ECO-CITY AND ECO-PLANNING IN CHINA: TAKING AN EXAMPLE FOR CAOFEIDIAN ECO-CITY

Qiang, Ma *

* Tsinghua University, 100084, Beijing, P.R.China, Email: ma-q@tsinghua.edu.cn

ABSTRACT: China is now beginning to build eco-cities throughout the country. Eco-city means much to Chinese cities, which are faced with rapid urbanization and development. But the eco-city plans in China are carrying on in different ways. Caofeidian eco-city in Tangshan is a important and large-scale project in China, and it absorbs many interests from different parts. Caofeidian eco-city plan presents some attempts on how to build a coastal eco-city under severe conditions. However, it shows that eco-city planning is far from quite perfect, and there are lots of things to be done.
KEYWORDS: Eco-city, Conventional planning, Eco-city planning, Caofidian

1 RECENT PROGRESSES OF ECO-PLANNING IN CHINA

Chinese government has called for building "a conservation-oriented and environment-friendly society" since 2003, which is called in other words, "Two-oriented society". From then on, a new policy emphasized on "harmony between humanity and nature" has emerged. Nearly at the same time, a new notion, "conservation culture", has been appeared in China, which is first mentioned by President Hu Jintao during the 17th Chinese National Communist Party Congress in the time of Oct.2007.

As the most important physical space to build the "Two-oriented society", more and more Chinese cities realized that they should develop, plan, build themselves by totally different ways.

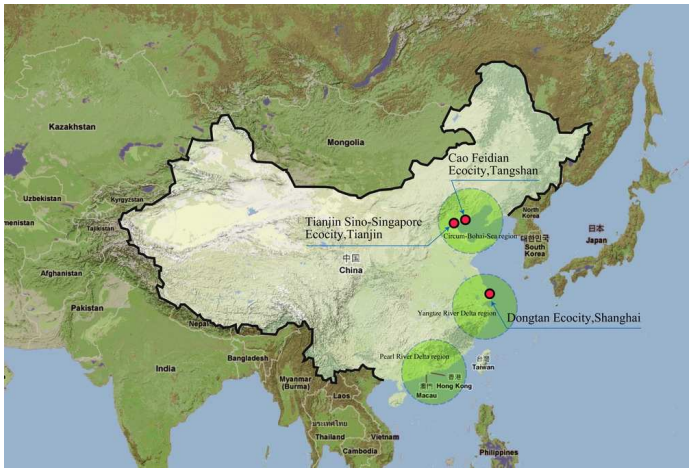

Figure 1 Three representative eco-city examples in China

The hope well-timed echoes a new wave of city ecological planning (eco-planning, ab.) globally. As we know, "eco-city" was first systematically proposed by Richard Register in his book "Eco-city Berkeley: Building Cities for a Healthy Future", 1987. Since then, the notion of eco-city became fashionable throughout the world.

In the beginning of 21th century, there is an upsurge in China to build eco-cities. In May, 2003, Chinese ministry of Environmental Protection issued "Guidelines on building ecological province, ecological city and ecological county", which was revised in 2007.

However, how to plan, design and build a eco-city physically is not defined clearly. There are two different ways in eco-city planning and design in China nowadays, one stems from eco architecture design, in another word from microscope level, which focus on “designing” an eco-city physically; the other roots in ecology and environmental science, which do researches from macroscopic level, mainly on “research”. But how the conventional city planning should change following the tide of “eco-city” is underdetermined.

In these circumstances, otherwise, Chinese cities do not hesitate to carry on kinds of eco-city plans, which consist of different scale development, in which the most famous three examples are Dongtan Eco-city in Shanghai, Sino-Singapore Eco-city in Tianjin, and Caofeidian Eco-city in Tangshan.

1.1 Dongtan Eco-city Planning

Dongtan eco-city, planned by Arup in 2003, was located on Chongming Island close to Shanghai, with accommodation for 50,000, in time for the Expo 2010 in Shanghai. By 2040, the city is slated to be one-third the size of Manhattan, with a total planned population of 500,000 . Dongtan was presented at the United Nations World Urban Forum by China as an example of an eco-city. The cities are planned to be ecologically friendly, with zero-greenhouse-emission transit and complete self-sufficiency in water and energy, together with the use of zero energy building principles. Energy demand will be substantially lower than comparable conventional cities due to the high performance of buildings and a zero emission transport zone within the city. Waste is considered to be a resource and most of the city's waste will be recycled.

