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Research on the Green Building Index System Based on the Low Carbon Ecology Detailed Planning

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ABSTRACT: A lot of exploratory demonstration work has been carried out in the fields of low carbon ecological planning and green building domestically and overseas that have formed their index systems. However, there is an empty space in the research that how to form a direct index correspondence between the green building and the superior low carbon ecological planning. Through the research between the domestic and overseas low carbon ecological planning indexes and the related green building indexes, based on the conclusion of practical experience this thesis combines the targets of green building and urban low carbon eco-development combining the Beijing local characteristics from a detailed plan stage. It also establishes the index system of low carbon ecology detailed plan stage and green building plan stage. The detailed plan stage covers space planning, traffic, resource utilization and ecotope and 20 indexes. The green building plan stage covers the building, structure, water supply and drainage, heating, ventilation and air conditioning, electric, landscape environment and interior trim and 27 indexes. The indexes in these two stages are mutually corresponding and are put into practice layer-by-layer in examination and approval. It provides a practical index system for the development of the Low carbon ecological planning and green building in the world.

KEYWORDS: Low carbon ecological planning; Green building; Index system.

INTRODUCTION

Now the world is going into alow carbon age and the development of low carbon becomes a key issue of every city's development in the world. China's the 12th Five-year Plan has clearly put forward that "clear the idea of green and low carbon development; focus on energy conservation and emission reduction; improve the incentive and restriction mechanism; speed up the construction of resource-conserving and environmentally friendly production mode and consumption model". Low carbon eco-planning and green buildings have been moved to an important status. The report of 18thPeople's Congress of Communist party of China also proposed that "Focus on the green development, cyclic development and low carbon development that form the resource-conserving and environmentally friendly spatial pattern, industrial structure, production mode, life style and reverse worsen of environment and create a better environment for people's producing and living and contribute to the ecological safety of the world".

ANALYSIS OF PRESENT DOMESTIC AND OVERSEAS LOW CARBON ECO-PLANNING INDEX SYSTEM

Research on the Domestic and Overseas Low Carbon Eco-planning

The metropolises all over the world give great impetus to the construction of low carbon ecological city, such as the Masdar of United Arab Emirates Abu Dhabi and China-Singapore Tianjin Eco-city that have been introduced the idea of low carbon ecological city. The comprehensive low carbon eco-planning not only covers the application of low carbon technology, such as the utilization of renewable energy sources, the energy saving renovation of buildings and the construction of public transit system, but also includes the guide and specification mechanism led by planning strategy. In the fields of land, transportation, energy, virescence and architecture and so on, low carbon ecological city has corresponding planning concept and action (Table 1).

The stage of development of western large cities has passed, so the city pattern has been formed basically and it is very difficult to adjust and change urban spatial structure. Western world focuses on the green building, such as the building energy-saving renovation and small-scale ecological community in the field of energy conservation and emission reduction. However, China has been in an overwhelmingly different stage of development and the urbanization has been in the ascendant. Therefore it is significant to explore one low carbon ecological implementation suited to national conditions from a lay of macroscopic project.

Table 1. Planning and strategies of international Low-carbon city.

Classification	Strategy category	Detailedfields	Detailedaction and key point
Space	Land	city planning	TOD development mode, adding the density appropriately
Transportation	Transportation	Individual transit	Boost bicycle project, management of transportationneed, power-driven project, green taxi project
		public transit	BRT technology, low emission transportation system, intelligent public transport card system, field low emission limitation
Energy	Energy	Supply and transit	Application of renewable energy technology, reward mechanism of renewable energy, blend energy production,smart power grids
		For electricity	LED roadway lighting, intelligent lighting system
	Water	Water supply and consumption	Decrease the leakage of water supply, increase the use ratio of water and cut the water resource consumption
		Sewage/rainwater	Recycle of sewage, intelligent management ofrainwater
	Waste	House refuse	Encourage the recycle of refuse by adjustment price mechanism, reduce the waste, biodegradation
			Reduce the non-house refuse, refuse recycle, landfill, flue gas recycle
Ecology	Virescence	Ecological protection	Urban landscaping and keep the biodiversity, protection mechanism of green open space, ecological block, disaster prevention and emergency
Building	Building	Residential building	The promotion of energy efficiency/ building renovation, production of renewable energy sources in base, roof greening
		Public building	The promotion of energy efficiency/ building renovation, Building rating system, nursery finance for building renovation, production and well-knitdevelopment of renewable energy sources in base, standard control of build and development

