overall influence of the city. Regional planning should replace simple administrative planning, and the boundary of urban aggregation should be determined by its economic influence scope. The *Outline* has a broad and far-reaching influence. It has not only achieved considerable development in research,

but also reflected the importance and response to the ecological development of cities in many important documents. In terms of research, in 1952, R. E. Park, a representative of the Chicago school of human ecology, published city and human ecology, advocating the creation of urban ecology, studying urban environmental problems and improving the ideological system of city and human ecology. In 1977, American scholar B. J. L. Berry's "contemporary urban ecology" systematically discussed the origin, development and theoretical basis of urban ecology, and systematically analyzed the spatial structure, dynamic changes and formation mechanism of urban population in the process of urbanization, thus forming the ecological research foundation taking the city as the object. In terms of important documents, in 1971, the "Man and the Biosphere" (MAB) research plan formulated by UNESCO put forward 14 research projects, of which the 10th project was "the impact of engineering construction on man and his environment", and the 11th project was "ecological problems of urban systems focusing on energy utilization". This is a reflection of the research on urbanization from the perspective of ecology, and the direction of urbanization research is determined to be ecology. In 1972, the declaration of the United Nations conference on the human environment pointed out that human settlement and urbanization must be planned to avoid adverse effects on the environment, and to achieve the maximum benefits from the three aspects of society, economy and environment for everyone. It clearly expressed that the development of urbanization should deal with the relationship between the environment, economy and society. The above shows that the eco-city theory has achieved unprecedented development. Here, the city is considered as a part of the natural ecological green system, and urban planning should build the city itself as an important organic ecosystem.

Third, the comprehensive practice period of green urbanization theory (since 1980s).

During this period, the green ecological concept of urbanization was further developed from theory to practice, and the idea of green city construction penetrated into all aspects. Especially in the 1990s, green development became the mainstream. In the process of urbanization, green ideas were promoted in an all-round way, from focusing only on green planning to permeating into green production, green circulation, green consumption and green culture in an all-round way. In 1981, the Soviet union city ecologist O. Yanitsky proposed the ideal model of eco-city, in which technology and nature are fully integrated, human creativity and productivity are maximized, and residents' physical and

mental health and environmental quality are protected to the maximum extent. Although the current reality is not very operable, this concept contains the yearning for a better city life and puts people-oriented and green development at the top of urban development. In 1987, Richard Register, an American ecologist, argued in *Ecocity Berkeley—Building Cities for a Healthier Future* that eco-city is a compact, energetic, energy saving and harmonious living place with nature, which reflects the idea of attaching importance to the harmony between environment, human and nature in the development of urbanization. In 1990, the urban ecology organization, which was organized and initiated by Richard Register, held the first international conference on ecological cities in Berkeley, putting forward the goal of reconstructing cities in ecological principles and improving the principles of ecological cities in 1996. These principles reflect the idea of emphasizing green and environmental protection. For example, the resource consumption and total amount of waste in cities should be much less than the current level of cities; choose green travel mode; give priority to the development of compact, green and safe mixed land use communities; advocate recycling, adopts new and excellent technology and resource protection technology; and reduce the discharge of pollutants and dangerous goods. In 1993, T. Domnski believed that the development of cities should follow the three-step pattern, that is, reduce, reuse and recycle. This is often referred to as the "three r's" principle, which embodies the green ideas in production, circulation and consumption. In 2002, the fifth international conference on eco-cities issued the *Shenzhen Declaration on Eco-City Construction*, which defined how to build an eco-city, including ecological security, ecological health, ecological industry metabolism and ecological landscape integration. These contents reflect that the urban construction reflects the concern for people everywhere, and puts green ecology at the center of urban construction, which greatly promotes the green construction of the city. This declaration has become a concrete action plan to guide countries to build eco-cities. In a word, the construction of eco-city in this period changed from idea to action and started comprehensive exploration and active practice.

