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**RESEARCH ON THE PRACTICE AND CHARACTERISTICS  
OF CHINA'S ECO-CITY CONSTRUCTION**

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# Abstract

Due to the harsh ecological environment of the earth, while the ecological civilization is being put forward, the eco-city has received more and more attention, and it has become a new target for the reconstruction of the old city or the construction of a new city. However, because of the uncertainty of the concept of eco-city and the ambiguity of scope, many related academics and practices have different biases in the original understanding, but there is some consensus.

This thesis begins with clarifying the concept and scope of a seemingly chaotic eco-city, Based on reviewing relevant international research, summarize the evolution process of the concept of eco-city concept, and compare and classify it; Combine the definition of eco-city with the practice of eco-city construction in China, and analyze the concept similar to eco-city; According to the similar characteristics of scale and attribute, the eco-city is divided into two categories: "Top-Down type" and "Bottom-Up type" to better understand the course of practice and characteristics. It also expounds the practice history of eco-city construction in 1986-2016 and divides it into three stages according to the characteristics of construction quantity and quality; Summarize the background, the general situation of practice and the promotion of policies of each stage of practice, and on this basis, analyze the whole process to see the current status of China's eco-city practice. Then, according to the different characteristics of each type, the classification is made on the basis of the two types of eco-city division, and the characteristics are summarized on the basis of types, so that the eco-city types are more refined and perfect. Through the collection of the ecological city and the selected two parts of the Chinese ecological demonstration zone, the chart is used to show the overall development characteristics of the eco-city, which analyzes the characteristics of time, space, base site selection, land use scale and development subject; The case analysis method is used to deeply analyze the characteristics of the refinement types of the two types of eco-cities, and each refinement type and large-type features are obtained. Based on the summary analysis of the course of practice and characteristics, combined with internationally renowned case analysis and comparison, found problems in the process of China's eco-city construction and made relevant suggestions, hoping to provide a basis for the development of eco-city development strategies.

**Keywords:** China; Eco-city; Practice Process; Classification; Case; Characteristics;

# Chapter 1. Introduction

## 1.1 Research Background

### 1.1.1 Ecological civilization has become China's basic national policy

China has paid enormous resources and environmental costs in the rapid development of the economy, which has seriously restricted China's sustainable development. In 2007, the "*17th National Congress*" report of the Communist Party of China first proposed "*ecological civilization*" and began to comprehensively promote the construction of ecological civilization in terms of national strategy and policy<sup>1</sup>. In 2012, the CCP's "*18th National Congress*" report proposed "*putting the construction of ecological civilization in a prominent position*" and placed the ecological civilization on an equal footing with political civilization, economy, society and culture, and upgraded to the "*five in one*" level to discussion.<sup>2</sup> The Third Plenary Session of the 18th CPC Central Committee held in November 2013 proposed to deepen the reform system of ecological civilization construction. This shows that ecological civilization has become China's basic national policy to promote sustainable development.

### 1.1.2 New urbanization strategy clearly proposes green city development

Urbanization is the main potential and maximum demand for China's next stage of development. Since the "*18th National Congress of the Communist Party of China*" pointed out that adhering to the new industrialization, informationization, urbanization and agricultural modernization with Chinese characteristics<sup>3</sup>, China began to explore new urbanization development models. The Central Economic Work Conference at the end of 2013 made it clear that "*the concept and principles of ecological civilization should be fully integrated into the whole process of urbanization, and a new urbanization path of intensive, intelligent, green and low-carbon will be adopted*"<sup>4</sup>. The subsequent Central Urbanization Work Conference proposed to focus on green development, circular development, and low-carbon development. Green ecological development has become the core measure of China's new urbanization strategy. The government work report of March 2014 puts forward: adhere to the new urbanization road of taking people as the foundation, synchronizing the four modernizations, optimizing the layout, ecological civilization and inheriting culture. Immediately after the "*National New Urbanization Planning (2014-2020)*" was officially announced, as a programmatic document guiding China's new urbanization, the plan regards "*ecological civilization, green and low carbon*" as one of the important principles to be adhered to in planning. Require the concept of innovative planning, "*to integrate people-oriented, respect for nature, inherit history, green low-carbon concept into the whole process of urban planning*", and elaborate on the green city in green energy, green buildings,

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<sup>1</sup> Lian Yuming. (2014). Report on the Development of Ecological Civilization in China. Contemporary China Publishing House, 22-23.

<sup>2</sup> Wu Jingjing & Zhu Huanghe. 2013(1). Ecological Civilization Construction under the Perspective of "Five in One". Marxism and Reality. 157-162.

<sup>3</sup> Chen Yulu. 2013(2). Financial Support in China's New Urbanization Construction. Economic Research. 10-12.

<sup>4</sup> Huang Juan. 2014. The new urbanization ecological civilization road with Chinese characteristics[C]. China Economic Law Research Association Annual Meeting and "Economic System Reform and Regional Economic Development" Theory Seminar. 12-13.



green transportation, industrial park recycling, urban environment Comprehensive governance and green new life activities, etc<sup>5</sup>.

### **1.1.3 Green development has become a common consensus of the international community**

Green development is the consensus of most countries and international organizations in the world. In recent years, most countries have regarded green development as an important measure to promote transformation and development, and have successively proposed a series of green development strategies to promote sustainable development in the region through strategies such as green growth planning, green cities, and green investment<sup>6</sup>. The UK is one of the first countries to promote green development, and green city construction is the carrier of its green development model. Germany has made breakthroughs in the exploration of green environmental technology industry development. In 2010, Japan formulated the "Green Development Strategy" master plan, and based on this, launched a rate revolution at the economic and social levels. In 2008, the United Nations Environment Program proposed an initiative for a green economy and a green new policy, emphasizing that "greening" is the driving force for economic growth and has received positive response from the international community. The European Commission issued the "*EU Strategic Plan 2020*", proposing green as one of the core developments, and supporting the EU's transition to energy efficient use and low-carbon economy through the establishment of energy efficiency alliances.

## **1.2 Research purposes and significance**

### **1.2.1 Research purposes**

This study attempts to integrate various documents and sort out the concept of eco-city that is most recognized by the academic community in Chapter 2. And based on a clear concept, reinterpret the type of eco-city; An overall review and combing of the practice of eco-city construction in China over the past 25 years will be carried out, and the analysis of eco-cities will show diverse characteristics in terms of time and space axis and other aspects. Look forward to have a more comprehensive understanding of China's rapid urbanization process and eco-city practice, and to build a harmonious, beautiful and sustainable Chinese city with a calmer and more rational attitude and approach.

### **1.2.2 Research significance**

#### **(1) Define the scope of China's eco-city and classify it**

The concept of eco-city is chaotic and the definition is not clear. Every scholar has its own interpretation, which leads to a vague concept. This paper will define the eco-city according to the status quo of China's eco-city, so that the term eco-city has a unified basis in the future use.

#### **(2) Make up for the blank of evolution, and organize the evolution of the past**

This study will systematically sort out the history of China's eco-city practice construction in the past 25 years, and focuses on analyzing and tidying up the past ten

<sup>5</sup> National New Urbanization Planning. Rural Work Communication, 2014(6): 32-48.

<sup>6</sup> Wu Zhiqiang, Ji Lingyun. 2006(4). Background and Prospects of China's Ecological City Construction. Architecture and Culture, 32-34.

years, making up for the gaps in the literature at this stage, forming a context, and providing an information base for further research in related fields in the future.

### **(3) Summarize the characteristics of the construction practice process and discover the law of practice construction**

This study not only summarizes the practice process, but also analyzes the characteristics of its practice history reflected in time and space. It is presented in a qualitative and semi-quantitative way, make it more visual, more intuitive, and easier to distinguish, which is more helpful to discover the law of the evolution of practice construction.

### **(4) Establish a foundation for in-depth research in related fields and explore future trends**

Chinese cities are entering an era of ecological civilization. However, due to the imperfection of relevant theories and the ambiguity of facing basic conceptual methods at the operational level, it is difficult to form a comprehensive theoretical framework for ecological cities. In this way, it is difficult to clarify the unified thinking towards the construction and development of ecological cities, and even design itself will become an obstacle to the city's ecological and even sustainable development. Therefore, exploring and improving the basic cognition and theory of eco-cities is an inevitable path for industrial cities to move towards eco-cities. It is hoped that the final results of this paper can better guide the development of eco-cities in the future.

## **1.3 Summary of Chinese and international studies**

### **1.3.1 International eco-city related research**

#### **(1) Development of eco-city ideas**

Although the eco-city has developed rapidly since the 1980s, its concept has a long history. Whether it is the human settlements in ancient China, or the ancient European cities and the villages of the American southwestern Indians, the prototype of the eco-city can be seen<sup>7</sup>. Modern eco-city ideas originated directly from the idyllic city of Howard. The idyllic city theory shows us the ecological charm of the balance between city and nature. Letchworth in England was an idyllic city designed by Howard<sup>8</sup> and built in 1903. After almost a century, the town is still one of the most pleasant habitats: Letchworth received state funding far below the average English town; Public health indicators—infant mortality, average life expectancy, and so on, are another town in England, Welwyn. Welwyn is another English idyllic city designed by Howard.

The two climaxes of urban ecology that have emerged since this century have greatly promoted the improvement of people's environmental awareness and the development of urban ecological research. The relationship between man and nature has been re-recognized and reflected in the context of modern society. As early as the 1940s, Sert<sup>9</sup> summarized the documents of the 1930 CIMA conference into a book, "*Can Our City Survive*," which has warned of the consequences of environmental damage. In 1962,

<sup>7</sup> Ma Jiaoguo, Yang Yongchun. 2004. A Review of the Study of Ecological City Theory. Journal of Lanzhou University: Social Science Edition, 32(5): 108-117.

<sup>8</sup> Ebenezer Howard OBE (29 January 1850– 1 May 1928), the English founder of the garden city movement, is known for his publication *To-Morrow: A Peaceful Path to Real Reform* (1898)

<sup>9</sup> Josep Lluís Sert i López (1 July 1902 – 15 March 1983) was an architect and city planner born in Catalonia, Spain.

ecologist Rachel published the popular science book "*The Silent Spring*", and many of the masterpieces represented by "*The Limits to Growth*" and "*A Blue print for Survival*" reflect the general concern of the ecological environment. Questions have been raised about the existing economic growth model.

The United Nations Conference on the Human Environment was held in Stockholm from 5 to 16 June 1972. The conference issued a declaration on the human environment. The declaration clearly stated that "*human settlement and urbanization must be planned to avoid adverse effects on the environment and to maximize the social, economic and environmental benefits for everyone.*" In 1975, Richard<sup>10</sup> and several friends founded the Urban Ecology, a non-profit organization that aims to "*rebuild cities in balance with nature*". Since then, the organization has been involved in a series of ecological construction activities in Berkeley and has had an international impact. In the same period, the study of urban ecology in the world has been vigorously developed, and the connotation of eco-city has been continuously enriched. Register believes that in addition to Berkeley's "urban ecology" organization, there are many others who have contributed critical ideas to the basic concepts of eco-city. Such as Ian's "*Design with Nature*"<sup>11</sup>, Paolo's<sup>12</sup> "*Arcology, the City in the Image of Man*", and E.F. Schumacher's "*Small is Beautiful*." In addition, the book "*Another Beginning*" and Kenneth's "*Autokindvs.Mankind*" and "*The Community Space Frame*" provide a more direct explanation of the eco-city. Due to the efforts of many research organizations and the publication of some of the works, the concept of eco-city has become flesh and blood, such as Richard's "*Edible City*" and the work done by Paolo, European Green organizational design of eco-city political structures and so on. Among them, Paolo has been practicing the city concept he advocated, starting in July 1970, starting his experimental city in Arcosanti, Arizona. Roseland believes that the concept of eco-city does not exist independently, but coexists with other related concepts and contains other ideas<sup>13</sup>. Explain that they are not mutually involved and progressively related. They are in the same scope, but they are independent and interdependent. They have connections and are not directly related. They belong to the same level and are concepts at the same level. The essence of an eco-city is actually a comprehensive discipline that deals with the contradiction between the environment and the city. The ecological city has a wide range of implications, and the theoretical research of related courses has a positive impact on the theoretical research and development of eco-city. The former Soviet urban ecologist Yanitsky elaborated on the concept of an eco-city (*ecopolis* or *ecoville*). In the same year, Register published the book "*Ecocity Berkeley - Building Cities for a Healthy Future*". Register discusses the significance and principles of building an eco-city in the book, and proposes how to build Berkeley into an eco-city in the next few decades. At the same time, the Urban Ecology, led by Register, published a new eco-city publication "*Urban Ecologist*".

## (2) International eco-city related research

The study of eco-city theory abroad pays great attention to practicality and operability, combines the practical problems of urban society in various countries, pays attention to the theory and practice, and sets long-term and short-term development goals. Some of the measures they have implemented are only one or several aspects of urban ecological

<sup>10</sup> Richard Register, Founder and Emissary of Ecocity Builders, is one of the world's great theorists and authors in ecological city design and planning.

<sup>11</sup> Ian L. McHarg (20.11.1920 – 5.3. 2001) was a Scottish landscape architect and writer on regional planning using natural systems.

<sup>12</sup> Paolo Soleri (21.6.1919 – 9.4.2013) was an Italian architect. He established the educational Cosanti Foundation and Arcosanti.

<sup>13</sup> Roseland M. 1997. Dimensions of the eco-city. *Cities*, 14(4),197-202.

construction, so they can solve many problems in reality.

Its planning and construction theory research is to control the disorderly spread of cities, and most of them advocate sustainable urban planning and control of car development, encourage public transportation and walking and other modes of travel. For example, the ten principles of establishing an eco-city proposed by Register emphasize the priority of developing land close to bus stations and transportation facilities, Revise the priority of traffic construction, put walking, bicycle, carriage and public transportation modes in a priority position than the car mode, emphasizing “*going near*”. The International Eco-City Reconstruction Plan, adopted by the 2nd and 3rd International Conferences on Eco-Cities, proposes to establish a transportation system oriented by walking, bicycles and public transportation, and to stop various subsidy policies for car transportation. The ten key principles of sustainable human settlements proposed by the European Union also point to the proximity of homes and workplaces, while developing efficient public transport systems.

### **(3) International eco-city related practices**

Since the concept of eco-city has been proposed, the urban ecological construction of many countries in the world has achieved success to varying degrees. One is to target “green cities” and add green elements and green spaces, such as the city of Milton Keynes in the United Kingdom. The second is to establish standards for eco-cities and build new eco-cities. The United States, Australia, India, Brazil, Denmark, Sweden, Japan and other countries have put forward basic requirements and specific standards for eco-city construction plans. For example, Brazil's Curitiba and Santos Australia's Whyalla and Adelaide, India's Bangalore, Denmark's Copenhagen, and the US's Berkeley, Cleveland, and Portland metropolitan areas have launched eco-city construction plans. , has achieved encouraging results and successful experience that can be used for practical operations. There are still many cities around the world that are planning and building in accordance with the goals of eco-city. For example, Cleveland<sup>14</sup> and Berkeley<sup>15</sup> in the United States, Erlangen<sup>16</sup> and Freiburg<sup>17</sup> in Germany, Bangalore in India<sup>18</sup>, and Curitiba in Brazil<sup>19, 20</sup>, Australia's Whyalla<sup>21, 22</sup> and Adelaide<sup>23</sup>, New Zealand's Waitakere<sup>24</sup>, Denmark's Copenhagen<sup>25, 26</sup>, Japan's Osaka and Chiba New City<sup>27</sup>, France Paris<sup>28</sup> and Lyon, etc. It can be said that these cases represent the

<sup>14</sup> Ma S J. 1990. Prospective of modern ecology. Beijing: Science Press, 15 (2): 83-93.

<sup>15</sup> GB Bonan, 2000. The Microclimates of a Suburban Colorado Landscape and Implications for Planning and Design. Landscape and Urban Planning, 32 (1): 55-57.

<sup>16</sup> Peter Hall. 2006. Cities in Civilization (New Ed Edition). Orion Publishing, 124-127.

<sup>17</sup> Geddes P. 1997. Cities in Evolution: Introduction to The Town Planning Movement and to The Study of Cities. Routledge/Thoemmes Press, London, 44-48.

<sup>18</sup> Schmitt L, Kumar J, Sun D, et al. 2013. Ecocity Upon a Hill: Microgrids and the Future of the European City. Power & Energy Magazine IEEE, 11 (4): 59-70.

<sup>19</sup> Alley T. 1996. Curitiba: A Visit to an Ecological City. Urban Ecologist, 71-74.

<sup>20</sup> Finlay J & Massey J. 2012. Eco-campus: applying the ecocity model to develop green university and college campuses. International Journal of Sustainability in Higher Education, 13 (2): 150-165.

<sup>21</sup> Crabtree L. 2005. Sustainable Housing Development in Urban Australia: exploring obstacles to and opportunities for ecocity efforts. Australian Geographer, 36 (3): 333-350.

<sup>22</sup> Smith R & Miller K. 2013. Ecocity mapping using GIS: introducing a planning method for assessing and improving neighborhood vitality.. Progress in Community Health Partnerships Research Education & Action, 7 (1): 95.

<sup>23</sup> Liao Y T, Chern S G. 2015. Strategic ecocity development in urban-rural fringes: Analyzing Wulai District. Sustainable Cities & Society, 19: 98-108.

<sup>24</sup> Zhou Z. 2014. Townscape Reform Movement in Taiwan and Its Inspiration to the Construction of Rural Human Settlement in Mainland. Urban Planning International, 12 (4): 45-47.

<sup>25</sup> Shenderov B A. 2011. Modern condition and prospective host microecology investigations. Microbial Ecology in Health & Disease, 19 (3): 145-149.

<sup>26</sup> Joss S, 2011, Eco-cities: The Mainstreaming of Urban Sustainability; Key Characteristics and Driving Factor[R]. International Journal of Sustainable Development and Planning, 6 (3): 268-285.

<sup>27</sup> Liang Yonghua. 2004(7). Analysis of the Theory and Practice of Ecological City Construction—Thoughts from Three Examples of Ecological City Construction. Small Town Construction, 88-89.

<sup>28</sup> THE ECO-DISTRICT . Retrieved from: [http://www.clichy-batignolles.fr/sites/default/files/exe\\_web\\_cb\\_dossierpresse-en.pdf](http://www.clichy-batignolles.fr/sites/default/files/exe_web_cb_dossierpresse-en.pdf)

development trend of the ecological city in the world today. They have achieved encouraging results and provided people with successful experiences.

### 1.3.2 China Eco-City Related Research

#### (1) Theoretical Research

In the 1990s, the theory and practice of ecological cities in the world were very rich. Under the advocacy of Mr. Ma Shijun, a large number of eco-city towns and ecological villages have been built and studied in China, which have greatly promoted the development of domestic eco-city theory.

China's ecologist Ma Shijun believes that "*the basic principles of ecology have been regarded as the theoretical basis for sustainable economic development.*" Therefore, the ecological city theory based on ecological principles has been widely recognized since its birth, and is considered to be a future urban paradigm that can achieve sustainable development.<sup>29</sup>

Wang Rusong and others believe that "*the eco-city is not an ideal realm that is unmatched and perfect, but a sustainable development process that is expected to be a new and ecological revolution.*" "*Through the construction of eco-city, we can fully explore the potential under the existing resources and environment, and achieve a production and lifestyle that is neither traditional nor Western, and achieve high efficiency, harmony, health and prosperity*".<sup>30</sup>

Shen Qingji believes that since the United Nations Conference on Environment and Development in 1992, "*ecological cities have received widespread attention and acceptance from all over the world*".<sup>31</sup>

However, for eco-cities, the views of the planning community seem to be very contradictory, and Mr. Zou Deci's views are quite representative. He believes that although the "*ecological city model is full of ideals and wisdom, it is very inspiring*", but still believes that "*the ecological city itself is not mature enough in theory and practice.*"

Chinese scholars put forward a lot of views on how to combine their own national conditions, and made in-depth research on concepts and connotations. After 1980, they gradually formed a system; However, the theory is highly macroscopic, and most of the research is in the fields of ecology and architectural planning. There is a lack of comprehensive research on disciplines and limited guidance on specific practices.

#### (2) Related Policy Aspects

The "*ecological civilization*" construction and the "*two-type society*" policy proposed by the 17th National Congress of the Communist Party of China have a great impact on the eco-city. During this period, a large number of papers related to these two keywords can be retrieved. Many scholars have elaborated on the relationship between "*ecological civilization*" and "*two-type society*" and eco-city. Most scholars agree that the final development goals of the two are consistent, and the policy proposal will contribute to the promotion and recognition of eco-city. In the CCP's "*18th National Congress*" proposed a new urbanization, once again caused a wave of discussion on eco-city, many scholars explored the construction of eco-city under the new situation. In fact, the two most important reasons for the discussion boom in China's eco-cities are caused by population

<sup>29</sup> Ma Shijun. 1990. Perspective of Modern Ecology . Science Press, 66-69.

<sup>30</sup> Qian Y & Zhang P. 2005. A Study on Ecocity Construction. Environmental Protection of Xinjiang, 3:91-92.

<sup>31</sup> Shen Qingji. 2012. Theory and Practice of Low Carbon Ecological City. China City Press, 35-38.

and environmental issues, so there are many studies on policy. However, most of them are based on China's national conditions to analyze the status quo of urban development, problem development strategies and countermeasures. Most of the analysis is not deep enough, but it has injected new ideas into the study of eco-city, making the development of eco-city more in line with the characteristics of Chinese practice.

### **(3) Related Technical Research**

The Chinese government attaches great importance to relying on scientific and technological innovation to achieve sustainable urban development, and has made a series of important arrangements for this. The national “*Twelfth Five-Year*” science and technology plan will establish a series of energy resources and environmental technologies that support sustainable development as the core key technology areas that need to be broken through. A number of sustainable development experimental zones with prominent scientific and technological support and high levels of sustainable economic and social development have been built throughout the country, which have provided a good demonstration of regional economic transformation and played an important role in radiation. China has launched commercial demonstration projects to promote electric vehicles, photovoltaic power generation and semiconductor lighting, accelerate the application of major innovations in the field of new energy, and provide strong scientific and technological support for cultivating and developing strategic emerging industries and promoting industrial optimization and upgrading. Its application in ecological cities has become a major proposition with global significance.