The Practice of Beijing Low-carbon Ecological Function Area

Recently, in Beijing, many low carbon ecological function area practices has been carried out in typical functional areas of the city such as Yanqing County, ChangXindian of Fengtai and future science and technology of Changping. Green building ecological community of ChangXindian of Fengtai proposed aneco-friendly city planning strategy mixed with space planning, resource utilization and ecological remediation and innovatively carried out the low carbonguiderule of regulatory plan. Studying and implementing the goal of ecological city as the city planning management, it has added ten ecological indexes land remising that completely solved the difficult problem of eco-development goal in the urban construction. Green building ecological community of Chang Xindian of Fengtai is the first practical eco-planning project with a complete system (Figure 1) [6].

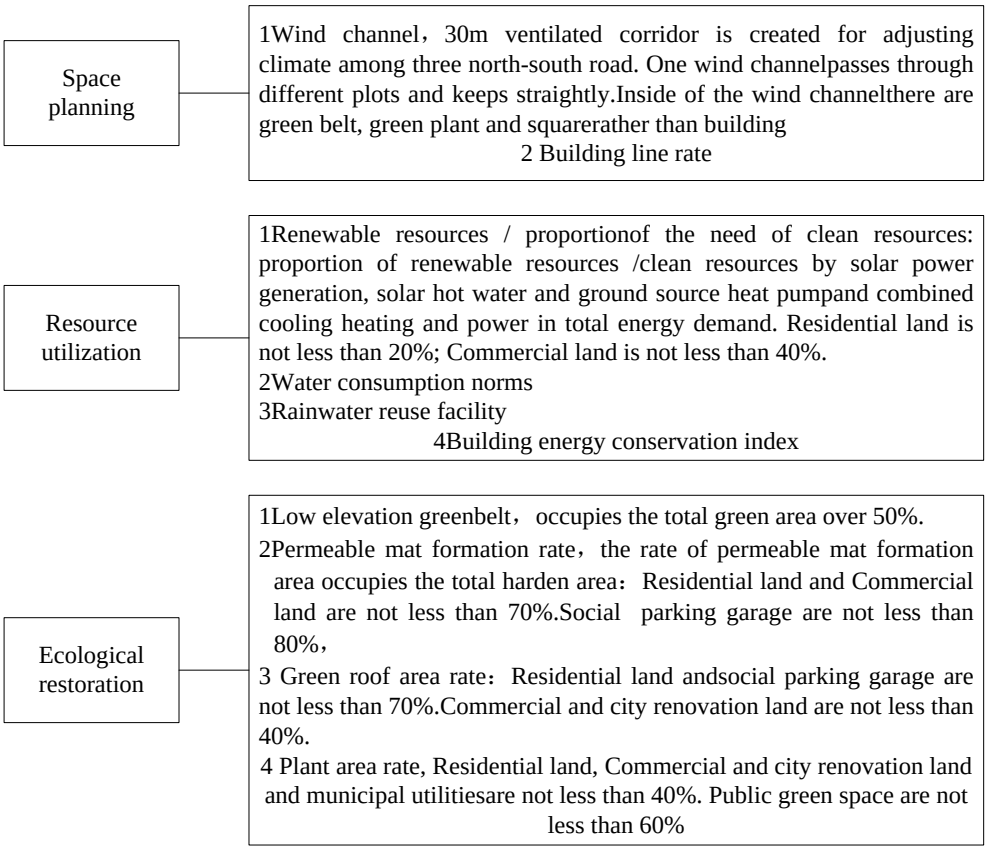

Figure 1. Index of green building ecological community planning of ChangXindian of Fengtai.

