

Can a Sustainable Urban Development Model be Exported?

Construction of the “Exemplary” Tianjin Eco-city

YINGHAO LI, CÉLINE BONHOMME, AND JOSÉ-FRÉDÉRIC DEROUBAIX

ABSTRACT: In the search for more sustainable models for Chinese cities, the concept of “eco-city” has been advanced and widely discussed as capable of providing solutions for environmental, ecological, and socio-economic problems. This article questions the specificities of the concept against lessons drawn from the experiences of eco- and sustainable quarters being implemented in France and other places in Europe. The model for a Chinese eco-city is considered in the light of our study of the Tianjin eco-city, which is a Sino-Singaporean project half-way towards its intended completion in 2020. Our study was conducted on the spot within this eco-city, and it enables us to make a close examination of a number of its specific aspects and to raise questions, in a manner not yet fully researched in this area, as to how widely such an urban model might be diffused. Its implementation of a system of performance indicators, and its introduction of a structure of governance to support environmental protection, represent promising avenues for a paradigm change in Chinese urban planning. On the other hand, the bias in favour of technological solutions and the lack of concern with the residents’ life styles are a matter for debate over the pertinence and sustainability of such a model for urban development.

KEYWORDS: Sustainable Development, Chinese Urban Planning, Indicator, Governance, Tianjin Eco-city.

Introduction: Urban growth in China and development of eco-cities

With urban population figures above 58% at the beginning of 2018 and six megacities of more than ten million inhabitants, China is becoming increasingly urbanised. The country’s massive urban growth over more than three decades is not only the consequence of its economic reforms launched at the beginning of the 1980s, but also the result of the strategies adopted by the central government for land management, which will presumably continue for the coming three decades (Obshita et al. 2009). High consumption of non-renewable natural resources and the disastrous environmental impact arising from these developmental options have started to present a serious threat to public health and to political power (Pow and Neo 2013; Xu 2016; World Bank 2009). Aware of these threats, and facing criticisms from abroad, the Chinese government has engaged in an “environmental turning” since late 1990s. One of the main stages of this turning was the set of “ecological modernisation” (*shengtai xiandaihua* 生态现代化) adopted as a national goal at the 17th National People’s Congress in 2007 (Pow and Neo 2015; Shiu-Shen 2013). Simultaneously, several eco-city projects were launched by the authorities in places such as Dongtan, Caofeidian, and Tianjin, which claimed to embody the “turn towards ecological modernisation” (Fulong 2012).⁽¹⁾ In his book *Towards Green Civilisation* (2004), Guo Yanhua argues that the eco-city offers China a viable solution for its environmental problems.

A number of scholars have questioned the significance of these experiments for “ecological modernisation.” Bonard and Matthey’s (2010) work

emphasises the “exemplary” role of French eco-quarters, which are often considered laboratories for the city of the future. From this standpoint, the ultimate goal of the Tianjin eco-city is not limited to the city itself but includes the broader goal of allowing the spread of “virtuous” urban practices, be it ecological, economic, or social. This goal of extending practical application has sometimes been considered difficult to achieve in Europe: “The eco-quarter emerges as an islet of sustainability amidst a sea of urban pollution that it is incapable of transforming.”⁽²⁾ So the question rises of analysing the capacity of Chinese eco-cities to operate as matrices for the propagation of new urban planning practices.

In Europe, the eco-quarters are strongly integrated into the urban fabric and are perceived as “town pieces” that depend on an operational town centre providing activities and amenities. In the case of the Tianjin eco-city, its gigantic scale and long distance from Tianjin itself marks the intention of this eco-city to be self-sufficient, serving as an *ex nihilo* creation in a previously uninhabited place (salty humid zones close to the shore and sparsely inhabited by fishing communities), even though the designers of the Tianjin eco-city seem to have never settled the question of how dependent or independent their project should be in relation to the main city of Tianjin. The installation of a railway line between the two has never been completed, as if the public authorities have deliberately “decided not to de-

The research for this article is part of the work carried out by the “Urban planning and dynamics” group organised by the Labex *Urban futures* led since 2012 by Céline Bonhomme and José-Frédéric Deroubaix.