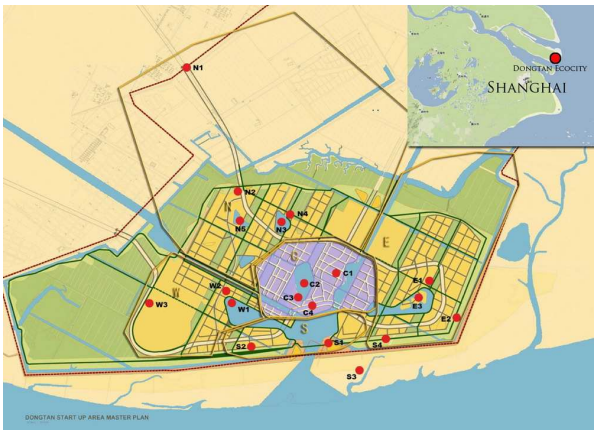

Figure 2 Master Plan of Dongtan Eco-city

However, no construction of the eco-city has taken place yet, and all references to Dongtan were removed from the Shanghai World Expo website.

1.2 Sino-Singapore Tianjin Eco-city Planning

The Sino-Singapore Tianjin Eco-city, designed to be 34.2 square kilometers, is the result of a collaborative agreement between the Governments of China and Singapore to jointly develop a socially harmonious, environmentally friendly and resource-conserving city in China. Designed to be practical, replicable and scaleable, the Tianjin Eco-city is actually the first experiment to plan, build a new city in an ecological way.

The Master Plan of Sino-Singapore Tianjin Eco-city was jointly developed in 2008, by the China Academy of Urban Planning and Design, the Tianjin Institute of Urban Planning and Design, and the Singapore planning team. In the planning of the Tianjin Eco-city, one of the main guiding principles was to adopt a holistic approach towards creating and designing a livable, efficient and compact city, which would be developed in an ecologically sound and environmentally sustainable manner.

There is a set of 26 Key Performance Indicators (KPIs) for the Sino-Singapore Tianjin Eco-city. In formulating these KPIs, reference is made to national standards in China and Singapore, as well as international standards. These 26 KPIs were divided by four groups, (1) Good Natural Environment, (2) Healthy Balance in the Man-made Environment, (3) Good Lifestyle Habits, (4) Developing a Dynamic and Efficient Economy.

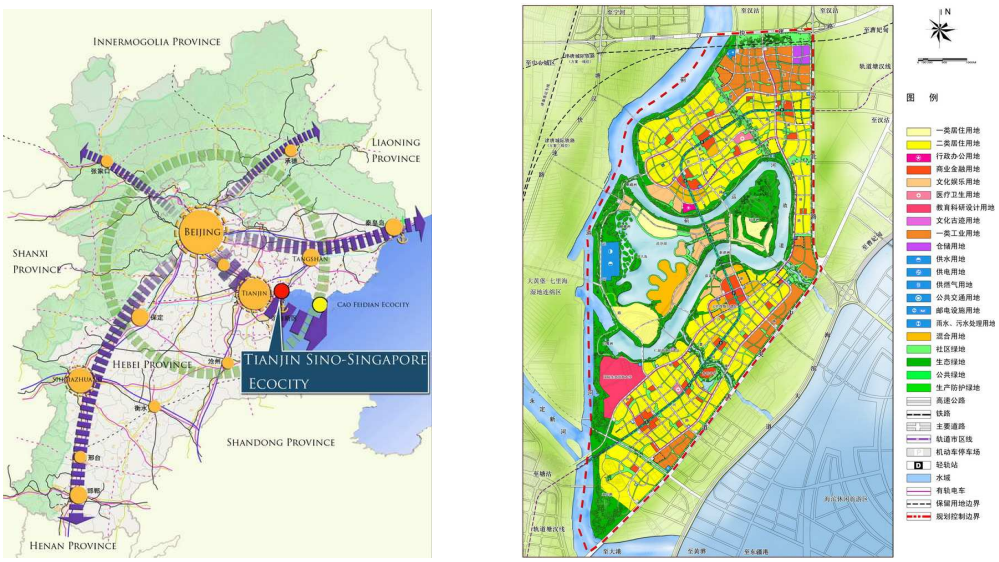

Figure 3 Master Plan of Sino-Singapore Tianjin Eco-city

The planning of Sino-Singapore Tianjin Eco-city has great influence on the way of eco-city planning in China. According to the leading planners of this project, there are seven distinct innovations in this planning, such as protection on natural ecological structure, land use layout planning, green transportation, ecological neighborhood planning, cultural context preservation, water resource utilization, energy saving as well. Especially, to build a system of KPIs in the process of planning was followed by many other eco-city plans.