RESEARCH AND ANALYSIS OF PRESENT DOMESTIC AND OVERSEAS GREEN BUILDING INDEX SYSTEM

Foreign Standard and Idea for Formulating of Green Building

Since 1990s, the western world has successively carried out several green building standards that are different in the detailed evaluation methodology. Japanese comprehensive assessment system for building environmental efficiency (CASBEE) has proposed that the evaluation of green building need comprehensive positive and negative factors. Through the building environmental efficiency (BEE), the comprehensive balance between the building performance and environmental costs can be considered comprehensively. German assessment system for green building (DGNB)has combined the economical index and full life circle idea, and proposed a scientific computing method the life cycle cost (LOW CARBON) that can dynamically compute the construction cost, operation cost and cost-recovering and make green building match the fixed building performance optimization and get the goal of environmental protection and energy saving. USA has assessment system of green building for community (LEED-ND)that mainly includes the smart land selecting and connection, community mode and design, green building and technology, innovation and designing method. And its general framework covers site selecting, efficiency of water resources use, efficiency of energy use, atmospheric environment protection, effective use of material and resource, design process innovation and regional advantage. And the objects of standards above are the results of design, and their influence on design is comparatively indirectly and lack guide and control during the whole design.

Present Chinese Green Building Research

The research of green building in China divided into two layers: design and evaluation. In November 2010, Chinese Ministry of Construction of urban-rural housing issued the "Specification of green design of civil building" in which the chapter and section are divided into several parts such as the site, building, water supply and drainage, heating and ventilation and electric and so on. It also proposed the technology integration and optimized direction and chose the fitting green technical system. Because this specification focuses on the design guide of building monomer level, the plan cannot directly match the sustainable development of the whole city. In August 2011, Beijing released Green building assessing standard that focused on the assessment of specific building and the description of design goal. From six aspects land saving and energy saving, water saving, material shaving, indoor environment to the operations

managements, it evaluates the building, and gets the star level results according to the satisfied number of terms. In order to implement the low carbon ecological city strategy, green building and development of ecological city should be jointed. The practicable and enforceable index system—green building index system based on the low carbon ecological with detailed planning. However, based on the formulation of low carbon ecological with detailed planning, it is necessary to use the domestic and overseas correlational research fruits and practical experiences. And owing to their differences, it is more direct to use Chinese advancing explore in the fields of style, section and operation etc. But as for the overseas relevant practical research, we pay more attention to design idea, standard, mutual relations among design actions, the formulation and management of specific index of green building design.

THE GENERAL THOUGHT OF FORMULATION OF GREEN BUILDING INDEX SYSTEM BASED ON LOW CARBON ECOLOGICAL SPECIFIC PLANNING

Analysis of relations among index system, low carbon ecological planning and green building

The green building index system based on low carbon ecological specific planning integrates the low carbon ecological city strategy and building design. low carbon ecological city stresses the transportation, building and virescence and so on; building design covers building, structure, water supply and drainage, heating, ventilation and air conditioning, electric, landscape environment and interior trim etc. These two divisional indexes are matched in the specific planning, spatial planning, traffic organization, resource utilization and ecological environment as the breaking point of two indexes that can realize the transition from the low carbon eco-planning to green, building (Figure 2). The mutual correspondence among low carbon ecological city strategy, specific planning section and building design section are tight. For example, low carbon ecological city strategy encourage the non-motor vehicle traffic in the traffic section, which closely links to the spatial planning, traffic organization in detailed planning section and the building and landscape environment of building design section and needs a small block design and creates a urban scale that is both friendly to pedestrians and bikers with the enough bus stops; in the level of building, the distance between building and bus stop are controlled and the comfortable non-motor vehicle are offered that can implement the low carbon ecological city strategy step by step. The ideas of low carbon ecological city strategy in the virescence field and building field urge for the implementations of spatial planning, traffic organization, resource utilization and ecological environment and the building design (Figure 3).