1. Out of these three projects, the one in Tianjin is currently the only one being put into effect. These Chinese eco-city projects are part of a global urbanising trend that has been widely studied, particularly in the French-speaking world (Souami 2009).
2. Bonard and Matthey (2010).

cide" and are waiting to see whether its endogenous development would enable a plan to populate the eco-city.

In the specific context of China, some observers question the break from the "post-Maoist" planning that these eco-city projects might constitute (Doulet 2008). Would they not be yet another variant of the "urban entrepreneurial" construction described by certain researchers (Shiuh-Shen 2013; Pow and Neo 2013)? Indeed, many believe that municipalities suffering from budgetary constraints and growing intra-city competition are pressing forward with urban growth through property development, often at the cost of relaxing controls over property and industrial speculation. In order to obtain the endorsement of provincial and national authorities, municipalities often establish international cooperation in an eco-city project, with Western partners providing expertise that facilitates a certain form of technology transfer (De Jong et al. 2013). Martin de Jong shows that in a situation where the success of the local economy dominates the performance assessments of local cadres (and thus the advancement their careers), the orientation towards entrepreneurial development is of no concern to the central authorities. However, this interpretation of urban entrepreneurialism as a new version of a fundamentally developmentalist paradigm is not supported by everyone.

Peter Christoff (1996) has made a distinction between a so-called "weak" ecological modernisation and a "strong" one. The former is economic, technological, instrumental, technocratic, and enclosed within a national perspective, while the latter is ecological, institutional, systematic, communicative, deliberative, and democratic, with an open international perspective. Chinese eco-cities may be classified in the "weak" category of ecological modernisation. As Pow and Neo (2013) observed, their most striking aspect is the emphasis on technologies. This technological bias has been widely criticised for its operation within a "social vacuum," which encourages belief in the universal validity of the new technologies without considering their adoption by the public (Milanez and Bührs 2007).

This question of lifestyle has been widely discussed in France. According to Emelianoff (2008):

[An eco-quarter] is not just a space for lodging, like a shell, but on the contrary it may serve as a means for initiating a change in ways of living, which can in turn lead to a new perception of social belonging. It reflects a deep, but still latent cultural shift.

Seen in this light, the actual effects of civil participation on environmental performance are considered ambiguous (La Branche 2015). Tafouik Souami (2009) shows that there is no specific energy structure or environmental initiative that can be attributed to the users' decision-making or participation. Yet, although there may not be obvious correlation between ecological ambition and collective participation, it seems that under certain circumstances (especially if collective organisations existed previously) a voluntary association with residents can contribute to adequate changes of lifestyle and behaviour (Faburel and Tribout 2011).

That being so, some theorists such as Joseph Huber have argued that the best way to avoid the environmental degradation caused by "over-industrialisation" is to introduce a new generation of experimental technologies to enable societies to progress towards an ecologically viable era of "hyper-industrialisation" (Huber 2004). Following the lines proposed by Vincent Renaud (2012), it is pertinent to raise questions over the socially subversive character of technological innovation, which might lead to the emergence

of new ways of tackling social practices. This belief in technology's ability to overcome problems brought on by over-consumption of natural resources is shared by a number of Chinese writers who suggest that China is able to play a leading role in building a recycling economy (Su Biwei et al. 2013). On the urban scale, the most frequently cited example is the case of Dongtan, an eco-city project on Chongming Island north of the Shanghai municipality, planned jointly with the English consultancy ARUP. While some people consider these projects to be mere marketing operations for the sale of land (Curien 2014), others see them as models for a viable future type of city planning (Hefa and Yuanan 2010; Hald 2009), and even as having the potential to serve as an eventual "integrationist" model that integrates the demands of different sectors in urban activities, such as transport, energy, waste disposal, and even employment (Doulet 2015).

The eco-city of Tianjin was born in 2007 out of the ambition to provide conditions for developing an environmentally friendly city by making strict controlling norms in the form of Key Performance Indicators (KPIs), which were presented from the beginning as an innovative approach. However, the system depends almost exclusively on technical quantifications of goals to be reached, to such an extent that this experimental city may be seen as a natural laboratory. From this point of view, Bonard and Mathey (2010) noted the same functional assessment of the French eco-quarters, which are considered to be laboratories for the cities of the future. Over and above the hyper-technological aspect, the ultimate goal of the Tianjin eco-city does not lie in the city itself but in its ability to diffuse urban planning practices, whether ecological, economic, or social. We aim thus, through the example of the Tianjin eco-city, to analyse the ability of the Chinese eco-cities to act as matrices of diffusion of new urban development practices.