Marked with the planning of Sino-Singapore Tianjin Eco-city, Chinese cities enter into a massive period of eco-city planning.

1.3 Caofeidian Eco-city

Following Sino-Singapore Tianjin Eco-city, Tangshan municipality also wants to build a new coastal eco-city, Caofeidian Eco-city, which is near to the south of Sino-Singapore Tianjin Eco-city.

Caofeidian, located offshore to the south of Tangshan, was a small belt-like alluvial sandy isle formed over 5,500 years ago under the lashing force from inlet flows of the ancient Luanhe River into the sea. Caofeidian has the best condition to build coastal harbor in the area of Bohai sea. From 2003, the central government of China and Tangshan authority began to construct the Caofeidian harbor which can stop a ship up to 300,000 tons. Moreover, many big industries have move to Caofeidian industrial area, in which the best known is “Capital Steel and Iron Corporation”.

Following the construction of great harbor of Caofeidian and subsequent industrial development, there is a urgent need to build a new city to provide accommodation and public facilities for the people working there. Furthermore, the top officials in Tangshan city wish this new city to be a sub-center of Tangshan.

The top officials hope the new city should meet their some expectations. First of all, the planning of Caofeidian new city should gives answer on where the city is. The government wishes the city is totally by the sea, a coastal new city. Secondly, the plan should answer how the city will to be. The new city should be built based on a totally different modal compared with nowadays conventional cities in China, in other words, an eco-city will be favorable; Thirdly, Caofeidian new city should be play much more roles on supporting the industrial development.

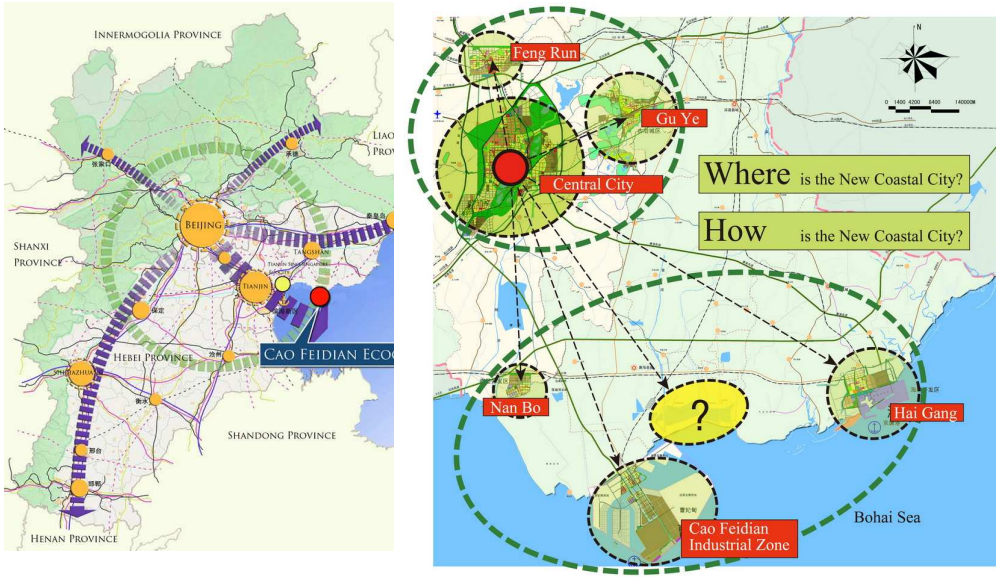

Figure 4 Location of Caofieidian Eco-city

In order to facilitate the planning of Caofeidian new city, a research titled "Strategic Planning of Southern Coastal Area of Tangshan" was carried on, in 2006, by three Chinese planning institutes, including Urban Planning and Design Institute of Tsinghua University, Chinese Academy of Urban Planning and Design, Shenzhen Urban Planning and Design Institute. By this strategic plan research, the background of Caofeidian area was deeply investigated, and the site, the population and the land of Caofeidian new city were determined elementarily. The formal name of the city was confirmed with "Caofeidian International Eco-city" (in this paper, the abbreviation of "Caofeidian Eco-city" is used frequently).

