Constructing Utopias: China's Emerging Eco-cities

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ABSTRACT: Each year about 16 millions of China's rural residents – equivalent to the total population of the Netherlands – are moving into cities. This trend has continued for nearly two decades in this "largest mass migration ever seen in human history" (David Harvey). Amid such dramatic demographic shift and the resulting construction boom are ambitious plans throughout China to create new towns to house swelling population and to sustain economic growth. A series of prototype eco-new towns have been proposed in this wave of mass urbanization. They are often conceived as exemplary piece of urbanism showcasing the latest design and environmental technologies in town building, and represent a new chapter in China's continuing effort of organized urbanization as a strategy to address complex economic and environmental issues.

This paper studies three eco-new town projects, including Dongdan Eco-city, Binhai Eco-city, and Qingdao Eco-block. They were intended as "models" to showcase the best practice in planning and development and to provide duplicable experience for other cities in the country. The paper examines these eco-new towns through the lens of urbanism and utopianism, focusing on the relationship between place making and social development. These projects were either initiated by the governments or created by private organizations or joint ventures, demonstrating different strategies of developing eco-city and representing different political and economic agendas. However, they were all encountered some dilemmas due to the current land policies and prevalent patterns of urban development in China, which indicates more fundamental issues to tackle to move toward a sustainable society. Studying China's emerging eco-city movement from design and policy perspectives, this paper contribute to the understanding of new patterns of urban growth in our globalized era, and shed a new light on the strategies of dealing with the current environmental crises.

KEYWORDS: Utopia, Dystopia, Eco-city, Model new town, Architecture and social change

INTRODUCTION

China has been undergoing massive urbanization for more than two decades, which has resulted in an unprecedented construction boom and generated numerous plans of new towns. These ambitious new town projects not only serve to house the swelling population but also provide new venues to sustain economic growth in major cities. Concurrently, the country's economic marketization and entrepreneurial governance tend to encourage investments in previously untried environmental technologies, which are used in various eco-city experiments to explore future urban forms. The residential quarters often constitute the main component in the eco-cities, and embody primary planning ideas. To a great extent, these new towns and ecological communities represent emerging urban forms under China's rapid urbanization, and reflect the changing relationship between physical environment and social structure.

This paper studies three eco-city and eco-community projects, analyzing their different approaches to environmental technologies and ecological urbanism as well as different notions in applying them in community design. They were intended as "models" to exemplify the best practice in planning and development using present-day technologies, and supposedly able to be duplicated in other cities across the country. However, they often ran into practical difficulties themselves when attempts were make to implement these plans. As a result, some of them still remain on the drawing board, and for others the initial environmental agenda was substantially cut back in the process of realization. It calls into question the economic and market feasibility of eco-city concept and its compatibility with current Chinese land and planning system. Through these case studies, the paper compares different approaches to

eco-community and discusses the challenges facing the sustainable development of Chinese cities.

1. CHINA'S URBANIZATION AND NEW TOWN MOVEMENT

China's national development agenda set a goal of sixty percent urbanization by 2030, which means that each year about sixteen million of its rural inhabitants – equivalent to the population of the Netherlands – are moving into cities of different sizes. This trend has continued for more than two decades in what sociologist David Harvey regards *as* "the largest mass migration the world has ever seen."[1] In 1985, less than 20 percent of Chinese people were urban residents. Since then the urban population has grown at a rate of about one percent each year. It exceeded 50% of the national population in 2011 despite the fact that the birth rate has remained low in the cities because of China's family control policy.[2] In the meantime, the rural population has continued to drop due to the steady outflow.