#### **1.3.3 A Summary of Related Research**

China's eco-city planning theory emphasizes ecological planning, ecological design and ecological management. The theoretical research on eco-city is rich in content. However, at present, China's domestic ecological community has not been able to work with planning academics and other disciplines to carry out more influential and deeper ecological city research projects. From the above discussion, international eco-city research pays more attention to specific design features and technical features. It emphasizes the specific implementation of eco-cities for urban realities in Western countries (such as low-density, car-oriented and high-consumption consumption), and its theory is closely integrated with eco-city practices. For example, Register has proposed transformation measures for the low-density status of urban cities in the United States, including the transfer of development rights, and the concept of eco-city proposed by Yanitsky has certain philosophical implications. But in general, the international ecological city theory is quite practical. Compared with international research, China's domestic eco-city research emphasizes the inheritance of traditional Chinese cultural characteristics, focusing on integrity and more systematic theory. Moreover, the research on China's domestic eco-city is mainly concentrated in the ecological and planning circles, in addition to environmental disciplines and other fields. In general, although China's domestic ecological community has done a lot of work in the construction of ecological villages, ecological counties and ecological city planning, at the same time, some theoretical studies have been carried out in various disciplines in China. However, the existing practices and theories of China's domestic eco-cities have a very limited impact on current urban planning.

In the achievements of eco-city construction, the construction of China's eco-city started late, but it has made great progress in the development process of nearly ten years. Although there have been certain achievements and progress in the research and practice of the eco-city, there are still many problems and doubts. International scholars have strong practical research on the basic concepts of eco-city, paying attention to specific design features and technical characteristics, emphasizing the practical problems of cities in western countries (such as low density, small car mode and high consumption). The specific plan for implementing an eco-city is put forward, and its theory is closely integrated with the practice of eco-city. The theoretical study and construction practice of eco-city in China emphasizes the inheritance of traditional Chinese cultural characteristics and focuses on the holistic and systematic theoretical research. Although a lot of work has been done in eco-city planning and practice construction, the ecological, planning, and other scholars engaged in eco-city research in China focus on the perspective of the discipline. The research perspective and research focus are different, and the methods and tools used are also very different, and the integration between them is insufficient. It is difficult to effectively combine the existing theoretical and practical activities of domestic eco-cities, and thus the influence is limited. At present, there are still some shortcomings in the research on ecological city related thoughts and theories. The exploration of ecological urban construction thoughts needs to be further combed and improved. The conclusions of relevant theories are not comprehensive enough to form a system. It can be seen that domestic eco-city construction and planning studies emphasize the integration of traditional Chinese characteristics, focusing on the overall and systematic grasp of the direction of urban ecological construction, and achieving harmony between man and nature. But the theory is highly macroscopic, and most of the research is in the fields of ecology and architectural planning. There is a lack of comprehensive research on disciplines and limited guidance on specific practices.

## 1.4 Research Methods and Content

### 1.4.1 Research Methods

Combined with the research content of this paper, this research intends to adopt the following research methods:

#### (1) Literature Research Method

Through extensive literature reading and collation, we will understand the research and practice trends of the current practice of eco-city construction in China, and obtain relevant research and practical results to lay the foundation for further research.

#### (2) System Induction Method

The process of system induction includes the research methods of system analysis and classification induction. That is to say, the paper systematically analyzes the existing literature and case data, and summarizes some experiences and conclusions, and summarizes the practice history and characteristics of China's eco-city.

**(3) Case Analysis Method**

Through practical examples, analyze problems, see the essence through phenomena, solve problems, and get general solutions after promotion to other cases. Find commonalities through special cases and come to a conclusion.

**(4) Comparative Research Method**

Comparative research is one of the important methods for people to understand objective things. It is the basic method of understanding things from comparison and reference, and it is also a way to make regular summaries from recurring phenomena.

**(5) Questionnaire Method**

The questionnaire survey method, also called the questionnaire method, is a survey method in which the investigator uses a uniformly designed questionnaire to understand the situation or seek opinions from the selected respondents. Questionnaire survey is a research method that collects information in the form of written questions.

**1.4.2 Research Content**

This study will analyze the concept of eco-city, classify the types of eco-cities, and discuss some of the issues that are currently neglected by the Eco-City Institute; The systematic review of the practice of China's eco-city practice in the past 30 years will make up for the gaps in the lack of information at this stage, and form a context for the development of the entire Chinese eco-city.

And through the summarization of the data to quantify the ecological city space and time axis, in terms of types and other characteristics of the visualization, and explore the specific characteristics of the eco-city through the form of case analysis, to establish a basis for the in-depth study of the eco-city, Summarize the law of development.

In addition, in the Guiyang City, one of the key construction areas of the eco-city, an on-site questionnaire was conducted to investigate the public's satisfaction with the construction of the local eco-city and to obtain constructive suggestions.



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## Chapter 2. Ecological City and Planning Related Theory

### 2.1 Eco-City Connotation

The concept of urban planning before an eco-city mostly satisfies the needs of humans through the transformation of nature. It is human hope to achieve the control of nature by means of planning, and eco-city is not. As Richard Register said, an eco-city is an urban model that satisfies the good development of people and the health of the natural environment. Its main purpose is to achieve two coordinations. In order to get along with nature, we must respect nature and respect life, and we can promote the recycling of nature. In the perspective of urban social development, we need to be friendly, convenient, healthy, cultural, and diverse. The residents are physically and mentally healthy and grow together. Compared with traditional urban development models, eco-cities are synonymous with the healthy development of cities such as climate adaptation, convenient slow-moving systems, efficient use of green energy, and respect for the natural environment.

#### 2.1.1 The Basic Connotation of Ecological City

The basic connotation of an eco-city includes the following: Coordinating with surrounding areas to promote socio-economic development in the surrounding area; Forming a balanced network of mixed land use, centralized and decentralized urban network structure; Having a prosperous local economy, providing employment opportunities for residents; Development of cultural and social diversity, physical and mental well-being, and happiness of residents; encouragement of walking, cycling, and public transportation, reducing the dependence of urban residents on cars; having open green spaces, comfortable urban climate, minimizing damage to land; recycling of waste Use, Intensive use of water resources, and harmony with nature.

- 1) **Healthy City.** The ecological city should first be a healthy city with fresh air, bright sunshine and open space for activities. The natural and artificial facilities in the entire city are healthy and healthy, providing urban residents with comfortable, clean and safe social living conditions. , To meet the city's pursuit of physical and mental health.
- 2) **Coordinated City.** Pursuit of the balance between urban and natural ecology, the social one person one ecological coordination is the essential characteristics of the ecological city. The simple economic development or ecological environment protection or high social agglomeration is not the goal pursued by the ecological city, nor can it become the development goal of the ecological city. The ecological city should be a coordinated city. The systems of the city co-exist in harmony. While creating a comfortable living environment for the urban residents, they must pay attention to the development of the urban residents themselves and the maintenance of the ecological environment.
- 3) **Sustainable City.** Sustainability is a goal that must be achieved in the planning and construction of an eco-city. The scale of urban construction, the size of the population,

and the scale of transportation should not exceed the range that urban resources and environment can tolerate. In the construction of an eco-city, it is necessary to rationalize the relationship between the recent construction of the city and its long-term goals so as to avoid the disconnect between the recent construction and the long-term perspective.

- 4) **Sound City.** Eco-city needs to be equipped with a well-developed transportation system, a convenient and quick information system, and a complete modern infrastructure as a support. It will cooperate with efficient urban public services to meet the diverse needs of urban residents.

### 2.1.2 Basic Principles for The Construction of Eco-Cities

- 1) **Maintain a good ecological environment.** Including clean air, safe water resources, efficient sources and beautiful environment, this is the ecological support for the development of ecological cities.
- 2) **Perfect urban infrastructure.** Including convenient urban transport facilities, housing to meet demand, accessible urban public service facilities (including medical care, education, sports, welfare, etc.) provide urban residents with full employment opportunities, which are the hardware facilities for the construction of ecological cities.
- 3) **Form an inclusive cultural atmosphere.** Eco-city should promote the continuation and development of the cultural context. It should pay attention to the construction of social order, morality and culture. The ecological city contains diverse cultures. While respecting local culture, it also includes foreign cultures to facilitate communication among different groups of people.
- 4) **Develop an efficient economy.** Eco-city has a strong economy as a support, providing the impetus for urban development and meeting people's increasing production and living requirements. The economy in an eco-city is highly efficient, reducing output, and achieving high productivity while achieving smart growth.
- 5) **Significantly enhanced awareness of social civilization.** Residents in ecological cities have a high sense of social responsibility and protect natural consciousness. Ecological culture is the theme of values. The public enhances their living standards while enhancing their overall quality and sense of civilization.

## 2.2 Division of Eco-City

There are many perspectives on the classification of eco-cities. According to different classification criteria and classification methods, Chinese and international scholars also have different classifications of eco-cities, the different focus of some classifications will be mentioned in section 2.3 of this chapter.

Some are divided into four types, and some are divided into five types, but this paper from the fundamental point of view, according to Wang Ruosong, Li Dexiang, Huang Guangyu and other related viewpoints, combined with China's national conditions, the characteristics of the eco-city scale and attributes are classified into two categories. In China,

eco-cities are promoted in two forms. In summary, they are "**top-down**"- promoted and "**bottom-up**"-oriented.

### 2.2.1 Top-Down Ecological Demonstration City

At the beginning of the construction of eco-cities in China, most of them were built by relevant state departments and central ministries, and they led the construction and development of eco-cities through appraisal. Establish some demonstration points with promotion value to promote the transformation of urban construction. This eco-city planned by the whole, most of which is directly recognized by the state as an eco-city, can be summarized as a "top-down" promoted eco-city, such as the national demonstration zone promulgated by the state, the national eco-city, and low carbon ecological pilot cities, etc., are called ecological demonstration cities. Such eco-cities have a common feature, and the constituent units are municipalities.

### 2.2.2 Bottom-Up Eco-City

Under the guidance of China's national policy, many cities in China have proposed the idea of building an ecological city, doing a lot of theoretical research and practical promotion work, and actively taking steps to implement it. This kind of ecological city, which is initiated spontaneously by various administrative regions or developers, and most of which are oriented to the construction of new city projects, can be summarized as a bottom-up oriented eco-city, which is called eco-city. Such as Chongqing Yuelai Ecological City, Shenzhen Guangming New City and so on.

## 2.3 Theory Related to Eco-city Planning

At different stages of development in society, urban planning theory is not the same. Early human urban construction activities focused on the influence of nature on the operation of cities. For example, in ancient China, "*the people's place of residence should be dominated by the mountains and rivers*"<sup>32</sup>, ancient Rome's "*The Ten Books of Architecture*"<sup>33</sup> and so on all proposed the coordination of the city and nature. Corresponding requirements, the core idea is that cities should adapt to natural factors. With the process of urban construction practice, many urban planning theories or ideas have emerged, some of which have a corresponding relationship with the planning of eco-city.

### 2.3.1 Guiding the Planning Theory of the Concept of Eco-City

When the concept of "eco-city" has not been proposed, various urban planning ideas implicitly contain the concept of eco-city, which can be traced back to many planning ideas related to the core ideas of eco-city, such as Howard's pastoral cities and horses. The Matta's belt-shaped city, organic city and so on. These ideas concern the relationship between cities

<sup>32</sup> Li Xiangyu, Zhang Xiaochun, 1999(2). Migration Urban Ecological Planning and Its Development Direction in China . Urban Studies, 11-1

<sup>33</sup> Vitruvian, Gao Lutai Translation, 2001,3.The Ten Books on Architecture/ (Ancient Rome) . Beijing: Intellectual Property Publishing House.

and transportation, rural areas, and urban density.

### 1) Strip City

In 1982, the Spanish engineer Arturo Soria y Mata proposed to develop urban belts along major transportation routes under new modes of transport, and cities use convenient transportation methods to connect with each other<sup>34-35</sup>. Mata proposed that the basic principle of the banded city is "*to solve urban construction problems on the basis of urban transportation problems*"(source: Wiki). The urban structure that meets this principle will make the daily travel distance in the city the shortest and the least time-consuming.

The theory of strip-shaped cities pays attention to the coordination between cities and traffic and emphasizes the convenience of urban traffic. Encouraging the use of railways as the city's main means of transportation is the starting point for the theory of the strip-shaped cities. However, with the development of public transportation, bus routes have also become an important factor influencing the development of strip-shaped cities. This point of view has certain implications for the development of urban transport in the eco-city planning, especially the development of urban public transport routes.

### 2) Pastoral City

In 1898, Ebenezer Howard explained his "urban city" concept in *Tomorrow, a road to peace for real reform*, and proposed the idea of building an ideal city with both urban and rural features. Solve the problems of crowding and deterioration of health in the city. Howard believes that the pastoral city has a reasonable scale, provides urban residents with a rich social life, and achieves communication between cities through rapid transportation<sup>36</sup>. The design of the idyllic city ensures that the city will not be overcrowded and that it will be convenient for urban residents to get close to the rural natural space. The essence of this is to build a combination of urban and rural areas. Howard promoted the implementation of his garden city ideas through practical work, such as the Garden City Association (1899) organized by him, the pastoral cities Letchworth and Welwyn.

In response to the urban problems that have arisen during the process of urban modernization, the Pastoral City Theory proposes to combine the urban and rural areas as a whole to conduct research, and to describe the urban planning from the aspects of urban scale, density, green belt construction, etc., as an ecological city. Theory has produced one of the most influential theories in the urban planning community.

### 3) Organic City

Patrick Geddes conducted an ecological study of the city, emphasizing the relationship between the city and nature, breaking through the traditional concept of the city, and conducting urban planning research in the framework of natural space. After this idea was perfected and promoted by Lewis Mumford and others, it formed a regional comprehensive study and regional planning<sup>37</sup>.

<sup>34</sup> Deng Xueyuan. 2003. *Urban Space in Utopia*. Zhengzhou: Zhengzhou University.

<sup>35</sup> Mu Wu. 1984. *Utopian socialists in European history*. Harbin: Heilongjiang People's Publishing House.

<sup>36</sup> E. Howard. 1898. *Garden Cities of Tomorrow*. Swan Sonnenschein & Co.

<sup>37</sup> Zhou Guoyan & Yu Li. 2010. *An Overview of Western Modern Urban Planning Theory*. Nanjing: Southeast University Press.

Geddes used sociological, biological and philosophical perspectives to reveal the complexity of urban development in time and space, and proposed that urban planning should first study the current conditions of the city and obtain planning scope through field research. The first-hand information within this area is exactly what should be emphasized in the planning of eco-city.

### 2.3.2 Planning Theory to Learn from Ecological City

In 1970, the concept of an eco-city was born. Some urban planning theories were also successively formed in the same period of the same period. They have also exerted important influence on the urban planning field, such as bionic city theory, urban diversity theory, design and integration, and human settlement and environment science. Theory and so on. These theories are the same as the era social background of the concept of an eco-city. They focus on the development of the city from different perspectives and play an important role in the further improvement of the concept of an eco-city.

#### 1) Bionic city theory

Bionic city theory was born in the 1960s and is a theoretical concept similar to an ecological city. It was proposed by the Italian architect Paolo Soleri. The theory draws on the plant image to simulate the urban planning structure and expects to make the city an ecological giant system like a green plant. This theory, as a theory of concentrating, is a conception of future urban development from the perspective of architectural technology, with a small scope of influence. However, bionic urban theory, as a theory of combining urban and ecological plants for urban planning research, has certain reference for eco-city theory.

#### 2) Urban Diversity Theory

Jane Jacobs<sup>38</sup> used sociological methods to investigate American cities in "The Death and Life of American cities"<sup>39</sup>, and presented urban diversity theories with unique insights. Jacobs thinks that as a complex organic system, the social life of a city is a diversity of basic functions in both economics and sociology<sup>40</sup>. Mixed layout is the core of urban diversity theory. A region should include multiple main functions. To ensure that enough people can be attracted in different time periods<sup>41</sup>. The streets of the city should have vitality. From the perspective of people, the length of the city's streets should be determined.

The theory of urban diversity focuses on the richness of the economy and society in the process of urban development. It believes that the city should be a diversified and complex city. It encourages a mix of urban basic functions to facilitate the production and life of urban residents.

#### 3) Design combined with nature

McHarg discussed environmental issues from the perspectives of nature, history, and humanities. He believed that urban planning and design should integrate local natural conditions and have important academic significance for urban ecological

<sup>38</sup> Jane Jacobs OC OOnt (née Butzner; May 4, 1916 – April 25, 2006) was an American-Canadian journalist, author, and activist who influenced urban studies, sociology, and economics.

<sup>39</sup> Jane Jacobs. 1961. *The Death and Life of American cities*. Random House, New York.

<sup>40</sup> Hu Yizhi. 2006 (2). Rereading Jane Jacobs: "The Death and Life of American cities" is still vital? . *Beijing Planning and Construction*, 53-54.

<sup>41</sup> Fraser, Benjamin. 2009. The kind of problem cities pose: Jane Jacobs at the Intersection of Philosophy, Pedagogy, and Urban Theory. *Teaching in Higher Education*, 24(3), 265-276.

environmental studies. The choice of urban land should be based on the “natural process” of urban land to select the location of ecological land, combine urban construction with nature, and provide comfortable space for urban residents.<sup>42</sup>

McHarg’s concept of “*Designing in combination with nature*” was a major breakthrough in urban planning theory. It was the first time to completely introduce ecological methods into urban planning. In the planning and construction of ecological cities, designing the combination of nature is also the main method of planning or Concept, but the connotation and depth of eco-city planning far exceeds this concept.

#### 4) Human Settlements Environmental Science Theory

In the 1980s, referring to the theory of human settlement, Mr. Wu Liangyong proposed the theory of “*General Architecture*” and extended the research field of architecture to urban areas, advocating the combination of architecture and city. At the same time, Mr. Wu Liangyong also proposed the concept of “*Earth Landscape Planning*”, which puts urban landscape modeling in the context of the region for research. In 1993, based on these two concepts, the concept of “human settlement science” was formally proposed.

The human settlements science is based on the relationship between man and the environment. A comprehensive, systematic, and comprehensive research on the coordinated development of buildings, neighborhoods, cities<sup>43</sup>, and the environment conforms to the ideal environment for human settlements. The theory of human settlements environment has made cities and rural areas the two interdependent elements of the social economic system. It is expected that the coordination between the two parties will promote urban and rural development. The concept of human settlement environmental science theory is basically the same as the purpose of ecological urban planning and construction. It is a reflection of the ideal city from the perspective of architecture engineering.

### 2.3.3 Planning Theory Complementary to Eco-City

After the concept of eco-city emerged, urban planning theory continued to develop, resulting in a series of new urban planning ideas, such as New Urbanism, compact cities, cyber cities, and landscape urbanism. These ideas have played a good role in the reference to the eco-city theory to a certain extent and complement each other. It has a good role in promoting the concept and construction of eco-city.

#### 1) New Urbanism

New Urbanism advocates rebuilding and creating compact, mixed-use, walkable communities. It also pays attention to restoring the features of the old city and traditional communities, combining urban civilization with natural harmony<sup>44</sup>, adhering to the close relationship between material space and social environment, encouraging the maintenance of old styles and renovating urban centers with the needs of modern residents. The theory of New Urbanism mainly includes the Theory of traditional Neighborhood community Development (*TND*) and public Transport-Oriented Development theory (*TOD*).

<sup>42</sup> Ian McHarg. 1969. *Design with Nature*. Garden City, N.Y., Published for the American Museum of Natural History

<sup>43</sup> Wu Liangyong. 1996. “Exploring Architectural Theory for Regional Reality—Generalized Architecture” (《Wu Liangyong Urban Research Proceedings (1986-1995)》). Beijing: China Building Industry Press.

<sup>44</sup> Peter Hall. 2000. Urban Renaissance/New Urbanism—Two Side of Same Coin? . *Journal of American Planning Association*, 66(4), 359-367.



## (1) TND

The TND model was proposed by Andres Duany and Elizabeth Zyberk. Priority is given to the layout of public spaces and public buildings within the community as a community public activity center; With densely organized grid roads, the width of main roads is about 10 meters wide, which creates a traffic environment conducive to pedestrians and bicycles; a modest building volume ratio facilitates the improvement of land and infrastructure utilization efficiency and reduces development costs.

## (2) TOD

The TOD proposed by Peter Calthrope is mainly aimed at challenging the traditional American planning concept. He believes that the development of urban space should be consistent with the development of public transport. The city should be compact in form and the land should be suitable for walking <sup>45</sup>. TOD pays attention to the development of regional or urban centers, and carries out compact and multi-functional development along the city's main traffic corridors. Urban residents mainly rely on public transport to provide necessary public transport facilities for residents to travel.

## 2) Compact City

Compact city theory was first proposed in 1973, but it has not received attention from the academic community. Its real theory was formed in the early 1990s <sup>46-47</sup>. As a combination of high-density and mixed-use development, the compact city focuses on the mixed use of urban construction density and urban land <sup>48</sup>. Compact cities can protect existing rural systems and prevent urban sprawl to the countryside; reducing the city's energy consumption through the use of public transport and bicycle systems.

### (1) Moderate compact city

The compactness mentioned in the Compact City Theory refers to a relatively modest compactness. The urban land should be of a suitable high density to avoid the expansion of the city to the countryside and to protect the development space of the urban suburbs. At the same time, proper compactness will help reduce travel distance and reduce motor vehicle travel, thereby reducing the energy demand of urban traffic and traffic pollution <sup>49</sup>. Compact cities also facilitate the organization of urban public services and urban social activities, reduce the daily travel of residents, and help improve the efficiency of urban public services and utilization of infrastructure <sup>50-51</sup>.

### (2) Land use function mixing

An important feature of the difference between compact cities and general cities is the mixed use of urban land. This mix includes not only the mixed layout of various types of urban land, but also the mixed use of functions within a single

<sup>45</sup> Chen Guang. 2012. A Preliminary Study on Urban Development Strategy Based on TOD—Taking Xiamen City as an Example. Beijing: Tsinghua University.

<sup>46</sup> Dantzing G, Saaty T. 1973. Compact city: a plan for a liveable urban environment. Freeman and Company, San Francisco.

<sup>47</sup> Mike Jenks, Elizabeth Burton, Katie Williams. 1996. The Compact City: A Sustainable Urban Form? .

<sup>48</sup> Jen-Jia Lin, An-Tse Yang. 2006. Does the compact city paradigm foster sustainability? An empirical study in Taiwan. Environment and Planning B: Planning and Design, 33, 365-380

<sup>49</sup> Jenks M, et al. 1966. The compact city—a sustainable urban form?. London: E&FN Spon Press, 36-44

<sup>50</sup> McLaren D. 1992. Compact or dispersed? Dilution is no solution. Built Environment, 18(4):268-284

<sup>51</sup> Lu Bin, Qi Lei. 2008. Enlightenment of Compact City Theory to Urbanization in China. Urban Planning Journal, 4, 61-63

building and urban community. The mixed use of various functions in the city can facilitate the production and living of urban residents and contribute to the realization of urban social equity.

### 3) Network City

Network cities are new types of urban agglomerations under new social and economic development conditions. Many cities use inter-city road traffic and communication systems to realize the flow of materials, energy, and information between cities and promote cooperation and exchanges between cities<sup>52</sup>. Network cities include realistic material networks (traffic corridors) and intangible virtual networks (communication systems), which are new spaces created by the extension of cities.