The objective of our article is to show to what extent novel practices invented in the Tianjin eco-city can be considered truly innovative. What are the specific problems concerning the use of facilities considered by managers and designers of technologies that presumably render the city more environmentally viable? How did the initiators of the eco-city envisage the assessment of the technologies chosen? To what extent do the latter allow for resolving the contradictions among different sectors of urban management (energy, transport, water, rubbish disposal, etc.)? If these technologies are considered a showcase for China's capabilities in urban planning, can they be reproduced in a different context? Is it possible to export urban developments created in a politically protected and physically isolated situation?

After a historical review of the Tianjin eco-city and its governance, the article will assess the KPI system, which is presented as a central strategic element in the governance of the eco-city, as shown by the operational breakdown of the relevant indicators. In the last section, the overall data will be discussed with particular regard to the issues of the innovation and "exportability" of these urban management practices, which are often presented as examples to be followed.

Sources and methods

The elements presented and analysed in this article were gathered through our field work between March and June 2016. Our study covers both our own observations on the operation and management of the eco-city at the mid-point of its Phase 1 (due to be completed in 2020) and interviews with a panel of agents involved in the project. Those interviewed in the course of our semi-controlled discussions represented the following agencies:

- the administrative committee of the eco-city (*zhongxin shengtaicheng guanli weiyuanhui 中新生态城管理委员会*), represented by the environmental office (*huanjingju 环境局*);
- the (public) environmental company of the eco-city (*huanbao gongsi 环保公司*);
- the (public) water company of the eco-city (*shuiwu gongsi 水务公司*);
- the sanitation centre for the eco-city (*huan wei zhi jia 环卫之家*), under the management of the environmental company (*huanbao gongsi 环保公司*);
- the eco-city's industrial park (*shengtai chanyeyuan 生态产业园*);
- the Tianjin Academy of Environmental Sciences (*Tianjinshi huanjingbaohu kexue yanjiuyuan 天津市环境保护科学研究院*);
- the Tianjin Institute of Engineering and Urban Research (*Tianjinshi shizhengongcheng sheji yanjiuyuan 天津市市政工程设计研究院*).

During these interviews we focused particularly on our interlocutors' statements about the progress of the eco-city and the implementation of its performance indicators (KPIs). Our discussions focused on the difficulties encountered in implementing this system, and on the different levels of environmental, social, and economic performance expected or actually achieved through applying the various urban technologies. We also conducted a dozen informal interviews with some of the residents. We chose

not to impose any direction on interviews with the latter in order to evaluate the importance of their own criteria in making their choice to live in the eco-city. However, after allowing them to give free opinions about their choice, we tried to ascertain the ways in which they made use of the technologies and services offered by the eco-city. Finally, we posed as potential buyers of property in order to understand the relations between the estate agents and future residents, and to reach a more precise assessment of the weight of environmental arguments in property sales.

It very rapidly became apparent that we would have to abandon the interview schemata that we had devised prior to our field study in order to collect factual and quantified information on the environmental performance of the eco-city. This need to adapt research methodology to on-ground realities in China is quite well known. For example, in the book *Doing Fieldwork in China* (Heimer and Thogeron 2006), researchers reported their experience of modifying or even abandoning preparatory documentation. A Chinese civil servant finds it simply incomprehensible to be interviewed by a foreign researcher without any clear instruction from his superior. Certain questions that are legitimate to a French researcher, such as residents' participation in the outcome of an innovation, cannot be posed in the same terms to a Chinese interviewee. The former will pay attention to the factors determining a resident's personal use of a particular innovation, while the latter will insist on showing that the procedures for ensuring participation

Figure 1 – Geographical location of the Tianjin eco-city



Source: Tianjin eco-city website, 2016.

Figure 2 – Overall map of the Tianjin eco-city



Source: Tianjin eco-city website, 2016.

have been correctly implemented. As a counterpoint, a free discussion with Chinese interviewees can often lead to surprising discoveries and open up new areas for reflection.

