

Practice and Innovation of Low-carbon Concept in the Planning of Hongqiao Business District

Yang Wenyao

Along with continuous development of social economy, global population keeps increasing, energy consumption aggravates, and environment keeps deteriorating. In particular, utilization of large amounts of fossil energy¹ results in continuous increase of discharge of green-house gas, thus causing global climate warming. Since the beginning of the 21st century, energy safety and climatic change has been a wide concern of the international society, it becomes more and more clear that only the low-carbon development mode is the sole means of responding to global climatic change and that it will become one of the major targets for social and economic development in the new era of the mankind.

1. Connotation of low-carbon concept

Low carbon refers to lower discharge of green-house gases (mainly carbon oxide). Literally, low carbon may contain the following two meanings: first, reduction of energy sources used, and second, improvement and optimization of energy structure, as well as reduction of carbon density in energy sources. The origin and evolution of the concept has undergone a long process. In a wide sense, low carbon is a concept with a very extensive meaning, containing contents in many aspects. It is also a concept which keeps developing, for efforts and innovation of various countries in the world are continuously supplementing and perfecting its connotation.

- **Low-carbon economy**

The concept of low-carbon economy was first proposed in the UK in 2003 in an article of the “White paper on energy sources”², entitled “Future energy source, creation of low-carbon economy”, which aroused wide concern from the international society.

As pointed out in the “White paper on energy sources”, “we have to handle the menace from climatic change”, “our country need a new policy on energy sources”, “we have the opportunity to transform British economy into low-carbon economy without hesitation, develop, utilize and export most advanced technologies, create new business, and provide more employment opportunities...”. Therefore, low-carbon economy may be summarized as achieving more economic output through less consumption of natural resources and environment pollution, namely “low energy consumption, low pollution and low discharge, high performance, high efficiency and high benefit”.

- **Low-carbon society**

Since the concept of low-carbon economy was proposed in the UK, transformation to low-carbon economy has become the general tendency for economic development of the

whole world. The concept of “low-carbon society” was proposed by the Central Environmental Review Committee, a consultative institution for the Minister of Environment in Japan. In its “A study on low-carbon social mode in Japan and its feasibility” promulgated in February 2007, the Japanese government proposed the target for reducing CO₂ discharge by 70% as against 1990 by the year of 2050. In May 2008, it further proposed the “action plan for the low-carbon society program”. The Japanese low-carbon society observes three basic principles, namely, reducing carbon discharge in all departments; advocating frugality, achieving high-quality life through more simple ways of life, and shifting from a high consumption society to a high-quality society; and harmonic coexistence with the Nature and maintaining and safeguarding natural environment becoming essential pursuance the human society.

- **Low-carbon city**

“Low-carbon city” is a concept closely related to urban construction proposed after “low-carbon economy” and “low-carbon society”. After the meeting held in Copenhagen in particular, people got to recognize the position and function of the city in the course of development of low-carbon, and upsurges of discussion of the concept of low-carbon city appeared in various parts of the world. Many domestic and foreign experts, including many planners and architects, have made deep studies but have not reached unanimity yet. No matter how the concept is defined, the basic characteristic remains quite clear – “low-carbon city” stresses the development mode where an overall consideration is taken of economic, social and environmental factors; it stresses that unified planning, policies and procedures should be formulated under the guidance of the low-carbon concept and that the public should participate extensively. “Low-carbon city” is an innovation of low-carbon concept in the field of urban construction, as well as a development of and integration with the concepts of “low-carbon economy” and “low-carbon society”.

From the entire process from British “low-carbon economy”, Japanese “low-carbon society” to “low-carbon city”, we can clearly see the absoluteness of the low-carbon concept, namely, it is a global concept with a highly unified target of the whole world- improving the level of human development and promoting sustainable development. Furthermore, we can clearly understand the relativity of low-carbon concept, namely, it has different emphasis points in different countries and regions and at different stage of historical development. Therefore, the low-carbon concept should be such a vision that, under sufficient consideration of the socio-economic development stage, characteristics of natural resources and geographical conditions, scientific development level and innovation capability, social awareness and capability level of an economic entity, increases carbon productivity³ as much as possible and finally improve the level of human civilization development, so that the social economy may advance along a path of sustainable development.