3.2 The Practice Mode of Green Urbanization in Foreign Countries

From the practice of green urbanization in the world, the path of green urbanization development is not smooth. It can be said that it is to solve

the problems of resources and environment in urbanization, and it is a reflection, inspection and transformation of the traditional urbanization model. For example, in the accelerated process of urbanization in the UK, serious air pollution incidents occurred in London and other places. The large-scale development of suburbs in the United States leads to the continuous expansion of urban land, resulting in traffic congestion, environmental damage, loss of traditional culture and a series of other problems. Due to water pollution, the United States once closed 11,270 lakes and beaches nationwide. In the process of rapid urbanization in Brazil, the construction of supporting facilities has not kept up with the rapid development, resulting in serious garbage siege and slum problems. In the course of Japan's urbanization, serious environmental pollution problems, such as mad hatter's village, minamata disease, itamata disease, asthma and nuclear pollution, which once shocked the world. In recent years, India's cities have been expanding rapidly. Due to the shortage of environmental infrastructure, serious "urban diseases" such as environmental pollution, environmental recession, slums and urban poverty have also been brought about. In this way, in order to cope with various environmental problems in the process of urbanization, many countries have begun to explore a new green urbanization model featuring green, low-carbon and sustainable development.

In the practice of green urbanization, all countries adopt corresponding models and practices according to their own characteristics and main problems (see Table 2). Among them, although the UK started to implement the idyllic city concept proposed by Howard as early as the beginning of the twentieth century, it was not until 2007 that the UK really started to build eco-town nationwide. It was initiated by British Prime Minister Gordon brown at that time. He attached great importance to promoting environment-friendly technologies to protect the environment and control carbon emissions and consider the use of public transportation and reduce the use of private cars in the stage of town planning; promote sustainable communities; focus on the storage, collection, treatment, classification and reuse of garbage; reasonable use of construction waste in the construction process, to achieve zero waste emissions in the construction process. The United States combined the pre-Second World War American urban design concept with modern environmental protection and energy-saving design principles, and promoted the new urbanism and "smart growth" model. It advocates the

Table 2 Foreign models of green urbanization development

Country	*Model*	*Features*	*Major practices*
UK	Ecological low-carbon green city Construction mode	(1) The concept of "garden city" and "idyllic city"; (2) long history of green buildings; (3) balance urban and rural regional development; (4) comprehensively promote the construction of ecological towns; (5) social equity and justice, and a sound social security system; (6) the treatment of "urban disease" is relatively successful; (7) planning and legislation to correctly guide the development of urbanization	(1) Simultaneous development of urbanization in the industrial revolution; (2) scientific planning and guidance for overall planning of urban construction; (3) strict control of carbon emission standards; (4) lay a solid foundation for agriculture and coordinate urban and rural development; (5) pay attention to rural industry and intensify the construction of urbanization; (6) develop green transportation and attach importance to urban green space management
United States	(1) Ecological sustainability and "smart growth" concept of cities; (2) compact mode of land use	(1) Modern environmental protection and energy-saving design, scientific management, the management idea and the mode are operable; (2) the large-scale expansion of suburbanization in the United States after World War II; (3) set up special ecological sustainable research institutions; (4) coordinate regional development and attach importance to coordination	(1) Build ecological towns with local characteristics; (2) to create a residential environment with humanistic care and intensive use of land suitable for walking; (3) improve the quality of life, pay attention to the short-term and long-term ecological integrity; (4) delimit "urban development" to curb excessive development; (5) advocate the mode of public transportation and walking; (6) emphasize ecological design in new urban construction and restoration; (7) promoting circular economy projects and resource recycling

(continued)

Table 2 (continued)

Country	*Model*	*Features*	*Major practices*
Australia	High public participation and the concept of eco-city community	(1) Attach importance to the construction of sustainable green transport and promote sustainable rural urbanization; (2) attach importance to investment in environmental protection and build a green and environment-friendly town; (3) Resource cycling use	(1) Strengthen the coordination and investment of public transportation construction; (2) through price reform, the urban construction increases the green space in a large number; (3) promoting renewable resources and energy, sustainable water use and sustainable building technologies; (4) formulated feasible environmental planning, urban planning, energy planning and climate protection planning
India	(1) Green revolution; (2) population explosion and central city agglomeration pattern	(1) The metropolitan and the neighborhood form lasting space gathering; (2) The economy, society and system all show characteristics of rural; (3) The transferring speed of rural population to the urban is slow in India; the level of urbanization is only 30%	(1) Supporting urban infrastructure to increase development momentum; (2) ensure the realization of "greening construction" requirements in urban planning; (3) implement strict pollution prevention and control policies; (4) give priority to the development of public transportation and the controlled use of motor vehicles; (5) focus on the development of large enterprises
Japan	"East Asian model" of centralized urbanization	(1) Export-oriented development strategy; (2) spatial agglomeration mode with big cities as the core; (3) low-carbon life; (4) merging of town and village	(1) Attach importance to the formulation of environmental strategies, and environmental protection is the forerunner of urbanization; (2) accelerate the construction of ecological industrial park; (3) low-carbon construction; (4) urban expansion and urban and rural population flow and transfer, timely merger of town (town) village

Source Dong Zhanfeng, Yang Chunyu, Wu Qiong, et al. Research on the Strategic Framework of China's New Green Urbanization. *Ecological Economy*, 2014, 30 (2): 79–82, 92

construction of a residential environment with humanistic care, intensive land use and walkability, and promotes the sense of local belonging.