The birth of the Tianjin eco-city project and the state of its development

The birth of the Tianjin eco-city can be dated back to November 2007, when an agreement was signed by the governments of China and Singapore for the joint development of a Chinese city that would be "socially harmonious and respectful of the environment." Out of four possible candidates, the city of Tianjin was chosen thanks to the support of the central government, which was seeking to develop the new economic development zone of Binhai (*Binhai xinqu*) to the east of the city. A joint venture was set up, consisting of a Chinese consortium under the control of Tianjin TEDA Investment Holding and a Singaporean consortium under the control of Keppel. Motivated on one side by China's need to develop a sustainable urban model, and on the other by Singapore's wish to export its expertise (Bocquet 2013), the eco-city was nominated as an ideal site for transferring Singaporean expertise in sustainable urban landscaping. In January, the Sino-Singaporean Tianjin Eco-City Administrative Committee (*zhongxin shengtaicheng guanli weiyuanhui* 中新生态城管理委员会, hereunder referred to as "the Administrative Committee") was

established, opening the way for drawing up an overall plan by Chinese and Singaporean experts.

This plan provided for the development of an eco-city covering an area of 34.2 km², which would house 350,000 inhabitants and provide 190,000 employment positions by 2020. Located 45 km east of Tianjin, it required the preparation of three kinds of terrain: salt marshes, saline and alkaline land, and the Yingcheng basin covering 7.7 km² used for receiving industrial effluent. The non-arable nature of this land, in conjunction with the scarcity of water resources in the Tianjin region, was in line with Beijing's demands concerning the selection of the site. However, the water in the basin was heavily polluted and had to be cleaned up. The inflow of industrial effluent was therefore halted at the outset of the project, and a cleansing programme was established to restore the water in the basin. These operations lasted three years, from May 2008 to June 2011, during which 1,500,000 metric tons of contaminated mud were pumped out by treatment vessels, cleansed, and then buried in hermetically sealed containers. These operations have given rise to Qingjing Lake (Figure 3), which was deepened by about two metres. The burial site of the sediment is located under a hill near the lake and is covered with vegetation.

Alongside residential units and their infrastructure, the overall plan set a first phase zone of 4 km², subsequently enlarged to 8 km². At present, the construction of this zone is more or less complete. The Administrative Committee confirmed that the construction schedule was delayed in terms of the plan for completion in 2020, but this delay seems to have been "compensated" by the unit sales figures, which stand at 70% with 50,000 buyers. We have confirmed by ourselves the frequent visits to the estate agencies.

A governance model based on ecological modernisation

On paper, the governance of the eco-city is divided among four bodies: a Joint Steering Council, a Joint Working Committee, the Administrative Committee, and six Working Committees made up of specialists from the two countries. This structural organisation is presented as evidence of the close collaboration between China and Singapore. In reality the Administrative Committee, run exclusively by Chinese, is the real authority in the eco-city. As our Figure 4 shows, this committee is composed of different bureaus covering the various sectors, including the environmental bureau (*huanjingju* 环境局), which is in charge of overall environmental management, i.e., the city's sanitation and upkeep, and the management of its water supply, energy provision, and waste disposal. By relying on the KPIs, this bureau co-ordinates public and private agencies in order to ensure respect for environmental guidelines throughout the different phases of the project. Attached to this bureau is an environmental company (*huanbao gongsi* 环保公司), which takes care of the city's sanitation and upkeep through a centre known as the "sanitation centre" (*huan wei zhi jia* 环卫之家). In addition, a water company (*shuiwu gongsi* 水务公司) is in charge of piloting all of the projects related to the city's water management, including the restoration of Lake Qingjing. It also runs the eco-city's water treatment plant.

This vertical structure in charge of the environment is rather rare among Chinese municipal authorities. It not only demonstrates a strong concern for the environmental dimension of the project but also clarifies the areas of responsibility. Moreover, this structure strengthens the weight of environmental concerns within the government in relation to the traditionally dominant construction and economic sectors (Jiang 2016). Therefore,

Figure 3 – Geographical location of the Tianjin eco-city

Source: Tianjin eco-city website, 2016.

