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A Research on Countermeasures for Zero Carbon Community Development under the Double Carbon Target

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Abstract: ' Green ' and ' low carbon ' are hot words that have appeared frequently in recent years. Promoting the green transformation of economic development in an all-round way and achieving carbon peak and carbon neutrality are the inherent requirements for implementing the new development concept, building a new development pattern and promoting high-quality development. In China, the construction industry accounts for more than 40% of carbon emissions. Therefore, achieving low-carbon development in the construction industry is the top priority to achieve the ' double carbon ' goal. In the construction industry, it is an important task to develop zero-carbon communities and create an environment-friendly living environment. Through the problems found in the process of building new zero-carbon communities in recent years, the corresponding improvement measures are put forward in order to provide reference for the development of zero-carbon communities.

Keywords: Green; Low-carbon; The "double carbon" goal; Zero Carbon Community.

1. Introduction

In recent years, China's economy has risen steadily, people 's living standards have also risen in a straight line, and people 's pursuit of high-quality life has become higher and higher. However, since industrialization, greenhouse gases have been emitted in large quantities, and climate change has become a huge challenge facing mankind today. It is the common responsibility of all countries to solve climate problems. In the outline of the 14th Five-Year Plan issued by China, it is mentioned that in order to achieve green development and ' double carbon ', we should strengthen the research and development of green low-carbon technology from multiple scales such as urban, rural and community, and form a green, low-carbon and circular urban and rural development mode and construction mode. As one of the basic functional units of the city, the community is also a collection of people and residential buildings. It is imperative to low-carbonize the community.

2. The definition of zero carbon community and related policies

2.1. Definition of zero-carbon community

Table 1. Five levels of zero-carbon community

hierarchy division	carbon emission	zero carbon
First level	LNC=CC+OC-CS LNC: Net carbon emissions over the life cycle of a community OC: CO2 produced in the community operation stage CC: CO2 indirectly generated by other stages of the community (non-operational stage) CS: Carbon sinks in community sites	Zero-carbon community-Community achieves carbon neutrality in the whole process from planning to construction to demolition.: LNC (on-site) =0
Second level	LNC=CC+OC-CS-CO LNC: Net carbon emissions over the life cycle of a community CC: CO2 indirectly generated by other stages of the community (non-operational stage) CS: Carbon sinks in community sites CO: Carbon compensation outside the community site	Carbon neutral community-community the remaining small amount of carbon emissions in the whole life cycle is neutralized by off-site carbon compensation: LNC=0
The third level	ONC=OC-CS ONC: Net carbon emissions in the community operation stage OC: CO2 produced in the community operation stage CS: Carbon sinks in community sites	Zero carbon community-Community in the operation stage in a variety of ways to produce carbon emissions to carbon neutral: ONC (on-site) =0
The fourth level	ONC=OC-CS-CO ONC: Net carbon emissions in the community operation stage OC: CO2 produced in the community operation stage CS: Carbon sinks in community sites CO: Carbon compensation outside the community site	Carbon production and community-community the remaining small amount of net carbon emissions generated by each system during the operation phase are neutralized by carbon compensation outside the site: ONC=0
The fifth level	EC: Net carbon emissions of energy consumption demand in community operation stage	Near-Zero Carbon Communities - Communities can achieve overall carbon neutrality through energy reuse or renewable resources during the operational phase: EC=0

After comparing the relevant literature of ' zero carbon ' and ' zero carbon community ', it is found that due to the

differences in the calculation methods of carbon emissions by various experts and scholars and the different emphasis on community carbon emissions, the level of ' zero carbon ' community can now be divided into five different levels : first, the community is carbon neutral in the whole process from planning to construction to demolition ; second, the community 's remaining small carbon emissions throughout the life cycle are neutralized through off-site carbon compensation ; thirdly, the community produces carbon emissions in various ways to achieve carbon neutrality during the operation stage ; fourth, the remaining small amount of net carbon emissions generated by each system in the operation stage of the community are neutralized by carbon compensation outside the site ; fifth, the community can achieve overall carbon neutrality through energy reuse or renewable resources in the operation stage. [1]

Corresponding to the different levels of ' zero carbon ' at the above community level, the five levels of zero carbon community are summarized as table 1. [2]

2.2. Policies on zero-carbon communities and related areas

Table 2. Green development related policies of some provinces and cities in China

