SPATIAL PLANNING IN SHENZHEN TO BUILT A LOW CARBON CITY

Introduction

Cities are the key to sustainability. According to the State of the World's City 2008/2009 (UN-HABITAT, 2008), 60% of the world people will live in cities. To abate urban CO_2 emission and energy consumption, a lot of cities over the world have adopted Low Carbon Economy as a new development philosophy, and to create Low Carbon City (LCC) has become a common goal.

Among the measures that contribute to LCC, urban planning should be concerned as a precondition since it can 'lock' the CO_2 emission and energy use by determination to the spatial structure of a city. According to Pan and Tang et al. (2008), the physical space form of a city will deeply affect the modes of socio-economic activities once it has been built. Although the adjustment of industrial structure, healthy life style and technological innovation are helpful to cut down the CO_2 emission and energy use in production and living, however, these measures can hardly change traffic volume and relative energy consumption and emission determined by urban spatial structure.

Shenzhen is one of the cities which have been urbanized very fast in China. In less than 30 years, Shenzhen has been developed boomingly from a remote smaller border town with a population of merely 20,000 into a prosperous modern metropolitan which plays significant roles in Pearl River Delta and even in Southeast Asia. However, the booming urbanization process has also caused a lot of problems, such as shortage of land and water resources, constrains of energy, vulnerability of ecological system, deterioration of environment, increasing CO_2 emission and improving heat island effect, etc. In order to break these bottlenecks of sustainable development, Shenzhen integrates the target of LCC into urban planning via spatial layout, delimitation of ecological baseline, density zoning, renovation of land-use mode and creation of green living environment.

1. The Compact and Resilient spatial structure

As mentioned above, urban planning determines the spatial structure and finally determines the energy use and CO_2 emission of a city. Constructed to the loose pattern of urban structure once prevailing in Europe, consolidated pattern is more appropriate to Asian cities which are highly popularized and constrained by limited land area since consolidated spatial pattern can efficiently control urban sprawl and save energy. During the evolution of Shenzhen's spatial structure since Shenzhen's Master plan 1996, the framework of consolidated development pattern has already been established by three axes from west to east and clusters with the Special Economic Zone as the main urban center (Fig. 1). The

spatial pattern displayed in Figure 1 not only tailors to Shenzhen's natural landform, but also integrates resources among different clusters via the connection of development axes and thereby improves resource use efficiency.

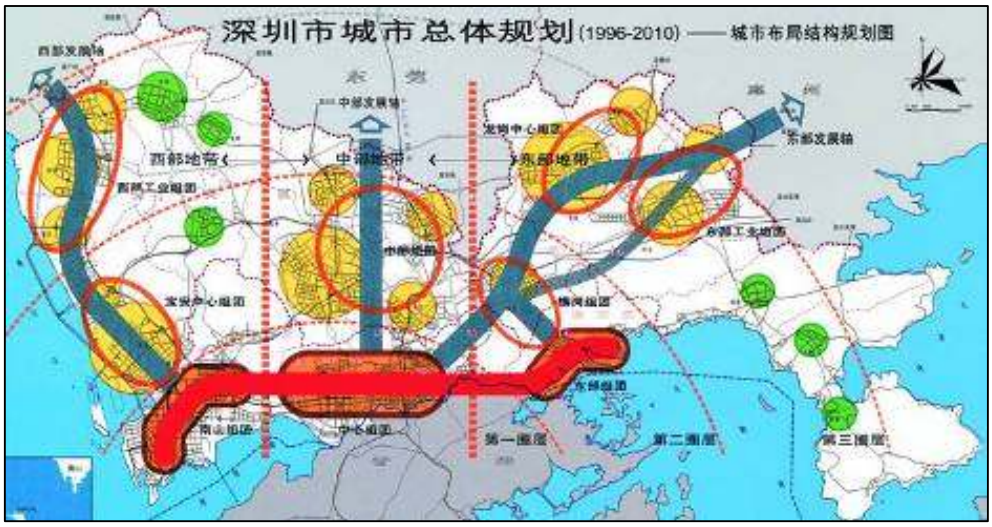

Figure 1 Urban Spatial Structure Plan 1996-2010

Source: Shenzhen Urban Master Plan 1996-2010

With the boom of growth poles on and out of the three axes, the spatial structure of Shenzhen is turning into a spatial network. Development belts have been come into being and cluster centers become to be denser than ever. Against this background, the north and south development belts were framed into the original spatial layout and the cluster system was improved into a hierarchical urban center system in the new Master Plan of Shenzhen (Fig. 2). While keeping compact in structure, the new spatial layout is more resilient and adaptive to future development of the city.