2. Development of low-carbon concept in China

Recent years have witnessed much attention paid to the low-carbon development mode in China, but the relativity of the low-carbon concept decides that at the present stage, development of low-carbon economy, construction of low-carbon society, or establishment of low-carbon cities will all be under restraint of many factors in developing countries like China:

- China’s huge population⁴ and its growing tendency in a certain period of time will put

pressure on the control over total carbon discharge;

- Heavy chemical industry with high carbon discharge still holds an important position in China, now at an essential stage in its process of industrialization;

- China is at a stage of quick urbanization, and nearly 3/4 of carbon discharge in the world comes from cities. The carbon discharge of cities in china will increase in a certain period;

- China's characteristics in the respect of energy sources determine that coal still remains to be the main energy source at the present stage;

- China has inadequate reserves for low-carbon technology and is weak in its capability of independent innovation, showing a big gap when compared with advanced countries;

- improvement of people's awareness and reform of social systems require a long and complicated process...

Of course, the low-carbon tide will bring new growth points to economic and social development in China, such as creation of new forms of employment opportunities, promotion of improvement of scientific and technical level and innovation capability, and optimization of energy structure. In recent years, the Chinese government has intensified its efforts in this aspect ⁵, and clearly expressed its attitude on several occasions regarding development of low-carbon economy and construction of low-carbon society. In September 2007, President Hu Jintao clearly advocated "development of low-carbon economy" at the APEC meeting. He pointed out that China should "make great efforts to develop green economy, and active efforts to develop low-carbon economy and cycle economy" at the UN summit meeting on climatic changes in September 2009. In December 2009, the Chinese government proposed that by the year of 2020, carbon discharge percentage per unit GDP should come down by 40%-50% in comparison to that of 2005.

3. Practice and application of low-carbon concept in the planning of Hongqiao Business District

In the respect of combining low-carbon concept and urban planning and construction, the Chinese government has invested a lot of man power and materials in its active exploration and innovation to push ahead with development and improvement of the theory of low-carbon city. Among representative projects are the core area of Shanghai Hongqiao Business District, Tianjin Zhongxin Ecological City, Beijing CBD East Extension, and Tangshan Caojitian Ecological City. The Hongqiao project, in which the author participates directly in its whole process, is one of the most typical cases of low-carbon city construction.

- **Tianjin Zhongxin Ecological City**

Located in Tianjin Binhai New Area, Tianjin Zhongxin Ecological City is 15km away from the

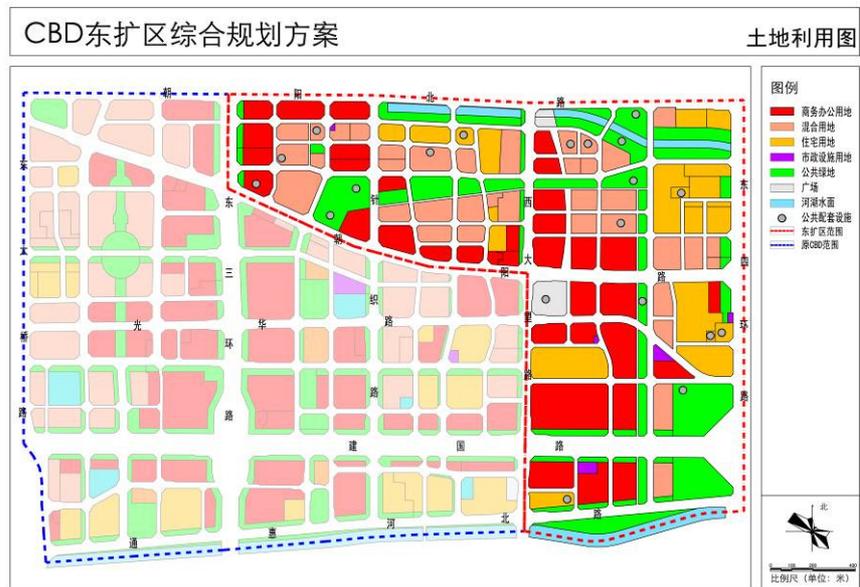


core area of the new area, with around 34.2 square kilometers land under planning. As planned, it will become a platform of independent technical innovation for ecological protection, energy saving and discharge reduction as well as green buildings in China; a state-level exhibition center for R&D and exchange of education of environment protection as well as ecological industrial base; a window participating in international business regarding development of ecological environment; a exemplary ecological new city suitable to live in.