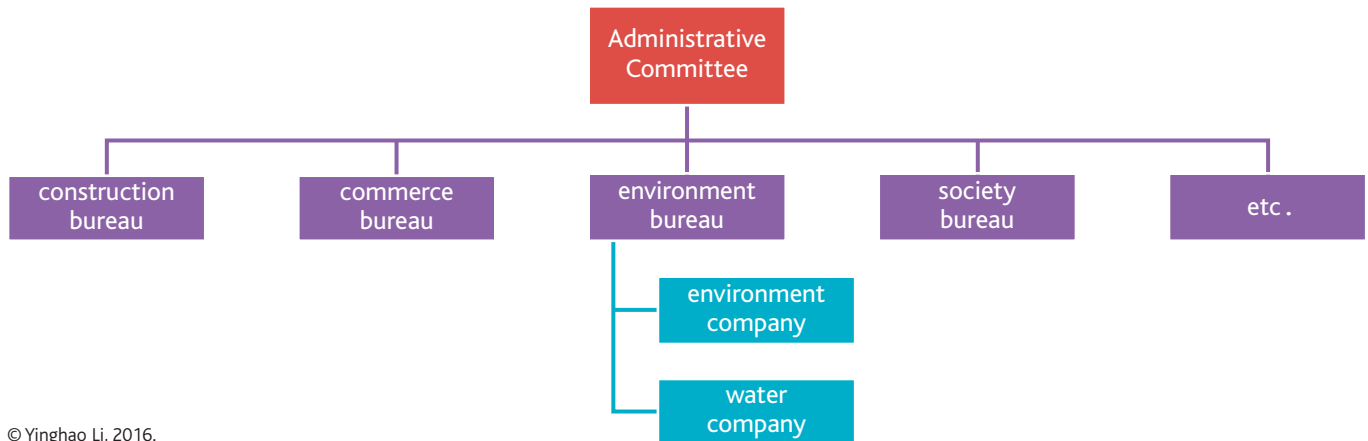
whereas in France, and Europe in general, it is difficult to establish a clear relationship between a form of governance (which is more or less horizontal) and environmental aspirations (Souami 2009), it seems that in China a vertical structure of governance under the control of an environmental authority is a guarantee of sustained and effective implementation of its environmental objectives. However, we may well wonder about the potential of this vertical governance to drive compromise between actors who have competing if not conflicting interests in the projects. These compromises are factors that will effectively favour the development of integrated innovations, that is to say, solutions that permanently bind the different sectors to each other and to their users (Verhage and Leroy 2014).

The active role played by the Key Performance Indicators system

Before and during the conception of the master plan, the Ministry of Housing and Urban-Rural Development (MOHURD), which supervised the whole project, insisted on drawing up a "comprehensive" system of performance indicators with the participation of the Tianjin Academy of Environmental Sciences (*Tianjinshi huanjing baohu kexue yanjiuyuan* 天津市环境保护科学研究院). The latter therefore laid out its environmental indicators by drawing on existing local and international indicators stored in the municipal records, before submitting them in 2008 to MOHURD, which then added social and economic indicators. That is how the Key Performance Indicators (KPI) system was produced and transferred to the Administrative Committee of the eco-city. It includes 26 indicators, of which 22 were intended for "quantitative control," each having a numerically defined goal,

and four were intended to provide "qualitative" guidelines. As many publications have testified (Pheng Low, Jun Ying, and Peng 2009; Curien 2016; Caprotti 2014; Hu 2015; Li 2014; Pow and Neo 2015), the KPIs rapidly became a "showcase" for the eco-city, and played out both in China and abroad. However, contrary to the impression given by the voluminous references to the KPIs, the publication of the 26 indicators was not the end of the story for this assessment system. In fact, the Administrative Committee decided to craft an operational breakdown of the indicators in response to the demand from the MOHURD that "the KPIs must be implemented according to the eco-city's design/construction/operational needs, assessed, synthesised, and revised periodically, and continually improved" (Research Team of Tianjin Eco-City KPI 2009). In February 2009, this task was entrusted to the Beijing consultancy Bluepath (*yudao* 御道). After one year's work, Bluepath's proposal was examined by the MOHURD in January 2010, and re-examined a little later during a Sino-Singaporean working session. In May 2010, at a joint Sino-Singaporean ministerial meeting, the Administrative Committee presented the operational breakdown of the KPIs to the officials representing the two countries alongside representatives from the United Nations Environment Programme. Finally, the Tianjin eco-city's KPIs and their operational listing were published in a 608-page book entitled *Navigating the Eco-City*.