There are close functional links between the networked cities, which can promote the improvement of urban and rural infrastructure in the region, reduce the cost of urban and rural infrastructure construction, and achieve regional integration development<sup>53</sup>. Network cities emphasize the interrelationships between cities and cities and between cities and regions, puts individual cities in the “urban-area” system for planning and research, which can improve the level of development of the city. As an urban development model, the ecological city should be a regional city. In its planning and construction, it should pay attention to the impact of urban network development.

### 4) Landscape Urbanism

In the late 1990s, Charles Waldheim proposed Landscape Urbanism<sup>54</sup> to introduce landscape environmental planning into the development of cities, identify the important impact of landscape environment on urban development and expect to break through the limitations of traditional urban planning, integrates the natural environment system with urban development, to make the city to become a good environment, beautiful landscape, sustainable artificial ecosystem<sup>55</sup>. From the perspective of landscape ecology, considering the issue of urban construction is the core idea of landscape urbanism. Ecological strategies have become an important entry point for landscape urbanists to solve urban problems.

The contribution of landscape urbanism to the theory of eco-city is to attach importance to the impact of urban infrastructure on urban form and space. This is an urban element that was overlooked by past urban planners and architects.

<sup>52</sup> Wei Yaping,Zhao Min,Xiao Yingguang. 2006,(4). A Multi-center and Orderly Compact Space System in Guangzhou.Urban Planning Journal,41-46

<sup>53</sup> Zeng Juxin. 2001. Modern urban and rural network development model . Beijing: Science Press.

<sup>54</sup> Hua Xiaoning, Wu Lang. 2009,(12). The Idea and Practice of Urbanism in Contemporary Landscape.Journal of Architecture,85-89

<sup>55</sup> James Comer. 2004. Landscape Urbanism/Mohsen Mostafavi and Ciro Najle. Landscape Urbanism: A manual for Machinic Landscape. London: AA Publication.

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## Chapter 3. The Division of The Practice Stage and Process Analysis of China's Eco-City Construction

This chapter selected time range is defined as starting from the initial exploration of China's first eco-city since 1986 to now. According to the changes in the quantity and quality of its practice, the whole process can be divided into three stages: **“Awakening – Spontaneity – Reflection”**.

### 3.1 Exploring Awakening Period

According to the practical characteristics of China's eco-city, the first phase of time is divided into 1986-1999. The eco-city at this stage started from the top-down type. Some scholars introduced the concept of eco-city and began to practice. The process from theory to practice was very fast, and it also showed good results. Immediately after China's urbanization and environmental issues, the Chinese government began to realize the importance of ecological construction, promulgated regulations on environmental improvement, and began to build ecological demonstration zones. This also marks the official start of construction of the top-down eco-city.

#### 3.1.1 Practice Background

The practice of China's eco-city can be traced back to the beginning of urban ecologicalization. It does not form a theoretical system of eco-city systems and is at a low-level stage of eco-urbanization. From the beginning of China's reform and opening up in the last century, to the mid-eighties. The urban ecological construction mainly focuses on the urban social ecological balance. The urban economy and management system is still the planned economic system. The urban population has a strict household registration management system to maintain a low level of balance, economic backwardness and poor living environment. But at this stage, the first exploration of deep-level eco-cities began to emerge and it has developed rapidly. In 1984, the first China Urban Ecological Science Symposium was held in Shanghai, focusing on the objects, objectives, tasks and methods of urban ecology research. It was proposed that urban ecology research should be closely combined with practical problems in urban development and construction for urban development planning, environmental protection and economic development services. From the mid-eighties to the early 1990s, the stage of urban ecological environment deterioration began. With the reform of the city to the city, forming a model of urban development taking economic construction as the center, each city unilaterally pursues GDP growth, the secondary and tertiary industries continue to develop, and urban development lacks scientific planning.

### 3.1.2 Research Support of Related Practices

The practice of eco-city began in 1984, but the study of relevant theories of eco-city began in 1987. The overall trend of research in this period has grown rapidly in the J-shaped form. It began to grow in 1994 after the early 5 years of exploration, and reached 30 in 1999, as shown in Figure 3-1. In 1995, China's promulgation of eco-environment, ecological demonstration zones and other related policies and pilot projects have had a very positive impact on the research and practice of eco-cities. Most of the ecological research at this stage is to explore the theory of ecological city construction, the development model, the idea of building an ecological city, and the reference significance of studying foreign ecological cities. Most of the researches on this stage of ecology are to explore the theory of ecological city construction, the development model, the idea of building an ecological city, and the reference significance of studying foreign ecological cities. Eco-city and sustainable development research have also begun to receive attention. At this time, related disciplines are concentrated in six categories: construction science and engineering, environmental science, sociology and biology.

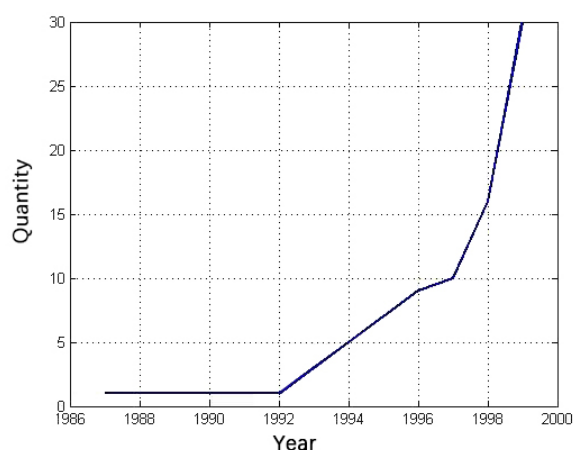


Figure 3-1 Overall trend of papers published in 1986-1999 on eco-city papers

Source: Author

### 3.1.3 Preliminary Exploration and Technical Methods of Practice

In this context, the first exploration of the eco-city began. In 1986, Yichun City of Jiangxi Province proposed to build an eco-city development goal, which is the first specific time for China's eco-city construction. This is also the first top-down eco-city in China. And with the pilot work of eco-city planning and construction started in 1987, it opened the prelude to the construction of China's eco-city and achieved good results.

Yichun City is the first eco-city pilot in China, and its construction practice has certain reference for other cities. Yichun City Ecological City Planning takes urban and rural artificial composite ecosystem as the research object, first analyzes the structure of society, economy and natural system. The second step is to determine a structure that summarizes the entire system and facilitates analysis and regulation, then analyze the coordination item by item. The third step, comprehensive evaluation, according to the evaluation results, adjust the

system structure, function, and then regulate, so cycle until satisfied<sup>56</sup>.

In 1987, Huang Guangyu and other scholars carried out the planning and practice of eco-city in Leshan City, Sichuan Province; Promoted the development of China's eco-city construction practice. By 1990, a set of construction theory and methodologies guided by a socio-economic-natural complex ecosystem had been formed.

### 3.1.4 Practice Overview and Promotion Policy

The success of the first construction of an eco-city has certain reference to other urban construction. However, the scope of influence is small, and promotion takes some time; Most of China's cities still stayed in the natural environment of beautifying cities. From the early 1990s to the end of the last century, with the in-depth development of reform and opening up, the urban environment was bad, which seriously affected the city's competitiveness, restricting the development of the city; People began to realize that the environment is also productive. In order to improve the image and attractiveness of the city, it began to beautify the natural environment, mainly to rectify and beautify the adverse consequences caused by the unhealthy environment of the city and the disorderly development of the city. However, during this period, people's ecological construction of the city's natural environment was limited to a shallow level. The main purpose is to build and protect the environment from the perspective of beautifying the natural environment of the city rather than from the perspective of ecological cycle. The treatment of pollution is limited to the end of production control, and the area of green space is only to beautify. This is still a big gap from the requirements for building an ecological city. In 1988, the Environmental Protection Committee of the State Council of China issued the "Decision on the Quantitative Assessment of Urban Environmental Comprehensive Improvement", which marked the beginning of the construction of the national ecological city and focused on pollution prevention and ecological environment construction<sup>57</sup>. The urban environment comprehensive remediation quantitative assessment system has identified 20 indicators including air environmental protection, water environmental protection, noise control, solid waste disposal and greening. The system has been widely implemented in urban environmental management in China, effectively promoted urban environmental protection work, At the same time, the state has also vigorously promoted health cities, garden cities, environmental protection and remediation<sup>58</sup>. With the continuous deepening of urban environmental remediation work, China has further carried out urban ecological construction work.

In the early 1990s, China announced the National Ecological Environment Construction Plan, with a planning period of 50 years, requiring localities to compile eco-environmental construction plans in light of actual conditions. Since 1995, the State Environmental Protection Administration has issued the Outline of the National Ecological Demonstration Zone Construction Plan (1996-2050), which proposes the concept and construction content of the ecological demonstration zone, and established the construction target of the

<sup>56</sup> Wang X J, Tu C L, Wang Z S. 2014. Structuring and Measurement of Evaluation System of Eco-Civilization Construction in China. *Advanced Materials Research*, 955-959: 4110-4118.

<sup>57</sup> Yu Li. 2012. Critical Analysis of Problems in Chinese Eco-city Development. *New Architecture*, (4): 25-26.

<sup>58</sup> Castries Francesco D, Hadley Malcolm. 1984. People in The Ecosystem. *International Social Science Journal: Chinese Version*, 1(4): 3-6.

national ecological demonstration zone to reach 50% of the national land area by 2050<sup>59</sup>. In 1996, the former National Environmental Protection Agency identified the first batch of pilot units for the construction of ecological demonstration zones in China. The construction of infrastructure such as public green space, nature reserves, garbage disposal and sewage treatment in these areas has raised high requirements from the development of industries such as ecological agriculture, clean production and eco-tourism, And require these cities or regions to incorporate the construction of ecological demonstration zones into the national economic and social development plan<sup>60</sup>. It can be seen that the ecological demonstration zone during this period still does not fully consider the humanistic significance of "ecology". But the construction of "ecological demonstration zone" has significant practical significance. After several years of hard work, the ecological environment of these cities or regions has been effectively improved, effectively promoting the development of material and spiritual civilization in cities or regions; And a large number of demonstration projects have emerged in the fields of ecological housing construction, solar energy utilization and equipment production, ecological agriculture, eco-tourism, green food base, ecological industry, rural new energy development, biodiversity conservation, soil and water conservation, and environmental pollution control. It laid a good foundation for the construction of an ecological city.

## 3.2 Rapid Development Period

According to the practical characteristics of China's eco-city, the second phase of time is divided into 2000-2008. At this phase, under the guidance of ecological civilization and two-oriented society, China's eco-cities have shown that the top-down city and the bottom-up eco-city go hand in hand, both in terms of scale and quantity. But it also makes most of the ecological city construction quality decline.

### 3.2.1 Practice Background

At the beginning of this century, with the improvement of practice and understanding, especially under the guidance of the scientific concept of development, people have a deeper understanding of the ecological city. It is considered that in the urban construction, the ecological law should be followed to coordinate the various functions within the city and between the urban artificial environment and the ecological natural environment to ensure the sustainable development of the city. And think that the "ecology" in eco-city is not purely biological connotation, it should be based on circular economy, including social ecological, industrial ecological, transportation ecological, urban natural environment or landscape ecological. In practice, more and more cities are beginning to formulate plans to implement eco-city construction. However, paying attention to the form and ignoring the actual effect,

<sup>59</sup> Oleg Yanni. 1984. Towards Eco-city: A Combination of Knowledge and Practice Problems. International Social Science Journal: Chinese Version, 1(4): 103-114.

<sup>60</sup> Sheng X L, Peng B Z, Wang H, et al. 2001. Perspective on Ideology about Building Ecocity and Its Standards for Evaluating Ecocity. Environment Herald, 4(3): 66-70.

and due to insufficient attention to objective constraints, make the gap between the effect and the expected goal is large.

### 3.2.2 Research support of Related Practices

This stage is a period of vigorous development of eco-city construction practice. In the field of academic research, it is also a qualitative leap from the previous period. The number of the whole shows no downward trend. A rapid growth turning point occurred in 2002-2003 and 2007-2008, as shown in Figure 3-2. During this period, the construction of eco-city showed a diversified development trend, and the transition to a period of relatively mature theory and practice, the implementation of China's relevant policies and eco-city has increased greatly, and there have also been high-quality eco-cities. Relevant keywords involve ecological footprint theory and ecological city construction, eco-city planning legislation, population prediction in eco-city planning, and related concepts of eco-city planning. At this time, related disciplines are mainly distributed in more than 40 categories such as environmental science, economic management, building science and engineering, and forestry.

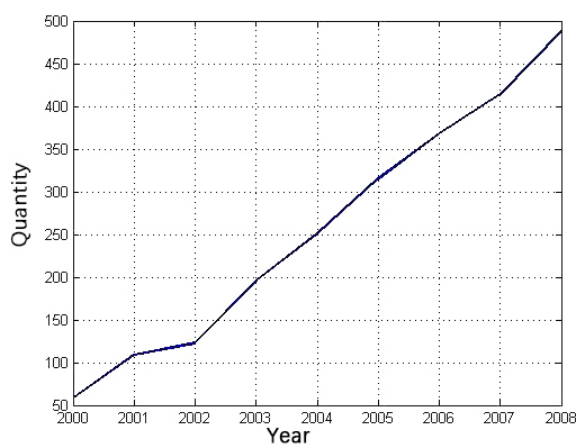


Figure 3-2 Overall trend of papers published in eco-city papers from 2000 to 2008

Source: Author

### 3.2.3 Practice Overview and Promotion Policy

Under the impetus of China's policies, the work of developing eco-cities in various provinces and cities has steadily improved. A large number of top-down eco-cities have emerged, including newly promulgated ecological provinces and cities, and national and local governments have actively participated in the construction of eco-cities. During 2002, Guiyang City, Guizhou Province was approved by the State Environmental Protection Administration of China as a pilot city for the construction of a circular economy eco-city, and made active explorations for the construction of eco-cities in resource-based cities.



On May 23, 2003, the State Environmental Protection Administration of China issued the “*Eco-County, Eco-City, and Ecological Province Construction Indicators (Trial)*”. From the three aspects of economic development, environmental protection and social progress, clear construction indicators have been set for ecological county, ecological city and ecological province, of which 28 are construction indicators of ecological city;

From 2005 to 2007, the “*National Ecological County, Ecological City Creation Work Assessment Program*”, “*National Ecological County, Ecological City Assessment and Acceptance Procedures*” and “*Guidelines for the State Environmental Protection Administration on Strengthening the Establishment of Ecological Demonstration*” were issued; In 2005, it was compiled by the Chinese Academy of Sciences. The State Environmental Protection Administration issued the Interim Regulations on Ecological Functional Zoning, which stipulated the general principles, methods, procedures, contents and requirements for ecological functional zoning. Since then, the preparation of ecological function zoning has been carried out nationwide, and the division of ecological functional areas has become one of the important contents of eco-city construction planning<sup>61</sup>. In March 2006, the Ministry of Construction of China issued a green building evaluation standard, which established a guiding system for green building.

In addition, the construction of the eco-city by Singapore and Tianjin started construction in Tianjin Binhai New Area, which is the first eco-city between the two countries in the world. It marks that China's eco-city construction has taken a positive step in the direction of international cooperation and successfully opened the foundation laying ceremony in 2009.<sup>62,63</sup>

On January 15, 2008, the “Eco-County, Eco-City, and Eco-Provincial Construction Indicators (Revised Draft)” was promulgated, among which the eco-city construction indicators include 19 indicators: economic development, environmental protection, and social progress. A number of indicators have been revised to make them instructive and operational, laying a solid foundation for the creation of ecological demonstration zones.

### 3.3 Enhancing Reflection Period

According to the practical characteristics of China's eco-city, the time of the third stage is divided into 2009-2016. The eco-city construction at this stage has been significantly reduced in quantity compared with the previous stage, and the quality has been improved. Many quality eco-city projects have emerged. And began to move towards more targeted and focused eco-city construction, such as low-carbon eco-city and smart city.

<sup>61</sup> Fan Jie. 2007. Analysis on The Restrictive Factors of Regional Coordinative Development. *Strategy and Decision-making Research*, 22(3): 194-201.

<sup>62</sup> Wang Xiaojun, Si Qing. 2014. Discussion on Planning and Design of Ecological City. *City Construction Theory Research*, (11): 66-69.

<sup>63</sup> Jingyuan Li, Tongjin Yang. 2016. *China's Eco-city Construction*-Springer-Verlag Berlin Heidelberg, 50

### 3.3.1 Practice Background

With the implementation of the sustainable development strategy, the spread of the concept of ecological civilization and the scientific concept of development, China has set off a trend of ecological city construction. At the same time, in response to the smog problem of air pollution, the introduction of the concept of "circular economy" and "low-carbon economy", China began to build an eco-city with a focus on low-carbon energy conservation and development of new energy.

### 3.3.2 Research Support of Related Practices

At this stage, the overall number of academic research fields showed a trend of increasing first and then decreasing. In 2011, there was a peak, followed by a decline, and the downward trend was faster, as shown in Figure 3-3. It shows that the theoretical research and development of eco-city has reached saturation, and its academic accumulation from quantity to quality has reached. The eco-city keywords evolved from the original single eco-city to more similar fields such as low-carbon cities and smart cities entering the academic field. At this time, related disciplines are mainly distributed in more than 70 categories such as economic management, building science and engineering, environmental science, and economics.

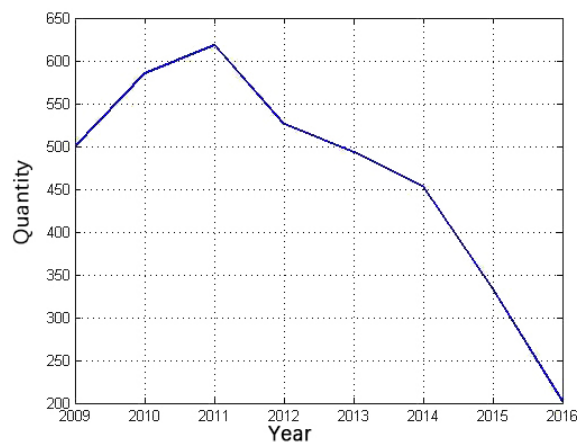


Figure 3-3 Overall trend of the number of papers published on eco-city papers in 2009-2016

Source: Author

### 3.3.3 Practice Overview and Promotion Policy

In 2010, the National Development and Reform Commission issued the "Notice on Launching Pilot Work in Low Carbon Provinces and Low Carbon Cities" to build cities with low carbon as the main target. It is clear that pilot projects will be carried out in the five provinces of Guangdong, Liaoning, Hubei, Shaanxi and Yunnan, as well as Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang and Baoding. The National Energy Administration issued the "Notice on Declaring New Energy Demonstration Cities and Industrial Zones", encourage innovative urban new energy development models, increase the proportion of clean energy in cities, and promote the construction of resource-saving and environment-friendly society.

In October 2011, the 12th China Western International Expo “Eco-City and Green Building Summit Forum” was held in Chengdu. The forum put forward the development model of “promoting eco-city construction with low-carbon development methods”.

In the same year, the Ministry of Housing and Urban-Rural Development issued the Interim Measures for the Administration of the Low-carbon Ecology Pilot City (Town) Reporting of the Ministry of Housing and Urban-Rural Development. Also, a low-carbon eco-city construction leading group was set up to organize research on low-carbon eco-city development plans, policy recommendations, indicator systems, and demonstration technologies to guide the development of low-carbon eco-cities in China.

## **3.4 Analysis of the practice process**

### **3.4.1 From Urban Environmental Governance to Ecological Urban Construction**

As a different stage of eco-city construction, China started with the improvement of urban city appearance and environmental sanitation, carried out the construction of sanitary city, and carried out the construction of garden city and forest city from the perspective of urban beautification; Subsequently, for promote urban environmental protection and sustainable development, with the main objectives of pollution control, clean production, safety and disaster prevention, and recycling, the construction of environmental protection model cities was carried out, And pursue environment-friendly and resource-conserving city, forming a recycling-based city; The practice of the first eco-city in Yichun City has also achieved great success, and the urban and rural artificial complex ecosystem has also received good feedback. All of these reflect the concern and attention of the cities in China from the government to the public on ecological and environmental issues. China has officially embarked on the road of ecological construction.

### **3.4.2 Transforming From a Macro-Ecological City to a Micro-Ecological City**

Recently, from the pursuit of the rationality of urban management and the convenience of life, the construction of digital cities and intelligent cities is proposed; Nowadays, global warming has become the focus of people around the world. Eco-city construction has entered a new stage of low-carbon society construction. The exploration of new urbanization roads has begun throughout the country. The concept of ecological civilization has further penetrated the hearts of the people. The institutional reform of ecological cities has started, and China's eco-city construction has made new progress. These national political decisions have provided a new era for the construction of China's eco-city, set new development goals for the construction of China's eco-city, and injected new impetus for the construction of China's urban cities. It is not difficult to see that the construction of China's eco-city is undergoing a gradual and dynamic development process.

## Conclusion

This chapter sorts out the practice history of eco-city construction. The construction process is divided into three stages according to the development law, and the eco-city history is elaborated from the background, relevant academic support, technical methods and related construction profiles and policies. Among them, the practical problems are found in the summary of the process, and the history of the entire eco-city is analyzed: The whole construction process is a process of continuous deepening. The construction of eco-city is gradually transitioning from the governance of urban environment to the construction of eco-city, and gradually transforms from a wide-ranging eco-city to a more focused eco-city construction process.

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## Chapter 4. Types and characteristics of construction practices in China's eco-cities

The focus of this chapter is to present the characteristics of an eco-city through charts and case studies. Based on the two categories of ecological city classification in Chapter 2, and then subdivided, Through the data analysis, the general characteristics of the law are obtained, and then the characteristics of each type of eco-city are summarized through case analysis.

### 4.1 Types of Practice and General Characteristics of China's Eco-Cities

With the development of eco-city construction practices, eco-cities have also produced many types of practice. Regarding the type, many scholars have elaborated, such as Wan Yanhong, which divides the ecological city into three types: ecological management, ecological construction, and comprehensive development<sup>64</sup>. Cheng Wei proposed the main types of current eco-city construction in China, namely resource-based eco-city, tourism-type eco-city, and comprehensive eco-city, and pointed out the problems that should be paid attention to during the construction process<sup>65</sup>. Li Dexiang proposed that there are three types in the current “eco-city” practice: ideal planning, small-scale technology optimization and large-scale overall improvement<sup>66</sup>. Based on the characteristics of natural resources, Xue Mei divides the domestic eco-city into landscape garden eco-city, forest-type eco-city, coastal eco-city, sunny eco-city, water-saving eco-city and tourism-type eco-city<sup>67</sup>. According to the nature of the land use and the development and construction model of the eco-city practice cases currently under development, Li Xun divides it into three categories: Eco-city practice in newly built areas, eco-city practice of existing urban renewal, and eco-city practice of existing urban expansion.<sup>68</sup>

#### 4.1.1 Types of Practice and General Characteristics of Top-Down Ecological Demonstration Cities

This section will provide statistics on two types of eco-city projects and ecological demonstration zones that can obtain data from top-down eco-model cities and bottom-up eco-cities. The characteristics of the construction practice of eco-city are also the result of the combined effects of urban economic foundation, cultural environment differences, and government-led policies. As an important manifestation of urban health development, urban and rural ecological cycle, and their large time span, they have strong representativeness and typicality. The data are derived from the information collected from the seven batches of national-level ecological demonstration zones awarded by the state in 1986-2016 and the relevant eco-city construction practice information summarized by the

<sup>64</sup> Wan Hongyan. 2004. Research on the paradigm of ecological city. Beijing Normal University, 22-23.