The outcomes of this massive urbanization have been seen in tremendous infrastructural projects and large-scale building sites across the country from dams, bridges, and highways to gated communities, shopping malls, and spectacular civic buildings. Eleven millions units of housing are built each year in China, and ten to fifteen new communities are created every day.[3] They have fundamentally changed China's urban landscapes. More significantly, this dramatic demographic shift and construction boom has led to ambitious plans of creating new towns. At the beginning of the new Millennium, Chinese government announced that they would build 20 new cities each year for 20 years; therefore 400 new cities would emerge by 2020.[4]

In addition to the changing demography, China's "great leap forward" of new town building also has to do with local government's search for new areas of economic growth. There are more than 150 so-called National Economic Development Zones or High-tech Industrial Parks – and the number is still growing – as well as numerous similar arrangements on the provincial level. Although originally created for industrial use, most of them shifted the focus to residential and commercial development since the late 1990s under the real estate boom. These new towns are often associated with China's large cities both to decentralize urban population and to attract investment for economic development. For instance, there are about ten new towns in Zhejiang Province, most of which are located around the three major cities, Hangzhou, Ningbo, and Wenzhou.

The only precedents of such massive town building were the postwar British New Town Movement and the Urban Renewal in the United States in the 1950s and 1960s, but China's ongoing urbanization surpasses both in scale and scope of intervention. While the British movement was a systematic project of decentralization under the national planning and the US Urban Renewal focused on enhancing or replacing old neighborhoods and building affording housing, these emerging Chinese new towns are created by municipalities of the country's large cities as an economic engine to attract investments and as a branding tool to enhance the image of the cities. They thus come with a strong imprint of globalization. Carried out under an elaborate process of design and development to control physical environments, they are often conceived as exemplary pieces of urbanism, showcasing the latest technologies in town building and exploring various themes of planning.

The eco-city represents a recent development in this new town movement. China surpassed the US to become the world's largest emitter of greenhouse gas in 2007. Many projects have tried to address the environmental issues. In the meantime, China has become a laboratory for new technologies and designs where global talents seek to realize their futurist visions. The economic marketization and centralized governance continue to stimulate tremendous investments in cutting-edge environmental technologies and ideas that are sometimes harder to implement in the West. As a result, China has become the sites of many recent eco-city and eco-community experiments. They vary in scale and adopt different approach to urban planning and ecological technologies. The following sessions will focus on two groups of eco-community projects, one initiated by governments and the other created by private sectors. They represented different agendas of sustainability and approaches to ecological planning, yet both encountered issues when carrying out the plans.

2. PROTOTYPE ECO-CITIES: DONGTAN AND BINHAI

The first group includes two ambitious flagship eco-cities established by Chinese government, comparable to Masdar of the United Arab Emirates. They are Dongtan New Town in Shanghai and Binhai Eco-city in Tianjin. They were both intended as wholesale experiments of ecological planning and design on a comprehensive urban scale. Dongtan was created in 2004 and boosted as the world's first carbon-neutral eco-city. It was endorsed by Chinese and British central governments. Arup was hired for its master plan, and it will be carried out by Shanghai Industrial Investment (Holding) Co. Ltd. (SIIC) as a global example of sustainability. The 630-hecture site is located at the tip of Chongming Island, an alluvial island in the Yangtze River. The new city was expected to house 400,000 by 2050.

Figure 1: Rendering of Dongtan Eco-city East Village (Source: Courtesy of Arup).

The Arup team introduced the latest environmental technology and laid out a fairly ambitious agenda. The goal was to use 60 percent less carbon footprint than in conventional Chinese cities, and to achieve 66 percent reduction in energy demand. When built, Dongtan would run on 100 percent renewable energy, including 40 percent of the energy supplied from bioenergy. The city would recycle and reuse all wastewater. Landfill waste would be marked down by 83 percent. No fossil-fuel transportation would be allowed, with only hydrogen and electric vehicles permitted within the city. Visitors coming with conventional petrol-fuelled cars would have to leave their cars outside Dongtan and take public transit.[5]

The first phase of the new city would be organized into three villages around the city center. All housing would be located within seven minutes' walking distance to public transport. Moving away from the prevalent highrise typology in Chinese cities, the plan of Dongtan proposed midrise dwellings of five to eight stories, resulting in a density of 75 units per hectare. It would also created expansive green and water feature across the city. To support employment within the city, an institute of environmental study was proposed as the central program for the first phase, along with commercial, entertainment, and culture.