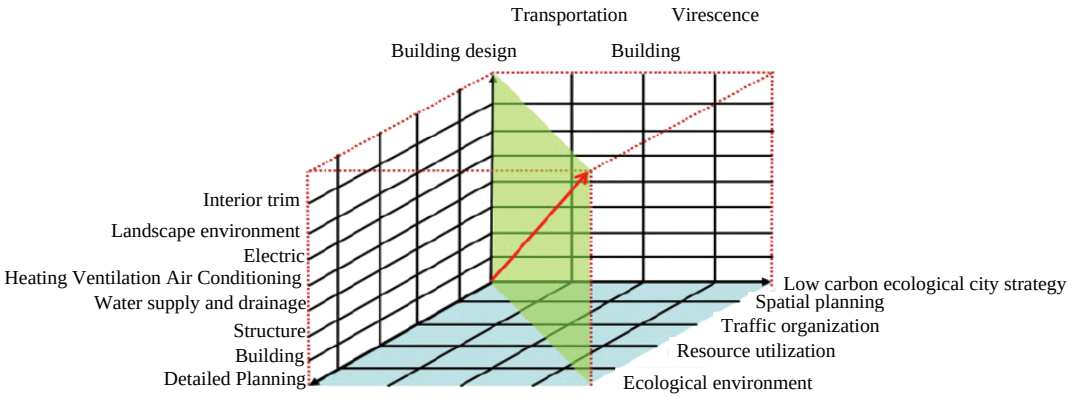

Figure 2. Analysis of relations among low carbon ecological city strategy, detailed Planning and building design.

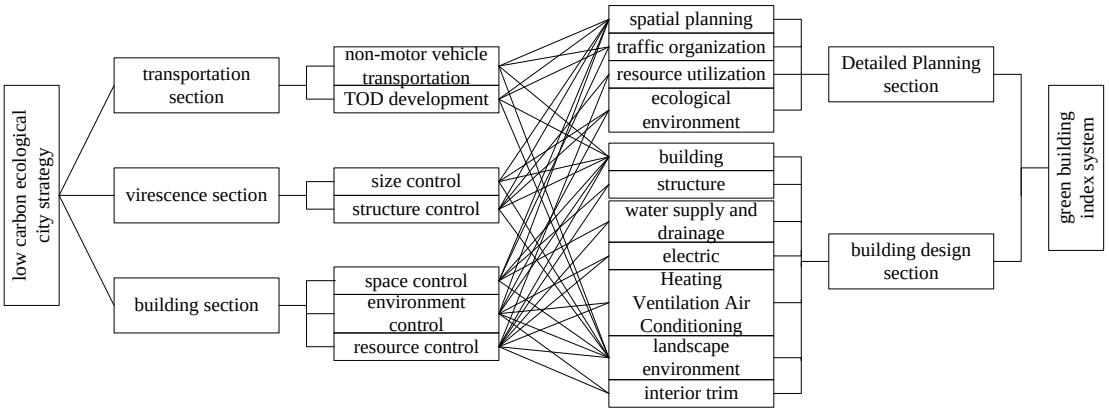

Figure 3. The indicators oflow carbon ecological city strategy, detailed planning section and building planning.

The General Thought of Index System

Guided by urban low carbon development, grading index management and control mechanism "guided by planning, index controlling, index implementing and index verifying" is established, and green building index system based on low carbon ecological detailed planning is set up that can link the indexes of detailed planning stage with ones of building design stage and can be implemented in the stage of examination and approval. In the end, it will pass the identification assessment and guarantee the implementations of planning strategy and the building design (Shown as Figure 4).