In this book, the 26 indicators are organised into four compartments: society, economics, resources, and environment. Each indicator is subdivided into "key factors" (*hexin yaosu* 核心要素), "key components" (*guanjian huanjie* 关键环节), and "control measures" (*kongzhi cuoshi* 控制措施). Among the latter, some are concerned with quantifiable objectives and are labelled "control targets" (*kongzhi mubiao* 控制目标). Overall, the 22 control

Figure 4 – Diagram showing composition of the Tianjin eco-city Administrative Committee

© Yinghao Li, 2016.

indicators and the four guidance indicators are broken down into 51 key factors, 129 key components, and 723 control measures, including 275 control targets. Figure 5 gives an example of this ordering in the case of the indicator for air quality.

Measures adopted and technologies required

- Renewable energy

Three different types of renewable energy have been put in place for the eco-city: solar, geothermal, and wind. Solar panels are installed for lighting public roads. In addition, a solar panel park in the south of the eco-city supplies surrounding offices. Some wind turbines at the entrance to the eco-city are currently operative and supplement the solar panels. As for geothermal energy, it is now being used at a public building (see below).

- Energy saving in public buildings

The administration for social housing is located in a two-storey building, which is also the service centre for residents (payment office for electricity, water, and local charges). Beyond its normal functions, this building also serves as an example of energy saving. About 50 geothermal pumps, in conjunction with a ground-coupled air exchanger, are distributed around the building to ensure adequate air-conditioning. The windows are designed for many tasks (air circulation, natural light, etc.). The electricity for lighting at night and for running the geothermal pumps is provided by solar panels. These installations make the building energy positive, so the excess energy is injected into the municipal supply network. As for water conservation, the bathroom units have ecological taps and toilets with flushing controlled to ensure minimal wastage. Strips of lawn and porous paving surround the building to allow rainwater to infiltrate and be stored in an underground reservoir before being used for cleaning roads and watering plants.

- Managing waste and urban sanitation

The cleaning and sanitation of the eco-city are managed in a "sanitation centre," run by the environmental company. The documents we have been able to see, and the presentations we attended, show off the "exemplary" organisation of human and material resources aimed at the cleanliness of the eco-city, and an equally "exemplary" model of care for the urban environment. The presentation of the eco-city's pneumatic rubbish collection system is quintessential in this respect. There is a plan

