

Comparative study on low carbon city construction in post industrial era

Yaoning Yang^{1,a}, Xiaodie Yuan^{2,b}, Jun Zhang^{2,c,*}

¹Technische Universitaet Berlin, Berlin, Germany

²School of Architecture and Planning, Yunnan University, Yunnan Kunming, China

^ayangyaoning@163.com, ^bxdy@mail.ynu.edu.cn, ^ctj_xbb@126.com

Abstract: In order to alleviate the pressure of global warming and find a new direction for urban development, we will sort out and summarize the low-carbon city construction cases in the post-industrial era, focusing on its development model, practical points, spatial development strategies, and related safeguard measures, etc. A horizontal comparative study of low-carbon city construction cases in the post-industrial era is carried out in multiple dimensions, and finally the similarities and differences of these case cities in the above aspects are summarized.

Keywords: Post industrial era; Low carbon; Urban construction

1. Introduction

Cities are an important battlefield for fossil energy consumption and occupy a dominant position in the strategy of facing global climate change [1]. In the process of tackling climate change and transforming the development mode, the construction of low-carbon cities may play an important role. At present, many cities around the world have begun low-carbon city construction practices and gained valuable experience.

The overall state of cities in China is still in the middle stage of industrialization. However, some major cities with fast economic development are undergoing fundamental changes under the impact of urban renewal process, and have gradually entered the post industrial era.

However, there is still a lack of systematic research and summary regarding the construction of low-carbon cities at home and abroad in the post-industrial era [3]. Due to the differences in the resource endowments, social development and urbanization stages of cities at home and abroad, and the different low-carbon development strategies at the national level, low-carbon city construction at home and abroad has comparative research value in many aspects. In order to solve the confusion of low-carbon city construction direction in the post industrial era, based on the analysis and summary of the general situation of low-carbon city construction at home and abroad, this paper makes a horizontal comparative study of typical cases of low-carbon city construction from the aspects of development mode, specific practice strategy, understanding of low-carbon city spatial form and relevant implementation guarantee measures, In order to summarize the successful experience of the existing low-carbon city construction, research the development direction of urban construction.

2. Overview of low-carbon city construction in the post-industrial era

The concept of low carbon city has been booming in recent years and a boom of low-carbon city construction has appeared in the whole country. In January, 2008, the national development and Reform Commission and the world natural foundation (WWF) jointly identified Shanghai and Baoding as two pilot cities for China's low-carbon urban development project.

Urban design is an important guideline to guide urban development [4]. Strengthening its impact on the allocation of spatial resources will play an important role in the development of low-carbon cities. Current urban design theoretical research rarely takes carbon emissions as a consideration [5] Analyzing its impact on urban development, there is a lack of thinking about the impact of urban carbon emissions feedback on urban space, and there is no scientific statistical research on the carbon emissions generated by human activity spaces in urban design projects. Innovative urban design

methods and ideas based on low-carbon emission reduction, to ensure that the measures to reduce carbon emissions can be combined with the construction of urban development theory, and can be implemented in the process of China's urbanization construction, will become the forward goal of low-carbon urban design theory innovation.

3. Comparison of low-carbon city construction cases

This chapter makes a horizontal comparison on the development mode, practical points, spatial development strategies and related safeguard measures of low-carbon city construction cases in the post industrial era.

3.1. Comparison of development models

Taking Shanghai, Xiamen, Hangzhou, Wuhan, Hangzhou, Wuxi, Guiyang and other cities as examples, China proposes to build comprehensive low-carbon cities, but at the present stage, they all stay in the macro strategic planning, and the development mode convergence of domestic case cities is prominent: as shown in Table 1, A considerable number of cities follow the industry leading mode based on the development of new energy and low-carbon industry represented by Baoding and the New District demonstration mode represented by Sino Singapore Tianjin eco city.