2 THE PLANNING OF CAO FEIDIAN ECOCITY

2.1 The planning procedure of Caofeidian Eco-city

The planning procedures were arranged with four phases.

Phase 1, Nov. 2007-Apr.2008, first round of international planning competition;

Phase 2, Apr.2008-June, 2008, second round of international planning competition;

Phase 3, July,2008-Feb. 2009, joint concept planning by Sweco from Sweden and Tsinghua;

Phase 4, July,2008-Nov. 2008, master planning by Tsinghua, which was approved by provincial government of Hebei in the end of 2008.

The planning of Caofeidian Eco-city absorbed interests globally, over 10 teams from different countries took part in the planning competition and processes, mainly including Arup from UK, EDAW from USA, DHV from Netherlands, ArchA from Italy, Sweco from Sweden, and many domestic institutes, mainly including Urban Planning and Design Institute of Tsinghua University, and Chinese Academy of Urban Planning and Design. Several overseas universities also involved in the planning process, such as Harvard University, Nottingham University

Tsinghua University took part in the whole progress of Caofeidian Eco-city plan, and won two round competitions. Now team of Tsinghua is preparing the regulatory plan for the first development of Caofeidian Eco-city.

2.2 The Challenges of Caofeidian Planning

How to build Caofeidian city is confront with several challenges, for example, natural resources, energy supply, protection of natural ecological system, transportation, and so on. Like other northern coastal cities of China, Caofeidian city is in the region lacking of fresh water, especially where is inadequate of rainfall and threatened by salt water heavily. Absolutely by the Bohai sea, Caofeidian city will be faced with threat of

storm surge, which will increase the difficulties and cost of construction. Additionally, the development of a new coastal city will heavily affect the original natural condition of the coastal beach, which habitat many wild animals and clusters of plants. Definitely, Caofeidian city must be constructed by the way of Eco-city, which can cope with the complicated conditions of challenges.

From the beginning, we set several principles for the planning.

(1) An environment-friendly city: respect and harmony with natural conditions and system. The detrimental effects on natural systems by the development of Caofeidian eco-city will Reduce to a minimum level.

(2) A conservation-oriented city: compact city and resources saving. Caofeidian eco-city will significantly decrease demand of land, water, and energy.

(3) A hi-tech city: reaching the standard of tomorrow city. All the ideas of Caofeidian eco-city should have long-term perspectives. So many advanced ecological technologies should be widely utilized during the building process.

(4) A healthy, safe, livable city: meet the demand of citizen. Caofeidian eco-city will provide safety of environment and ecological system.

2.3 Proposals and Response to The Challenges

Integrating ideas from many participants, Our Tsinghua team provided a planning framework including four sub-systems to deal with the challenges Caofeidian eco-city will face with.

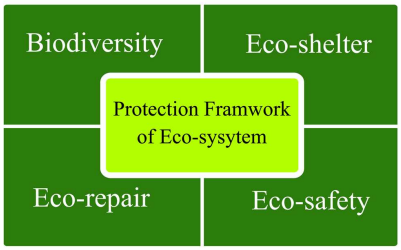

Figure 5 Framework of eco-system protection of Caofieidian

- Comprehensive ecological protection and repair system, which is placed as the premise of eco-city.

Caofeidian eco-city is in a transition region between land and sea. There are four major rivers flowing to the gulf, and there are full of sauternes and shrimp fields by the coastal area. The first thing we did is to preserve such “corridors and wetlands” in our proposals. Furthermore, we established a framework and grid of “ecological green space” based on these wetlands to keep the original ecological system from ruin.