Natural and cultural resources protection, community planning for equitable distribution of development costs and benefits, community design, community development and community revitalization. The United States attaches great importance to legislative norms, and has proposed 27 new urban development principles in the form of the charter, supplemented by the government's guidance to achieve green urbanization. Urbanization in Australia has strengthened urban green planning, increased green space, promoted renewable energy and promoted the reuse of resources. India, on the other hand, has adopted strict pollution control measures and green construction requirements in response to the random and disorderly development in the surrounding development of big cities, and has taken measures to control, reduce and eliminate pollution by prioritizing the development of public transportation and large enterprises and increasing supporting infrastructure in cities. Japan is vigorously promoting the construction of ecological cities and towns across the country, the main methods including advocate low carbon life concept, popularize low carbon technology, lead people to choose low carbon goods, such as the government introduced a policy of "green point", namely, when consumer is buying energy-efficient appliances can get a share of the green points, which can be used to buy other energy-saving appliances. Japan also vigorously promotes low-carbon construction technology to achieve low-carbon construction.

3.3 International Experience and Inspiration of Green Urbanization

The international experience of green urbanization can be summarized as follows: First, it is necessary to have clear problem orientation and feasible pursuit goals. Green urbanization is the substitution and transcendentation of the traditional urbanization model. As a transformation model of urbanization, it must clearly identify the problems to be solved, overcome the disadvantages of traditional urbanization and formulate feasible goals and implementation plans. Second, individuality, innovation and difference. Although the main problem to be solved by green urbanization is the construction of resource and environment problems and life support system in urbanization, the specific conditions of each city are different and the main problems to be solved are

also different. Therefore, the path and content of green urbanization are also different. For example, for the same green transportation construction, some promote bicycles, some develop bus network system, some carry out equal planning and some focus on the development of big cities. Third, green urbanization is always combined with low-carbon environmental protection, resource conservation, circular economy and life support. Third, green urbanization is always combined with low-carbon environmental protection, resource conservation, circular economy and life support. Fourth, extensive public participation. Green urbanization is an activity that requires the participation of the whole society. No matter from the formulation of planning plans to the actual construction process, or the follow-up supervision and control; specific measures are required to ensure the broad participation and support of the public. Fifth, the perfect legal policy and the management system. Green urbanization not only needs to rely on sound laws and regulations to force the implementation, but also needs the support of science and technology to ensure its implementation in a sound management system.

4 Practices and Obstacles in the Green Transformation and Development of Urbanization in China

4.1 The Practice of Green Transformation and Development of Urbanization in China

The practice of green transformation development of urbanization in China started late, and it was not until the ninth five-year plan that it gradually received national attention. Although there is no systematic strategic consideration for green urbanization at the national level and relevant special policy documents are issued, a series of practices related to green urbanization have been carried out in a scattered way, aiming at preventing and controlling serious ecological and environmental problems in the process of urbanization. At the national level, the national development and reform commission, the ministry of housing and urban–rural development, the ministry of finance and the ministry of environmental protection have introduced a series of related policies, actively promoted green ecological construction, including supporting