<sup>65</sup> Cheng Wei. 2007. Research on the Types of Ecological City Construction in China. Journal of Tianjin Institute of Urban Construction, 13(4): 239-242.

<sup>66</sup> Li Dexiang, Zou Tao. 2008. Classification and Experience Promotion of “Ecological City”. 2008 International Forum on Urban Development and Planning, 103-105.

<sup>67</sup> Xue Mei, Dong Suocheng, Li Yu. 2009. Comparative Study on the Construction Models of Eco-Cities at Home and Abroad. Urban Problems, (04): 71-75.

<sup>68</sup> Li Xun. 2012. Practice and Exploration of Building a Low Carbon Eco-city. Low Carbon World, (4): 58-62.

author, using quantitative statistics and spatial analysis methods, exploring the overall change characteristics of the practice of eco-city, supplementing the lack of eco-city in the basic research field, and providing reference and reference for the further deepening of China's ecological civilization construction.

## **1. Types of Practice in Top-Down Eco-model Cities**

Based on the classification of eco-city types by scholars Cheng Wei and Xue Mei, this paper combines the construction of China's eco-city into four modes based on the current construction practice:

### **(1) Circular Economy Type Ecological Demonstration City**

The construction of a circular economy ecological demonstration city to achieve sound and rapid economic development and achieve efficient production; Transforming production and consumption patterns, changing the traditional extensive mode of resource consumption to drive economic development, and gradually transitioning to a model of sustainable recycling and efficient use of resources.

### **(2) Resource-Based Ecological Demonstration City**

Such ecological demonstration cities have outstanding general resource advantages and are based on local natural resources, especially in relation to the natural geographical conditions and climatic conditions within the region.

### **(3) Economic Compound Ecological Demonstration City**

This model of ecological demonstration city has a high level of economic development and is common in large cities in developing countries, such as Shenzhen. It is built on the foundation of excellent urban greening, so that the city's economy and society can develop rapidly and sustainably.

### **(4) Garden Ecological Demonstration City**

It is a new ecological city construction model, new concepts, and new practices. The premise of building such an ecological city is that it must have a certain garden foundation and possess the characteristics and functions of an ecological city. The city has accumulated the green heritage of the garden city, which integrates the garden and the ecology. The green layout of the city is reasonable and the functions are effectively played.

## **2. Overall Characteristics of Top-Down Eco-model Cities**

### **(1) Data source**

As of 2016, the Ministry of Environmental Protection has officially awarded seven batches of national-level ecological demonstration zones. The seven batches have been promulgated between 2000 and 2012, with a total of 528 national-level ecological demonstration zones, as shown in Table 4-1. The data is from the official website of the Department of Natural Ecology Protection of the Ministry of Environmental Protection of China (<http://sts.mep.gov.cn/stsfcj/>). For other relevant information, please refer to the China Statistical Yearbook (2000-2011).

Region	Quantity	Region	Quantity	Region	Quantity
Jiangsu	64	Anhui	17	Tianjin	7
Heilongjiang	49	Sichuan	16	Hubei	7
Shandong	41	Shanxi	16	Guangdong	6
Henan	37	Jiangxi	15	Xinjiang	3
Zhejiang	36	Fujian	12	Chongqing	3
Hunan	33	Beijing	11	Shanghai	1
Shaanxi	32	Jilin	11	Hainan	1
Hebei	30	Guizhou	11	Ningxia	1
Guangxi	26	Inner Mongolia	10	Gansu	1
Liaoning	22	Yunnan	10	Total	528

Table 4-1 China National Ecological Demonstration Zone

## (2) Overall time and space pattern

The overall number shows an increasing trend, and the distribution characteristics are more universal. It is in line with China's social development and has its own development law. The main pattern presents a “multi-center-aggregate” distribution, the pattern of “south-eastern dense and western-sparse”. As an important manifestation of urban health development and urban and rural ecological cycle, the national ecological demonstration zone reflects the transformation and development of social economy and the construction and changes of human settlement environment within a certain period of time. Since the construction period of the national ecological demonstration zone is from 2000 to 2012, this chapter divides it into three phases, with three time nodes in 2000, 2006 and 2011. The point analysis shows the overall distribution of the space of China's national ecological demonstration zone, as shown in Figure 4-1.

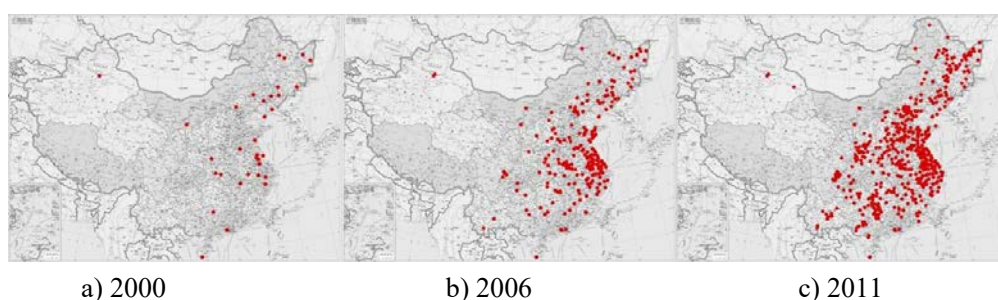


Figure 4-1 Spatial distribution map of China's national ecological demonstration zone

The distribution of national-level ecological demonstration zones generally shows the spatial pattern of the main coastal development along the non-equilibrium distribution along the contrast line of China's population density. The first time node ecological demonstration zone presents a significant “multi-center” scatter distribution; In the second time, the node ecological demonstration zone showed a “multi-center-multi-axis” distribution, and the whole expanded with a central wraparound structure.

By the end of the time, the ecological demonstration zone has become a large-scale gathering development, and its "multi-center-aggregate" distribution mode is more obvious. In general, the direction of optimization and coordination is changed, and the geographical position moves from northeast to southwest.

The spatial distribution characteristics of the ecological demonstration area show a decreasing distribution pattern from coastal to inland expansion. The high-density core distribution area is characterized by "coastalization" and the low-density distribution area is characterized by "inlandization".

#### 4.1.2 Types of Practice and General Characteristics of Bottom-Up Eco-Cities

##### 1. The Status Quo of Bottom-Up Eco-City Construction

The number of bottom-up eco-cities is large and the types are complex. Through the field research of eco-city construction practice project, domestic and international conference (forum) tracking, journal paper retrieval, web search engine query, etc., this paper searches for 287 prefecture-level cities and above, and retrieves them, there are 154 named projects as "ecological city", "Ecological New City" and "Ecological New Area", which are distributed in 21 provinces, 5 autonomous regions and 4 municipalities.

From the sorted out data, the China Eco-City differs greatly in terms of size and industrial direction. It can be clearly divided into real estate development, ecological transformation of existing urban areas, ecological zones of tertiary industries, ecological demonstration zones (technical parks, industrial parks) and . There are 5 types, as shown in Figure 4-2.

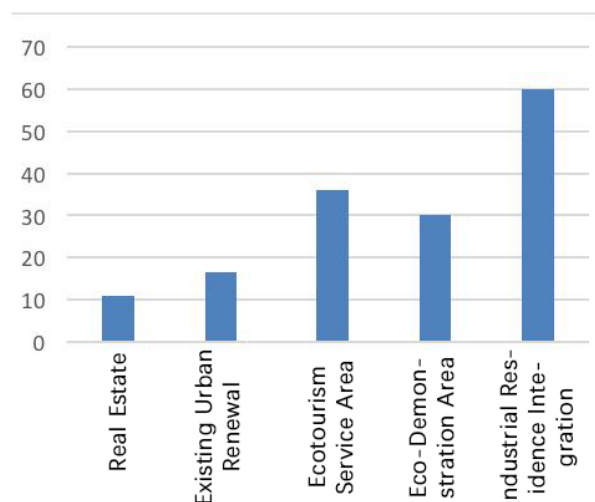


Figure 4-2 Number of various types of eco-cities

Source: Author



## **2. Types of Practice from Bottom-Up Eco-City**

### **(1) Real estate development eco-city**

It is a green building community that explores water-saving, energy-saving, land-saving, material-saving and environmental protection in response to the requirements of high-quality living environment in response to energy conservation and environmental protection, and is named the Eco-City. There are a large number of such eco-cities, totaling 10, with an average planned area of  $4.8\text{km}^2$ , often based on a single residential function, and some projects are comprehensive real estate projects with leisure recreation and tourism functions.

### **(2) Existing Urban Ecological Transformation Eco-City**

At present, the number is small in China, and only 17 projects with existing urban renewal projects are collected, mainly using international green technologies for energy system, building energy-saving renovation, and sanitation facilities construction projects.

### **(3) Eco-tech park eco-city**

It is a part of industrial parks, science parks or economic and technological development zones. With the expansion of industrial scale and the continuous accumulation of population, it is necessary to increase the comprehensive functions of cities such as residence and commerce, so the eco-city will be built on the basis of the park. At present, the number of such eco-cities is 30, and the average planned area is  $230\text{ km}^2$ . The main industries are industrial, commercial, logistics, residential, research and development.

### **(4) Tertiary industry ecological zone eco-city**

For the development and construction projects with eco-tourism and leisure and vacation as the main industries, most of them choose high-quality tourism resources such as forests, rivers, lakes, wetlands, reservoirs, hot springs, coastal areas and mountain areas for comprehensive development and construction. According to statistics, the total number of such eco-cities is 36, accounting for 23% of all eco-city projects, with an average planned area of  $22\text{ km}^2$ . Its industry types mainly include leisure and entertainment, health and wellness, conference and exhibition, education and training, golf, ecological agriculture, hotel villas, and high-end residence.

### **(5) Industrial residence integration eco-city**

Most of the new cities (satellite cities) or new urban areas in large cities are generally characterized by large planned areas, complete functions, and complete industrial categories. According to statistics, the number of ecological new towns in the 154 projects is 30, and the number of ecological new districts is 31, totaling 61 projects, accounting for 40% of the total eco-city. In terms of scale, the ecological new city is large in scale, with an average planned area of  $152.8\text{ km}^2$ , while the ecological new area is small in scale, with an average planned area of  $36.5\text{ km}^2$ . The eco-new town is usually planned as a new administrative center, which will drive the development of the new city by relocating the government from the old city to the ecological new city. At the same time, it combines the good ecological landscape environment and high-quality public service facilities of the ecological new city, developing business exhibitions, cultural creativity, leisure tourism, modern services, high-tech, high-end residential and other industrial types, the future will gradually develop into a functional city or urban area.

### 3. General Characteristics of Bottom-Up Eco-City Construction Practice

#### (1) Time Distribution Feature

From the distribution characteristics of the start-up time of China's new eco-city, as shown in Figure 4-3. China's substantial ecological new city construction began in 2002, and the number was not large before 2009. It began to grow in 2007 and began to accelerate after 2009. In particular, between 2010 and 2012, 83 ecological new city construction projects were concentrated, accounting for 54% of the total; At present, 6 of the 154 eco-city projects in China are not in the planning stage, 13 eco-cities have been completed, and the remaining 135 eco-cities are in an unfinished state, accounting for 88% of the total. It shows that most of China's eco-city projects have entered the stage of substantive construction.

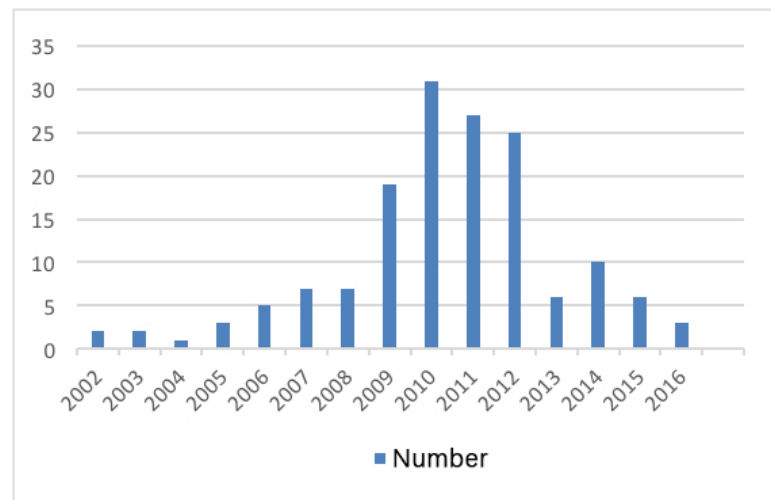
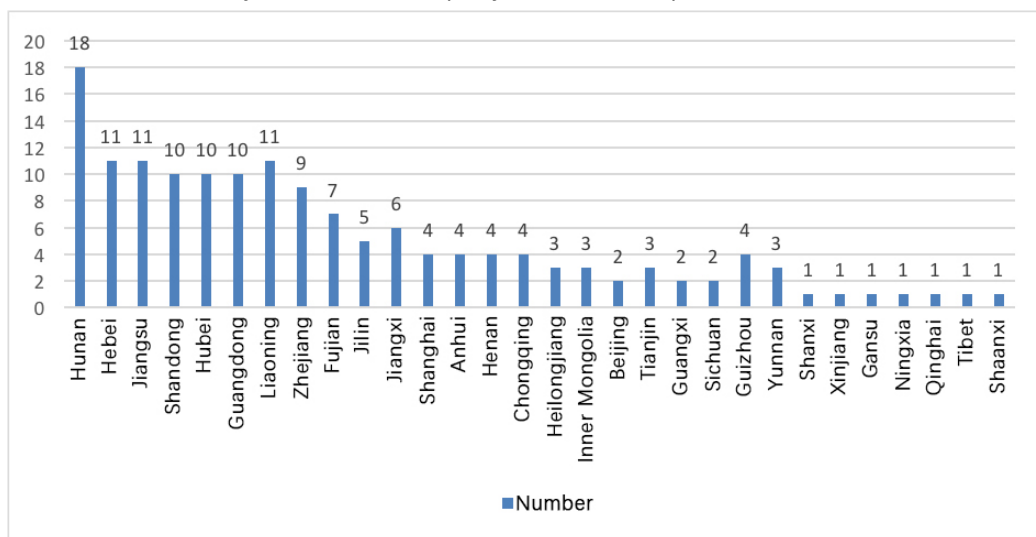


Figure 4-3 Start time of eco-city construction project

Source: Author

#### (2) Spatial Distribution Characteristics

According to the distribution characteristics of eco-city provinces, the number of eco-city construction projects in coastal areas such as Hunan, Hebei, Jiangsu, Hubei, Guangdong, Shandong, and Liaoning ranks among the top in China, with an average of more than 11 eco-city construction projects in each province;



Province (autonomous region, municipality)

Figure 4-4 Number of eco-city projects in various provinces (urban areas) in China. Source: Author

In particular, Hunan Province has 18 outstanding constructions in the eco-city, far ahead of other cities. Shaanxi, Shanxi, Gansu, Qinghai and other provinces and Xinjiang, Tibet, and Ningxia Autonomous Region each have an ecological new city project. Except for all provinces in Taiwan and Hainan, there are eco-city practices, as shown in Figure 4-4.

From the perspective of the distribution characteristics of China's new ecological space, as shown in Figure 4-5, most of the ecological new cities are concentrated in the national economic zones and new districts that are under national development.

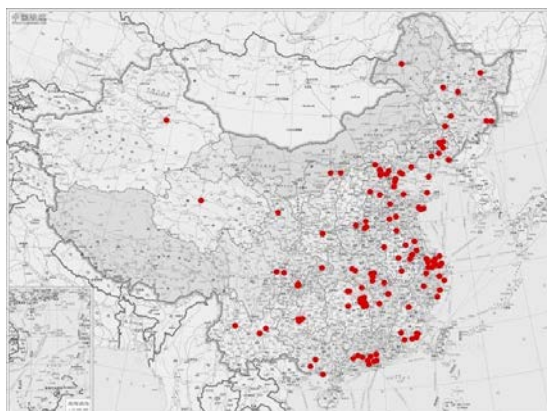


Figure 4-5 Overall spatial distribution of China Eco-City

Source: Author

Such as the coastal economic belt of Liaoning, the cooperative development zone of the Tumen River area, the national new industrialization comprehensive reform pilot zone of the Shenyang Economic Zone, the Beijing-Tianjin-Hebei metropolitan area, the Tianjin Binhai New Area, and the Shandong Blue Economic Zone, Shandong Yellow River Delta Efficient Ecological Economic Zone, Henan Zhongyuan Economic Zone, Yangtze River Delta Economic Zone, Chengdu-Chongqing Economic Zone, Liangjiang New District, Wuhan City Circle, Changsha, Zhuzhou and Xiangtan urban agglomerations - the national resource-saving and environment-friendly society construction comprehensive supporting reform pilot zone, the Pearl River Delta Economic Zone, the Pudong New Area, the Guangxi Beibu Gulf Economic Zone, etc. Among them, Changsha, Zhuzhou and Xiangtan, the Pearl River Delta and the Yangtze River Delta are the most concentrated. The construction of the eco-city fully demonstrates that the new cities in China's major strategic regions have taken green low-carbon ecological development as the main direction of urban construction, and also explained the relatively loose land and fiscal policies of various economic zones, and provided a good policy environment for the construction of ecological new cities.

From the perspective of time and space, the construction practice of the eco-city is completely in line with the division of the eco-city construction stage. The earliest time to start construction is in the second phase of the eco-city construction, and the vigorous development phase will enhance the reflection period in the third phase. Due to the high resource requirements and high cost of the eco-city construction, it did not appear during the exploration period, and gradually began to form and develop after 7 years of development at the rapid development stage. In 2009, it began to enter the peak construction period of 4 years, and the construction project reached 102 items;

By 2013, the quantity construction began to decrease sharply, and the construction of the eco-city entered the stage of upgrading and reflecting. From these three stages, the characteristics of the construction area of the eco-city are relatively similar, and the ecological demonstration area presents similar development rules, as shown in Figure 4-6.

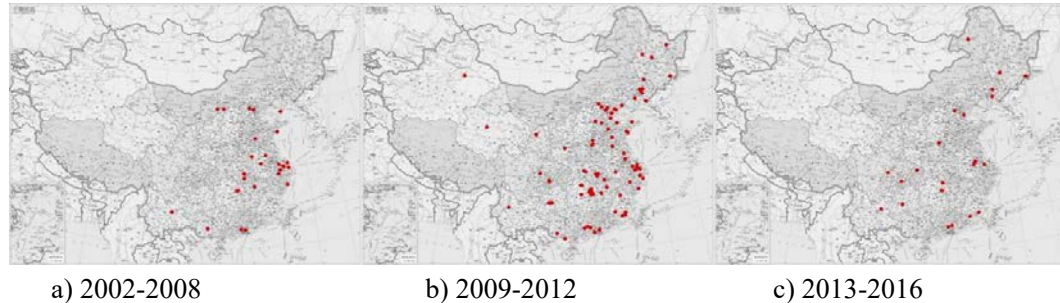


Figure 4-6 Distribution of China Eco-City by time segmentation

Source: Author

### (3) Site Selection Characteristics of Bottom-Up Eco-City Natural Base

Urban development and construction will inevitably bring damage to the natural base and is an irreversible process of destruction. From the site selection characteristics of China's eco-city construction projects, as shown in Figure 4-5, eco-city projects built around natural waters such as lakes, rivers, coastal areas, reservoirs, wetlands, etc. accounted for 26.7%, 14.9%, 10.9%, 5.9%, and 4% of the total, amounting to 62% of the total number of eco-city; Projects for selecting farmland and mountainous areas accounted for 17.8% and 13.8%, respectively; other types of eco-city projects accounted for 6%. It fully shows that most of the current China Eco-City is selected for development and construction in various types of waters, mountains and farmland with beautiful ecological environment. The main reasons are as follows. First, the eco-city is an ideal urban form that is in harmony with nature. A good ecological environment provides unique natural conditions for the construction of an eco-city, which is convenient for creating a high-quality landscape environment, also conducive to land appreciation and attracting high-end industries.

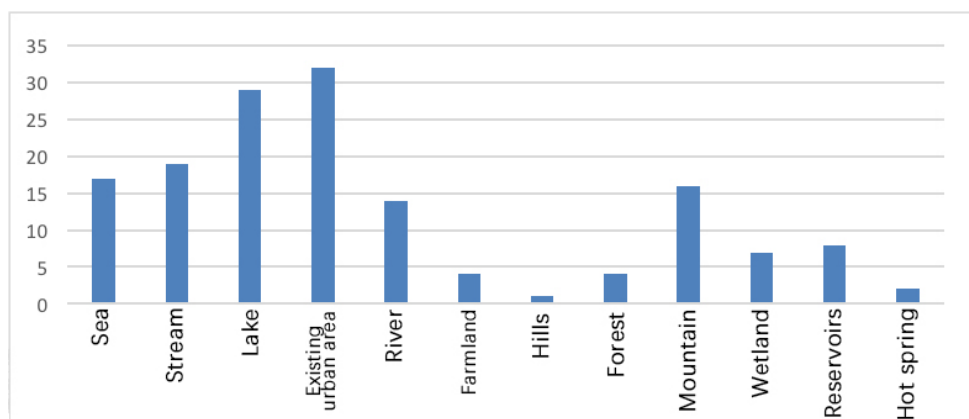


Figure 4-7 Location characteristics of China Eco-City

Source: Author

It is the first choice for eco-city construction; Second, land with high ecological value around wetlands such as rivers, lakes and seas is classified as unused land in the land use classification system, and is not subject to the rigid restriction of basic farmland protection, and there are fewer villages and farmland in this range, demolition and land acquisition costs are low, and often become the best area for eco-city construction, as shown in Figure 4-7.