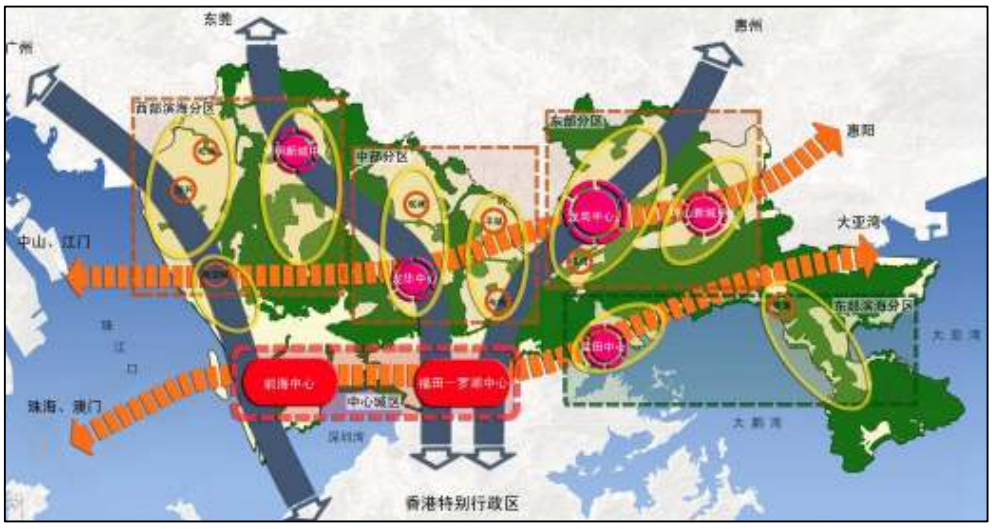

Figure 2 Urban Spatial Structure Plan 2009-2020

Source: Shenzhen Urban Master Plan 2009-2020

2. Delimitation of ecological baseline to maintain ecological security

Based on the fear of over urbanization and corresponding excessive CO_2 emission, Chinese urban planners have got a common understanding in control the speed of urban sprawl by delimitating ecological baseline for the city – the so called 'urban growth boundary'. In 2005, Shenzhen Municipal Government issued the Ordain of Shenzhen Basic Ecological Control Line. According to the Ordain, nearly half of the land area of Shenzhen that falls in the scope of the Basic Ecological Control Line is permanently prohibited from development (Fig. 3). In this way, Shenzhen maintains ecological security of the city under the pressure of fast urbanization and then achieve sustainability.

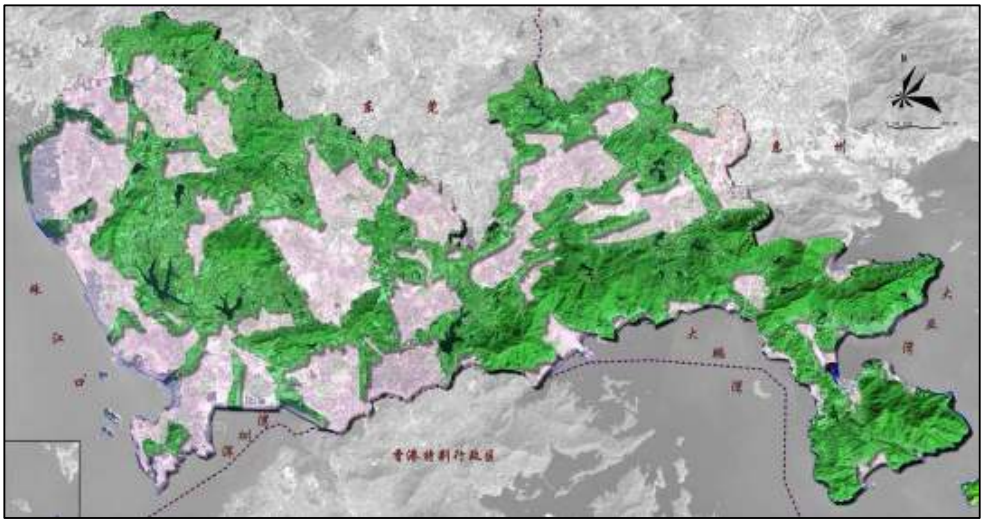

Figure 3 The Scope of Shenzhen's Basic Ecological Control Line

Source: The Plan of Shenzhen's Basic Ecological Control Line

Furthermore, Shenzhen also set down the 'Blue Line' and the 'Purple Line' in urban planning to reinforce the governance of water resource and historical and cultural relics respectively. All these measures have played a significant role in protecting spaces of strategic ecological importance and thereby contribute a lot to Shenzhen's sustainable development and construction of LCC.