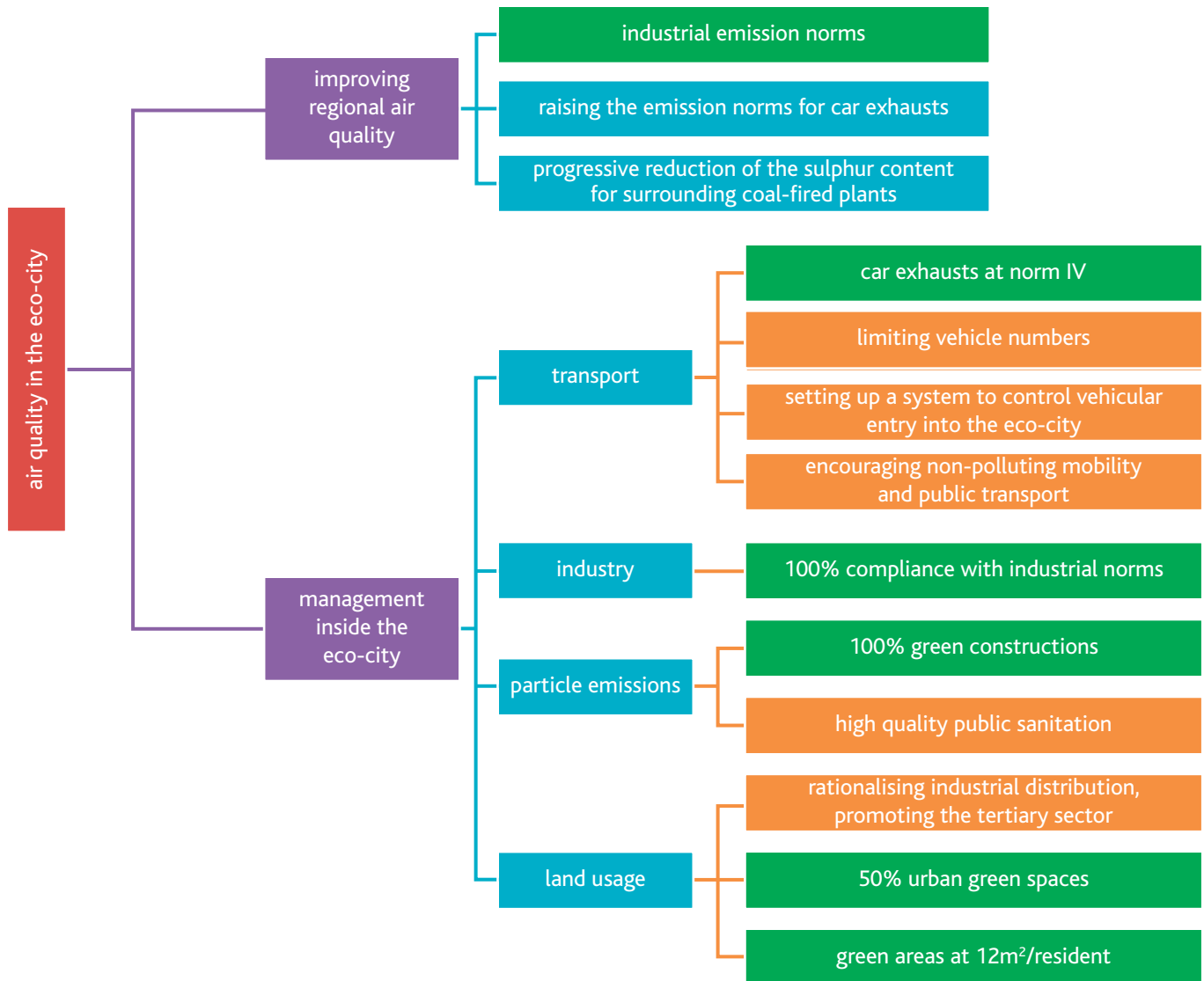
for five collecting chutes over the long term, and one of them is already in operation. The collection points are in the public area of each *xiaoqu* (residential quarter, see Photo 1). The rubbish bags are sucked in and carried to the end of tubes, where they are gathered and sent off for incineration. Rubbish collection depends on the voluntary participation of the residents—traditional rubbish bins are also available in the basement of the residential blocks—but there is also a financial incentive: when they use the system, residents gain points that give them credit in local shops. According to our official guide, "The residents initially disliked the pneumatic system because of its perceived complexity, but this negative perception has steadily decreased."

- Managing effluent and rainwater

Industrial effluent and rainwater are collected through separate underground networks. The effluent is channelled into a treatment plant, which has a capacity of 150,000 cubic metres per day. It also receives the effluent from factories nearby, which currently represents "40% of the total volume treated." In order to deal with the toxic "stress" caused by industrial effluent, the technology chosen for the first treatment chain was a simple and robust one, but it is understood that at present the output can only comply with level 1-B of the national norm for industrial effluent. Following a tightening of the norms for the output from water treatment plants, a second treatment chain is being built. This new chain will incorporate a more advanced technology and allow the quality of the outflow to rise from 1-B towards 1-A. To meet the norm for waste water reuse, a system of membrane filtering will also be necessary.

For its part, rainwater management in the eco-city involves Lake Qingjing, the Jiyun canal, and four artificial streams. Some pipes and wide tunnel sections have been buried to form a deep 63.2 km drainage network that carries the rainwater to four pumping stations along the canal. When the water is pumped to the surface, it is fed through a concrete channel followed by a reed bed before joining the water body.

In addition to these technological decisions, mention should be made of the canal's lock system, which allows the eco-city to be completely enclosed from a hydraulic point of view. In order to prevent the mass of enclosed water from becoming stagnant, the Huifeng rivulet has been extended to bring in water from an electric desalination plant on the coast. Nevertheless, the eutrophication problem in the lake has already become apparent, and the environmental company is working intensively to deal with it.

Figure 5 – An analysis of the indicator for air quality in the eco-city

By taking into account the regional management of emissions produced at source, and the variable factors involved, the indicator is divided into two key factors, five key components, and 13 control measures including six control targets (in dark green). Source: *Navigating the Eco-city*.