The planning of this project emphasizes control over ecological system, establishment of a green transportation system, as well as repair and maintaining of a water ecological environment, and a key study is made of the energy system as well as the planning and construction of green buildings. Graphics

- **Beijing CBD East Extension**

Beijing CBD East Extension Beijing CBD East Extension refers to the eastern extension of present CBD along Caoyangbei Road and Tonghui River up to East No.4 Ring, with about 3.0 square kilometers and 7 million square meters of total floor area. The east extension will have the same function as the present CBD, stressing on development of head office economy, international finance and high-end business, so that the CBD may become a modern high-end business district.



From : the Planning of Beijing CBD East Extension

The planning of the east extension continues the style of the present CBD and emphasizes the low-carbon design concept while ensuring its integrity, particularly in the respects of green energy supply, efficient energy transmission/distribution, advocating of low-carbon working and living style, as well as standard for architectural energy saving. It will become the first business district of low-carbon discharge in the whole world.

- **Tangshan Caofeidian Ecological City**

Located in the east part of Caojidian New Area, Tangshan, Hebei, Tangshan Caojidian Ecological City is 120 km distant from Tianjin, with 150 square kilometers of area under planning. The concept of ecology and cycle is carried out in the planning and construction so as to build this ecological city into a future city, an innovation city, an ecological city and a happy city. Its most outstanding characteristics include its own ecological indexes system including many aspects such as water utilization and processing, garbage processing and

utilization, development and utilization of new energy, transportation assurance, plantation system, public facilities, city scenery and green buildings.

● **Core area of Hongqiao CBD**

Located on the western side of the central part of Shanghai, Hongqiao CBD is established under consideration of Hongqiao Comprehensive Transportation Hub. The core area of Hongqiao CBD is the area with most concentrated business functions in the CBD, neighboring with the main body of the transportation hub, and having an area of around 3.7 square km⁶. In its planning, the concept of low-carbon and community is proposed in order to create in Shanghai the first vigorous and attractive low-carbon CBD of diversified functions, easy transportation, pleasant space and high ecological effect.

Through establishment of a system of low-carbon indexes, the low-carbon concept is realized at various stages of urban construction, expressed mainly in the four respects : urban spatial layout, transportation organization, energy utilization and architectural design (Table 1).



From :the Regulatory Plan of the Core area of

Table 1: System of low-carbon indexes

| Urban planning layout | |
|--|----------------------------------|
| Mixed configuration of housing blocks | reaching 100% |
| Average plantation ratio in housing blocks | Over 30% |
| Walking distance to the nearest green space | Not over 200m |
| Energy and resource management | |
| Percentage of buildings under contractual energy management | Not below 50% |
| Percentage of buildings under energy consumption supervision | Reaching 100% |
| Utilization ratio of rain | Not below 30 % |
| Utilization ratio of non-conventional water sources | Not below 20 % |
| Green transportation | |
| Percentage of green trips | Not below 90% |
| Dispatch interval of backbone bus lines | Not over 5 minutes |
| Percentage of bus lane or priority lane | Not below 20% |
| Percentage of shaded walk and bicycle lane | Not below 80% |
| Waking distance to the nearest public transportation station | Not over 400 m (about 5 minutes) |
| Waking distance to the nearest shop of daily necessities | Not over 800m (10 minutes) |

| Architectural design | |
|--|---------------|
| Percentage of one-star green buildings | Reaching 100% |
| Percentage of green buildings of two stars and above | Not below 50% |
| Total energy consumption of architectural design below state-approved/filed index of energy saving by | Less than 80% |
| Percentage of external window of a building that can be opened | Not below 50% |
| Percentage of main functional space with indoor natural lighting satisfying national standards | Not below 75% |
| Proportion between roof greening area and total roof area that can be made green | Not below 50% |
| Proportion between main sunshine area and the integrated adjustable external shading of the building | Reaching 100% |
| Percentage of the building which avoids light pollution from curtain walls and outdoor scenic lighting upon peripheral buildings | Reaching 100% |