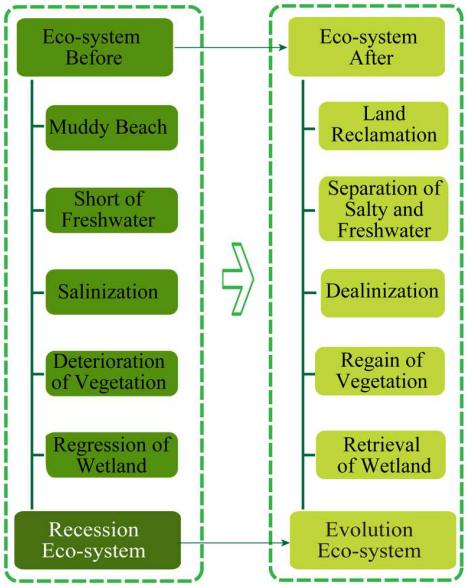

Figure 6 Changes of eco-system before and after built

There is another balance should be considered carefully, which is how to deal with the threat from the sea. The threats can be divided into two parts, one is storm, and the other is salinization of soil. Enlightened by the scheme of DHV, a team from Netherlands, we suggest that two dams be built by the way just like in Holland. These two dikes form three kinds of water space from beach to outer sea. Between the beach and inner dike is a lagoon, which could keep freshwater of two rivers. And by this way, it will be very helpful to mitigate the salinization of soil and groundwater. Between inner dike and outer dike, there is inner sea, which is peaceful and capable for many water sports. Beyond the outer dike, there is ordinary sea, which can hardly be controlled. The inner dam itself is for coastal avenue and could under the shelter of outer dike, which is used to prevent the storm and surge and therefore keep whole eco-city safe.

Figure 7 Caofeidian Eco-protection and repair system

By these means, Caofeidian eco-city will connect the natural ecological systems in a way of harmony and integration.

- Integration of land-use and green transportation

An eco-city will play much more attention on the integration of land-use and transportation. Prior to our research, we did lots of case studies of eco-planning, including from Europe, Australia, America, and Asia. We noticed a notion called “short distance city” from the report sponsored by EU, which is titled with “Eco-city: A better place to live”. The report considers that an eco-city could be studied from four parts, such as urban structure, transport, energy & material flows, and socio-economy. The most important part is urban structure, and the paper suggest an eco-city could be realized from different visions, in which the key vision is “city of short distance”, that is, an eco city should achieve balance and integration between land-use and transportation.

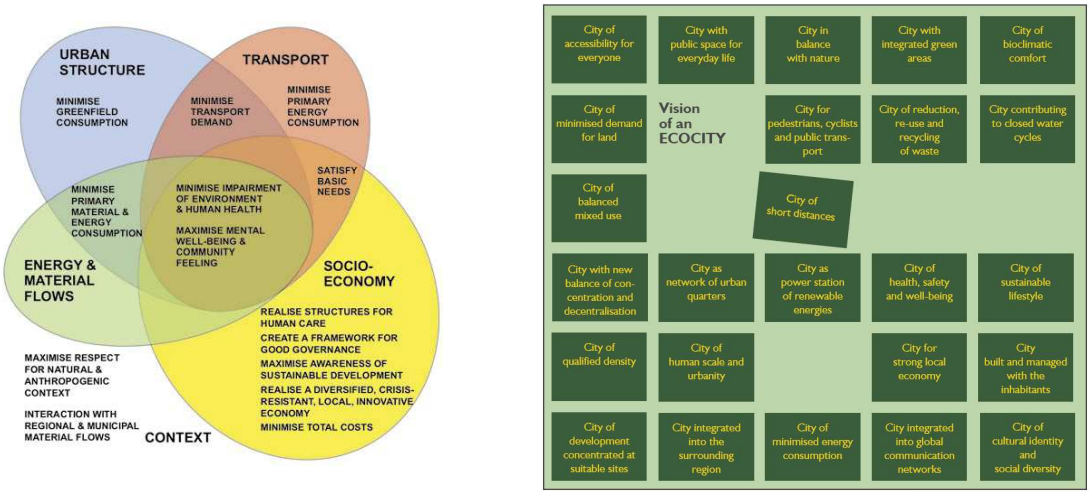

Figure 8 Vision of an eco-city, EU

How will Caofeidian eco-city turn to be a “city of short distance”? We think this goal should be achieved mainly by two measures. First, Caofeidian eco-city was planned to be mixed land-use, which could guarantee it to be a more compact city, which was separated to be more districts and sub-centers. Secondly, we design the city to be a transit-oriented city, city center and sub-centers were supported by light rail systems and BRTs. By these methods, the structure of Caofeidian eco-city will be heavily affected by public transportation and will be a city of the least land-consumption, and will be reduce trip distance. The city will be more livable and pedestrian-friendly, which will encourage less oil-consumption and carbon emission.

In the area of road system plan and transport policy, we suggest that Caofeidian eco-city adopt European road pattern, which features narrow right-of-way, dense road network, and restriction of car-use subsequently. By all means, we hope Caofeidian should be a city of short distance, traffic-calming, transit-oriented development and pedestrian-friendly.