the construction of green ecological urban areas, subsidizing green buildings, promoting building energy conservation, carrying out urban pilot demonstration, issuing or updating the relevant norms and standards, etc. By carrying out some advanced benchmarking and demonstration activities for ecological environment construction, they promoted the pilot exploration of green urbanization in pilot areas to accumulate experience and give play to demonstration effect. For example, the ministry of housing and urban–rural development has cooperated with local governments to carry out pilot projects of low-carbon ecological provinces and cities. By April 20, 2012, a total of 83 cities in China had established national model cities for environmental protection. 15 provinces, including Hainan, Jilin, Heilongjiang and Fujian, have launched ecological province construction. More than 1000 counties (cities and districts) have built ecological counties, and 38 counties (cities and districts) have built state-level ecological counties. A total of 1559 towns and townships were built into state-level ecological towns and townships. The Ministry of Environmental Protection (MEP) has initiated pilot studies on overall urban environmental planning in Fuzhou, Jiaxing and other cities. In recent years, the spontaneous exploration of green urbanization in local areas has also been accelerated. Zhejiang province has put forward the strategy of building green cities and towns, focusing on developing green buildings, building low-carbon cities and towns and creating humanistic characteristics of cities. Guizhou province has issued the national first green small town construction evaluation standard *Green Small Town Construction Evaluation Standard of Guizhou Province*, which plans to build 30 provincial demonstration small towns and 70 city-level (autonomous prefecture) demonstration small towns through pilot projects. Hunan province put forward the idea of green development throughout the whole process of new-type urbanization construction to realize the green rise. In addition, many cities, such as Dalian, Beijing and Hangzhou, have begun to pay more attention to ecological and environmental protection in their overall urban planning. In general, China's green urbanization practice is currently mainly in the stage of "top-down" promotion of pilot demonstration and "bottom-up" spontaneous exploration. These practices and explorations have initially shown the concept of ecological civilization and provided good experience for the extensive promotion and implementation of green urbanization strategy.

4.2 Obstacles to the Green Transformation and Development of China's Urbanization

The Objective Existence of Regional Development Gap

The Environmental Kuznets Curve indicates that the economic development in urbanization has a regular relationship with material resource consumption at a certain stage (see Fig. 9). That is to say, in the early stage of urbanization, the economic development level is low and the environmental pollution is relatively light. Then with the accelerated development of urbanization, economic growth and development are accelerated, the intensity of environmental damage is also enhanced, and the environmental quality deteriorates to different degrees. However, after the economic development reaches a higher stage, the intensity of environmental damage declines, and the environmental quality tends to improve with the economic growth. In spite of this, different urbanization models have different resource consumption intensity, and the material consumption intensity of intensive development model is significantly lower than that of extensive and natural evolution model.

China's urbanization practice also shows that in recent years, with the economic strength of developed eastern coastal areas increasing, citizens' desire to pursue a good ecological living environment becomes more urgent. Local governments, on the other hand, "give in" to

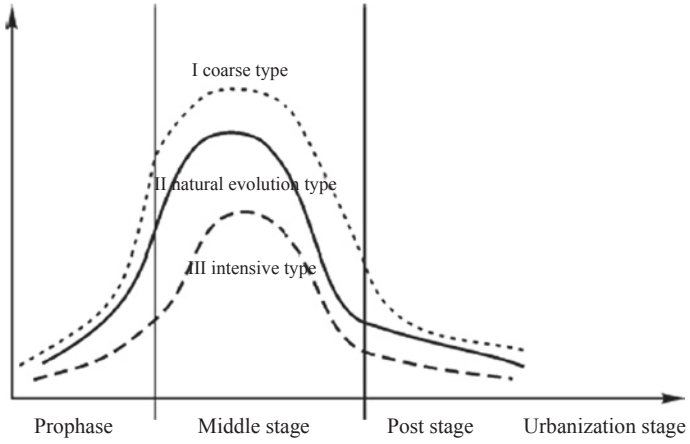

Fig. 9 Relationship between urbanization and material consumption intensity

citizens' pressure for environmental protection and "go with the flow". On the other hand, they have strong financial support from the government. Besides, promoting environmental governance can also give birth to environmental protection industry and cultivate new highlights of regional economy. Therefore, it is positive and effective in environmental governance, such as the environmental governance and environmental protection industry development around Taihu Lake in China. However, China's regional economic development is very uneven. There are still a large number of backward and poverty-stricken areas in the Central and Western regions, which are backward in economic and social development and have relatively low urbanization. In the future, the accelerated development of these areas is bound to increase environmental pressure, which is the objective resistance to the green transformation of urbanization.