#### (4) Scale Characteristics of Construction Land from Bottom-Up Eco-City

The scale of land use for the construction of eco-city is relatively large. According to the 151 eco-city projects that have obtained the scale data of planned land use, the total land use scale is 132,983 km<sup>2</sup>, and the average land for each eco-city is 880 km<sup>2</sup>, which includes the transformation of existing urban areas. Therefore, the overall average area is large. According to the classification statistics, as shown in Figure 4-8, there are 17 eco-city projects with an area larger than 200 km<sup>2</sup>, accounting for 11.2%, most of these eco-cities are ecological cities that are piloted for large-area divisions, and most of them are under construction. There are 22 eco-city projects with an area of 100~200 km<sup>2</sup>, accounting for 14.2%, mainly for the new city or satellite city of Guiyang, Hefei, Zhuzhou, Shenzhen, Wuhan, Shijiazhuang, Zhangzhou, Beijing and other provincial capitals and prefecture-level cities. There are 24 eco-city projects with a land size of 50~100 km<sup>2</sup>, accounting for 15.5%, mainly for the new city or urban new district of Jining, Tangshan, Daqing, Shanghai, Langfang, Wuhan, Dalian, Benxi, Changchun, Yantai, Changsha, Yangquan, Nanchang and other cities. There are 33 eco-city projects with a land area of 20~50 km<sup>2</sup>, accounting for 21.4%; mainly for small-scale new districts, ecological towns and eco-tourism resort projects. There are 28 eco-city projects with a land area of 5~20 km<sup>2</sup>, accounting for 18.2%, mainly for some large real estate development projects or eco-city demonstration construction areas. Most of the 1~5 km<sup>2</sup> eco-city is a real estate development project with a total of 27, accounting for 17.5% of the total.

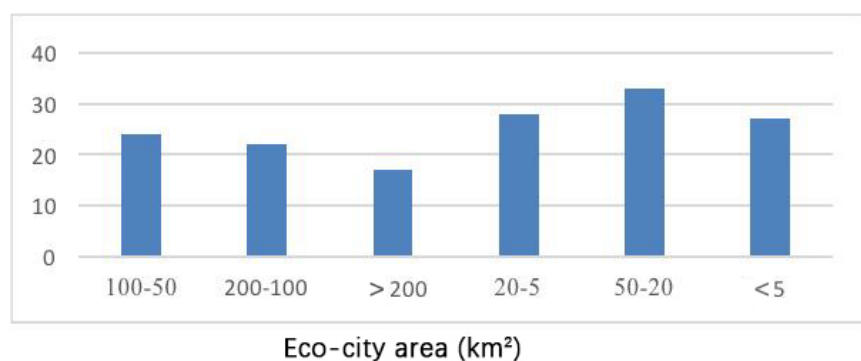


Figure 4-8 Scale characteristics of China's eco-city land. Source: Author

#### (5) Main Types of Bottom-Up Eco-City Development

From the perspective of the main characteristics of China's eco-city development, there are mainly international cooperation and joint construction, the provincial ministries and commissions jointly promote the construction, the national ministries and commissions jointly promote the construction, the city government leads the promotion and the developers lead the construction of five types.

## 4.2 Practice Examples and Related Characteristics of Top-Down Ecological Demonstration City Construction

This section will use the form of case analysis to enumerate and summarize the general situation and characteristics of the top-down eco-model city case, and analyze its type and overall characteristics.

### 4.2.1 Circular Economy Eco-model City Case and Related Characteristics

The construction of a circular economy eco-demonstration city to achieve sound and rapid economic development, achieve efficient production, clean environment, achieve a comprehensive construction of a well-off society, and continuously improve and improve the people's living standards; transforming production and consumption patterns, changing the traditional extensive mode of resource consumption to drive economic development, and gradually transitioning to a model of sustainable recycling and efficient use of resources.

#### 1. Taking Ecological Transformation to Replace Traditional Industrial Structure as Advance——A Case Study of Guiyang City

##### (1) Profile interpretation

Guiyang's landforms are dominated by mountains and hills, and the terrain is undulating. It has the characteristics of no cold in winter and no heat in summer. Guiyang is the distribution center and destination of tourism in Guizhou(Fig 4-9). In recent years, Guiyang's people's economy has maintained steady and rapid growth, but it is still in the mid-term of traditional industrialization.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Guiyang	Southwest China	8034 km <sup>2</sup>	4.862 million (2017)	353.796 billion Yuan

Table 4-2 Guiyang basic information.

Source: <https://baike.baidu.com/item/%E8%B4%B5%E9%98%B3>



Figure 4-9 Guiyang City in China's geographic location.

Source: Author

In Guiyang's "one, two and three" industries, the traditional high-material consumption, high-energy consumption, and high-pollution industrial sectors still account for a large proportion in the entire industrial system, while the development of emerging eco-industrial sectors such as green resource industry, green characteristic processing manufacturing, and high-tech industries is still relatively backward; although the pilot project of circular economy has been carried out in some regions, the development still lags behind; Enterprises still have not adopted economically efficient technologies and management methods that can save resources and reduce negative environmental impacts, as a result, the energy consumption of the entire industrial system remains high, and the impact of economic development on the environment is becoming increasingly serious.

## (2) Feature analysis

Guiyang City, Guizhou Province has made remarkable achievements in building a circular economy-type ecological demonstration city, and is a typical example of the construction of an ecological demonstration city in China<sup>69</sup>. The first is to adjust the economic structure, develop ecological industries, and rely on high-tech to develop ecological industries. The second is to change the traditional model and develop ecological agriculture. Guiyang City changed the traditional agricultural development model, followed the laws of nature, ecology and economic development, adjusted the agricultural economic structure, and vigorously developed pollution-free, green organic agricultural products. The third is to develop ecological tourism based on ecological advantages. Combine the local ecological advantages with tourism development, and vigorously develop eco-tourism focusing on natural ecology, historical culture and folk customs, and strive to transform ecological resources into economic resources and realize ecological industrialization. Finally, we will innovate institutional mechanisms, improve ecological civilization policies and regulations, increase capital investment, promote people's livelihood and infrastructure construction, increase publicity efforts, and strengthen constructive measures such as citizens' awareness of ecological civilization. It can be seen that Guiyang's ecological construction is mainly achieved through industrial transformation and optimization of traditional industrial models.

## 2. Promoting the comprehensive ecological utilization of gas--A case study of Huainan City

### (1) Profile interpretation

Huainan, a prefecture-level city under the jurisdiction of Anhui Province, is located in the north-central part of Anhui Province and is located in the hinterland of the Yangtze River Delta (Fig 4-10). Huainan City is a city with coal as its main body and various other mineral resources. The main mineral resources are coal, limestone, coalbed methane, and coal-bed methane associated with coal mining.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Huainan	East China	5571 km <sup>2</sup>	3.456 million (2016)	110 billion yuan

Table 4-3 Huainan basic information.

Source: <https://baike.baidu.com/item/%E6%B7%AE%E5%8D%97>

<sup>69</sup> Jingyuan Li, Tongjin Yang. 2016. China's Eco-city Construction-Springer-Verlag Berlin Heidelberg, 171.





Figure 4-10 Huainan City in China's geographic location.

Source: Author

Among them, Huai'nan coal-based energy structure and coal-based economic structure make it not only have the “three wastes” pollution problem of ordinary cities, but also have a series of environmental and ecological problems unique to resource-based cities. In recent years, in order to improve regional environmental quality and solve a series of environmental and ecological problems brought about by resource development and industrial and agricultural development, Huainan City has increased investment in human and financial resources and achieved certain results. However, due to the sharp increase in the scale of resource exploitation and utilization, the current investment can only be a drop in the bucket, and environmental problems such as structural pollution are difficult to be fundamentally resolved within a certain period of time.

## **(2) Feature analysis**

Comprehensive utilization of resources in Huainan City, implementation of standardized gas extraction maximization strategy; Innovate the key technologies of gas comprehensive management, formulate and implement rigid management systems, establish a simple and efficient gas comprehensive management organization structure, adhere to the direction of comprehensive utilization of gas power generation, waste heat utilization, and civil use, and conduct technical exchanges and cooperation through various forms. Huainan City mainly achieves the development of circular economy through the comprehensive utilization of sustainable environmental protection new energy. This kind of ecological construction is to some extent, it is to carry out industrial reform from the root, and it also has the difficulty of reforming according to local conditions. Although the risk of large investment in the early stage does not have certain reproducibility, the overall ecological construction effect is relatively good.

## **3. Summary of characteristics of circular economy ecological demonstration city**

The circular economy eco-model city is mainly to adjust the ecological energy of industrial energy to achieve efficient development. This kind of eco-city is generally poor in the early resources and environment, the industrial pollution problem is serious, and the industrial structure is backward. In the later period, the development of a single industry to a three-industry and the development of an eco-industry will not increase the consumption of natural resources at the expense of natural resources.



## 4.2.2 Resource-Based Ecological Demonstration City Case and Related Characteristics

Such ecological cities have outstanding advantages in general resources and are based on local natural resources, especially in terms of natural geographical conditions and climatic conditions within the region. Resource-based ecological demonstration cities are generally easier to establish the context of urban development planning, and have certain advantages in terms of location and natural conditions. Urban development is based on resources to a certain extent, such urban industrial structure is relatively simple, relatively easy to carry out transformation and upgrading, can solve some problems in economic development in a timely manner, is conducive to the optimization of human settlements, and has certain potential for economic development.

### 1. Formulate an ecological plan that follows the laws of urban development - Kunming

#### (1) Profile interpretation

Kunming has advantages in terms of geography, climatic conditions and species diversity (Fig 4-10). As the capital of Yunnan and the political, economic and cultural center of Yunnan, Kunming has an advantage in terms of capital, technology and talents. As one of the regional central cities in western China, especially in the southwest, Kunming has maintained a rapid growth rate in the national economy since the founding of New China. The urban area is also expanding rapidly, kunming's comprehensive urban capacity has been significantly enhanced and improved. However, in the process of urbanization, urban environmental pollution, land shortage, and insufficient water supply have become increasingly prominent. Various "urban diseases" have become an important factor restricting the sustainable development of cities.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Kunming	Southwest China	21473 km <sup>2</sup>	6.7280 million (2016)	485.76 billion yuan

Table 4-4 Kunming basic information.

Source: <https://baike.baidu.com/item/%E6%98%86%E6%98%8F>



Figure 4-10 Kunming City in China's geographic location.

Source: Author

## (2) Feature analysis

Propose the objective laws of Kunming's urban development, the basic laws of ecosystem and ecological construction, and apply ecological science and urban science theory, it proposes the construction of "Spring City", "Historical and Cultural City" and modern city in one landscape garden city, and highlights Kunming's international cities facing Southeast Asia and the cultural characteristics of "King culture", "protecting the country" and "anti-Japanese war and minority cultural cities". With the scientific urban planning, functional division and industrial layout to ensure the construction of ecological city, the urban garden structure covering the city's green heart, green belt and green ring is formed. Taking the carrying capacity of the urban ecosystem as the bottom line of urban planning, the urban planning and construction of the city will be guided by organic evacuation of urban planning, and the urban agglomeration framework of one main, three and several small and medium-sized towns will be built. Taking the construction of key ecological and ecological projects as a breakthrough, in accordance with the basic requirements of ecological construction, we will adopt comprehensive measures such as biology, engineering and horticulture to adjust the industrial structure and develop high-tech industries, develop an ecological and intensive ecological economy and increase the capacity of the ecological environment in stages. In terms of system selection, deepen the dynamic mechanism and guarantee system of urban construction, and promote the coordination and unification of ecological, economic and social benefits. It can be seen that the ecological construction of Kunming is mainly aimed at the entry point of resources, and the implementation of the auxiliary development mode such as the transformation of the industry on the basis of respecting the natural environment and the law of urban development. This is also the biggest feature of this type of ecological city construction.

## 2. Taking the scientific theories such as ecological corridors as the entry point - Case study of Ganzhou City

### (1) Profile interpretation

Ganzhou is a sub-central city in Jiangxi Province (Fig 4-11) with a history of more than 2,200 years. The historical and cultural accumulation of the city is very rich, most of which are well preserved and have been developed to a certain extent. The downtown area and the urban area are surrounded by mountains and rivers. The water system of the city and its surrounding areas, Zhangjiang and Gongjiang, is integrated into the urban area through urban areas, mountains and gullies, forming a green background of the entire city. Effectively improved the overall ecological environment of the city. At the same time, due to the long history of the city, the city is full of old trees and trees.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Ganzhou	East China	39379.64 km <sup>2</sup>	9.7425 million (2017)	252.401 billion yuan

Table 4-5 Ganzhou basic information.

Source: <https://baike.baidu.com/item/%E8%B5%A3%E5%B7%9E/142839>



Figure 4-11 Ganzhou City in China's geographic location.

Source: Author

## (2) Feature analysis

Ganzhou City adopts multi-disciplinary theories such as ecological principles, circular economy theory, environmental theory and advanced concepts such as ecological corridors, ventilation corridors and ecological greenways to implement the basic strategy of sustainable development. In accordance with the overall concept of “ecological priority, urban and rural integration”, under the premise of fully protecting the good mountain and water ecological environment around the built-up area, based on the nature and scale of the city determined by the overall plan, the ecological corridor, the ventilation corridor and the ecological greenway are taken as the entry points, and the urban green space ecosystem is determined scientifically and rationally. Construct an ecological network structure with “five waters, six points, ten corridors” as the skeleton: five major water ecosystem corridors, six ecological function nodes, and ten ecological green corridors.

### 3. Summary of characteristics of resource-based ecological demonstration cities

As the name implies, the resource-based eco-city has a good base for resources and environment, a suitable climate and a profound cultural heritage. This type of eco-city generally develops tertiary industries such as tourism, with a single industry, but the general urban infrastructure is poor. These have provided a good foundation for ecological transformation. On the basis of the original urban environment, urban planners stand on a higher perspective and are no longer limited to the greening and beautification of the environment, but realize that the overall urbanization Ecological planning, ecological planning is not only a regional planning but a regional overall; and it will fully respect the natural laws and reduce the damage to the natural environment.

### 4.2.3 Economic Composite Ecological Demonstration City Case and Related Characteristics

This model of eco-city has a high level of economic development and is common in large cities in developing countries, such as Shenzhen. The economic complex eco-city is based on excellent urban greening, and the urban economy and society are developed rapidly and sustainably. In such an eco-city, economic development is the most critical factor, and it is also the first indicator to measure the construction of this type of city. While the level of economic development is constantly improving, the relationship with the urban environment is well coordinated.

#### 1. Economic and Ecological Parallel——Shenzhen Case Analysis

##### (1) Profile interpretation

Shenzhen is one of the four first-tier cities in China and a municipality under the jurisdiction of Guangdong Province. Shenzhen is located in the south of Guangdong, on the east bank of the Pearl River Estuary, separated from Hong Kong by water (Fig 4-12). Shenzhen is the first special economic zone established by China, a window for China's reform and opening up and an emerging immigrant city. Over the past 30 years of reform and opening up, Shenzhen has always adhered to ecological concepts, pragmatic planning, and independent innovation in the course of rapid development, and has created a new method of urban environmental construction. However, in the past 30 years of super-normal development, Shenzhen has also encountered environmental problems faced by other cities: water pollution, traffic congestion, sharp decline in biodiversity, and garbage siege. Although the demonstration work of ecological construction in Shenzhen has achieved good results for many years, there is no complete systematic evaluation of the work.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Shenzhen	South China	1997.47 km <sup>2</sup>	12.5283 million (2017)	2.243839 trillion yuan

Table 4-6 Shenzhen basic information.

Source: <https://baike.baidu.com/item/%E6%B7%B1%E5%9C%B3>



Figure 4-12 Shenzhen City in China's geographic location.

Source: Author

## (2) Feature analysis

Since 1999, Shenzhen has promoted the demonstration work of ecological construction, focusing on the four levels of ecological construction demonstration work of “National Eco-city”, “National Ecological Zone”, “Shenzhen Ecological Street” and “Ecological Industrial Park”. A lot of related work. In the early stage of urban construction, Shenzhen implemented the plan first and achieved harmonious development. And began to implement quantitative assessment, the city, district and other levels of ecological construction units have implemented the planning requirements, the establishment of the establishment of leading groups and working groups, and actively carry out the work of the performance evaluation, so as to promote the orderly development of the various creations. And walk in the front end of ecological construction, actively explore and dare to innovate. Under the strategic height of “Eco-establishment”, we actively promoted the creation of cell-levels and pioneered the “ecological street” cell unit. In the process of creation, we have actively carried out various forms of publicity work, and we have become passively created to participate independently and create voluntarily, and truly realize the value and meaning of creation. It can be seen that Shenzhen has always been at the leading level in the country in the process of building an ecological city. It has the courage to try, actively innovate, and achieve good construction results.

## 2. All-round ecologicalization - Shanghai case study

### (1) Profile interpretation

Shanghai is a municipality directly under the Central Government and the first coastal open city. Located at the mouth of the Yangtze River (Fig 4-13), Shanghai is the leading city in the Yangtze River Economic Belt. Shanghai is now a national garden city, and it maintains a good state in terms of ecological construction. However, with the population growth in the process of rapid development, the population load in the central urban area increases, and Shanghai begins to present problems such as land resources and water resources.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Shanghai	East China	6340 km <sup>2</sup>	24.1833 million (2017)	3.013386 trillion yuan

Table 4-7 Shanghai basic information.

Source: <https://baike.baidu.com/item/%E4%B8%8A%E6%B5%B7/114606>



Figure 4-13 Shanghai City in China's geographic location. Source: Author

## **(2) Feature analysis**

Starting from the 11th Five-Year Plan, Shanghai clearly proposed to build an ecological city. First, it began to change the past high-energy and non-circulating operation mechanism, and built a self-organized and efficient ecological industrial system with good and rational allocation resources. In order to solve the population problem and promote urban-rural integration, it is necessary not only to meet the needs of urban and rural residents, to achieve economic development, but also to improve the common development under the new coordinated overall order, so that the suburbs can share the urban population and realize the social ecologicalization of Shanghai. Economic ecologicalization and natural ecologicalization.

## **3. Summary of characteristics of economic complex ecological demonstration city**

Economic complex eco-cities generally have a high level of economic development. They have classified ecological governance as part of urban development in the early stages of urban development, so cities do not need ecological improvement and environmental governance. and the better development of the economy has also played a good support for ecological construction. This benign cycle has made the ecological construction of such cities always at the domestic advanced level. it is a model for the development of other cities, and ecological construction has always been prioritized over other cities.

### **4.2.4 Garden-type Ecological Demonstration City case and Related Characteristics**

Garden-type eco-city is a new eco-city construction model, new concepts, and new practices. The premise of building a garden-type eco-city is that it must have a certain garden foundation and possess the characteristics and functions of an eco-city. the city has more green vegetation and accumulates the green heritage of the garden city. The greening rate, the per capita public green area and the green viewing rate reach a certain level, which can effectively regulate the urban respiratory system. adding the comfortable feeling of the garden city, the garden and the ecological nature are integrated together; the urban ecological planning is rationally arranged, and various functions are effectively played; develop ecological industry and circular economy, industrial “three wastes” pollution to achieve harmless treatment, clean production, clean emissions, fresh air, clean environment; develop science and technology, raise the level of high-tech utilization, change the traditional economic development model, and use new energy and new materials to achieve high economic efficiency and low energy consumption.

## **1. Organic Integration of Natural Landscape and Artificial Landscape——A Case Study of Weihai City**

### **(1) Profile interpretation**

Weihai is a prefecture-level city in Shandong Province, located at the eastern end of the Shandong Peninsula. It is the closest city in mainland China to Japan and Korea (Fig 4-14).

Weihai City has enjoyed the reputation of “National Health City” for ten consecutive years. It has begun to put the city's environmental construction on the agenda in the early stage of urban planning. Its urban greening emphasizes adapting to local conditions, strengthening the systematic nature of greening, and creating urban greening experience with green seams.

City Name	Geographic Location	Acreage	Population	GDP in 2017
Weihai	East China	5797 km <sup>2</sup>	2.8256 million (2017)	348.01 billion yuan

Table 4-8 Weihai basic information.

Source: <https://baike.baidu.com/item/%E5%A8%81%E6%B5%B7>



Figure 4-14 Weihai City in China's geographic location.

Source: Author

## (2) Feature analysis

From the end of 1996, Weihai City began to build a clear goal of building an ecological city. Put forward the slogan of “not seeking scale, but seeking exquisiteness”, emphasizing the effective protection of the natural environment and natural resources in planning and construction, and striving for the organic integration of the city and the mountains and seas, the artificial landscape and the natural landscape complement each other, attach importance to the infrastructure construction closely related to the life of the citizens, and emphasize the principle of people-oriented, strive to improve functions, pay attention to the overall coordination of planning and construction, and adjust the unreasonable industrial layout of the city.

## 2. From environmental governance to ecological planning - a case study of Dalian

### (1) Profile interpretation

Located at the southern tip of the Liaodong Peninsula in Liaoning Province, Dalian is located on the coast of the Huanghua Sea (Fig 4-15). It is backed by the northeastern hinterland of China and faces the Shandong Peninsula across the sea. It is an important economic, trade, port, industrial and tourist city on the eastern coast of China. Since the reform and development, the Dalian Municipal Party Committee and the Municipal Government have put the urban ecological environment construction in an unprecedentedly important position, and have carried out their work creatively and achieved remarkable results.



City Name	Geographic Location	Acreage	Population	GDP in 2017
Dalian	Northeast China	13237 km <sup>2</sup>	6.987 million (2015)	736.3 billion yuan

Table 4-9 Dalian basic information.

Source: <https://baike.baidu.com/item/%E5%A4%A7%E8%BF%9E/152852>

Figure 4-15 Dalian City in China's geographic location.

Source: Author

As early as 1993, Dalian successively rectified the air pollution project for a limited period of time, which significantly improved the air quality in Dalian, and the government invested funds to complete the wastewater treatment project. At the same time, the company will implement the enterprise relocation and transformation project, and implement the relocation and transformation of enterprises with high energy consumption, heavy pollution and poor efficiency in the prosperous area, for the development of the tertiary industry, houses, squares and green spaces. Immediately after 1995, the Dalian government began to implement the greening and beautification project, and built four "greening dragons" such as the coastal road green belt, which is also the foundation for the construction of garden-type cities in Dalian, but the ecological construction at this stage stayed at a low level.

## (2) Feature analysis

In the "*10th Five-Year Plan*" period, Dalian began to scientifically plan ecological construction, formulate sustainable development strategies, and implement them at all levels of urban planning. Judging and defining the quality of urban development and economic operation from the perspective of ecology and ecological environment, the coordination of economic development, social progress and environmental protection will be the key issue of urban overall planning and comprehensive decision-making. Through continuous improvement of infrastructure, adjustment and optimization of economic structure, integration of the original industrial structure, reconstruction of urban framework and functions, and optimization of allocation of land resources. In the early stage of urban construction, starting from greening and remediation of pollution, from small-scale politics to ecological planning, it is the continuous improvement of urban construction awareness, and it is also the main feature of this type of eco-city.



### **3. Summary of characteristics of economic complex ecological demonstration city**

The garden-type ecological demonstration city is generally a city with better environment. During the construction process, the city has been continuously strengthening the urban greening and environmental management. These shallow ecological constructions are not meaningless. This provided a good foundation for the later construction of the eco-city. In the later period, the city began the overall planning and construction of the ecological, rather than the construction of the ecological part, so that the garden and ecological planning were rationally laid out and fully utilized.