From : the Regulatory Plan of the Core area of Hongqiao CBD

(1) Mixing

The integral homogeneous unity is the general character of the spatial pattern of the core area, high-density, small size and low height is the most distinct regional characteristic, diversified mixed-use is the essential step taken in the functional arrangement in the low-carbon CBD. The principal function of the core area is business office, and its supplementary functions include retails, culture and entertainment, sports and leisure, high-end conference, display of fine works, catering and hotel. The development area for Phase I of the core area totals about 1.7m square meters, with business/office making up about 60%. In the respect of planning layout, conventional mode of functional area gives place to the highly efficient mode of mixed penetration and flexible combination. Business/office is evenly arranged while hotels are dispersed to some extent. Business function relies on retail, mainly covering high-grade, middle-grade and daily shopping areas. High and middle-grade shopping areas are aligned along the axis, while the daily shopping area is located in public space within the housing block in combination with business/office. The entertainment and sports function, mainly including catering, coffee bar, fitness, theater and cinema, art gallery and museum, are all mixed with offices and hotels. The functional layout of 3-dimensional spaces embodies the character of diversified mix. The business function is arranged above floor 3, while shopping function is mainly assigned in the range of basement 1 to floor 3, with other functions being mixed there. The mixed layout will effectively reduce trips necessitated through connection between different functions, being an important embodiment of



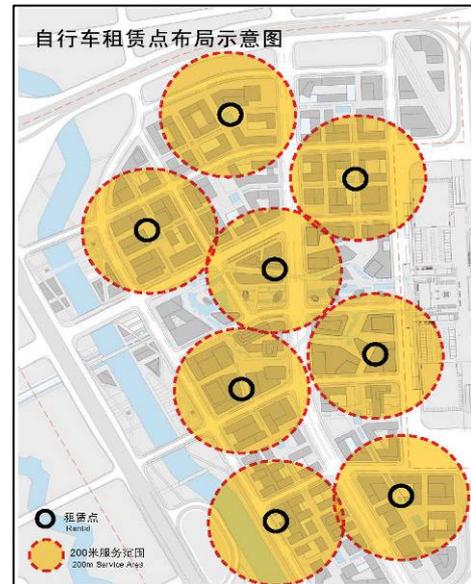
From :the Regulatory Plan of the Core area of

low-carbon and energy saving.

(2)Green transportation

In the respect of transportation organization, low carbon is to build up a green transportation system, and advocate and implement a transportation mode with public transportation as the mainstay.

By encouraging public transportation and strengthening static transportation planning, this project aims at controlling the amount of private transportation in and outside of the core area, thus attaining the target of carbon reduction. As generally planned, the public transportation network of the business district will have 4 bus lines for external connection as well as one internal ring bus line. New types of energy-saving environmentally friendly vehicles will be used for connection to pivot and transit public traffic lines. Furthermore, public bicycle rental points of 500m service radius will be set up, with each point having at



From : the Regulatory Plan of the Core

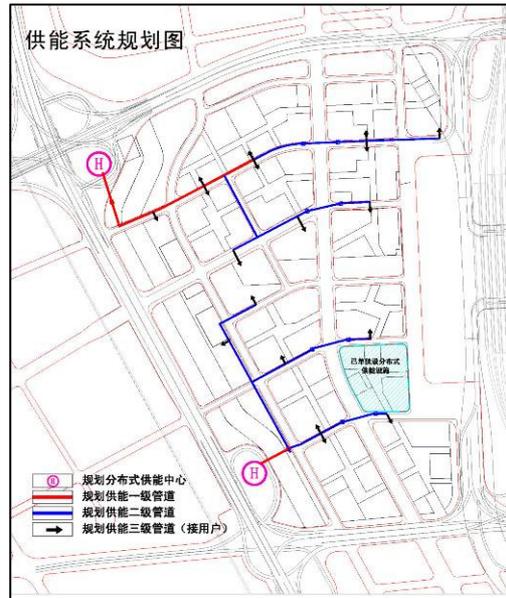
least 20 bicycles, so that a green transportation mode of “metro public bicycle” may be established. With respect to static transportation planning, aggressive steps will be taken to control the upper limit of parking space⁷ on the principle of moderate supply, which will be arranged in the 2 basements. Underground parking space is planned to reach 11.000 positions.