The Reform of Resource and Asset Management Lags Behind

On the surface, the direct cause of the extensive use of resources in China is the low price of resources and resource products. But the fundamental reason is that the reform of China's resource asset management lags behind. The constitution stipulates that most natural resources belong to the state, and the state is the main owner of resource assets, while the state-owned natural resources adopt the principal-agent management mode. Some are delegated to corresponding ministries and commissions, while others are delegated to local governments, which in turn adopt a multi-level model of delegated and entrusted management. Thus, all natural resources of the state are managed separately by ministries and commissions and governments at all levels. More seriously, in the process of marketization, China's reform in the field of resources and assets lags behind, and is still affected by the past planned economic system. The ownership of resources is indistinguishable from the administrative right of resources and to some extent the executive power of resources wrongly replaces the ownership of resources. This leads to the sideline of the state as the owner of resources, the loss of the income of state-owned resource assets and the incomplete composition of the total cost of resources, which leads to the excessively low prices of resources and resource products in the market. Taking mineral resources assets as an example, China's mineral resources were allocated without compensation before the mid-1980s, but began to be used with compensation after the mid-1980s. The form of paid use is the collection

of resource compensation fees, resource taxes and paid mining rights in recent years. The compensation for resources is the state's past geological exploration input. In the resource market, the state should obtain the value-added income of capital input, and not just compensate for the past geological exploration input. Resource tax is a kind of tax, which is the income obtained by the government without compensation by virtue of administrative power, and it is not the income of the state as the owner of resource assets. In addition, these two charges are very low, the average rate of resource compensation is only 1.18%, and it has been canceled recently. The royalty rate of foreign countries equivalent to China's resource compensation is generally 2~8%, and that of the United States and other market economy countries is more than 12%. Compensation rates for some resources are even higher, ranging from 10 to 16% for petroleum, natural gas and mineral resources. Although the resource tax has been linked to the resource price after several reforms, it cannot reflect the purpose of the paid use of state-owned resources and the management of state-owned resource assets due to the weakness of the resource industry itself and the impact of the fluctuation of the market price of resource products. In terms of paid acquisition of mining rights, the proportion of paid acquisition through bidding, auction and listing is still relatively low. According to incomplete statistics, only 20,000 out of 150,000 mining enterprises have paid acquisition of mining rights through market mechanism, and the remaining 130,000 mining enterprises have paid acquisition of mining rights through administrative allocation. According to another survey, there are about 126,000 mining rights in China, and about 70,000, or 55.6%, of the state-funded mining rights are occupied free of charge. Therefore, the income status of the state as the owner of mineral resources assets is still not fully implemented. In addition, the environmental rights of Chinese citizens have not been clarified for a long time, and the environmental rights and interests violated in resource development have not been compensated. In this way, the total cost of resource production, which should be composed of the rent paid to the owner of the country, the compensation (governance) cost of resource development environment, the direct cost of resource production, the government fees and other parts, is saved from the rent paid to the owner of the country and the cost of resource development environment, which is the fundamental reason for the low price of resource products in China. Taking land resources as an example, China's constitution stipulates that urban land belongs to the state,

and the state can expropriate collective owner's land for the need of public interest, while the state-owned land in each city is managed by the local government. Therefore, local governments have a lot of power to decide on the use of land. In pursuit of the total GDP, land management, real estate development and other utilitarian thinking, local governments tend to expand the scale of land, and have a very weak sense of land conservation. But the expropriated land is abused due to the low compensation of land. Therefore, in order to realize the green transformation of urbanization, China should not only reform the prices of resources and resource products, but also improve the resource property rights at the source and strengthen the management of resource assets.

The Subject of Urban Management Mode Is Single

The distribution of power in China's traditional society is "great officials, tiny people", and the power is highly concentrated in the government. Since the reform and opening up, local government is the leading force of regional economic development and the main body of urban management. Local governments manage cities with their own advantages and indispensable management power, but cities are an open ecosystem, and environmental problems have strong externalities. Therefore, the management of urban environment depends not only on the government, but also on the full cooperation of the general public. In the past urbanization development, local government officials were aware of the existence of environmental risks to varying degrees in their development decisions based on the GDP scale and their own pursuit of promotion, appointment and dismissal. However, from the perspective of interest distribution and risk bearing, it was a more rational choice for them to prioritize economic development. In this mode of urban management, it is not difficult to understand the development thinking of "economy before environment". It is precisely because the city management power is highly concentrated in the local government, even if there is a problem, it may escape the accountability due to the promotion or relocation of officials, so that the long-term environmental risks of urbanization show a state of accumulation or even continuous outbreak. Although the system of resource and environment audit and lifelong accountability for outgoing officials has been gradually implemented, it still remains a single subject of urban management. Governance is different from management, which is top-down and emphasizes authority and obedience, while governance is interaction, dialog and consultation, communication and cooperation between the top