Arup's work on the project was completed in 2006 and handed to SIIC to be reviewed by the government. The original timetable called for the first phase be completed by 2010, the year Shanghai hosted the World's Fair, enabling the city to showcase its commitment to building a green future. However, no construction ever took place and the project was cancelled in 2009. Among other factors like political scandal and protest of environmentalists, there is a conspicuous gap between a radical vision and the concrete design and financial measures to

realize it.[6] The worldwide recession in 2008 also raised the concern whether the project can afford the high cost of building and operation when international funding became unavailable, and if it could be a valid model for other cities to imitate.

In 2007, the Central Government of China created another flagship new town, Binhai Eco-city in Tianjin, under a partnership with Singapore against the backdrop of increasing global attention on the importance of sustainable development. The two countries have collaborated in developing Suzhou Industrial Park since 1994, which has seen great success in urban planning and development and is now a thriving city of 700,000.[7] Binhai Eco-city was the second joint venture between the two countries. A groundbreaking ceremony of the project was held on September 28, 2008, attended by Singapore Senior Minister Goh Chok Tong and Chinese Premier Wen Jiabao. About forty kilometers from another mega-city Tianjin, the Eco-city occupies a total area of 30 square kilometers and will be home to 350,000 residents when completely built in 2020. The choice of the site with its majority being saline-alkali land and wasteland indicates the governments' awareness of ecological challenges and shrinking land resources and determination to tackle these issues. The parties creating this project learned from the lessons of Dongtan, and were able to push forward the development with a comprehensive planning framework, higher density, yet less ambitious environmental agenda.

The design guidelines of Tianjin Eco-city called for 26 Key Performance Indicators (KPIs). They refer to national standards of China and Singapore as well as international standards like LEED. Buildings would be insulated, double glazed and made of materials that abide by the government's green standards. Sixty percent of waste will be recycled. Tap water would be potable. Fifty percent of water supply in the eco-city would be from non-traditional sources such as desalination and recycled water by 2020. A mass transit will be established, including a light rail line, aiming to cut car journeys by ninety percent by 2020.[8]

Although some of these goals seem impressive considering China' current environmental conditions, compared to Dongtan's sustainable agenda, Binhai's approach to the eco-city concept is more pragmatic, even a bit low-key in terms of environmental performance. For instance, the renewable energy would account for only 20 percent of the total energy consumption by 2020, compared to China's national plan that requires 15 percent for renewable energy by 2015.[9] The majority of buildings in the Eco-city would only reach the basic level of the Green Building standards. Another KPI call for 20% of residential development to be subsidized affordable housing, but the number of affordable housing units in Tianjin has been around 50% of the total number of new housings since 2011.[10]

Figure 2: Street views of Binhao Eco-city (Source: Author, 2012).

The plan of Binhai Eco-city envisions developments to take place around a central core of rehabilitated wetlands, with four neighborhoods connected by the light rail line. The primary use is residential, but there would be a business center for the city, a commercial sub-center in each neighborhood, and some industries. The administrative building, one of the first structures, showcased most of the building standards, including double glare skin, a nice rooftop garden, solar-powered lighting fixture and solar-powered parking facility. The first neighborhood was completed in March 2012, and 60 families have moved in this residential

area. Numerous solar panels and wind turbines have been erected along major roads across the city, indicating the distinction of this city from other new districts in China.

However, when one takes a closer look at its planning and architecture, Binhai Eco-city turns out to be quite conventional. The residential neighborhoods and business centers were designed as clusters of free-standing towers indifferent to the site and context. The highrise buildings were laid out on super blocks along wide avenues where automobiles are apparently the dominant means of transportation, and cyclers and pedestrians are barely considered. The same attitude is present in the community design. The residential buildings are elevated to sit upon a one-story podium of parking deck that occupies the entire block. As a result, the shared outdoor spaces of the community, which in this case are located on top of the deck, is completely segregated from the surrounding streets and sidewalks. The design reflects the gated-community mentality that dominates Chinese new towns. Housings were designed to meet a minimum green building standard. The technological improvement was unfortunately compromised by the conservative approach to urbanism. The brand of eco-city largely becomes a form of technical legitimization of a conventional solution.