Table 1: Urban development concepts and models

City	Development concept and model
Shanghai	Emphasizing the construction of a comprehensive low-carbon city, planning and constructing Chongming Island Dongtan Eco-city and Lingang New City
Baoding	Low-carbon city construction led by industry
Tianjin	Taking the Sino-Singapore Tianjin Eco-City as an opportunity to build a low-carbon eco-city in the new district
Tangshan	Carry out low-carbon ecological city construction in the new area of Caofeidian Eco-city
Shenzhen	Emphasize the construction of a comprehensive low-carbon city, with the Guangming New District as a pilot
Nanchang	Low-carbon city construction led by industry
Wuhan	Emphasize the construction of comprehensive low-carbon cities
Changsha	Low-carbon city construction led by industry
Texas	Low-carbon city construction led by industry
Shenyang	Emphasis on the construction of demonstration low-carbon cities
Zhuhai	Focus on low-carbon buildings and low-carbon communities Building a low-carbon city
Jilin	Focus on industrial structure transformation
Xiamen	Emphasize the construction of comprehensive low-carbon cities
Hangzhou	Emphasize the construction of comprehensive low-carbon cities
Guiyang	Emphasize the construction of comprehensive low-carbon cities
Wuxi	Emphasize the construction of comprehensive low-carbon cities
Chongqing	Focus on industrial structure transformation

To sum up, there is no case in China to strictly follow the construction mode of comprehensive low-carbon city, and its development mode is dominated by industry oriented and new area demonstration.

3.2. Comparison of practice points

In the aspect of energy renewal, we should make use of its abundant wind resources to develop wind power generation; In cities, building solar power generation is integrated into the power grid. In terms of traffic emission reduction, cities focus on promoting clean energy vehicles, BRT and other environmental protection transportation modes; The city has carried out the construction of bicycle lanes; Replace the traditional traffic lights with LED traffic lights. In terms of building emission reduction, some cities promote building energy conservation by formulating or introducing relevant green building standards.

Table 2: Practice strategy and overview

City	Practice strategy and overview
Shanghai	The focus is on the development of new energy, hydrogen power grids, environmentally friendly buildings, and fuel cell buses. The Chongming Island Dongtan Eco-city and Lingang New City are the highlights of low-carbon city construction, but the Chongming Dongtan Eco-city construction project has been shelved.
Baoding	Based on the "China Power Valley" and "Solar City" plans, six industrial systems including wind power, photovoltaic, energy saving, power storage, power transmission and transformation and power automation are planned, and low-carbon city construction is carried out from the aspects of urban ecological environment construction, low-carbon community construction and low-carbon urban transportation system construction
Tianjin	Constructing a new recycling and low-carbon industrial system, a safe and healthy ecological environment system, a beautiful and natural urban landscape system, a convenient and fast green transportation system, a recycling and efficient resource and energy utilization system, and a livable and friendly ecological community model are expected to become a domestic low Sample of carbon ecological city construction
Tangshan	Taking advantage of the combined advantages of Chinese and Western experts, different ideas and knowledge will be combined into a new integrated urban form and system solution: comprehensive integrated planning guided by index system, focusing on the efficient and compact development of circular economy, energy saving, water saving and land saving
Shenzhen	Starting from the low-carbon construction of Guangming New Area, optimizing the urban spatial structure, improving the green municipal planning, guiding the low-carbon development of industry, establishing the green transportation system, and developing the green building, we will focus on the green building, and jointly build a "low-carbon ecological demonstration city" with the Ministry of housing and urban rural development
Nanchang	Build a low-carbon ecological industry system, develop the three major industries of semiconductor lighting, photovoltaics, and service outsourcing, and strive to build Nanchang into a world-class photovoltaic industry base
Wuhan	Explore the development mode of low-carbon energy, low-carbon transportation and low-carbon industry, and establish a policy system to promote resource conservation and low-carbon economic development
Changsha	Planning to build a low-carbon economy demonstration city, focusing on promoting the development of green industries such as new energy vehicles, solar energy utilization, renewable energy, energy-saving buildings, LEDs, etc.
Texas	Focus on the development of solar equipment manufacturing industry and solar energy utilization and promotion, and create "China Solar Valley"
Shenyang	Co-construct the "Eco-City" demonstration project in Yangyang Economic and Technological Development Zone and Shenyang High-tech Park with the United Nations Environment Programme, focusing on the introduction of low-carbon technologies
Zhuhai	At the same time, we should promote the construction of "green community", popularize the concept of low-carbon life, implement the "mountain greening" project, and increase the carbon sink to build a low-carbon city

