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Green Building Index System Based on Detailed Low-Carbon Ecological Planning

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Abstract: The low-carbon ecological planning and green building are continuously explored at home and abroad, and a corresponding index system is formed, but no reasonable relationship between green building and ecological planning is established. This paper concludes a pointcut of planning and an index system combining green building and low-carbon ecology through analysis and research on green building and low-carbon ecological indexes at home and abroad, and based on the urban characteristics and practice experience of Beijing city. In the planning process, this paper considers 20 indexes in four aspects: spatial planning, traffic organization, resource utilization and ecological environment, and the building design process includes 27 indexes in seven aspects, such as building, structure, water supply and drainage, and so on. The indexes in two aspects correspond to each other, and form a complete set of low-carbon ecological and green building index system.

Key words: Low-carbon ecological planning; green building; index system

Introduction

Various countries in the world constantly pursue low-carbon development, and low carbon becomes the development goal in the new period. In the "12th five-year plan", China also took energy conservation and emissions reduction as the major task, and built a resource saving and environment friendly environment. Low-carbon planning plays an increasingly more important role. Low-carbon city is supported and responded by all sectors of society after it was put forward. Taking low carbon as the goal of urban development is an important concept of building an environment friendly city. At present, urban construction on the premise of green building lacks relation with the urban sustainable development and low-carbon ecology. This paper forms a green building index system based on low-carbon ecology through analysis and research from the aspects of planning, design and management, and association of green building with low-carbon ecology.

1. Research on the current low-carbon ecological planning index system at home and abroad

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1.1 Research on low-carbon ecological planning at home and abroad

In China, low-carbon ecological planning is in the development stage, and the urbanization is also in its infancy. Therefore, China should find a suitable low-carbon ecological development path based on the actual situation. As can be found through a lot of investigation, by 2012, 280 regions set up low-carbon development goals, wherein the Sino-Singapore Tianjin Eco-city, Caofeidian International Eco-city, etc. all began constant exploration. Sino-Singapore Tianjin Eco-city index system established an index system through management mainly from the aspect of building a good natural environment, an artificial environment, a healthy lifestyle, and the like.

1.2 Practice of low-carbon ecological function areas in Beijing

In recent years, Beijing has implemented low-carbon ecology in typical functional areas, such as Yanqing County and Fengtai Changxindian. Yanqing obtains the contents in many aspects, such as measurement and analysis of urban and rural planning, analysis of carbon emissions, etc. through systematic evaluation and planning of carbon emissions, and also specifically analyzes low-carbon transport, ecological environment and other aspects.

2. Research and analysis on the prevailing green building index system at home and abroad

2.1 Foreign green building standards and formulation ideas

Since the 1990s, western countries have formulated relevant green building standards, but there are also certain differences therebetween. Japan evaluates buildings mainly considering the environmental performance of buildings, forms the environmental efficiency indexes of buildings, and ensures that the environment and building performance can be kept at a certain balance level. German green building evaluation system calculates the total life cycle cost mainly by associating the total project life cycle with economic indexes, so that buildings achieve the purpose of energy conservation and environmental protection.

2.2 Research on existing domestic green buildings

Domestic green buildings are mainly designed, evaluated and analyzed. In 2010, the Ministry of Housing and Urban-Rural Development issued the *Code for green design of civil buildings*, and arranged the chapters and sections according to the site, water supply and drainage, heating, etc. The code gives the development direction of technical improvement, builds a suitable green technical system, simply guides green buildings, and lacks correspondence relationship between green buildings and urban sustainable development. In August 2011, Beijing issued the *Green Building Evaluation Standard*, which mainly introduces the concrete building evaluation and the index design principle, evaluates buildings by considering many aspects, such as energy saving, water saving and material saving, reasonably combines green buildings with ecological cities, and designs an implementable index system.

3. Overall design thought of the green building index system based on detailed low-carbon ecological planning

3.1 Analysis on the relationship between the index system and the low-carbon ecological planning & green buildings

The green building index system of low-carbon ecological planning combines the green building design with the ecological city construction. Low-carbon ecological city mainly refers to building, traffic, greening, etc. Green building design mainly refers to buildings, structure, water supply and drainage, landscape environment, etc. The spatial planning, ecological environment, resource utilization, etc. are used as the connection points of the two, so as to realize the integration of low-carbon ecological planning and green buildings. Low-carbon eco-city strategy is closely related to green building design. Like low-carbon cities encouraging people to go out using non-motor vehicles, green building design also associates traffic and organization with the landscape environment, encourages everyone to go out on foot or by bike, and facilitates people to go out by widely establishing bus stops; low-carbon ecological city needs to make detailed plans on traffic, resources and ecological environment on the basis of the green building concept.