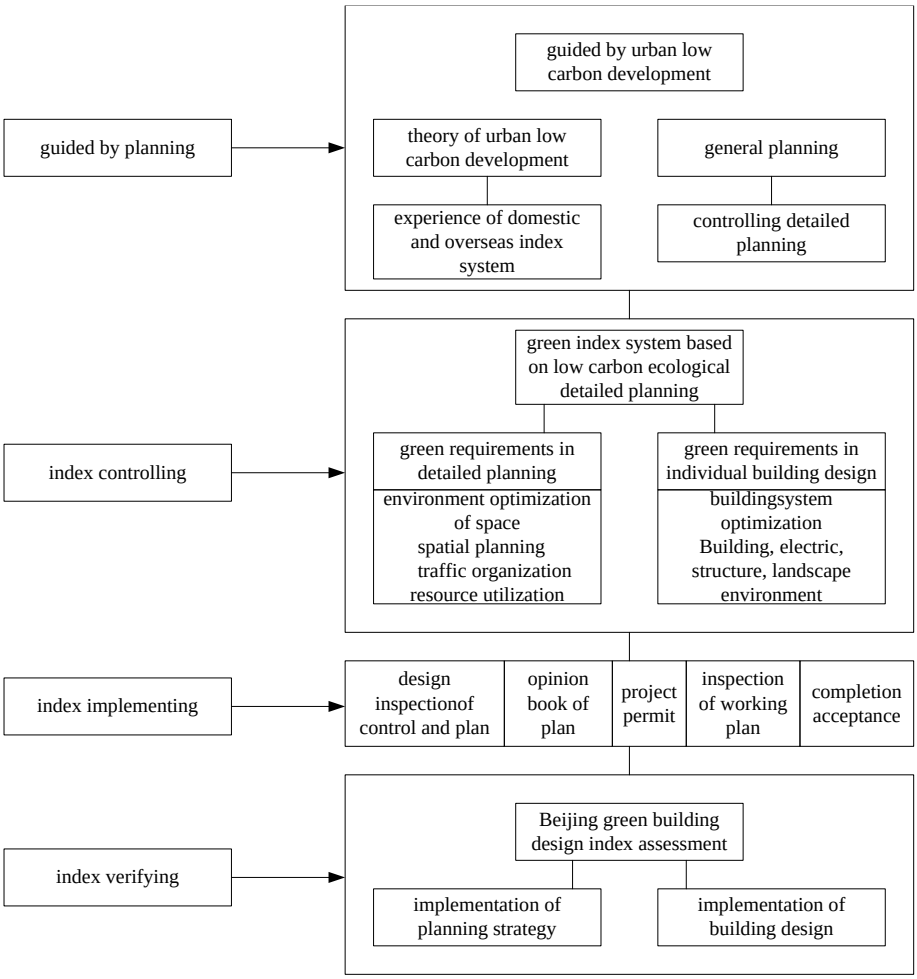

Figure 4. The general thought of the construction of index system.

GREEN BUILDING INDEX SYSTEM BASED ON LOW CARBON ECOLOGICAL DETAILEDPLANNING

The Principle for Setting Index System

(1) Stress the guide of planning. In order to realize the comprehensive benefits of green building in the resource saving and environmental protection, it not only need to get the specific goal of "environmental protection of four section" in the building design, but also need create a good basic condition for low carbon ecological city strategy in detailed planning. The goal of energy conservation and emission reduction and the work of goal decomposition of individual building design need the general coordination by planning that the indexes scattered in each section are set in the unified system. And the more macroscopic sustainable development will be corresponded and that realizes the combination of green building and low carbon ecological city strategy.

(2) Stress the reference of index. Through the study of the index of present typical functional zone and the analysis of important section influencing the urban carbon emission, the main influence factors are divided into spatial planning, traffic organization, resource utilization and ecological environment according to the urban planning that form the detailed planning design index system. This system is the example of Beijing low carbon ecological development goal in urban planning and building design and gives consideration to the requirements of management and design. Index system corresponding to the basic construction system expresses the requirements in each design stage and realizes the

full coverage of planning management and building design. The index system is brought into the planning opinion book, inspection of project, inspection of working plan and other management stage that can realize the management and control of the whole design.