#### **4.2.5 Summary of Characteristics of Top-Down Ecological demonstration cities**

From the case of the top-down ecological demonstration city listed above, it can be seen that the ecological construction of the circular economy type ecological demonstration city begins with multi-environment pollution and energy consumption, it mainly adopts the method of economic industry transformation and comprehensive management to carry out ecological construction; the resource-based ecological demonstration city generally has a good mountain water environment or humanistic heritage, and uses the ecological planning method to reshape the city's vitality on the basis of the original urban area; the garden-type ecological demonstration city has a good ecological foundation from the beginning, and on this basis, it uses scientific planning methods to improve urban development.

##### **1. Industrial transformation and ecological planning have become the main means of building a top-down ecological demonstration city**

The construction methods of top-down ecological demonstration cities in China can be divided into two categories. First, cities with developed industries and serious urban environmental pollution. The government has made ecological improvements through industrial transformation, environmental governance and emerging energy management models. adjust, the ecological demonstration cities of these cities are in the recovery phase of the relatively primitive urban environment, but have realized the use of ecological technology to solve problems. Second, the urban environment itself is better, which provides a good condition for the construction of an ecological demonstration city. The government uses ecological planning methods to solve urban urban diseases or urban renewal problems from a forward-looking perspective. and focus on the pursuit of coordinated development of urban society, economy and nature. The construction of China's top-down ecological demonstration city reflects the pursuit of ecological, economic and natural harmony and common development in different degree

##### **2. From technology to change to lead the overall development with planning ideas**

Urban planning is the outline of urban construction, and it is also the premise and guarantee for the construction of ecological demonstration city. The practice of the early ecological demonstration city is also the main reason for solving the problem and the advancement of technology. Since the environmental problem is the beginning, the urban problem is initially understood as a local problem.

As long as the specific technical measures can be dealt with, in the end, the old problems are solved, new problems have emerged, and in some cases, the technology itself has become the target of being chased. Therefore, in recent years, governments, enterprises and professionals have begun to realize that the urban and environmental problems facing China are comprehensive issues, even those related to the direction of human development. The problem should be top-down, it is necessary to propose a program through the so-called “top-level design”. The construction of many ecological demonstration cities has been raised from the initial simple problem-solving and improvement of greening rate to overall planning. Moreover, the ecological demonstration city is not a one-stop process, and it is necessary to seek a stable, long-term and sustainable development path.

### 4.3 Bottom-Up Eco-City Construction Practice characteristics

This section will use the form of case analysis to exemplify and summarize the overview and characteristics of the bottom-up eco-city case, and analyze its type and overall characteristics. The following are the practical characteristics of the construction of the six types of eco-cities from the bottom up:

#### 4.3.1 Real estate development eco-city case and related characteristics

Some real estate development projects are in response to the requirements of high-quality living environment for energy conservation and environmental protection, exploring green building communities that save water, energy, land, materials and environmental protection, or residential buildings that are built in beautiful scenery, and The eco-city is named.

##### 1. Low-carbon ecological high-speed rail economy livable new city——Wuguang New City case analysis.



Fig 4-16: source: google image

##### (1) Planning objectives

Wuguang New City is positioned as a high-speed rail economic demonstration zone in Changsha, a sub-center of the city and an ecological new city. The project covers an area of about 10 km<sup>2</sup>, about 12 km from the city center and 4.4 km<sup>2</sup> in the core area, with the high-speed railway south station as the core. The base is Liuyang River and Mopanzhou as the largest landscape resources (Figure 4-16).

Forming the axis of the east and west landscapes, combining the main sites, arranging a series of commercial and trade areas, developing trade, finance, and developing five residential groups to build an ecological community in which people and nature develop harmoniously. And along the main roads to establish a good greening relationship, the rational use of the surrounding water resources, so that the charm of the Liuyang River waterfront can be fully demonstrated.

## **(2) Feature analysis**

Wuguang New City adopted the concept of "three verticals, four horizontals and two axes" in the planning of road transportation network. The two axes refer to the landscape axis and the ecological axis dominated by Yandi Avenue. The landscape axis refers to the landscape view gallery, which is mainly arranged for commercial finance, cultural entertainment, business office and so on. The ecological axis combines topography and topography to preserve natural hills with steep slopes, good vegetation and large areas. The natural landscape penetrates into the interior of the cultural recreation area, forming a gallery that leads to the mountain. In accordance with the "one city and two centers" function to build three core themes: business, tourism and residence, the high-speed rail new city will become a low-carbon ecological livable new city in Zhuzhou. During the construction process, Wuguang New City was premised on the construction of economy and landscape construction, and attached to natural resources, but the plan did not fully consider the impact of design on the environment, but as a carrier to carry out planning.

## **2. Summary of characteristics of real estate development eco-city**

The real estate development eco-city is generally built with green buildings or real estates built in prime ecological areas. The second category accounts for the majority of real estate development. But in fact, this kind of eco-city is very destructive to the environment. They don't think too much about low-impact development in the construction process, and often the beautiful environment becomes the gimmick of its propaganda. Moreover, the construction sites of such eco-cities are often remote, and the industry is single, and often the effects after construction are mostly unsatisfactory.

### **4.3.2 Cases and related characteristics of ecological city with ecological transformation in urban areas**

It mainly uses international green technology to carry out projects for energy system, building energy-saving renovation and sanitation facilities construction.

## **1. Using advanced technology as a support - Shenzhen Pingshan case study**

### **(1) Planning objectives**

Improve the quality of the environment and build a livable eco-city; adopt a low-impact ecological low-carbon construction model, adopt various means to mitigate the impact and destruction of urban construction on the ecological environment, and maintain and restore the natural ecology.

## **(2) Project characteristics**

By transforming the land use model, we steadily promote urban renewal work, take into account the public interest, repair the ecological environment, improve the environmental quality, and form a situation of “building a livable ecological city with everyone involved” and promote the development of a livable ecological city. And through GIS technology, the factors affecting the urban environment are monitored. Reduce the environmental impact of these factors through the management of resource consumption, emission reduction and environmental pollution. Due to the excellent environmental resources, Pingshan New District has repaired and improved the ecology through technical means on the premise of protecting the original ecological foundation.

## **2. Summary of the characteristics of ecological city in the urban ecological transformation**

This type of eco-city construction should be the future development trend of the eco-city. Although the construction of the new city is small, the difficulty of carrying out the work is low, but after all, the transformation of the old city is the urgent need. There is no clear means for the construction of this type of eco-city, and ecological transformation is also a method of adapting to local conditions. according to the problems and urgent needs of the local area, the overall planning is carried out, and the advanced ecological technology or scientific ecological planning is used to transform the region into a virtuous circle.

### **4.3.3 Eco-tech park eco-city case and related characteristics**

Some industrial parks, science parks, or economic and technological development zones need to increase the comprehensive functions of cities such as residence and commerce, as the scale of the industry expands and the population gathers. Therefore, the eco-city is built on the basis of the park. This type of eco-city generally does not have a fixed construction method, generally follows the local development and construction status, and on this basis, ecological transformation is carried out according to local conditions.

## **1. Ecological Utilization of Beach Land: A Case Study of Caofeidian Ecological City in Tangshan**

### **(1) Planning objectives**

Building a new type of green, ecological and livable city has played a demonstration role in beach management, soil improvement, resource conservation and human settlements. Caofeidian Eco-city utilizes land resources, energy resources and environmental resources efficiently, and coordinates the relationship between industrial industries and the environment through international ecological planning, cutting-edge ecological technologies and innovative ecological indicator systems. protect and utilize tidal flat resources and energy, improve the ability of regulation, restoration, maintenance and development of coastal urban ecosystems, and achieve mutual benefit of people, cities and nature.

## **(2) Project characteristics**

The first is that the new city project is in the tidal flat, and the tidal flats often face urban problems such as soil salinization, vegetation degradation, lack of fresh water resources and seawater intrusion. Caofeidian Ecological City utilizes the geographical advantage located in the intertidal zone to construct a multi-level hydrological and ecological pattern of the outer sea-inner sea-inner lake-urban capillary water network. It can realize water cycle purification without any artificial equipment relying on the strength of the sea tide. The resource management center comprehensively and efficiently uses energy, garbage, and sewage. The Caofeidian Eco-city draws on the energy utilization model of the "Hamabi model" and uses the "resource-product-renewable resources" model to recycle energy at different levels of the city, so that the process of urban production and consumption produces only a small amount of waste. Finally, the quantitative analysis, guided by the ecological indicator system, more systematic, multi-level structure, comprehensive indicators content, and contain specific measures, implementation guidance, and make adjustments based on feedback data during the construction process.

## **2. Summary of the characteristics of eco-tech parks**

The eco-science park eco-city is mainly an improvement of the industry. The traditional industry is often accompanied by a large amount of pollution in the production process, and this kind of eco-city is mainly aimed at this problem. reduce the burden on the environment by upgrading the industry or assisting in the transformation of the service industry to transform the industry.

### **4.3.4 Cases of tertiary industry eco-city and related characteristics**

For the development and construction projects with eco-tourism and leisure and vacation as the main industries, most of them choose high-quality tourism resources such as forests, rivers, lakes, wetlands, reservoirs, hot springs, coastal areas and mountain areas for comprehensive development and construction.

#### **1. Clean Island Demonstration Zone——A Case Study of Low Carbon Island in Wuhu, Taiwan**

##### **(1) Planning objectives**

Trying to build a world-class clean island and become a low-carbon clean living area that achieves more than 55% of renewable energy use. And adapt to Taiwan's "regional energy conservation and carbon reduction plan" to build a low-carbon pilot sightseeing island.



Fig 4-17 Schematic diagram of urban space layout of low-carbon island in Penghu<sup>70</sup>

## (2) Project characteristics

The first is the island-based resource utilization model. Island-type cities are relatively independent in relation to each other and are far from the surrounding continents (figure 4-17). The resource path from the mainland is long and expensive. Therefore, if the island-type city can self-sufficiency, make full use of its own conditions, and use renewable energy as the main energy supply, it is the most energy-saving and environmentally-friendly energy supply model.

## 2. Summary of the characteristics of the tertiary industry eco-city

This type of eco-city is relatively extreme, with an exemplary eco-city and a project that fails to build a waist-fold. Since the location of this type of eco-city is mostly in a beautiful natural environment, the work in the early stage of ecological planning is relatively large. how to achieve urban planning in the case of minimal intrusion into the natural environment, and to ensure the circular economy system in the region, requires a lot of pre-examination and research. This type of eco-city focuses on how to rationalize ecological planning and how to use advanced ecological techniques to maintain the balance between urban and natural areas.

## 4.3.5 Cases of production and integration of eco-city and related characteristics

Most of the new cities (satellite cities) or new urban areas in large cities are generally characterized by large planned areas, complete functions, and complete industrial categories.

### 1. Successful example - case study of Tianjin Zhongxin Eco-city

#### (1) Planning objectives

The planning goal of the Sino-Singapore Eco-City is to build an eco-city with economic prosperity, social harmony, environmental friendliness and resource conservation. The overall positioning is eco-environmental technology research and development innovation and application promotion platform, national eco-environmental protection training center, modern high-tech eco-industrial base, resource-saving and environment-friendly livable demonstration new city, participating in the international ecological environment construction exchange display window.

<sup>70</sup> Jiao Jian, Bao Yanhui. 2013. Comparison and analysis of eco-city (town) at home and abroad. China Building Industry Press, 115-191.

## **(2) Project characteristics**

First, the land for the plot is 1/3 of the abandoned salt field, 1/3 is the polluted water surface, and the fresh water is lacking, which does not occupy the cultivated land. The construction of an eco-city in this area reflects the demonstration significance of building an eco-city under resource constraints. In response to unfavorable natural background conditions, the construction of sewage sludge and saline-alkali land will be focused on the initial construction of the eco-city. There is no blind use of high-tech technology, but it is combined with actual exploration and innovation to adapt to the local technical system. The second is to carry out rainwater harvesting, sewage reuse, seawater desalination, large-scale use of non-traditional water sources, and for the first time in China, half of the city's water use is provided by non-traditional water resources. This fully embodies the principle of resource utilization and economical utilization, and is conducive to alleviating the shortage of local water resources. Third, traditional energy is combined with renewable energy such as wind, solar and geothermal energy, and intelligent grid management demonstrations have explored new mechanisms for energy use in China.

On the one hand, large-scale use of renewable energy, on the other hand, the eco-city's smart grid integrated demonstration community effectively integrates renewable energy utilization and the Internet of Things. The fourth is to adopt the bus priority planning concept. Implement this concept at the beginning of construction to integrate urban bus transportation and land development. Through the plot ratio and the setting of public facilities, people's travel destinations are gathered near the bus axis, thus encouraging residents to use public transport to reduce the use of cars. It can be seen that the ecological construction of the Sino-Singapore Eco-City is very comprehensive. From site selection to how to overcome the difficulty of site selection, it has played a demonstration role in the construction of this type of eco-city.

## **2. Summary of characteristics of production and integration eco-city**

The most important feature of this type of eco-city is that it has complete functions, including housing and industry, forming a city that can be "self-sufficient". Generally led by the regional government, funds and technology can be strongly supported, so the general area is large and the implementation is good. It is also the target of key construction. Generally, such eco-cities are aimed at building an eco-city with demonstration significance.

### 4.3.6 Summary of the Characteristics of the Bottom-Up Eco-City

China's bottom-up eco-city has a large scale of construction; it is supported by local governments and provides policy support and guidance. It has not yet formed a mature market-oriented operation model; The planning of eco-city focuses on holistic, systematic and wide-ranging content, but it does not reflect the characteristics of the city; The definition of the relationship between ecological planning and the current planning system is unclear, and the concept of ecological planning is more difficult to fully reflect in the statutory planning system; Supporting policies, investment systems and social security systems are not sound enough, and it is difficult to support the implementation of eco-city construction; lack of effective public participation mechanisms, mostly mentioned by policies, and poor practice; Most regions are still in the planning phase or in the initial phase of implementation. However, the construction of eco-cities is developing on the positive side. This kind of practice movement that is constantly developing and perfecting in trials is imperceptibly affecting the understanding of cities and ecology.

#### 1. From the construction of the new city to the old city update

Most of China's bottom-up eco-cities are new towns. Because of the limited constraints, we can start from scratch and implement the ecological concept more thoroughly. When the new city chooses land use, it is divided into two types. One is to choose a geographical location with superior environment and abundant resources, mostly rivers and mountains. This kind of site selection is mostly two types of tertiary industry ecological parks, such as real estate development or ecotourism services. By using natural resources and ecological transformation to attract the attention of the masses, most of them have environmental damage caused by factors such as inadequate planning, incomplete considerations, and rush to start construction.

The other is to consider the priority of selecting waste industrial land, sand wasteland, saline-alkali land, etc. to make effective use of land, and to promote the benign return of the environment. The construction of these new towns will start with ecological restoration, including soil replacement, garbage disposal, water renewal, vegetation restoration and so on. However, ecological restoration often involves huge investment and takes a long time.

In fact, human society has developed to the present and should not expand the scope of the city. The ecological renewal of the old city should be the focus of work in the coming decades. The renewal of the old city should also be intensified in the direction of intensification - reducing the urban area and leaving as much natural space as possible. However, the renewal of the old city is very difficult and involves too many aspects, therefore, the formulation of the planning and implementation route not only tests the wisdom of urban managers, but also reflects the education of the citizens and the understanding of ideal life. There are not many successful cases like this, and it is often done in a piece of the city (for example, with large international exhibitions and the Olympics).



Ecological renewal in large cities may be one of the most difficult problems facing humanity. The big cities are very open, and the urban heat island effect is very obvious. The traffic load is also large, and the population is highly mobile, and people's homes are not strong. So far, there have been few successful cases of overall ecological renewal in big cities, but each city is carrying out arduous explorations in combination with its own situation.

## **2. Reproducibility is one of the development goals of most ecological new cities.**

It is not difficult to find out from the case that most of the planning objectives of the bottom-up eco-city contain the words "replicable" and "demonstration". China has been exploring a common planning method in the construction of eco-city. If we must seek a large-scale replicable model for the eco-city, it will follow the old path and replace the old ones with new ones. Perhaps the working methods, ideas and technical routes are informative, but the specific ready-made models and specific technologies are absolutely impossible to copy. Any city should formulate appropriate development goals, technical routes and implementation methods according to basic conditions, key issues, economic capabilities, etc., and flexibly adjust and revise them in the course of practice. To do this, we must ensure that the research is sufficient, the objectives are clear, and the objectives should be determined with great care and fully demonstrated. In the face of all kinds of problems and challenges, we constantly adjust ourselves and develop organically.

## Conclusion

This chapter starts with the top-down ecological demonstration city and the bottom-up eco-city, and analyzes the changes of the overall characteristics of these two types according to the data. On the basis of two types, based on the classification research of past scholars, combined with the practice of China's eco-city, the classification is carried out, and the cases are analyzed to illustrate the characteristics of various types of eco-city. The two types of practical characteristics are summarized, and the characteristics of these two types of eco-cities are analyzed in terms of total-sub-total form. The characteristics of the top-down eco-model cities are: Industrial transformation and ecological planning have become the main means of building a top-down ecological demonstration city; It is a process of holistic development, which is transformed from technology-driven to guided by planning ideas. The practical characteristics of the bottom-up eco-city are: the whole process is gradually upgraded from the construction of the new city to the old city; the reproducibility of the eco-city is one of the development goals of most eco-new cities.

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## Chapter 5. Internationally renowned case studies

### 5.1 Paris Clichy-Batignolles and Lyon Confluence Project In France

Clichy Batignolles and Lyon Confluence are both officially accredited and award-winning projects of the Eco-Quartier in the 2008 Eco-Building Competition in France. Both cases have proposed a more comprehensive sustainable development strategy, and put forward new ideas and strategies in public space, transportation, residential diversity, resource conservation, etc., which are typical and innovative. In-depth study of it will help to explore the construction of ecological settlements from the perspective of urban planning and design.

#### 5.1.1 Project location and Positioning

The Clichy district is located in the 17th arrondissement of the northwest of Paris. It used to be a railway station and related ancillary land. The Lyon Confluence is located on the southern side of the city of Lyon. It used to be industrial docks and storage sites. The recession has gradually become an area of environmental degradation and economic backwardness (Figure 3-1)<sup>71-72</sup>. Therefore, both the Clichy and Lyon Confluence Area projects aim to improve land value, improve the environment and form a new development center of the city through the development of ecological blocks. In addition, at the beginning of the project, Clichy District proposed to solve the problem of lack of public green space in the northwest area of the urban greening system in Paris. It is recommended to supplement and improve the greening network in the urban area of Paris by relying on the Clichy Ecological Street Project. The city park of 10hm<sup>2</sup> is used as the basis for the concept.



Fig.5-1: Location and original appearance of the projects. Source: Google Map& Image

The location and strategic positioning of the ecological block is very important. It should

<sup>71</sup> Song Yanqi. 2010. On the Progress of Ecological Community Studies in the World. *ModernUrban Research*, (12):5-10.

<sup>72</sup> Christian de Portzamparc. 2009. Dossier de Grand Paris: Consultation internationale pour l'avenir du paris métropolitain.

be considered to transform the existing urbanized areas, revitalize the city's internal land stock, supplement and improve the urban structure, and try to avoid opening new land in the periphery of the city, thus controlling the spread of the city. The resulting excessive consumption of land space and the reduction of infrastructure and operating costs including roads, railways, service facilities, etc.

### 5.1.2 The inner and outer combination of the spatial structure of the block

The “extroverted” public space provides a place for the city to be active, but it does not meet the privacy needs of the residents of the block; the “introverted” semi-public space ensures the security and privacy of the settlement, but the “introversion” of the large scale Residential areas are prone to fragmentation of urban space.

Diestrcy	Area	Building density	Average number of layers	Volume rate
Lyon	32.5 hm2	25%	7	1.41
Clichy	32.0 hm2	20%	10	1.55

Table 5-1 Basic Profile. Source:Wiki

The Clichy District and the Lyon Confluence Area are medium-strength development projects (Table 5-1), which use the “Central Greenbelt in Combination with High-Dense Compact Blocks” model to construct the block structure (Figure 5-2, Figure 5-3). The central green space provides a variety of activities for all types of people: sports venues for young people, walking trails for the elderly, and flower stands for students to read, forming a vibrant public space; Each neighborhood forms a closed, semi-public courtyard space through the height of the building enclosure or artificial platform, combined with a variety of vegetation and daily leisure venues (such as barbecues, children's play, etc.), so that the residents in the neighborhood form a very Strong sense of belonging and high level of communication. The combination of public space and semi-public space not only promotes the integration of the residents of the neighborhood and the surrounding citizens, but also ensures the needs of local residents for the semi-private living space.

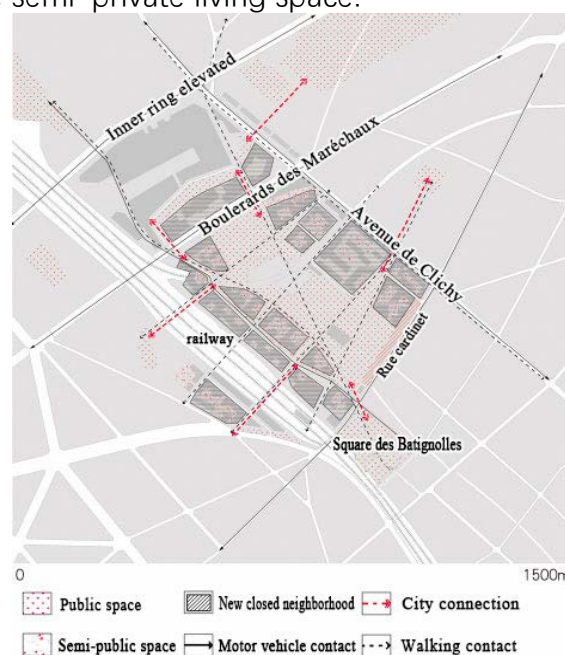


Fig 5-2 The Plan of Clichy District. Source:Author





Fig 5-3 The Clichy District

Source: <http://anyportinastorm.proboards.com/thread/6031/paris-parc-martin-luther-king>

At present, China's domestic settlements are mostly developed and constructed with large-scale and closed semi-public space models, lacking the grading of external space from the scale of the block. Therefore, the ecological block can draw on the model of “big openness and small closure” to achieve the combination of “extroversion” and “introversion”. Under the premise of ensuring the privacy of residents in this neighborhood, part of the space will be opened to the city. Enhance the appeal and influence of neighborhoods and benefit more people through sharing. This requires the integration and coordination of the relationship and proportion of public space and semi-public space, relying on the spatial definition and division between the two, and coordinating the contradiction between public and private.