3. MODEL ECO-COMMUNITIES: QINGDAO

In additional to the national eco-city projects like Dongtan and Binhai, there have been numerous attempts across the country to explore ecological planning. They often involved local governments and private sectors that collaborate in the search of innovative approaches to community design. These experiments targeted a particular region or a particular type of development, and usually proposed a smaller scale of intervention compared to the eco-cities. They aimed to invent a model of sustainable community design that could be duplicated and would thus influence the wider practice of urban development.

In 2006, an international team involving the College of Environmental Design of University of California at Berkeley, Tianjin Urban Planning and Design Institute, and Huahui Design Group was looking for a site for an eco-planning concept called “Eco-block.” The objective is to invent a sustainable model of urbanism that could be applied throughout the developing world. The planning and design of this experimental project would be funded by the Gordon and Betty Moore Foundation in San Francisco. Eventually their proposal was accepted by the city of Qingdao with an administration also quite interested in sustainable development, and a site of about 50 hectares in Fushan District was identified to building the first Eco-block community.[11]

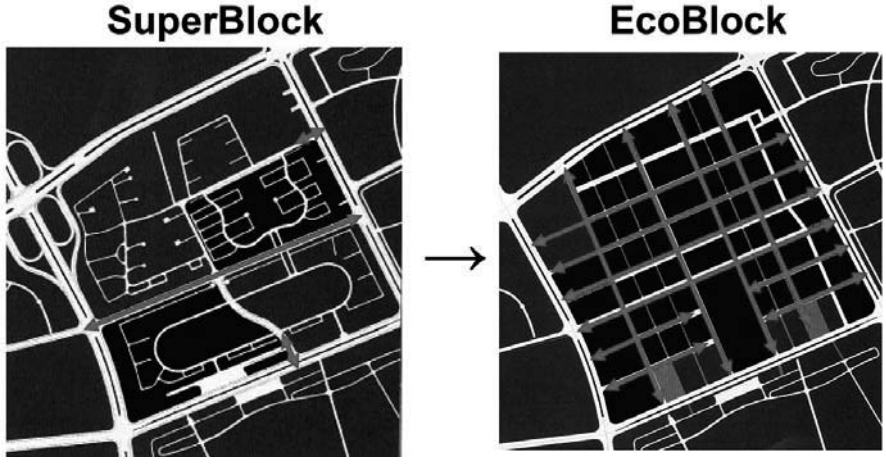

Figure 3: Diagrams of Eco-block v/s Superblock (Source: Courtesy of Huahui Design).

Eco-block is a concept coined by Harrison Fraker, then dean of the College of Environmental Design at Berkeley. He contends that conventional city planning in China usually involves the Superblock, a model that not only leads to automobile-driven gated-communities, but also relies on a centralized infrastructure of power plants and electric power lines, sewage

treatment plants and sewers, and a sanitary water supply provided by the city or provincial utilities. Superblock represents an unsustainable model of development, generating enormous energy consumption, carbon emission, and untreated waste and water. As its alternative, Eco-block will be a self-sufficient community with respect to energy, water, and waste. An Eco-block would generate renewable energy on-site to meet 100% of its demand, recycle 100% wastewater on-site and reuse it, and treat its own waste. Therefore demand of infrastructure and natural resources would be significantly reduced. Fraker and his team envisioned that a basic Eco-block would occupy 3.5 hectare of land with a density of 171 units/ha, and consist of 600 housing units for 1,800 residents. It constitutes a community "module" and could be duplicated multiple times into a larger self-sufficient neighborhood with its own infrastructural system combining power supply, water recycling, and waste treatment.