3. Improvement of land-use efficiency by density zoning and urban renewal

The extensive and inefficient use of land is also a main reason leading to high energy consumption and CO_2 emission. In 2007, the GDP output per km_2 of Shenzhen is RMB 0.9 billion yuan, only 1/3 of the land-use efficiency of Singapore and 1/7 of Hong Kong. To improve the land-use efficiency in Shenzhen, the measure of density zoning was proposed in the Master Plan. An important principle of the density zoning was to keep consistent with urban structure and the characteristics of physical and socio-economic environment. In this way, the density zoning classified the city into three featured areas which are explored to

different density grades. From low to high the three types of density permissions are respectively corresponding to ecological reservation area, periphery urban area and kernel urban area (Fig 4). In ecological reservation area, the development intensity is strictly controlled in low level.

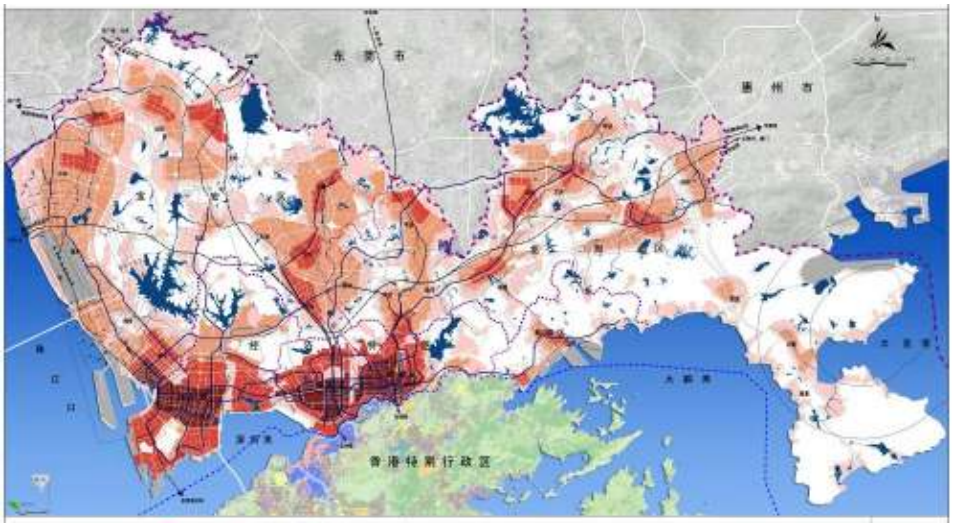

Figure 4 The density zoning plan

Source: Shenzhen Urban Master Plan 2009-2020

At the same time, urban renewal becomes an important measure to control the immoderate development of untapped built-up land and break the development bottleneck of land resource shortage. According to the Master Plan, the newly increased land area for development in following 13 years should be limited in 140 km^2 whereas the renewed land area should achieve 190 km^2 (Fig.5). In this light, urban renewal becomes the key to realize the renovation of land-use mode toward higher efficiency.

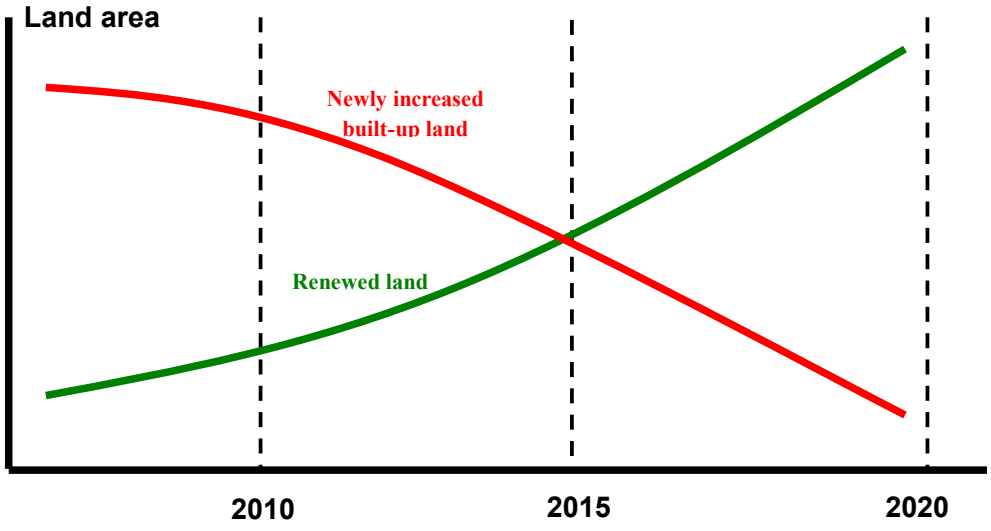

Figure 5 The relationship between newly increased built-up land and renewed land

4. Creation of green living environment: the urban green system

Green land is the natural absorber of CO_2. A well planned green system can greatly decrease the CO_2 emission and reduce heat island effect of the city. Shenzhen compiled the first Green System Plan in 2002. After times of amendment, the Green System Plan tends to be more integrative with the theory and philosophy of ecological zoning and gives more prominence to inner correlation and functional diversity of ecological system. The Green System Plan also pays much attention to the providing of public Greenland. Based on the traditional urban park plan, Shenzhen's Green System Plan takes the requirement of ecological conservation and recreational activities of residents into account and establishes a hierarchy of three grades which is constituted of outskirt parks, urban parks and community parks (Fig. 6). The public green system not only provides favourable places for recreation and leisure of citizens, but also increases refuge areas and thereby effectively improves the ecological security level of the city.