Walking system is not only an important short-distance transportation form, but also a constituent part at the start and end of all transportation means; in the meantime, it is an embodiment of urban characteristics. Shopping walks on the ground pass through the entire core area of the CBD. Basement 1 walking space directly connected to transportation pivot, and floor 2 corridors integrated to the middle shopping area form a cubic distribution of pedestrian and vehicle flows in the core area, so that a safe, comfortable and convenient walking transportation is guaranteed on the ground floor, basement floor and floor 2. Green land, squares and public facilities, connected via walks, become the primary carrier for waling activities as a important part of the green transportation system.

(3)Green energy

Energy utilization refers to utilization of “green energy”, including utilization of solar energy, wind electricity and water electricity, as well as application of new technologies and processes for improving energy utilization efficiency. The comprehensive efficient energy utilization is the key link of low-carbon concept in urban planning and construction and also a basic guarantee for the construction of low-carbon cities.

This project adopts a distributive energy system of combined gas cooling/heating and electricity, supplemented during night valley by electrical accumulation. In the long run, netted green electricity from regenerative energy will be used as supplement, and photovoltaic lighting of solar energy and photo-thermal domestic water system will be used as demonstration. Furthermore, contractual energy management mechanism will be introduced, namely, based on the requirement of urban planning and design and under consideration of such project circumstances as design capacity, energy utilization time and piping space, a commercially operated contractual energy service company will set up two regional energy centers. In such a way, it will manage the construction and operation of the whole investment of the project, take on all purchasing,



From :the Regulatory Plan of the Core area of supply and management of energy sources for the area, undertake or trust integrated energy supply and saving services of the project execution units, and share with them the benefits from the transactions regarding verification of discharge reduction.

The distributive energy supply system refers to the energy supply system using gas power generation system as the key equipment, characterized through efficient utilization of energy steps, reliable electricity supply, good economic benefit and environmental friendliness, which can provide electricity, cooling and heating to the housing blocks. This project adopts 4-pipe cooling, hot water system, requiring an independent heat exchange station and heat-measuring device in each building.

(4)Green building

Construction work and maintaining building operation is a major consumption of urban energy, therefore, architectural energy saving is an important component of low-carbon concept.

In the layout of architectural space, the size of the housing blocks is minimized and their building density is increased. As planned, the size of a housing block is around 150x200m⁸, its scale is between 3 and 5 hectares, and its building density is mostly above 50%. Block streets are arranged in good order, and the buildings adjoin closely with each other, thus effectively reducing the total heat dispersion area of the buildings. Furthermore, single unit of building, mostly adopting an architectural pattern of regular shape and big depth



From :the Regulatory Plan of the Core area of

in an enclosed layout, facilitates formation of a pleasant micro-climate in the public space of the blocks.

In the design of architectural greening, roof greening is encouraged through various means. Roof greening has an extremely important meaning in increasing urban forestation area, alleviating urban hot-island effect and sandstorm harm to the mankind, improving living conditions and life quality, and beautifying urban environment. In the planning of the core area of the CBD, the area of roof greening is 50%, which can be included in the proportion of green land.⁹

With respect to architectural design, all buildings must meet the requirement on energy saving, and the whole process of architectural design, construction and operation will proceed strictly in accordance with the “evaluation standard for green buildings” of the state. Among the main technologies are new building materials, external shading system, water saving system, regulation device for natural lighting and intelligent energy management equipment. The core area of the CBD will have over 6 green buildings of 3-star grade of the national standard¹⁰. Green buildings of 2-star grade and above will make up over 50%, and all buildings will meet the state standard for green buildings of one star grade. High-grade green buildings will become the symbol of the core area of Hongqiao Business District, a highlight of the CBD and even urban construction in Shanghai and an important characteristic differentiating it from other business districts.

Implementation of the project of Hongqiao CBD core area has started in all respects, and that has an important meaning in pushing forward the development of the theory of low-carbon city in China. Many low-carbon measures and related technologies adopted in the court of planning and construction are not necessarily the most advanced ones in the world, and some of them are relatively backward ones, but that is the first solid step China takes on the low-carbon development road under special circumstances, and the exemplary and pioneering part it plays will surpass by far the role it plays with respect to carbon reduction.