The planning team of Huahui Design Group led by Leon Huang moved forward to develop a master plan for Fushan Residential Area site. It consisted of 16 Eco-blocks and would provide 10,000 housing units in total. The plan was characterized by interconnected street network in contrast to the Superblock layout originally prepared for this site, and a pedestrian and biking system connecting numerous courtyards enclosed by mid-rise and high-rise buildings in the block. Each Eco-block would be a rectangle of about 90 meters by 400 meters. The plan also envisaged a Bus Rapid Transit (BRT) line to connect the neighborhood with Qingdao's center city that should substantially reduce the need of automobile usage, and reserved a spot for the BRT stop in the north end of the linear central green in the neighborhood.[12]

The plan proposed an integrated system of energy generation, water conservation and supply, and waste treatment. With various ecological design features such as building shading, high-performance glazing, passive solar heating, shaded walkways, and using energy efficient equipment, the energy consumption was expected to be 40% lower than conventional development, or a saving of 1.65 million kWh/year by each Eco-block. The remaining demand should be covered by the energy supply generated internally through a comprehensive system of building integrated wind turbines (53%), photovoltaics (40%), and anaerobic digester (7%). With a series of measures of water conservation and increasing efficiency, demand of potable water would be cut down by 35%. Non-drinking water supply would be primarily gained through various wastewater treatment and rainwater harvesting, leaving only 15% to be supplied from off-site. In addition, the system would transfer 54% of waste into energy, recycling 29%, and dispose only the remaining 17% of waste.[13] Arup provided technical consulting and evaluation for this plan.

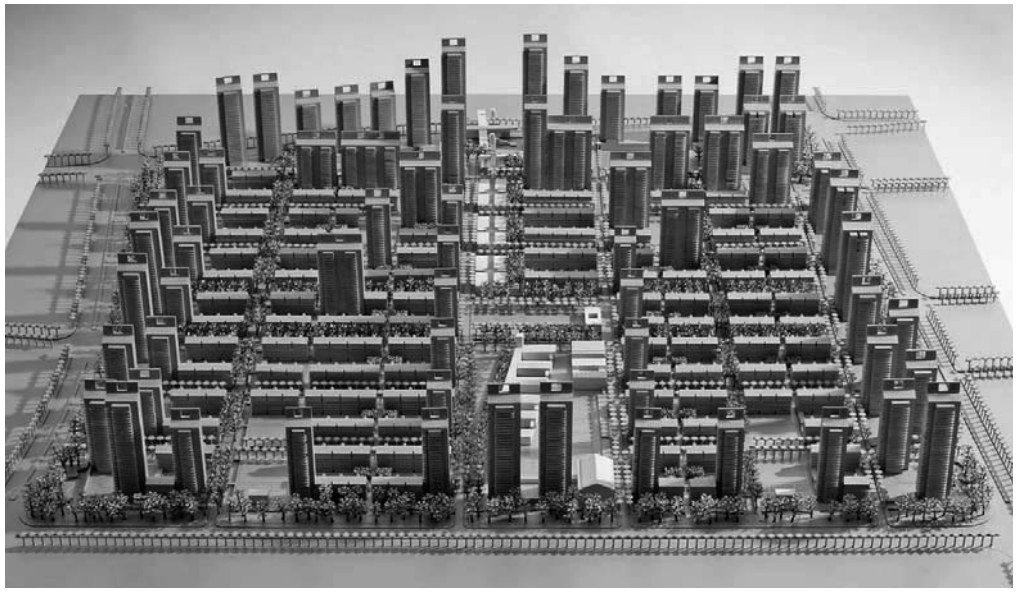

Figure 4: Model of Qingdao Eco-block (Source: Courtesy of HHD).