3.2 Overall concept of the index system

Under the premise of urban sustainable development, design plan arrangement, implementing corresponding indexes, forming the green building index system based on the detailed low-carbon ecological planning, practically conducting each stage in place, and detailed planning and green building design can all run smoothly.

4. Green building index system based on detailed low-carbon ecological planning

4.1 Index system setting principle

4.1.1 Emphasize the leading role of planning

In order to ensure that green building reaches certain energy saving and environmental protection standards, and can get sufficient economic benefits, it is necessary to not only consider these factors in the design phase, but also create favorable implementation conditions for detailed planning of low-carbon cities. The building energy efficiency design is combined with low-carbon urban ecological planning to form a unified index system, and the content thereof is constantly increased to promote the urban sustainable development strategy, and comprehensively implement green building and low-carbon urban planning.

4.1.2 Indexes are associated

Important links affecting the low-carbon city development are found through analysis on the existing indexes in typical areas. According to city planning, the influencing factors can be divided into spatial planning, urban traffic, resource utilization and ecological environment, and the index system of detailed planning is formed. As can be found through analysis on the low-carbon ecological development goal of Beijing, it comprehensively considers various periods of management and building. Through management of the design submissions, construction drawing review, etc., low carbon energy saving management of the whole design process is achieved.

4.1.3 Indexes reflect local characteristics

Many problems, such as the very high population density, traffic jam phenomenon, environmental pollution, and the like, arise constantly in Beijing city. A city shall change its status constantly. Large amounts of water, energy and

materials are supplied from the outside. The city has serious water and energy shortage phenomenon. Therefore, it is necessary to set up a scientific green building index system of detailed low-carbon ecological planning according to the economic development level of Beijing.

4.2 Index system construction

Indexes in detailed planning level are built according to the implementable principle. During the low-carbon ecological design and building design, it is necessary to comprehensively consider important indexes, combine green building design with low-carbon ecology, and constantly optimize the building design. Low-carbon ecological indexes should include 56 indexes such as "industrial indexes". According to the actual implementation conditions, the indexes are constantly adjusted, those unqualified indexes are deleted, like the green plot ratio, new energy automobile supply sites and other immature indexes, and eventually 20 index systems are formed. The index system as shown in Table 1 below is formed after comprehensive consideration.

Table 1 Index System

No.	Class	Low-carbon traffic concept	Index content
1	Building	Green traffic	Distance from building exits/entrances to bus stops
2		Building envelope	Energy saving design index of external building envelope
3			Moveable external sunshade area ratio
4		Building material	Cost ratio of purely decorative components
5			Enclosed space area ratio of recyclable partition walls
6			Waste material utilization
7			Recyclable material utilization
8		Indoor environment	Standard-reaching rate of indoor noise of main functional space
9			Standard-reaching rate of barrier-free design
10	Structure	High performance buil	Proportion of high strength steel bar (exploratory index)
11			Proportion of high strength concrete (exploratory index)

12		ding materials	Proportion of high performance steel consumption (exploratory index)
13	Water supply & drainage	Non-traditional water source	Non-traditional water utilization
14		Water saving	Utilization of water-saving appliances and equipment
15			Water-saving irrigation utilization of green space
16	HVAC	Hot and cold sources	Summated refrigerating coefficient of performance (SCOP) of concentrated cold source chiller (heat pump)
17			Coefficient of performance (COP) of concentrated cold source chiller (heat pump)
18		Distribution system	System distribution efficiency
19	Electrics	Lighting system	Lighting power density
20		Equipment energy saving	Target energy efficiency of transformers
21	Landscape environment	Outdoor lighting	Nightscape lighting power density of the building elevation
22		Rigid pavement	Solar radiation absorption rate of rigid pavement
23		Greening environment	Shading rate of outdoor parking space (exploratory index)
24			Tree shading rate in walkways and bicycle lanes (exploratory index)
25			Number of arbors per 100 m^2 green space
26			Woody plant species
27	Interior finish	Decoration material conservation	Integration rate of civil construction and decoration

Conclusion

The green building index system based on detailed low-carbon ecological planning adheres to the requirements of sustainable development, combines green building with urban low-carbon ecology to formulate the index system, reasonably associates green building with low-carbon ecology, and promotes better urban development. This index system guides and makes great contributions to the future development of low-carbon ecological planning and green building in the world by combining multiple specialties.

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