### 5.1.3 Integrated development strategy

Based on the experience of the Clichy and Lyon Confluence Area projects, the planning of the eco-blocks should develop a special transportation plan for the block. On the one hand, the degree of linkage between ecological blocks and the city centre should be strengthened through public transport strategies. The Clichy project, combined with the Paris transportation plan, proposes a strategy for optimizing public transportation. By strengthening rail transit, increasing bus routes and frequency of departures, the Clichy project strengthens the connection between the base and the city center and the suburbs. Finally, the Clichy eco-block A strong and diversified traffic flow will be formed by nine bus lines, subway lines 13, 14 and one tram line, and regional express rail line C. In the construction of the Lyon Confluence Area, a direct connection to the tram and the city center (Fig. 5-4) is also set up for the ecological block.

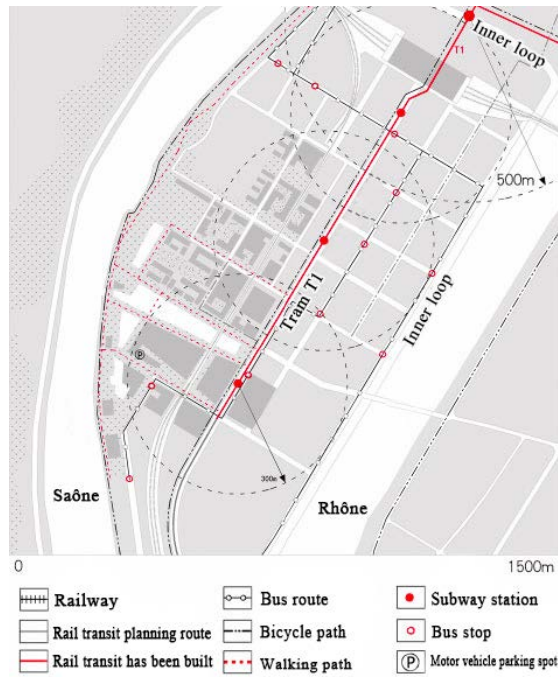


Fig 5-4 The Plan of Lyon Confluence Area. Source: Author

On the other hand, the non-motorized traffic travel strategy should be used to optimize the short-distance travel environment around the eco-block. In the Clichy District and the Confluence Area of Lyon, a pedestrian network and a bicycle network were designed in combination with the public space system, and the residential, green and bus stations were connected in series based on the simulation of the daily travel routes of the residents.

It not only improves the walking and bicycle accessibility of parks and service facilities in the neighborhood, but also restores the connection between the neighborhood and the surrounding area, and promotes the way of green travel.

Therefore, eco-blocks should be equipped with efficient and large-capacity public transport corridors (such as subways, trams, bus lanes, etc.), and the macro-strategy of promoting urban development in the city will be based on the establishment of an important area. Become a link between the environment and the economic downturn. In addition, the ecological street area and its surrounding areas should strengthen the penetration of the block by constructing a non-motorized transportation network to encourage non-motorized transportation. Finally, the spatial form of ecological blocks (including public space systems, road networks, etc.) should be coupled with public transportation networks and non-motorized transportation networks to enhance the advantages of green transportation. This requires traffic travel strategies and ecological block design in the early stages of the program. It must be considered at the same time that the development of blocks and the construction of public transport facilities should also be carried out simultaneously.

### 5.1.4 Compound utilization of functions

The core of the eco-block is to create a settlement that fully meets people's needs, so it must be a mixed-use neighborhood. The combination of functions helps to improve the efficiency of use of the facilities and save resources; and the mix of functions at the block level helps people to contact and interact, increasing the vitality and security of the city. Both the Clichy and Lyon Confluence districts have a high degree of mix of neighborhood functions: the relative weight of residential, office, commercial, and entertainment functions is relatively balanced. In addition to community-level daily service facilities, such as restaurants, bars, and shops, city-level functions such as entertainment centers, auditoriums, hotels, and multinational corporations are introduced (Figure 5-5). The two cases rely on the functional composite space utilization model to successfully transform from the industrial decay zone. As a central area, they provide various activities such as economic activities, cultural and recreational activities, and as a living area, they provide a mixed living mode for all walks of life. Jobs at all levels.

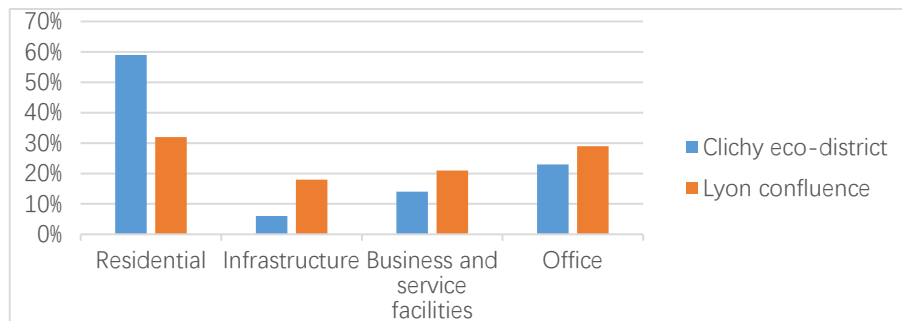


Figure 5-5 Different Function Compare. Source: Author

The construction of China's ecological block can also break the single residential land division model, and try to build a space for composite functions, from "community mode" to "block mode". On the one hand, the mixed development of functions contributes to the polarization of urban node space. Ecological blocks can often form regional centers and even urban centers through the construction of public facilities, which will help promote the formation of multi-center and multi-polarity in metropolises and strengthen regional vitality. On the other hand, functional compounding improves the accessibility and convenience of public service facilities. Many service facilities are located in the neighborhood or on the ground floor of the residential building, so that people's daily life travels within 500m; moreover, the entrances and exits of service facilities often become places where residents meet and interact, and promote the relationship between neighbors.

### 5.1.5 Diversification and dynamic construction mode of block buildings

The diversity of eco-blocks should be reflected in the richness of the settlement itself, including the diversity of the building and the shaping of the overall characteristics of the block.



Fig 5-6



Fig 5-7

Source: Author

The diversity of architectural image is closely related to the design of the project and the process of project development. The Clichy District and the Lyon Confluence District create a vibrant, active and highly personalized image of the city due to the diversity of architectural forms and the changing spaces (Figure 5-6, 5-7). The Clichy and Lyon Confluence schemes are based on a “general guide” that defines the overall spatial form of the block during the overall design phase and defines in principle the form, scale and height of each building. In this way, while ensuring the integrity and overall harmony of the block, it consciously guides the diversity of the form, height and volume of the building, creating conditions for the diversified design of the building. On this basis, each neighborhood and even each building is designed and built by different architects. Each architect expresses and reflects different ideas and ideas in their respective architectural works based on the principles of ecology and sustainability. Ultimately, eco-blocks seek a balance between overall coordination and individual diversity.

The creation of vitality and heterogeneity in eco-blocks depends on three aspects of architecture, function and social diversity. These three complement each other. Because the diversity of architecture should meet the needs of different groups of people and different functions in addition to the pursuit of rich form design, the diverse needs of functions and social groups in turn create conditions for the diversity of architectural design.

However, in order to realize the diversification and overall unity of individual blocks, it is required to have flexibility and variability in the development and construction of ecological blocks. This “flexibility” is reflected in the fact that the entire development is a dynamic development process, not based on a fixed solution.

The planning and construction of the Clichy District and the Confluence Area of Lyon is not carried out in accordance with a fixed design plan from beginning to end, but adopts the “gradual process planning and construction” model: the block is divided into small-scale neighborhoods by the public branch network, which are suitable for independent commercial development and operation. Each neighborhood is built on a site-by-ground basis, and the design of the post-building block must respect the built-up neighborhood and surrounding environment. In the end, the neighborhood gradually formed with the “growth” of the neighborhood. This gradual model helps planners and architects use state-of-the-art concepts and techniques for later building, leaving a certain amount of flexibility so that ecological technologies and ideas can be updated and improved in a timely manner.



Replacing the rapid development model of “one-time overall construction” in the past, the design and construction of China's eco-blocks should try to gradually develop in stages, that is, all the neighborhoods in the ecological block should be built one by one. The design of each neighborhood must follow the overall control indicators set by the planner, but at the same time have a large creative space. Through the design of colors, materials, architectural shapes, etc., you can create a dynamic and original architectural work. The gradual development ensures the variability and adaptability of the block in time and space, effectively controls the phenomenon of large-scale demolition and construction, and reduces the waste of resources.

## 5.2 Eco-Viikki Eco-Residential Area, Finland

The Viikki Experimental New Area is located in the northeastern suburb of Helsinki, about 8 km from the central city and covers an area of about 1100 hm<sup>2</sup>. It is mainly composed of ecologically themed residential areas, natural development areas, science parks and commercial service facilities. It is a large-scale project in the city that has been experimentally developed using ecological concepts in recent years. It aims to create an ecological and livable environment while creating an international experimental zone in the fields of biological sciences and technology, agronomy and agriculture.

The residential area planning of the Viikki Experimental New Area is determined by a series of demanding and strict specifications and through an open design competition. The winning scheme of Petri Laaksonen replanted the urban form that is commonly seen in Helsinki, the block layout of the green corridor.

### 5.2.1 Residential District Planning

#### 1. Spatial layout

In terms of spatial layout, it takes the form of a typical courtyard in the Finnish region: the west and north end houses of the enclosed courtyard are generally 4-6 stories, and the south facing houses are no more than 2 stories; Then, through the sub-level street space, the courtyards are connected in series, and each household needs to pass through the courtyard to enter the building. The semi-public space thus enclosed can not only block the sunshine, but also block the dominant southerly wind, creating a pleasant microclimate. It can also serve as a public activity space shared by the entire courtyard, which will promote communication and contact within the community as well as the formation of cohesiveness and sense of belonging (Figure5-8)<sup>73</sup>.



Fig 5-8 Plan and Section

<sup>73</sup> Dominique Gauzin-Müller. 2002. *Sustainable Architecture and Urbanism*. Boston: Birkhäuser, 162.

## 2. Green space system

In the green space system, the eco-residential area adopts a “finger structure”: A green finger protrudes from the main skeleton (green space, farmland, and natural area) and infiltrates into the courtyards and streets enclosed and defined by the house. Strolling through the green spaces between the buildings, there are private gardens and public spaces for activities, which not only make systematic natural elements part of the daily life of Viikki residents, but also provide space for arable land and ecological water bodies and waste disposal.

## 3. Residential design

The residential design of the settlement was commissioned by eight construction groups in accordance with a construction competition in 1996, and more stringent regulations were made for this purpose. To ensure the diversity of families and user groups, the settlement emphasizes the flexibility and diversity of residential design: on the one hand, the design of the set is diverse, including duplex apartments, terraced houses, point houses, and determinant houses. Flexible units of different area sizes (approximately 500-5000 m<sup>2</sup>) can be formed, leaving room for the construction of nursery or small businesses; on the other hand, at least half of all dwellings have been rented more than once, and the rest of the dwellings are also subject to city jurisdiction. In this way, through the mixture of rental dwellings and dwellings with real estate ownership, a moderate mix of communities can be achieved to a certain extent to meet the multi-level living needs.

### 5.2.2 Protection of Natural Development Zones and Resources

In addition to the large agricultural land in the southern part of the Viikki Experimental New Area, there is a 254hm<sup>2</sup> wetland reserve (where 29hm<sup>2</sup> has been extended to the planned land). It is an important habitat for waterfowl birds and a nature reserve that prohibits human activities. It belongs to the jurisdiction of the International Wetland Agreement and is a special factor that needs special attention when developing new areas.

In view of this, the Viikki New District focuses on retaining and echoing the natural attributes and agricultural culture values of the area in the planning of the open space and green space system, and specially adjusted and re-arranged the plan, specially designed to give up a green north-south corridor in the living area, integrating the natural ecosystem inside and outside the base. It is connected to the Kivikko Sports Park in the north and to the Kivinokka and Arabianantana Waterfront Parks in the south. It also stretches out a large agro-ecological landscape in the open valley.

### 5.2.3 Ecological Planning

#### 1. PIMWAG system for environmental assessment

In order to assess the achievability of the goals of the Viikki Experimental New Area, and to motivate and explore the creativity of similar projects, the Helsinki City Government has appointed a team of experts to construct a standard system for evaluation. The resulting PIMWAG system uses a “Deep Ecology” principle approach that emphasizes the relevance of various types of life and their understanding of human function (Table 5-2). Among them, construction projects can be evaluated in five aspects: pollution, natural resources, health, species diversity and food production (Figure 5-9)<sup>74</sup>.

<sup>74</sup> Dominique Gauzin-Müller. 2002, Sustainable Architecture and Urbanism. Boston: Birkhäuser, 82.

Relevant economic and technical indicators for the Viikki experimental new district planning								
Economic index	Land area (hm <sup>2</sup> )	Construction area(10000 m <sup>2</sup> )					Number of residents	job opportunity
		Residential	Research facility	Commercial facility	Public utilities	Others		
Data	1132	68.0	17.1	14.9	6.9	1.5	13000	6000

Table 5-2

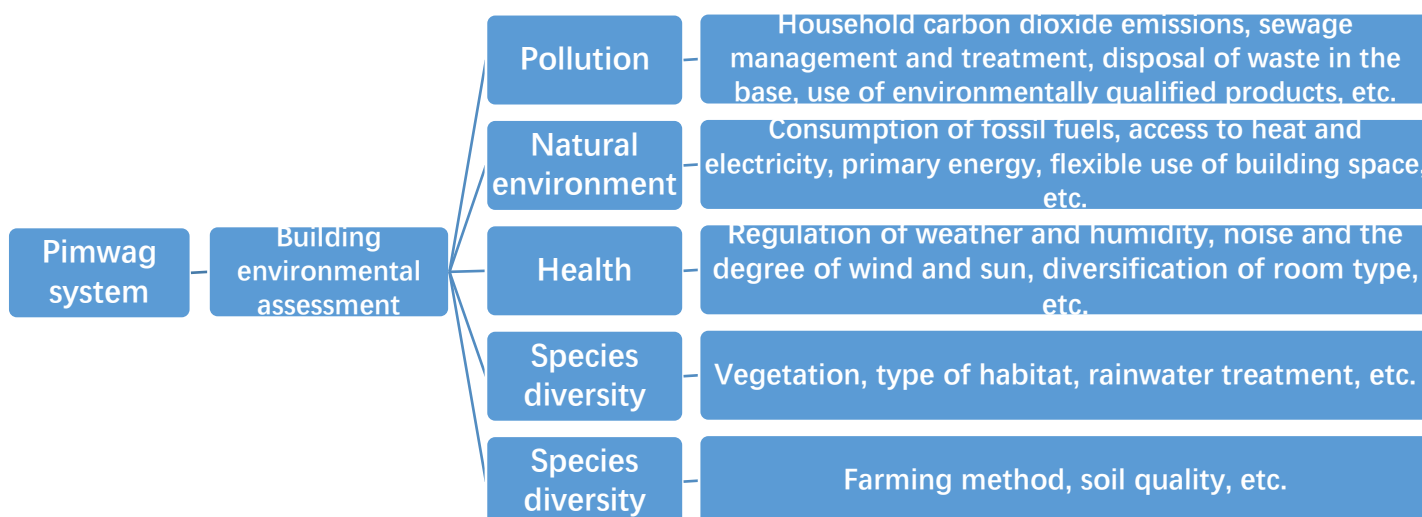


Fig 5-9

According to the principle of “points of integration”, this standard can be divided into multiple levels – the project can only obtain a construction permit if it is accumulated to a certain point. The CO<sup>2</sup> emission of a project shall not exceed 3200kg/m<sup>2</sup> in 50 years, and the average emission of residential buildings shall be reduced by 20% to obtain basic zero-value points; if the house's CO<sup>2</sup> emissions are reduced by 33% and passive solar installations are used, an integration point can be added; if the house's CO<sup>2</sup> emissions are reduced by 45% and the solar and buffer layers are actively used, two points can be reached. Different target levels and different heat energy consumption (105-65 Wh/m<sup>2</sup>), drinking water consumption (125-85 L/person-day) and garbage pollution (19-10 kg/m<sup>2</sup>) correspond to each other; if the additional construction cost does not exceed 5% of the increase, it will be compensated by the intensive liquidity.

On this basis, the following discussion starts from the macro-level community level and the micro-level construction level, involving water treatment, garbage disposal, energy conservation, greening, transportation, building materials, temperature control and many other fields.

## 2. Ecological planning at the community level<sup>75</sup>

### 1) Water treatment

The original stream that traversed the planned land has been diverted according to the plan, and it flows from the side of the residential area at a distance of 50-100m, with a total length of 740m. Designed by landscape architects, hydrologists, geological exploration engineers, botanists and landscape architects to undertake the river section and the berms on both

<sup>75</sup> case studies: Built Projects and Projects In Construction [EB/OL] .  
<http://www.arch.umanitoba.ca/vanvliet/sustainable/casestud.htm>.

sides. This stream with several pedestrian bridges is a key element in landscape design. It not only creates a specific home environment for special vegetation and wildlife, but also provides tools and materials for college education and research, as for the earthwork cut during the diversion of the stream, it can be used for landscape remediation and surface covering of the core area.

In terms of water treatment, the Viikki Experimental New Area has mainly made the following arrangements:

- \* Both the building and the site are connected to the municipal water supply and sewer network, and water-saving appliances and independent water meters are installed inside the building;
- \* Construct ecological pathways between residential groups to provide natural choice for rainwater to penetrate into underground soil layers, and to combine irrigation ponds and water filtration tanks;
- \* All rainwater is naturally discharged through the surface. Like the rainwater collected in the residential area, it is first introduced into three irrigation pools and then directly discharged into the wetlands with vegetation; the rainwater collected on the roof is filtered and introduced into the irrigation pond;
- \* Maintain water balance in existing sites by controlling drainage to eliminate flood hazards in design;
- \* Separate and utilize medium water on a small scale. Based on health requirements, the reclaimed water should be purified before being placed in an irrigation pond or reused.

## **2) Recycling of community waste**

The Viikki Experimental New Area treats waste as a resource, so the general disposal of waste is replaced by recycling. Especially in residential areas, each block provides a composting facility and household water recycling unit around the garden. The goal of waste disposal is to strengthen support for natural functions and different ecosystems (water, soil, vegetation), and to reduce the harm to people and the environment, such as exhaust, noise, and waste.

Specific measures developed in response to this include:

- \* The entire area has a 70m<sup>2</sup> recycling center beside the public square;
- \* Establish waste collection space, including a covered collection point (25 m<sup>2</sup> ) and surrounding outdoor facilities (10 m<sup>2</sup>);
- \* Prevent the emergence of new types of waste and encourage local recycling;
- \* Wastes are collected on-site, minimizing environmental impacts and minimizing traffic disruption from waste collection.

## **3) Energy design**

Although the Viikki Experimental New Area is under the coverage of urban heating and power supply networks, it has adopted the following strategies based on the goal of "intensive use of artificial energy and full use of ecological energy":

- \* Reduce heat loss in the building itself through microclimate improvement and microenvironment design;
- \* According to the principle of energy conservation, carefully select building materials and structures, and choose energy-saving HVAC, various appliances, devices and equipment;

- \* Integrate solar collectors with roofing structures to make full use of solar energy (domestic hot water and solar power);
- \* Adopt low-temperature heating system, each house is independently temperature-controlled, and has various energy consumption meters.

#### **4) Green gardening**

In addition to the private gardens behind the homes and the garden centres on the edge of the woodland, the Viikki Experimental Zone also offers an open space and green space system for living. According to the scale and type characteristics of different habitats, they can be divided into three categories: the first category is farming habitats, such as cultivated land, small fields, etc.; the second category is semi-cultivated habitats, such as parks and lawns; the third category is natural habitats, that is, habitats that do not require special care, such as slopes, ditches, wetlands, and woodlands where natural organisms grow.

The main measures developed by the Viikki Experimental New Area in this regard include:

- \* Around the residential area, planting trees and shrubs form a transition zone that reduces the effects of wind and creates a positive microclimate;
- \* The kitchen of each home should have a backyard area of 25-50m<sup>2</sup>, which makes it possible to expand in the future;
- \* Establish community gardening areas in finger-shaped green spaces in ecological residential areas, and set up composting facilities and rainwater and snow water processors;
- \* Establish large areas of vegetation coverage around the area while maintaining a high level of species diversity;
- \* Biologically purify pond waters, using floor coverings and plants to reduce surface water flow rates, as outdoor structures with ecological defenses and life cycles are more durable.

#### **5) Traffic organization**

The traffic organization goals of the Viikki Experimental New District are: Dividing people and vehicles to minimize motor vehicle traffic; at the same time, relying on a strong and extensive transportation network to ensure that the new district implements an efficient public transportation system both inside and outside, the traffic measures developed accordingly include:

- \* With a high proportion of pedestrian and bicycle traffic as the focus of the organization, work space and service facilities are provided by one bicycle per person;
- \* Focus on planning and vigorously developing bus, train and future tram traffic;
- \* The courtyard is also the carrying area of the main traffic, and both pedestrians and vehicles can share this space equally;
- \* All parking spaces are located on the ground floor and parking is only payable by the user;
- \* The parking space is configured according to the residential area of 95-190 m<sup>2</sup>/car, and the visitor parking is configured according to 1000 m<sup>2</sup>/car and parked along the street.

Under the premise of organically combining local natural factors, the Viikki Experimental New Area integrates systematically of various mature products and ecological technologies in many fields such as water treatment, garbage disposal, energy conservation, greening, transportation, building materials and temperature control, the overall construction of the ecological environment has been successfully implemented. This is the basic connotation of the current concept of sustainable development of cities and buildings, and it is also a highly integrated interactive process.

## Conclusion

Through a study of international success stories, a self-examination was conducted by comparing the practice and characteristics of China's current eco-city construction. Pursuing sustainable development and building a livable living environment has always been an ideal goal of social development. How to improve the living environment through urban construction is a problem that everyone should pay attention to and think about. In the process of eco-city construction, drawing on international advanced experience and planning and constructing according to local conditions is a good start to achieve this goal.

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## Chapter 6. Satisfaction Survey of Ecological City Construction in Guiyang City

### 6.1 Building an ecological city is an inevitable choice for Guiyang City

The connotation and characteristics of Guiyang City's construction of ecological and civilized cities mainly include the following aspects: First, the ecological environment is good, that is, the green mountains and green waters should always be maintained, the air is fresh and the climate is pleasant; Second, the ecological industry is developed, and the industrial structure of three, two, and one is stably formed. Modern service industries such as tourism culture, high-tech industries, and circular economy industries have become the leading industries. Third, cultural characteristics are distinct, that is, there must be prominent urban personalities. Have a good social atmosphere, rich and colorful cultural activities, and a cohesive urban spirit.