Area	Policy	Policy main-points
Henan province	'Henan province urban and rural construction field carbon peak action plan '	By 2025, a new pattern of green development in the field of urban and rural construction has been initially formed. New buildings in cities and towns fully implement green building standards, and the proportion of prefabricated buildings is striving to reach 40 %. The old communities that need to be transformed were basically completed before 2000, and the creation of urban green communities reached more than 60%.
Liao Cheng city in Shandong province	'Liao Cheng city urban and rural construction field carbon peak implementation plan '	Carry out green low-carbon community construction. Promote mixed blocks with complex functions, and advocate mixed layouts such as residential, commercial, and pollution-free industries. The new residential community strictly implements the " residential area planning and design standards " " complete residential community construction standards (Trial). " The existing residential communities are equipped with relevant facilities according to local conditions. By 2030, the coverage rate of complete residential communities will increase to more than 60 %.
Chengdu, Sichuan Province	'Chengdu Green Building Promotion Regulations'	It is clear that in terms of green building grade requirements, civil buildings are divided into basic level, one-star level, two-star level and three-star level. The planning, design and construction of new civil buildings should adopt basic level and above green building standards; industrial buildings are divided into one-star, two-star and three-star. The planning, design and construction of new industrial buildings should adopt the green building standards of one-star and above. [3]
Qingdao City, Shandong Province	'Qingdao carbon peak work plan'	We will promote the green and low-carbon transformation of urban and rural construction, establish a green and low-carbon management mechanism for the whole life cycle of buildings, promote green building materials and green construction methods, accelerate the industrialization of new buildings, and build green urban areas, green towns and green communities. Accelerate the improvement of building energy efficiency, promote the large-scale development of ultra-low-energy buildings and low-carbon buildings, guide the development of high-star green buildings, and improve the intelligent level of urban buildings and infrastructure operation and management.
Ordos of Inner Mongolia	'The implementation plan of strengthening building energy conservation and green building development in Ordos City'	By 2025, the proportion of star green buildings in the city 's new urban buildings will exceed 30 %; prefabricated buildings account for 30 % of new buildings; to carry out the pilot work of passive ultra-low energy consumption buildings; the integration project of building insulation structure accounts for more than 30% [4]; the application proportion of renewable energy in civil buildings reaches 30 %. All existing residential buildings have completed energy-saving renovation; the promotion area of green building materials has reached 800,000 square meters.
Shenzhen city of Guangdong province	'Shenzhen 's 14th Five-Year Plan for Climate Change'	According to the ' Implementation Plan for Pilot Construction of Near-zero Carbon Emission Areas in Shenzhen ' issued in 2021, the near-zero carbon community will focus on the steady decline of per capita carbon emissions and total carbon emissions in the community, focus on the development of energy-saving and low-carbon buildings such as green buildings and ultra-low-energy buildings, provide multi-level green space, build chronic roads, and use carbon inclusive mechanisms and various publicity activities to enhance residents ' low-carbon awareness and advocate green life.
Hunan province	'Green Building Development Regulations of Hunan Province (draft)'	It is stipulated that the provincial people 's government should incorporate the research and development, application and promotion of green building technology into the development plan of strategic emerging industries, promote the industrialization, digitization and intelligent development of green building, and clearly encourage colleges and universities, scientific research institutions and enterprises to carry out the research and development and application demonstration of green building technology to promote the transformation of scientific and technological achievements, the construction of public technology service platform and enterprise research and development institutions.[5]

In order to implement the '14th Five-Year Plan for Building Energy Conservation and Green Building Development' issued by the Ministry of Housing and Construction, and in response to the national " double carbon " policy, green development plans are being deployed throughout the country. Some provinces and cities in China have issued corresponding policies to support the development of green buildings and near-zero-carbon communities:

3. The problems and challenges faced by the development of zero-carbon communities in China

At present, the planning and construction of zero-carbon communities in China is on the right track, and the technology in building carbon reduction is becoming more and more mature. Therefore, the development of zero-carbon communities has great potential in China. However, the concept of zero-carbon community is still unclear in people 's minds, and there are still many problems in planning, construction and subsequent operation.