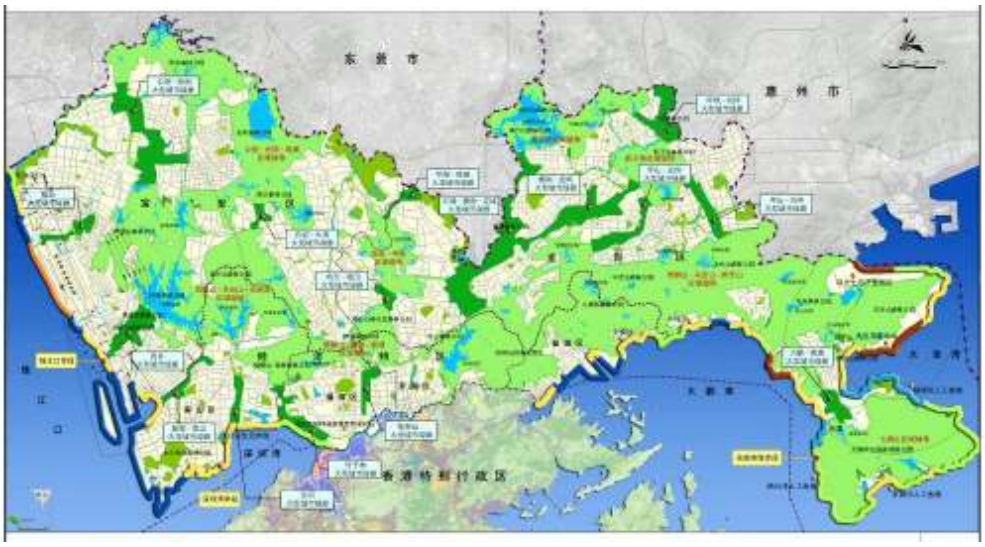

Figure 6 Urban Green System Plan of the Master Plan

Source: Shenzhen Urban Master Plan 2009-2020

5. The environment friendly traffic plan

The pattern of traffic organization is highly related to the development level of LCC since it determines the energy consumption and the tail gas emission of vehicles. With the improvement of living quality, the use of automobiles in Shenzhen is increasing year by year. As a result, problems of traffic jams, traffic pollution and traffic security are also aggravated much more than ever. In order to solve these problems, both the Integrative Traffic Plan and the Master Plan of Shenzhen have offered the development of public transit the first priority. According to the plans, Shenzhen will develop a passenger transportation system with the railway traffic as the pillar, the regular traffic as the majority and multiform traffic modes developing cooperatively. The plans indicate that by 2020 the public transit sharing rate should exceed 70% and the tail gas emission should be cut off by 70%. The achievement of

these targets will effectively promote the sustainable development of LCC.

Figure 7 The plan of public transit of Shenzhen
Source: Shenzhen Urban Master Plan 2009-2020

Conclusion

Experience of Shenzhen in LCC development can be summarized into five aspects:

1. Consolidated pattern of spatial layout is more efficient in resource use than loose pattern. As an important manifestation of consolidated spatial pattern, the 'axes + belts + cluster' framework of spatial layout plan is helpful to organize the urban structure in a compact but resilient way for the sustainable development of the city.

2. The delimitation of ecological baseline is an effective measure to maintain ecological security of the city. In order to protect the integrity of the ecological baseline from destroying and encroachment, government should enact corresponding laws or regulations to restrict illegal development in time and reinforce dynamic monitor to the development activities in reservation area.

3. In order to avoid excessive CO_2 emission caused by inappropriate organization of land functions, the extensive and inefficient land-use mode needs to be renovated. In this regard, scientific density zoning can be tackled to moderately improve land-use intensity and efficient; and urban renewal is an important measure to release land resource and break the bottleneck of land shortage.

4. The green land system of the city, as the main CO_2 absorber and the provider of favourable living environment, needs to be elaborately planned. In this process, the

application of theories of landscape ecology and the specific concern in citizens' requirements to open space are much preferable to the sound green land system plan.

5. The traffic organization mode directly determines the level of energy use and CO_2 emission of a city. The spatial structure of LCC in China must be established on the framework oriented by public transit system. To some extent, neglecting public transit system in traffic plan means giving up the sustainable future of the city.

Reference

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