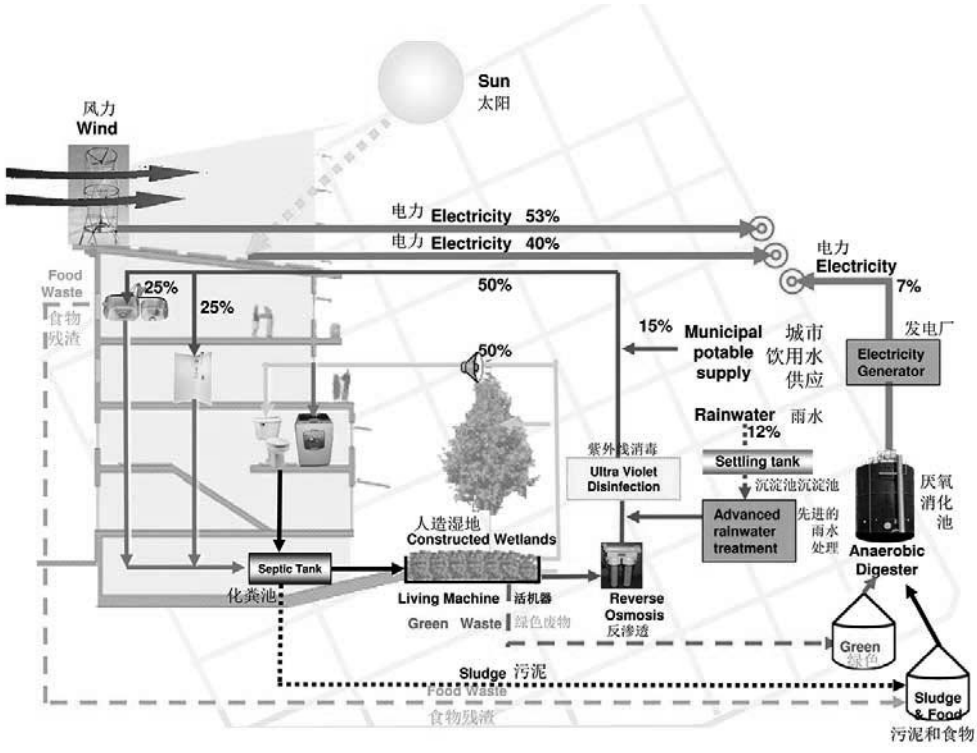

Figure 5: Diagram of the Integrated System, Qingdao Eco-block (Source: Courtesy of HHD).

From the beginning, these planners understood that the Eco-block not only meant a major breakthrough in ecological planning and design but also, more importantly, a revolution of the way a city is developed and operated, and its outcome would depend on whether the prevalent development process could be overturned. Fraker argued: "[S]uch eco-city developments will require a completely different way of doing business because the way the system is set up currently is slanted heavily in favor of developing fast and getting out, with minimal responsibility for environmental impact over the long term."[14] Eco-city developments, he believed, would require some sort of property management with self-interest in operating and maintaining these different, distributed small scale systems. In the Fushan project, the team experimented with this new approach of developing and managing a community, and their effort was backed by a few large multinational corporations. Although Moore Foundation later dropped out from its commitment of sponsorship, it was soon picked up by Microsoft. Siemens was to provide the Integrated Host System of energy, water, and waste treatment, and the return of its investment would be generated through property management. Cisco agreed to provide support of the system. Such international collaboration among enterprises, professionals, academia, and local government represents an effective model in the promotion of eco-planning.

Despite such productive collaboration and popular support, the Fushan project was not able to move forward into construction. The direct cause was the complication related to the land – it was previously leased to another developer. However, there were also a number of issues in the economic side that prevented an eco-block project from being carried out. For instance, the power that photovoltaic and wind turbines can generate fluctuates through a day, and there is a significant discrepancy between the pattern of energy production and that of energy usage during 24 hours. Using battery to store the surplus energy during off-peak hours of energy consumption and release it during peak-hours is quite costly, So the better solution would be to connect the internal system to the state grid. However, the State Grid Corporation did not accept such a proposal. The upfront cost of building an eco-block community is also about

10% higher than conventional community – although it could be paid back in a few years of operation – and developers are not willing to take on this approach without substantial subsidy. As a result, the planners have to search for other opportunity to realize the Eco-block concept.