3.1. Construction technology relies too much on foreign experience.

Nationwide, from planning to design and construction, the construction of buildings in zero-carbon communities faces many technical problems. First of all, the localization level of construction technology is not high. Our country in the construction of zero carbon community is mainly draw lessons from foreign experience, such as Britain 's Beddington zero energy community (BedZED), Germany 's Vauban (Vauban) community. The construction technology of low-carbon buildings in China is based on the construction technology of Germany. However, due to the complex climatic and geographical conditions of our country, especially the obvious climate difference between the north and the south, it is impossible to popularize this construction technology in the whole country. Moreover, the zero-carbon community has particularly stringent requirements for thermal insulation and energy saving of building materials, while at this stage, China 's domestic ultra-low-energy building materials production technology is backward. The production cycle is long and the production quantity cannot meet the requirements of large-scale use. In addition, due to the construction process of the construction of zero carbon community is complex, more links, in many nodes require higher construction technology, and according to China 's complex climatic conditions, and cannot copy the foreign construction technology, otherwise it will make the performance of the building greatly reduced.

3.2. Low carbon environmental protection building materials marketization degree is not high

First of all, to solve the problem of low carbon construction technology and low carbon environmental protection building materials is the most important. However, in the planning and design process, due to the high construction cost and the uncertain investment recovery period, the real estate developers are not enthusiastic about the investment of zero-carbon buildings. [6] At the same time, a large number of buyers now attach great importance to the return on investment of real estate. After solving their basic living needs, buyers are very concerned about the added value of real estate, such as school district housing. Moreover, because the concept of ' double carbon ' has become a new hot word, the government has increased its investment in policy research, but it is not deep in publicity and promotion. Therefore, buyers have insufficient understanding of zero-carbon communities, resulting in a low degree of marketization of zero-carbon communities. Under the premise of the ' 14th Five-Year ' development plan in the new era, the construction industry must solve this big problem.

3.3. The policy reward mechanism is not perfect enough

Under the guidance of the national goal of " carbon neutrality and carbon peak, " many governments have begun to study the road of green and low-carbon development, and have issued a series of policies to guide the development of low-carbon industries, but there are still some difficulties in the implementation of policy standards. First of all, since the reform and opening up, China has moved from a big infrastructure country to a strong infrastructure country. For green construction, a series of policy documents have also been issued. For example, Henan Province and the ' Henan Province Urban and Rural Construction Field Carbon Peak Action Plan ' issued in 2022 clearly pointed out that the creation of green communities by 2025 should reach more than 60 %, but there is no clear provision for specific practices and planning, which leads to difficulties in the implementation of policies ; secondly, in terms of the evaluation criteria of zero-carbon communities, China has learned from the advanced experience of foreign countries, such as the LEED-ND (LEED for Neighborhood Development) evaluation system in the United States and the BREEAM Communities sustainable community evaluation system in the United Kingdom. However, a unified low-carbon community evaluation system suitable for China 's national conditions has not been formed. Therefore, policy guidance is needed in the evaluation to develop an evaluation system suitable for China 's national conditions. Finally, due to the high investment in the planning and design of green communities in the early stage, the developers ' enthusiasm for development is insufficient. Moreover, because the government 's incentive mechanism for the development of zero-carbon communities is difficult to implement, and there is a lack of incentive subsidies for buyers who actively participate in the purchase of green houses, the enthusiasm of buyers is insufficient, which ultimately leads to the promotion of zero-carbon communities being constrained.

3.4. Lack of coordination in the whole process management of the project

The life cycle of zero carbon community construction project is divided into five stages, from the project planning, design, construction, operation and maintenance, demolition, long cycle, many nodes, uncertainty and complexity, during this period, the need for cooperation of various units, in order to ensure the quality of the whole project. However, China has not yet formed an industrial synergy model integrating planning and design, construction, operation and maintenance. First of all, from the perspective of each link of the construction project, there may be some enterprises can realize the whole process supervision of a building product from design to operation and maintenance, but the construction project itself covers a variety of building products, these products cannot be concentrated in one enterprise ; secondly, in the process of promoting the construction project, since each unit of the industrial chain is independent, from design to construction, the coordination ability of each unit is not high, and the demands of each other are different, so it is impossible to form a joint force in the market. When the market price fluctuates, it will affect the construction cost of the whole project, compress the profits of each enterprise, and ultimately fail to achieve a win-win

situation.