4. Conclusion

Urban planning is an embodiment of public interests and a guide for urban construction. To realize the low carbon concept in the course of urban construction, we have to give full play to the planning. Therefore, combination between the concept of low carbon and the theory of urban planning remains to be the key point of our future study. Innovation regarding regulations of management for urban planning and its formulation, and innovation regarding design ideas and means for urban planning is worthy of our high attention. For that reason, the author suggests that special subjects should be established at the level of management and formulation of urban planning and those relevant laws and regulations should be revised to guarantee execution of the low-carbon concept at various stages of urban construction. Furthermore, we should realize how important the establishment of a low-carbon index system is to the construction of low-carbon cities, and that its scientificness and accuracy has a direct bearing on the final effect of construction of low-carbon cities. There is now limited systematic research on the low-carbon indexes in the world. With respect to the appraisal method for low-carbon indexes, various countries and regions, under restraint of such reasons as technical conditions, find it missing or difficult to unify. That is another topic

which needs our special attention.

Yang,wenyao, shanghai urban planning and design research institute, China

Notes:

- 1. Fossil energy is a kind of hydrocarbon or its derivative, mainly including coal, petroleum and natural gas. Originating from sediment of fossil of ancient organism, it falls into the category of primary energy.**
- 2. White paper on energy sources refers to the report promulgated by the Trade and Industry Ministry of the UK on February 24, 2003, entitled “Future energy sources – creation of low-carbon economy”, which forms the original document on the subject of low-carbon economy.**
- 3. Carbon productivity refers to the GDP produced through unit discharge of carbon dioxide. Its increase means less material and energy are used to produce more social property.**
- 4. As forecast in relevant data, China’s population will still grow in the near future, and it will reach its peak of 1.5b by 2030 or so.**
- 5. Laws such as “Law of energy saving”, “Law of regenerative energy sources”, “Law of low-carbon economy” and “Law on promotion of cycle economy” have been passed and promulgated for implementation.**
- 6. Phase I of the core area of the CBD covers around 1.4 square km construction area.**
- 7. As specified in prevailing relevant stipulations in China, parking space in plot planning should be controlled in the method of low limit.**
- 8. In China, with exception of few housing blocks in the area of old towns having small size due to historical reasons, the others have an average size over 200 x 200m and relatively low density of road network.**
- 9. Proportion of green land is a compulsory index in the management of land planning and management in China, established for the purpose of ensuring environmental quality of the land plot. The conventional meaning of green land does not include roof greening. But, to encourage roof greening, this project throws away relevant prevailing regulations and makes it an index under calculation.**
- 10. In China, there are now a total of 8 green buildings of 3-star grade, 7 of them being public buildings.**

References :

Du,feilun(2009)” Reflections on the development of low-carbon economy in China”, Resources and environment, NO.10,pp30-31.

Du,feilun(2009)" The necessity and mode of development of low carbon cities in China", China Population, Resources and the Environment, vol.19.NO.3,pp12-17.

Liu,zhiling,Dai,yixin,Dong,changgui&Qi,ye(2009)"Concept and international experience in low-carbon city", Urban development research,vol.16,NO.6,pp1-7.

Lu,xiaochun(2009)" Practice and Prospects for low-carbon development in Shanghai", Shanghai energy conservation, NO.4,pp7-10.

Qi,ye(2009)" From reality, take the road of China's low-carbon", Green Leaf ,NO.1,pp51-56.

Shao,wei(2009)" New issues facing the Chinese economy is a low carbon economy", Urban development research,NO.9,pp33-34.

Wang,ling(2010)" Low-carbon development path of China",Impact of science on society,NO.1,pp.33-34.

Wu,xiaoqing(2008)"Recommendations on creating a lowcarbon economy in China" Environmental Protection , NO.5.pp22-23.

Xin,zhangping(2008)" low-carbon economy and low-carbon city", Urban development research,vol.15,NO.4,pp98-102.

Zhang,kunmin(2008)" China' s role ,challenges and strategy for the low carbon world"China Population, Resources and the Environment , vol.18.NO.3.pp1-7.

Zhang,xue(2009)"Low-carbon economy:Opportunities and Challenges", jie neng yu huan bao ,NO.7,pp14-16.