CONCLUSION

The three projects discussed in this paper, Dongdan Eco-city, Binhai Eco-city, and Qingdao Eco-block, represented different scale of intervention ranging from a couple of hectares to thirty square kilometers in area. All of them, however, were intended as "models" of eco-planning that was expected to influence the wide practice of urban development under the current massive urbanization in China. The ambitious eco-cities represented top-down governmental initiatives as wholesale introduction of cutting-edge ideas of planning and technologies. They aimed to establishing examples to guide new town developments in the decentralization of many major cities across the country. The eco-community projects created by the private sectors, although relatively modest in scale, were equally ambitious in their agenda. They started from the basic component of the city, a block, and tried to invent a new pattern of urban development incorporating ecological design and sustainable strategies. They explored the possibilities of turning technological advantages into marketable products.

However, neither the governmental initiatives of eco-city nor the private experiments of eco-community has seen much success in practice. Two out of the three studied examples stay unrealized. The only ongoing project Binhai Eco-city, after rounds of planning revision and execution by profit-minded developers, has degenerated to nearly a commonplace development, with some sorts of ecological features but without an ecological soul in general. There are a few obstacles that prevent an eco-project from being carried out or having a larger impact in Chinese urbanism, including technical readiness, economic feasibility, and land policy, which are somewhat connected to each other. The technical capacity is becoming less an issue. According to Leon Huang, the technologies to build an Eco-block are all matured techniques that have been used in other projects. In fact, a number of Zero-Emission Developments (ZED) or self-sufficient communities have been built in Europe, not to mention the flagship eco-cities like Masdar. China has also become the world leader in production and usage of photovoltaic equipment and wind installations. Economy wise, the building cost of an eco-community is estimated at 5-10% more than that of a conventional community, which is not a formidable cost and, in most cases, could be recovered by saving in energy and resources in a few years of occupancy.

The barrier more difficult to overcome is one related to land policies and patterns of land development in China. Eco-block was invented to counter the prevalent pattern of Superblock. However, the Superblock approach could not be replaced without tackling the fundamental issues of land and energy policies it is based on. In China, municipal governments control the land and tend to lease it out in large parcels to maximum revenue through bidding process as well as to achieve an impressive city image. The real estate sector relies on land speculation as primary means of profitability, which encourages developers to build fast and pursue maximum profit with little concern about the after-market performance of the properties. As a result, the interests of three parties involved in community development – the governments as landholder, the developers as producer, and the residents as consumer – are often inconsistent.

Although sustainability is apparently in the national agenda as the eco-city projects suggest, essential infrastructural and financial supports are either not in place or mismatched. In the case of Eco-block, the state-run energy corporations like the State Grid would not share their resources to support community-based systems. There is also lack of financial stimulus for developing new sustainable communities or improving the environmental performance of existing communities. The state has demanded building of enormous number of affordable housings across the country – 36 million units of subsidized housing are supposed to be built between 2011 and 2015.[15] The main objective of such state funding however, is the quantity (number of units to be built) not the quality.

Nevertheless, these emerging eco-city and eco-community projects are pioneers in guiding China's urbanization toward a more sustainable path, and they represent some meaningful

experiments of alternative concepts of planning. They are far from mainstream yet, and in some cases like Binhai, such eco-planning is developing with a Chinese characteristic. Apparently there are many things that should be done in order to develop a livable and truly sustainable city. Instead of showcasing uses of environmental technologies, ecological cities and communities should play a more fundamental role as a comprehensive social project in changing the urban pattern toward a more holistic development of society, economy, and environment.

ENDNOTE

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[6] The site of Dongtan is one of the important habitats of migratory birds in the east coast of China. Therefore, environmentalists had protested building a new town there although Arup's plan reserved large areas of wetlands. Chen Liangyu, the CCP chief of Shanghai was arrested in 2006 for economic issues. He endorsed Dongdan and the other new town projects in his tenure, and his step-down was widely regarded as one of the reasons of Dongtan's stagnancy.
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