As shown in Table 2, the construction of low-carbon cities in China is still in the preliminary exploration stage, and different experiments are being carried out in different cities. Continuously improve the construction of low-carbon cities.

3.3. Comparison of spatial development strategies

Among the domestic low-carbon city construction cases, Caofeidian eco city in Tangshan, Dongtan eco city in Chongming Island in Shanghai, Zhongxin eco city in Tianjin and Guangming New City in Shenzhen all involve urban spatial form planning: Caofeidian eco city focuses on the balance between the walking scale of neighborhood communities and high-efficiency road network, as well as the compactness of the city to a certain extent, And strengthen the high density and mixed use of land in some special places such as urban nodes and public streets; Ecology of Dongtan, Chongming Island, Shanghai.

The city emphasizes low ecological footprint and high residential density; Tianjin Sino-Singapore Eco-City builds a compact urban layout supported by green transportation, and uses ecological corridors and ecological communities as the basic urban structure; Shenzhen Guangming New City uses TOD mode For the basic organization of a clear and dense urban texture, a higher urban construction coverage rate is formed.

3.4. Comparison of relevant safeguard measures

Domestic demonstration cases of new urban areas, such as Caofeidian eco city in Tangshan and Zhongxin eco city in Tianjin, have introduced relevant evaluation systems, trying to establish a scientific, systematic and operable evaluation system to guide and ensure the low-carbon development of the region. The evaluation system of Zhongxin eco city is expected to become the national standard of low-carbon ecological construction in new urban areas.

But overall, the low-carbon city planning of most cities in China is still at the macro-strategy level, and related safeguards are lacking.

To sum up, the research results show that the practice points of low-carbon cities in the post industrial era mainly focus on the three fields of energy, construction and transportation, and pay attention to the construction of comprehensive low-carbon cities, and most of them formulate more effective low-carbon development models and strategies according to their own resource endowment, social development and urbanization stage; Although the city also emphasizes the construction of comprehensive low-carbon city, it still stays in the macro low-carbon development strategy at the present stage. A considerable number of case cities belong to the new area demonstration type and industry leading type in the development mode. In the aspect of low-carbon city construction guarantee, most of the domestic cases are in the initial exploration stage, so they are relatively lacking.

4. Conclusion

Through the comparative study of the previous cases, as far as the future development direction of domestic low-carbon city construction is concerned, efforts should be made to change the status quo of the convergence of its development models, and to explore the development models suitable for individual cases that match their socio-economic development and urbanization stages, and Pay attention to the in-depth macro strategy, formulate detailed strategies and rigid standards, and focus on the construction of low-carbon cities.

References

- [1] ZHANG Tingyin. *Research on the Path of Low-Carbon City Construction in my country—Comment on "Swiss Low-Carbon City Development Practice and Experience Research [J]. Ecological Economy, 2021, 37(01):230-231.*
- [2] Ju XiangRao Fangping. *LOW CARBON TOWN: FOREIGN DEVELOPMENT EXPERIENCE AND ENLIGHTENMENT [J]. Chinese Journal of Agricultural Resources and Regional Planning, 2021, 42(01):88-95.*
- [3] Jiang Wei. *The change and expansion of my country's low-carbon city construction and related research dimensions [J]. city,2021(02):50-59.*
- [4] Yuan Bin. *Promote the construction of green and low-carbon cities [J]. Construction Technology, 2021(08):1.*
- [5] ZHU Yufan. *Historical Objects and Post-Industrial Landscape [J]. Chinese Landscape Architecture, 2020, 36(03):6-14.*