and the bottom. The practice of green city development abroad shows that the sustainable urban development mode is a kind of urban governance mode with the participation of multiple subjects, especially the citizens' economic participation. For example, in the preparation of the green infrastructure planning guidelines for the northwest region of the UK, it was realized at the beginning that the construction of environmental assets involves multiple interests and needs to fully mobilize the enthusiasm of all stakeholders. Therefore, the development partners were first identified to emphasize their coordination of the interests of the most important investors, and the local public interests were evaluated to maximize the public interests and reduce the implementation resistance. As a result, this green infrastructure planning and construction achieved great success. Another example is Portland, Oregon, which is a typical sustainable city in the United States. It was listed as the top 50 green cities in the United States by *Popular Science* magazine in 2008. Its green city planning and construction take from the citizen stratum, from bottom to top mode, citizen's active participation has played an important role. For example, let all citizens have the opportunity to participate in the process of traffic planning, express their interest demands and finally promote the formation of ecological traffic system planning and energy saving and efficiency of traffic. However, multi-subject participation in green city management itself is a gradually developing and mature democratic development process. For China, it is difficult to change the government-led, top-down and single-subject urban management mode in a short term. Without a good official assessment mechanism and performance evaluation system, resources and environmental protection will still be in a marginal position, which is also one of the difficulties in the green transformation and development of urbanization in China.

Support and Restriction of Green Science and Technology Strength

The development of green urbanization needs not only ideological renewal, but also solid scientific and technological strength. From the perspective of green city development abroad, green cities and towns need to make major breakthroughs in urban space planning, green transportation, green buildings, green energy, waste management and other key areas of green development and also need to make corresponding reserves in terms of talents, capital and materials. What's more, they need to constantly explore, practice and improve their management systems. However, the concept of green transformation and development has

not been popular in China for a long time. The development of green science and technology in energy, transportation, construction, waste disposal and other key fields is relatively backward. Many green management systems have just been established and are not mature and perfect, which restricts the development of green urbanization in China. Taking garbage treatment as an example, Japan, Germany, Denmark and other countries have improved garbage classification, recycling, and tax collection, while China's urban garbage classification management has not been thoroughly implemented even in economically developed big cities. Taking energy use as an example, China's energy structure is mainly based on coal, and the urban energy in the north is even more dependent on coal. However, China's coal cleaning is restricted by technology, cost, safety, economy and other aspects.

5 China's Urbanization Green Transformation Development Ideas

5.1 The Specific Legalization of the Concept of Green Development

In recent years, the construction of "ecological city", "green city", "low-carbon city", "livable city" these terms is frequently reported in the network, why not put into action? There are two key points: One is the lack of concrete operational research on how to implement it and the second is the lack of a mechanism to impose constraints on the key subjects of implementation. Then the future solution is also two aspects: First, strengthen research on key areas of green urbanization, especially on specific operational links. For example, to strengthen the study of various resource conservation standards, such as (energy saving, land saving, water saving, etc.), sewage standards (waste water, waste gas, waste residue, etc.), green standards (per capita park area, green coverage rate of built-up areas, etc.), standards for the use of materials and tools (green building materials, green furniture, green transportation tools, etc.), waste disposal standards (sanitary landfill, high-temperature composting, incineration). According to relevant laws and regulations, formulate operational standardization management system to make it real, concrete implementation. The second is to strengthen the key influential subject of a strong constraint. These main bodies mainly include government officials in charge of local urban construction departments (for example, urban construction department, resource department,

environmental protection department, health department, etc.) and enterprises in related industries (such as real estate industry enterprises, energy industry enterprises, transportation industry enterprises, building materials industry enterprises, chemical industry enterprises and printing and dyeing industry enterprises, etc.), which are subject to strengthened constraints. Government departments mainly strengthen their sense of regulatory responsibility and supervision dereliction of duty accountability system. However, relevant enterprises need to combine the standard of "greening" of the industry with their actions to force some enterprises to update production technology or directly withdraw from the industry, so as to ensure the "green" support of green urbanization.