(3) Stress the localization of index. The high urban function of Beijing brings complex traffic congestion, environmental pollution and urban management problems. And the resource and environment stress are more and more serious and the urban construction faces serious resource bottleneck. Energy, water and materials and other key resource of the urban development depend on the external support heavily, including that 63% of energy uses arecoal-based resources; deficient water occupying 1/30 of the world per capita; simple biological community structure, and grass lawn occupies 80% total urban green land. Therefore, the establishment of green building index system based on thelow carbon ecological detailed planning that is focused on the most principal contradiction of sustainable development combines the characteristics and economic strength of Beijing and shows its own characteristics.

The Establishment of Index System

(1) The establishment of the index of detailed planning. According to the operability and universality of plan and design, the key indexes of low carbon ecological design of the detailed planning and green design of building design are extracted. And the control system of design goal of green building from the detailed plan to the individual design are set up that strengthens the relation between the planning stage and building designing stage, and matches the requirements of optimized planning design. From the original 56 indexes including industrial indexes, low carbon ecological planning index system experienced the repeated reputation guided by the operability of planning design Excluding the industrial indexes conformed to the traits of regulatory plan and green plot ratio, supply station of new energy automobile and other immaturity indexes in the architectural design. Finally, the detailed planning index system of four-categories 20 indexes including spatial planning, traffic organization, resource utilization and ecological environment. Related to the low carbon ecological planning system this system guarantees the quantification and implementation of low carbon ecological city strategy.

(2) The construction of index of building design. The building designing proposes 27 indexes in seven domains from the architecture, structure, water supply and drainage, heating, ventilation and air conditioning, electric, landscape environment, interior trim. In the field of low carbon ecological strategy, building design index need the conversion and match with the detailed planning index. For example, green trip proposes the index "the distance between bus stop and entrance of building are not bigger than 500 m" that matches" coverage of bus stop are around 500m" of the detailed planning that guarantees the realization from plan to building design; in the field of resource utilization, the setting of indexes such as high-performance building materials, water saving instrument, lighting power are all in order to realize the control of energy consumption in detailed planning; the virescence environment proposes the indexes "shade rate of outdoor parking space are not less than 30%", "shade rate of footpath and bicycle lane are not less than 75%", " the number of arbor per 100 ㎡ are not less than 3", " the number of woody plant's kind", that are the extending of detailed planning "ratio of forest land" in architecture.

Implementation of Index System

(1) Planning management. Supervision system of index with the principal line of capital construction is conducive to the implementation of the whole process. The legal base of planning management that is the regulatory plan is introduced, and in the stage of regulatory plan, the special green index is implemented, combining the management process and the plan of approach to the implementation management is formed. In the capital construction process. The examination of regulatory plan is a premised link, so a special examination of regulatory plan green building should be set. During the stage of examining the opinion book of plan, the examination of special project of green building are set up and the control of land grant on the green building related planning indexes should be strengthened; during the period of planning permission of construction projects, plan approval documents should set the special column of green building including the green building goal of the project, green building method and technique used by the design; during the period of examining the working plan, the indexes of opinion book of plan are carried out and the key points and stipulations of examine of the primary design and working plan of green building should be strengthened; during the supervision and acceptance phase, if the project meets the requirements of plan that will be supervised and the building operations and equipment installation quality are tested specially.

(2) The integration of design. In the management of the designed unit, the design documents in different stages have strict requirements: the proposal for the project must determine the target of green building and list the cost estimation of green building increment; feasibility study report must offer the operation strategy of green building; project design must include the green building special column; the primary design must cover the green building method, technology and investment estimation etc. with the integration table; the working plan should have a note of requirements for operation and management of green building with green building integration table; the test of working plan need include the green building special design examination opinion. In the indexes flow, the node control is set up that can guarantee the detailed realization of low carbon ecological city strategy.

CONCLUSION

Based on the low carbon ecological detailed plan, index system of green building are set up sustainably with planning first. The index system of low carbon ecological detailed planning linked with green building design is established combing the targets of green building and urban low carbon ecological development. Through the correspondence of green building and low carbon ecological planning, the empty plot between the planning idea and implementation of building. The index system integrates the related majors that guides the planning work of green ecological urban area, green settlement, low carbon ecological town and individual green building and provide a practical index system for boosting the world low carbon ecological plan and green building development.

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