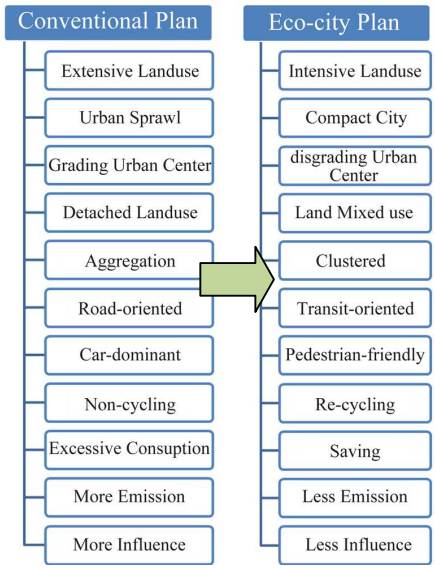

Figure 9 Conventional Planning and Eco-city planning

- Green energy and material conservation

Caofeidian eco-city locates at the site full of wind energy. So we decided that it should rely heavily on renewable energy sources, such as wind-energy. For there is oil and gas fields there, we suggest clean energy

resources, such as gas, should be utilized as possible. We planned a large wind field offshore, and hope wind energy will amount to at least 80% of total energy demand.

Learning from experience of Sweden, we realized renewable resources to be very important for the material-saving. We suggest wastes should be collected separately and treated carefully. The organic part will delivered to the recourse-management-center to get the biogas, which could fuel the public transportation. The other part of wastes could be burned for warming and to generate electric power.

Water-reuse is very important for Caofeidian eco-city. The plan encourages water-saving and reuse. We suggest reused water will account for 50% of whole water supply.

- Environment protection and urban safety

As a coastal city, Caofeidian eco city should build its flood-prevention system carefully. We provided strong dam system dependent on the outer dike, and we made use of lagoon, inner sea as space to store floodwater in emergency.

By the means of reducing emission, establishing green protection, and increasing recycling, Caofeidian eco-city will reach higher standard of environment protection.

Figure 10 Master plan for Caofeidian eco-city

3 RETHINKING OF ECO-CITY PLANNING IN CHINA

What has been shown from the planning of Caofeidian eco-city is a obvious shift of development strategy from conventional mode which is distinguished by high spatial expansion and economy growth speed, to a more rational and ecological pattern which emphasize more on efficiency. Caofeidian eco-city planning also reveals several important topics on eco-planning and eco-city, which should be clarified basically and deeply.

Figure 11 Bird-view of Caofeidian eco-city

Firstly, what are the eco-city and eco-planning, in another word, what are the key issues an eco-planning should emphasize? It can be revealed from nearly eco-city planning that what emphasizes most is the practice of ecological techniques, such as water treatment, waste recycling, and green energy. In term of planning techniques, there is little differences between eco-city plan and conventional plan. Therefore, We consider that there should be a methodology shift of city planning in term of eco-city. Besides the application of advanced techniques, we should need more planning techniques, especially of integration of land-use and transportation.

Secondly, how international ecological ideas and experiences is adopted by Chinese cities more efficiently? Chinese cities open to the overseas planners, which bring advanced ideas and technologies. However any treatment of planning should fit for today's situation in China.

Finally, how the stake-holders, such as authority, developers and citizens cooperate to implement the eco-plan until the eco-city principles ameliorate behaviors of citizens. There is a fever of eco-city in China, and what we urban planners and researchers should do urgently is to identify, clarify, and put into practice the eco-city principles scientifically and rationally.

Figure 12 City hall of Caofeidian eco-city

4 CONCLUSION

Caofeidian eco-city is now one of the biggest projects in China. Its planning is good for the eco-city planning movement. We gain wider experiences through the process of the planning, and learn much from many other planners. We do feel that Chinese cities need changing to eco-city, and eco-city planning is very promising in China.

REFERENCES

[1] Herbert Girardet ," Which way China?" China Dialogue, October 02, 2006.

[2] YANG Baojun; DONG Ke, " Theories and Practices of Eco-city Planning with Mater Plan of Sino-Singapore Eco-city in Tianjin as An Example", City Planning Review, VOL.32 NO.8, 2008.

[3] Philine Gaffron, Gé Huismans, Franz Skala, "Ecocity: A better place to live", Deliverable of the Project ECO-CITY 'Urban Development towards Appropriate Structures for Sustainable Transport' (2002 - 2005)

[4] Tsinghua University Institute of Urban planning and Design, "Mater plan for Caofeidian Eco-city (2008-2020)", 2008.