4. Countermeasures and Suggestions for the development of zero carbon community

4.1. Develop a new model of zero-carbon community that adapts to national conditions

Based on the basic national policy of sustainable development, taking foreign excellent zero-carbon community practice cases as experience for reference, learning from each other 's strengths and complementing each other 's weaknesses, and optimizing the layout of green industry according to China 's complex geographical conditions. The concept of zero carbon, zero carbon elements and sustainable development model are unified, and according to the differences between the north and the south, residents ' habits, meteorological and climatic differences and other factors, establish and improve the system of laws and regulations and standards, encourage the establishment of high-quality industrial layout based on sustainable development, and actively cultivate a large number of technical personnel, increase green technology, zero carbon technology related investment, through technological innovation, to achieve community is sustainable development, and on this basis, through the development of innovative operation mode, to create a new type of green, inclusive, livable innovative community, and ultimately achieve the " double carbon " goal of community development.

4.2. Improve the evaluation criteria of zero carbon community

Firstly, the connotation and concept of low-carbon community are analyzed, and the evaluation index system of low-carbon community is constructed on the basis of combing the research of relevant scholars at home and abroad and the questionnaire survey of relevant experts and scholars in the field of low-carbon economy. Secondly, select the appropriate evaluation methods, including index weighting methods and evaluation methods, and construct a low-carbon community evaluation model. Based on community carbon emissions, residents ' personal carbon emissions, transportation, energy, green buildings, green space coverage, waste recycling and other indicators, a zero-carbon community evaluation index system is constructed, and on this basis, green building materials and planning are formulated. Design. Construction. Operational technical standards. The government encourages relevant enterprises to formulate a series of green standards to adapt to market development, and encourages the corresponding green associations to formulate group standards. For example, the " sustainable development block evaluation standard " published by Shenzhen Promotion Association, combined with the characteristics of Shenzhen 's development, takes infrastructure construction, ecological environment, energy and resource utilization, and block governance as the main evaluation indicators to guide the sustainable development of Shenzhen 's blocks.

4.3. Vigorously develop zero carbon related technologies

As the core of sustainable development demonstration community construction, zero-carbon technology highlights the supporting role of scientific and technological innovation in low-carbon and sustainable development, and realizes the coupling of community construction, operation, sustainable development, scientific and technological innovation and industrial incubation [7]. Starting from the planning and design stage, BIM technology is used to optimize the rationality and adaptability of the overall layout and the utilization of land space. In terms of detail processing, ventilation, sunshine time, air circulation and construction technology are simulated and optimized. In the construction stage, the use of low-energy building materials, optimize the construction plan, improve construction efficiency, reduce building energy consumption, and through BIM three-dimensional information simulation, to achieve refined construction, information management, reduce material waste, greatly save construction costs. In terms of community operation, we can build a community intelligent platform and build a community cloud carbon smart center. Through real-time monitoring of the smart platform, we can monitor the real-time carbon emissions of the entire community and create dynamic carbon source data management and control capabilities to fundamentally reduce community carbon emissions.

4.4. Realize the whole process of project low carbon operation management

The whole process of building a zero-carbon community project is low-carbon technology and low-carbon management, which runs through the concept of green low-carbon, and finally realizes the zero-carbonization of the community. First of all, in the target formation stage, it mainly includes three links: pre-investment, planning and design, and bidding. In order to achieve the final low-carbonization of the project, it is necessary to clarify the project objectives: to achieve ultra-low control of carbon emissions throughout the life cycle of the project. In the investment stage, the government should make active guidance. After selecting the developer and determining the investment intention, the project is planned and designed. However, the cost of low-carbon management is large and the content is complex. It needs the active cooperation of relevant government departments, and increases the design drawings. The review of the planning content, the decomposition of the target to each participant in the bidding stage, and the strengthening of the coordination of the parties to jointly build ; secondly, in the construction stage, advanced green environmental protection construction technology is used to build a pure low-carbon industrial supply chain under the premise of ensuring safety and quality, using green building materials, green transportation and logistics, and using BIM technology to accurately control the construction site, so as to achieve high efficiency and low energy consumption. Finally, in the operation stage, the use of intelligent carbon reduction smart platform, efficient use of energy, water resources, and actively guide residents to low-carbon life, green travel, garbage classification and recycling and a series of measures to achieve energy conservation and carbon reduction throughout the community.

5. Complimentary close

Under the guidance of the national " double carbon " goal, it is a difficult and difficult road to realize the zero carbonization of the community. From the planning and

design to the final overall operation, every step must be flawed, and the scheme is excellent. Realizing the construction of zero-carbon community has strict requirements for the government, enterprises, groups and even individuals. Zero-carbon community is the ultimate goal of community development and a higher requirement for community development model. However, the realization of " carbon neutrality and carbon peak " in the community system is of far-reaching significance to China 's sustainable development strategy and the construction of a beautiful China.

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