Although green urbanization can be made from green (space) planning, green energy, green transportation, green building, green coverage and other aspects, but the specific situation of each town is different, the focus of "greening" and the conditions available for "greening" are also different, so the choice of green path is also different. As a matter of fact, the international green city construction and management practice also shows that green urbanization is more of a way to break through than a comprehensive attack for each specific city. For China, a country with a vast territory, large differences in natural conditions between the south and the north, and large gaps in regional development between the east and the west, green urbanization should not only set basic baseline standards for green development, but also encourage differentiated and individual development. For example, for the regions in the eastern coastal region with a relatively high level of economic development, incentive policies should be formulated to encourage the development of their green industries. On the one hand, it should promote the industrial transformation and upgrading in a timely manner; on the other hand, it should provide technological progress and material support for the green transformation and development of other backward regions through the development of their green industries. The Central and Western regions, which need to accelerate urbanization and industrialization, are encouraged to upgrade traditional industries and pursue energy conservation and low-carbon development. Cities in the south, where the temperature is higher all year round and do not need to rely heavily on traditional fossil energy, are encouraged to change their lifestyles, make full use of renewable energy and optimize the energy structure. For the northern cities, clean and economical use of traditional fossil energy is encouraged to improve energy efficiency. In short, regional differentiation should be

taken into consideration in green urbanization, and the exploration of green urbanization in various cities should be encouraged. Besides some mandatory green baseline standards, the choice and exploration of green development path should be respected.

5.2 Scientific and Systematic Management of Resources and Assets

First, implement classified management of resource assets. In view of the fact that the benefits of some natural resources are shared by all and should not be owned by individuals, the public welfare natural resources assets and operational natural resources assets should be strictly distinguished. The former is strictly prohibited from circulation in the private sector, ensuring that its public value (such as national security value, ecological value, genetic value, esthetic value, scientific research value, educational value) is shared by most people. For the latter, on the premise of not hindering its public value, it can enter the private circulation conditionally, but its negative effects should be strictly controlled through sound system. In new-type urbanization, the first step of urban planning is to identify and determine public welfare natural resource assets, carry out special protection for them and strictly limit their private interests such as operation and development.

Secondly, perfect the property right management of resource assets. At present, the ownership of state-owned natural resource assets is very clear, but the right of use and management need to be further set up scientifically. For example, the public welfare natural resource assets mentioned above need to clarify the right of use, supervision and management participation of the public, while the government needs to clarify the management obligation and the management power it can exercise. As for the state-owned operational resources and assets, the ownership is clearly owned by the state at present, but the rights of use, disposal and revenue need to be further clarified and improved. For example, state resources must be paid for, and must comply with the provisions on the protection of ownership. The power of local government and relevant ministries and commissions in resource and asset management should be clearly defined and standardized. The agent of the ownership of resource assets must faithfully fulfill the escrow obligation, and his behavior must not harm the interests of the state as the owner. For example, the state-owned resources and assets cannot be seized or sold cheaply, not

to profit from rent seeking. The concentrated expression in the right of return is to improve the income system, fully implement the national owner's income and ensure that these benefits are owned by the state. In the new urbanization, the property right management of land resource assets, tourism development resource assets and mineral resource assets in resource-based cities should be strengthened.

Third, strengthen the price management of resource assets. In order to economize and optimize the utilization of precious natural resource assets, it is necessary to improve the socialist market economic system, further eliminate the influence of monopoly and planned regulation through reform and make the price of resource assets reflect the market supply and demand situation sensitively. In the process of new-type urbanization, it is particularly necessary to change people's extravagance and waste of water, energy, land and other natural resources through the transmission of market price signals, so as to promote the conservation and utilization of resources and the formation of intensive new-type urbanization. In addition, comprehensive use of tax, price subsidies and other means to adjust the price of resource products, promote the optimal use of resources. Many natural resources have similar uses, and they can replace each other to a certain extent. In the case of different degrees of resource scarcity and environmental impact, price reform of resource products can be adopted to promote the rational use of resources. For example, many non-renewable mineral resources in China are not fully utilized, resulting in excessive waste and serious environmental pollution. In the new urbanization, the development of waste disposal industry can be stimulated and the price of recycling resource products can be raised to curb the development of primary mineral resources.