### **Building an ecological and civilized city is determined by Guiyang's own conditions.**

#### **(1) Economic conditions**

After years of hard work, the economic and social development of Guiyang City has made great progress. Since 2007, the city's first production value has reached 69.64 billion yuan. In recent years, there has been a lot of growth. It has laid a relatively solid foundation for building an ecological and civilized city. Only organic integration of economic development indicators and social development indicators, human and economic indicators, environmental indicators, It is conducive to accelerating the adjustment of economic structure and optimization of industrial layout, reducing environmental pollution and ecological damage, and better adding stamina to the development of productivity.

#### **(2) Natural conditions**

The land area of Guiyang City is 8034 square kilometers. It belongs to the mid-subtropical monsoon humid climate. It has the characteristics of no cold in winter, no heat in summer, abundant rainfall and long frost-free period. The annual average temperature is 15 °C, the average annual precipitation is 1197 mm, the annual sunshine is about 1278 hours, the annual relative humidity is 76.9%, and the frost-free period is about 270 days. Urban construction has mountains in the city, the city is in the mountains, and the mountains are surrounded by water.

In addition to rich mineral resources, Guiyang is characterized by being livable, mainly in the following aspects: First, the air is fresh, and it is a central city where the preparation of karst areas on the earth is well maintained. Second, the summer climate is cool, the average temperature is around 24 °C, and the annual average relative humidity is about 78%. Third, the altitude is moderate. At about 1000 meters, ultraviolet radiation is one of the least in the country and even the world. Physiological and health experiments show that the human body feels the best at atmospheric altitude at an altitude of about 1000 meters.

### (3) Social conditions

Since the reform and opening up of China, the economic development of Guiyang City has also achieved certain developments in social undertakings. However, in general, the contradiction in the development of social undertakings is still outstanding: First, there are many historical debts. In the coordinated development of economy and society, the emphasis is on making up for the debts of urban infrastructure construction, which objectively affects the investment in social public utilities and social development. Second, the development of social public utilities lags behind economic development, and social public construction is difficult to meet the increasing demand for public services in the production and life of residents.

## 6.2 Construction of Ecological City Citizen Satisfaction Survey

In order to more accurately understand the public's feelings about the environmental conditions in Guiyang, fully understand the regional ecological environment of Guiyang, understand the public's satisfaction with the ecological environment of Guiyang, and opinions and suggestions on future ecological construction plans and environmental protection measures. Through on-site consultation, the author conducted an eco-environmental satisfaction survey for local citizens in Shilihetan Wetland Park, Huaxi District, Guiyang City. This survey used questionnaires to distribute 120 questionnaires and 106 questionnaires. Among them, 100 valid questionnaires, the recovery rate of the questionnaire was 83.3%. The survey shows that the satisfaction of ecological environment quality in Guiyang is high, and citizens have a strong sense of participation in environmental protection. The results of the first survey are satisfactory, but there is still a certain gap from the requirements of ecological city construction.

### 6.2.1. The General Evaluation of The Environmental Quality of Guiyang City

**(1) The public's satisfaction with the current environmental quality status.** According to the survey, 3/4 of the respondents were satisfied or basically satisfied with the current environmental quality conditions in Guiyang, and the satisfaction rate reached 77%. However, 18% of the citizens expressed dissatisfaction with the status quo of environmental quality, and 5% said they were very dissatisfied.

**(2) The public's understanding of the construction of ecological cities.** By continuously increasing the intensity of comprehensive environmental management, we organized the theme activities of the ecological zone construction publicity week and the creation of ecological streets, so that the construction of ecological zones will gradually penetrate the hearts of the people. According to the survey results, 65% of the citizens expressed their participation or high participation in the construction of urban environmental protection activities in the ecological zone of Guiyang City. 20% of the citizens expressed their participation in general, but the specific situation is not well understood. 15% of the public said they have nothing to do with them.

**(3) The public's evaluation of the government's environmental protection.** On the two issues of "the government's work on environmental protection" and "greening of residence", the satisfaction rate of the citizens was 76% and 69% respectively. The public generally



affirmed the government's achievements in the field of environmental protection, but there are also 9% of the public suggested that the current government is out of touch with the actual publicity work, and there is serious formalism.

### 6.2.2 The Public's Evaluation of The Environmental Pollution Situation in Local

(1) **Air pollution** - the most troublesome problem for the people. When asked, "How is the city's air quality? (Please consider: overall air quality, visibility range, vehicle exhaust emissions, factory exhaust emissions, whether there are related diseases due to air quality, etc.)", 56% of the public think the air quality is considered to be average, and the proportion of bad air quality is also considered to be 16%. Motor vehicle exhaust and construction site dust are considered to be the most important factors affecting air quality. Road dust and hotel fumes are also issues that the public has reflected. Some citizens express strong dissatisfaction with the soot pollution of unlicensed vendors. They demanded that the environmental protection, urban management and other departments further strengthen supervision.

(2) **Industrial sewage and white pollution** – affecting the two major public hazards in the urban environment. Other serious pollution problems reflected by the public were water pollution, solid waste pollution and noise pollution. The preferred proportions of satisfaction were 19%, 17%, and 9% respectively. A few citizens also mentioned the light pollution problem of the glass curtain wall. The survey shows that the public believes that the most serious solid pollutants are construction site construction waste, and the dissatisfaction is as high as 54%, followed by urban solid waste pollution, and dissatisfaction accounts for 32%. Among them, 47% of the public think that the most serious is the proliferation of plastic packaging and containers. 28% of the public think that domestic garbage cannot be disposed of in time, and 22% of the public think that used batteries and batteries are not effectively recycled.

(3) **Noise pollution** - the focus of public attention. As environmental protection, administrative law enforcement and other departments take night noise monitoring, control construction noise, and increase the input of noise reduction materials, the public generally said in the survey that "there have been a lot of quiet in recent years," but there are still 54 % of the public expressed dissatisfaction with the noise pollution, and their attention was much higher than expected.

### 6.2.3 The Public's Awareness of Environmental Protection

Protecting the environment requires government decision-making actions, and more needs the participation of the whole people. The survey found that the "Water Ecological Civilized City Construction Pilot" evaluation meeting in Guiyang expanded the environmental protection momentum and publicized environmental protection knowledge, and the public awareness of environmental protection was significantly enhanced.

49% of the citizens expressed their support for the low-carbon energy-saving city in Guiyang. 37% of the citizens think that the low-carbon energy-saving construction in Guiyang is in place or in general. The key is that there is no clear energy-saving and emission-reduction target, and 8% of the citizens consider that low-carbon energy-saving construction is not in place.

65% of the citizens said that they showed a strong sense of social participation, and the participation of highly educated people was particularly strong. 20% of the public said that it does not matter, and 15% of the public are unwilling to participate.

67% of the public clearly stated that the overall environment of Guiyang is very suitable for long-term human habitation. However, due to the excessive urban construction area, it is not very well done in terms of physical and mental health. The public hopes that relevant departments, including relevant social groups, can further improve the areas of public activities in residential areas.

45% of the public expressed their approval for cleaning work in the community. At the same time, 32% of the public said that although they were not cleaned every day, the overall health condition was satisfactory. 22% of the public thought that the garbage collection device was not complete.

53% of the citizens have the most effective environmental protection policies and regulations in recent years, and they believe that the introduction of sound environmental protection policies and regulations and the promotion of environmental protection are the most effective. 18% of the citizens think that it is more effective to increase the reward and punishment of environmental protection and to regulate the environmental protection of enterprises. Most people think that as long as the environmental protection funds are invested to maintain the status quo, one infrastructure will be perfected, and the second is quality education is more important.

#### 6.2.4 Public Expectations and Suggestions

The survey was supported by local residents, and many suggestions and opinions on eco-city construction and environmental protection were collected.

According to the urban green space satisfaction survey, 50% of the citizens think that the urban green coverage rate is very good. 35% of the citizens expressed good or average green coverage of the city. 15% of the public said that it is not good or very bad for urban greening.

The most interesting issue is community green space satisfaction. When asked "Do you think that the greening level of the community you live in is in your ideal state?", the public has a high selection rate of two options: satisfaction and satisfaction, accounting for 53% and 35% respectively.

Some representative opinions and suggestions in the survey:

(1) Some residents living in old communities have proposed:

**a.** The sewage caused by the residential area and the water accumulated after the road surface is damaged will affect the environment, and the low-lying area should be filled;

**b.** There are blind spots and dead spots in the treatment of domestic garbage in residential areas, and the community should be taken as an important issue of health;

**c.** Investigate the urban sewage management export to prevent pollution from flowing into residential areas;

**d.** Implement an environmental responsibility system, and do a good job in garbage distribution and recycling of used batteries (especially batteries for battery vehicles should be recycled regularly);

**e.** It is required to solve the problem of vehicle exhaust pollution in the community;

**f.** Strengthen environmental protection law enforcement, carry out environmental protection volunteer activities, strengthen the popularization of science knowledge in ecological zone construction, and persevere, carry out ecological construction knowledge education in primary and secondary schools.

(2) On the basis of fully analyzing the supporting capacity and bottleneck of the ecosystem, we should prepare an ecological zone construction plan that can fully reflect the characteristics of the city, explore innovation, lead the planning concept, and be highly operational. Taking the landscape ecological construction as a breakthrough to improve the city's taste. Building an ecological central business district, adhere to the people-oriented, and create a humanistic ecological environment.

(3) Can learn the practice of Southeast Asia, relying on the law as a backing, and using enforcement measures to ensure that the behavior of natural persons and legal persons meets environmental protection requirements. This is an effective method. From this premise, environmental protection is equal to empty talk.

(4) Some community residents close to the main city area proposed that :

- a.** should control the glass curtain wall to reduce light pollution.
- b.** strengthen the enforcement of laws and regulations. On the roads, you can often see smoky mopeds and buses, and the exhaust gas is very polluted.

(5) Among the people who participated in the survey, the younger citizens suggested that :

- a.** the battery car has been put into use a lot, and the recycling of used batteries after one year has not kept up. I hope that there will be places to recycle as soon as possible.
- b.** Increase publicity so that every citizen can raise awareness of environmental protection. The government must create more necessary conditions (such as planting trees and greening) to improve the quality of the ecological environment.
- c.** Relatively low investment in environmental protection infrastructure construction. If the environmental protection infrastructure cannot be kept up for a long time, it is impossible to fundamentally improve the environmental quality of the city.

(6) Improve the level of urban planning and clearly separate residential areas, ecological areas and industrial parks.

(7) Many of the citizens who participated in the survey at the age of 60 thought that leaders and staff should spend more time in the public to understand the situation, timely carry out ecological construction, and promote environmental knowledge. To cultivate the public's awareness of environmental protection and hygiene, only everyone can start from me to keep up with the development of urban ecological construction and environmental protection. The government should invest more in high-tech environmental protection facilities to control the generation of pollution sources.

**Annex:**

## **SATISFACTION SURVEY OF ECOLOGICAL CITY CONSTRUCTION IN GUIYANG CITY**

Q1: Your gender:

- ☐ male
- ☐ Female

Q2: Your age:

- ☐ 15 years old or younger
- ☐ 15 years old ~ 30 years old
- ☐ 30 years old ~ 60 years old
- ☐ 60 years of age or older

Q3: Your occupation:

- ☐ Government department staff
- ☐ Corporate staff
- ☐ Military soldiers and Police
- ☐ City workers
- ☐ Freelancers
- ☐ other

Q4: Your education:

- ☐ Junior high school
- ☐ High school (secondary school)
- ☐ College
- ☐ Bachelor degree or above

Q5: Are you satisfied with the local government's work on ecological environment protection?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ General
- ☐ Not very satisfied
- ☐ Very dissatisfied
- ☐ Unclear

Q6: What is the quality of urban air? (Please consider: overall air quality, visibility range, vehicle exhaust emissions, factory exhaust emissions, whether there are related diseases due to air quality.)

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good
- ☐ Very bad

Q7: The quality of urban surface water (river, river, lake)? (Please consider: the clarity of the surface water, color, smell, whether there is floating garbage, whether there is pollution source discharge, etc.)

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good
- ☐ Very bad

Q8: City noise? (Please consider: traffic noise, construction noise, whether the noise of commercial entertainment venues affects your daily life and work.)

- ☐ Very noisy
- ☐ noisy
- ☐ Not too noisy
- ☐ Suitable

Q9: City solid waste? (Please consider: whether to promote the waste sorting policy, its propaganda efforts, and whether the city streets can be seen everywhere.)

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good
- ☐ Very bad

Q10: The natural environment around the city? (Please consider: whether the natural environment around the city has been affected by unreasonable development and destruction, species diversity, etc.)

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good
- ☐ Very bad

Q11: Traffic in the city? [Please consider: whether the public transportation system (bus, subway, ferry, taxi, etc.) is sound, whether it is comfortable/convenient to use public transportation, whether there is a city greenway, and whether there is a personal motor vehicle purchase restriction policy. ]

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good
- ☐ Very bad

Q12: Urban green space? [Please consider: whether the public green space area and the public green space system are sound (whether there are park green spaces, street green spaces, and institutional green spaces). ]

- ☐ Very good
- ☐ Good
- ☐ General
- ☐ not good

- ☐ Very bad

Q13: Low carbon energy saving city? [Please consider: whether to use renewable energy (solar, wind, water, biogas, etc.), whether there is a low-carbon zone pilot, and whether there are clear energy conservation and emission reduction targets. ]

- ☐ Low carbon energy saving is in place
- ☐ Low carbon energy saving is in place
- ☐ Low carbon energy saving
- ☐ Low carbon energy is not in place

Q14: Public participation in urban environmental protection? (Please consider: Whether the urban environmental quality information is publicly available, whether there is an environmental protection school or an environmental protection science popularization activity, whether you have participated in local activities related to environmental protection issues)

- ☐ I am very involved
- ☐ I have a high degree of participation
- ☐ I am generally involved
- ☐ has nothing to do with me

Q15: Ecologically livable city? (Please consider: Whether the environment of the whole city is suitable for human beings to live for a long time, and it is beneficial to the physical and mental health of the residents.)

- ☐ Very suitable
- ☐ Suitable
- ☐ General

Q16: What environmental problems do you think are currently in your community? [Multiple choice questions]

- ☐ Air pollution
- ☐ Water pollution
- ☐ Noise pollution
- ☐ Solid waste pollution such as garbage
- ☐ other

Q17: Where do you think the noise in the community comes from? [Multiple choice questions]

- ☐ car
- ☐ the noise on the road
- ☐ Various sounds generated by neighbors
- ☐ House decoration sound
- ☐ Nearby factory
- ☐ other

Q18: Is daily cleaning work in the community in place? Is the garbage collection device complete?

- ☐ Every day, there are a lot of trash cans
- ☐ Not clean every day, but there are more trash cans
- ☐ Clean daily, but less trash
- ☐ Not every day, the trash can is rare

Q19: What is the cause of your environmental problems in your community?

- ☐ Arbitrary discharge of sewage from nearby factories
- ☐ Residents destroy public facilities
- ☐ Residents dumping garbage
- ☐ Street hygiene is dirty
- ☐ Community greening is destroyed
- ☐ More cars in the community
- ☐ soot emissions
- ☐ other

Q20: Are you satisfied with the greening of your place of residence?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Not satisfied

Q21: In terms of environmental governance in recent years, which of the effective measures of urban environmental protection do you think is effective?

- ☐ Introduce comprehensive environmental protection policies and regulations
- ☐ Expand the promotion and education of environmental protection
- ☐ Strengthening social supervision
- ☐ Increase the reward and punishment of environmental protection
- ☐ Standardize the behavior of environmental protection of various enterprises
- ☐ Increase capital investment in environmental protection
- ☐ other

Q22: What specific suggestions do you have about how to achieve eco-city environmental protection?  
[optional]

## Chapter 7. Conclusion

In the context of increasingly serious global environmental problems, eco-cities are an inevitable trend of urban development. Due to the rapid development of China's eco-cities in the early stage of construction, there are many problems in the theory and practice of eco-cities.

### 7.1 Mainly Conclusions:

- (1) This paper analyzes the theory of eco-city, and defines the concept of connotation of eco-city based on the previous theoretical research. Classification makes people clear, and all the complicated things are traceable. According to the scale attribute, they are divided into top-down ecological demonstration city and bottom-up ecological city, which are divided into two. Subdividing on the basis of it further makes the concept of eco-city more clear.
- (2) Through the in-depth analysis of the practice history of eco-city construction, this paper is divided into three sections according to the similar characteristics of its construction practice: the exploration awakening period, the rapid development period, and the promotion reflection period. At each stage, from the practical background, the practice-related research support, the important events related to the eco-city and the general situation of the practice and the promotion of policies, it is concluded that the practice course of the eco-city is a continuous deepening process; Beginning with the governance of the urban environment, with the deepening of consciousness, it gradually transitioned to ecological construction; and from extensive construction to more targeted construction; finally gradually expanded from focusing only on human settlements to production.
- (3) In this paper, the general characteristics of the two types of eco-city construction practice and refine their type characteristics are summarized. Statistical analysis is carried out on top-down ecological demonstration cities and bottom-up eco-city cities that can obtain data, and their overall development rules, distribution and trends are summarized in the form of graphs. Then refine the classification on the basis of two types, by summarizing the characteristics of each type. Then refine the classification on the basis of two types, by summarizing the characteristics of each type. The characteristics of the top-down eco-model city are: industrial transformation and ecological planning become the main means of building a top-down ecological demonstration city; it is a process from technology-driven to planning-led thinking to lead the overall development. The practical characteristics of the bottom-up eco-city are: the whole process is gradually upgraded from the construction of the new city to the old city; the replicable nature of the eco-city is one of the development goals of most eco-new cities.



- (4) This paper examines the practice and characteristics of China's current eco-city construction through a case study of the Clichy region of France, the Confluence of Lyon and Viikki in Finland. As well as the study of the construction of ecological cities in the international community, it can be seen that the pursuit of sustainable development and the construction of a livable living environment have always been the ideal goal of social development. People should be concerned about the improvement of their living environment through the construction of cities. In the process of eco-city construction, drawing on international advanced experience and planning and constructing according to local conditions is a good start to achieve this goal.
- (5) Through the questionnaire survey on the satisfaction of eco-city construction in Guiyang City, this paper concludes that the government needs decision-making actions to protect the environment, and more needs the participation of the whole people. According to the survey, 3/4 of the respondents were satisfied or basically satisfied with the current environmental quality conditions in Guiyang; 65% of the citizens expressed their participation or high participation in the construction of urban environmental protection activities in the ecological zone of Guiyang City.
- (6) Through the questionnaire survey on the satisfaction of eco-city construction in Guiyang City, this paper also draws three major issues that are most concerned by the general public in the practice of eco-city construction: air quality, solid waste, noise pollution. Motor vehicle exhaust and construction site dust are considered to be the most important factors affecting air quality; The survey shows that the public believes that the most serious solid pollutants are construction site construction waste, and the dissatisfaction is as high as 54%, followed by urban solid waste pollution, and dissatisfaction accounts for 32%. Among them, 47% of the public think that the most serious is the proliferation of plastic packaging and containers. 28% of the public think that domestic garbage cannot be disposed of in time, and 22% of the public think that used batteries and batteries are not effectively recycled; there are still 54 % of the public expressed dissatisfaction with the noise pollution, and their attention was much higher than expected.
- (7) At the same time, this paper also collects some representative suggestions from the public.
1. Some residents living in old communities have proposed:
    - a.** The sewage caused by the residential area and the water accumulated after the road surface is damaged will affect the environment, and the low-lying area should be filled;.
    - b.** There are blind spots and dead spots in the treatment of domestic garbage in residential areas, and the community should be taken as an important issue of health;
    - c.** Investigate the urban sewage management export to prevent pollution from flowing into residential areas;
    - d.** Implement an environmental responsibility system, and do a good job in garbage distribution and recycling of used batteries (especially batteries for battery vehicles should be recycled regularly);.
    - e.** It is required to solve the problem of vehicle exhaust pollution in the community;

- f. Strengthen environmental protection law enforcement, carry out environmental protection volunteer activities, strengthen the popularization of science knowledge in ecological zone construction, and persevere, carry out ecological construction knowledge education in primary and secondary schools.
2. On the basis of fully analyzing the supporting capacity and bottleneck of the ecosystem, we should prepare an ecological zone construction plan that can fully reflect the characteristics of the city, explore innovation, lead the planning concept, and be highly operational. Taking the landscape ecological construction as a breakthrough to improve the city's taste. Building an ecological central business district, adhere to the people-oriented, and create a humanistic ecological environment.
3. Can learn the practice of Southeast Asia, relying on the law as a backing, and using enforcement measures to ensure that the behavior of natural persons and legal persons meets environmental protection requirements. This is an effective method. From this premise, environmental protection is equal to empty talk.
4. Some community residents close to the main city area proposed that :
  - a. should control the glass curtain wall to reduce light pollution.
  - b. strengthen the enforcement of laws and regulations. On the roads, you can often see smoky mopeds and buses, and the exhaust gas is very polluted.
5. Among the people who participated in the survey, the younger citizens suggested that :
  - a. the battery car has been put into use a lot, and the recycling of used batteries after one year has not kept up. I hope that there will be places to recycle as soon as possible.
  - b. Increase publicity so that every citizen can raise awareness of environmental protection. The government must create more necessary conditions (such as planting trees and greening) to improve the quality of the ecological environment.
  - c. Relatively low investment in environmental protection infrastructure construction. If the environmental protection infrastructure cannot be kept up for a long time, it is impossible to fundamentally improve the environmental quality of the city.
  - e. Improve the level of urban planning and clearly separate residential areas, ecological areas and industrial parks.
  - f. Many of the citizens who participated in the survey at the age of 60 thought that leaders and staff should spend more time in the public to understand the situation, timely carry out ecological construction, and promote environmental knowledge. To cultivate the public's awareness of environmental protection and hygiene, only everyone can start from me to keep up with the development of urban ecological construction and environmental protection. The government should invest more in high-tech environmental protection facilities to control the generation of pollution sources.
- (8) This paper intuitively reflects the views of the general public on the construction of local eco-city through the questionnaire survey data. Of course, the problems facing the construction of eco-city in Guiyang at present are not the only examples of the construction of eco-cities in China. The construction of eco-cities in other regions is also facing similar problems. . The government needs to communicate more with the public, less formalism, and the public should actively participate in the construction of ecological cities, so as to improve the construction of ecological cities.

## 7.2 Main Shortcomings

- (1) The construction practice of most eco-city can only be obtained from the literature, and the data is not comprehensive enough and cannot be investigated on the spot.
- (2) Statistics on eco-cities can only be retrieved through web pages and literature, and statistics may not be complete.
- (3) The research on the construction process of eco-city needs to be further deepened to further improve the conclusion.
- (4) Questionnaires are affected by manpower and time. The number of surveys is limited, and specific data may be biased.
- (5) According to the questionnaire survey data on the satisfaction of eco-city in Guiyang, there is still a considerable part of the public who has no knowledge of the construction of eco-city. In addition, there are many imperfect aspects in the process of eco-city construction.

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