5.3 Social Participation in Green City Management

Local governments are encouraged to mobilize the enthusiasm of the whole people and formulate the green city construction and management plan that all the people are enthusiastic to participate in, under the condition that the development of green urbanization path is differentiated and the choice is individualized. The local government should change the traditional top-down decision model, in the event of an important resource environmental impact on city development, such as a particular period of urban development strategy, urban space development planning, urban industrial layout planning, reconstruction of

urban resource conservation projects, urban sewage management reform and reconstruction of the urban greening. We should fully assess its environmental impact and sort out the relevant stakeholders that may be involved, invite these stakeholders to participate in the joint decision-making of the project, optimize the design of the project implementation scheme, make the relevant stakeholders have the sense of equal participation in the decision-making and improve the consciousness of cooperation and promotion in the project implementation. In the east coast of China, where the economy is more developed, the public has more urgent requirements for a good ecological environment, and the decision-making participation degree is higher, the socialized participation mode experiment of green city management can be given priority to, and the basic path for the public to participate in green city management can be explored, so as to provide experience for the green urbanization in other regions in the future. It can also be classified by region to explore the social governance model of green urbanization in different regions.

5.4 Ensuring the Supply of Key Supporting Technologies

The key supporting technologies in green city construction include "hard technology" and "soft technology". The former mainly includes resource conservation and utilization, resource recycling and ecological environment pollution control, while the latter is mainly scientific and effective management in various fields of green city construction. In terms of resource conservation and utilization, key supporting technologies include land saving, energy saving, water saving, ore saving (non-energy mineral resources) and forest saving (forestry resources). The key supporting technologies of resource recycling technology are urban garbage treatment, resource recycling technology in factories and resource recycling design in households. In terms of environmental pollution control, the key supporting technologies include water control (urban sewage treatment), gas control (atmospheric environment control of cities and urban agglomerations), soil control (land pollution control of urban and rural suburbs and mining cities), etc. Soft science and technology, on the other hand, covers the management science knowledge of green city construction, especially the knowledge of humanities and social sciences, such as the formation, cultivation and application of urban green consumption culture, social participation design of green city construction, legal regulations of green city

construction and so on. Priority should be given to these key support areas in the plan for tackling key scientific and technological problems, and special funds should be allocated to train and educate personnel and support scientific research. We will strengthen reform of the science and technology system and the financial management system, and encourage cities to formulate their own science and technology support plans for green cities in line with their own green city development plans. Through coordination and overall planning, the state shall conduct special research on key green supporting technologies with nationwide influence that are included in the national key science and technology program, and strengthen the sharing and promotion of research results. For the key supporting technologies with integrated ecological function, regional joint research is encouraged and necessary human, financial and institutional innovation support is provided by the state. As for the supporting technologies that are limited to the impact in individual cities, the state encourages local innovative research, and encourages research in the form of special funds, innovative selection, material awards and honorary titles.

5.5 Strengthening Practices in Key Influencing Areas

In terms of urban land use, it is necessary to adjust the structure of land use, increase the area and proportion of land used for public facilities, municipal facilities, external transportation and green space, and at the same time reduce the area and proportion of land used for living, industrial and especially heavy industry in the city. Improve land use efficiency and development intensity, adopt effective measures to coordinate land use, strictly prohibit land destruction and improve the utilization efficiency of existing urban land use and infrastructure utilization efficiency by improving plot ratio and population density; explore the internal potential of urban land, such as expanding urban space through old city reconstruction, strengthening the management of unused land and three-dimensional development of urban space; integrate planning of land use and transportation system; and promote the coordination of population, industry and transportation.

In the aspect of urban transportation construction, priority should be given to the development of public transportation system and the reduction of urban transportation energy consumption, such as the moderate construction and development of rail transit, the restriction of the use of cars, the emphasis on the development of slow traffic system (sidewalks,

bicycle paths, etc.), the promotion of environment-friendly vehicles and the development of intelligent transportation system. In addition, it is necessary to strengthen the coordinated planning of land and transportation, attach importance to the ecological protection of transportation construction and to the participation of the public in urban transportation planning and construction.

In terms of green space system construction, we should build an urban ecological network system integrating urban and rural areas. We should not only pay attention to the green space construction in the urban area, but also the green space construction in the surrounding areas of the city, making urban construction a part of urban regional ecosystem; protect the restricted ecological land, prohibit the ecological sensitive areas, and ensure the realization of urban ecological public functions; adjust measures to local conditions, develop fully, reasonable arrangement of all kinds of urban green space; strengthen the renovation and renewal of the old green space ecosystem and call on the residents to participate in the construction of the green space system.

In terms of urban waste management, we should advocate green consumption and reduce the amount of waste at the source; improve the garbage classification collection management system and the development of resources recycling industry; strengthen science and technology, improve the garbage resources, harmless treatment technology; ensure the investment of management funds; increase the supply of garbage treatment infrastructure.