Further discussion: What are the experiences of a city claiming to be a model of sustainability, and what lessons can be drawn?

The idea of a “model” appears in Chinese under a number of designations that refer to the associated idea of “reproducibility.” Such terms as *mofan* (模范 exemplary), *dianxing* (典型 typical), *bangyang* (榜样 model), and *biaozhun* (标准 standard) are currently used in political discourse. The Tianjin eco-city has been considered, ever since its outset, as a project that would be “practical,” “replicable,” and “scalable” (Pow and Neo 2013). In this respect, it is interesting to compare the ways in which the Tianjin eco-city presents itself in relation to the KPI system, and the implementation of this system as observed during our investigations.

The KPIs are the alpha and omega of the Tianjin eco-city

The KPI system is undeniably original, especially in its organised breakdown into sub-indicators and measures. Through their scrupulous elaboration,

the authorities made clear their ambition to make the Tianjin eco-city a sustainable and exportable urban developmental “model” by demonstrating the rationality of the KPI system and by overseeing its performance. The exemplary value attributed to the French eco-quarters by Benoît Boutaud (2009) is therefore re-affirmed in the case of the Tianjin eco-city. However, in France the question of the overall performance of the eco-quarters was at first set aside, or else assessed *a posteriori* by retrospective labels.⁽³⁾

In Tianjin, the “bible” of the indicators—*Navigating the Eco-City*—is also a practical manual for the city managers. Over and above their functions for ensuring continuity and control, the KPIs also fulfil a “hidden” function of negotiation support. Each indicator enables the different agencies to reach an agreement on its goals and ways of monitoring for meeting them. For public authorities, the establishment of the indicators therefore repre-

3. The ministerial drive initiated in 2007 has led to a reference system that is both prescriptive and normative: the French MEDDE asserted in fact that the eco-quarter is “an exemplary system for sustainable infrastructure” and thereby provided itself with a whole set of criteria to support its “EcoQuarter” projects in 2009, followed by an “EcoQuarter 2011” grid drawn up to support its second set of projects in 2011.



Photo 1 – Pneumatic rubbish collection points in a residential quarter of the Tianjin eco-city.

©Yinghao Li 2016

sents a new instrument for their intervention and reveals a quite innovative vision for city management in China. Each local administration registers its objectives and its requirements, backed by the powerful public authorities for the inclusion of environmental constraints in negotiations with private promoters and contractors. The negotiations also provide considerable room for concrete application of the KPI "bible." As such, the KPI system supports the vertical form of governance of the eco-city. It also favours the negotiation process and knowledge transfer among different private and public actors in the urban project, in a manner similar to that of the European eco-quarter projects (La Branche 2015). Finally, the KPI system is currently under revision by the public authorities, who hope to use the indicators to make continual adjustments in the implementation of the Tianjin eco-city project. In this sense, the "bible" is a reference that keeps developing, providing the alpha and omega for the overall development of the project

The Tianjin eco-city: Showcase and factitious environmental conservation

The Tianjin eco-city has bet heavily on widespread publicity that presents it as a "flagship" or "strategic" project, terms systematically employed in academic, political, and media circles. By invoking its technical installations, some of which have symbolic value rather than practical impact on the city's overall performance, the municipal and central administrations seek to show off the progress in environmental matters gained in modern China. From the eco-city's entire technological display, the large hall where images and videos of futuristic cities are exhibited, to the spotless uniforms of the cleaners, an antiseptic atmosphere constantly proclaims: "You are in the eco-city!" This ultra-technological presentation makes the eco-city completely artificial. In Tianjin, as elsewhere, when a city is created out of nothing, the question of how to populate its empty spaces is raised (Stock 2017). Here, however, the showcase aspect of the project does not in any event manage to create a "real space." But in the Chinese context, where the determining cultural and social factors are very different from Europe, the publicity around the eco-city, including its antiseptic aspect, might very well turn out to be a more attractive prospect than that of living in the polluted downtown of Tianjin.

The obscurities in the implementation of the KPI system

If, as we have shown in the preceding paragraphs, the ambition to install green technology has indeed been realised in a number of ways, the in-

tended use of indicators as guides to future planning and management seems less straightforward.

- Some perverse effects revealed by the indicators and the technical systems

According to *Navigating the eco-city*, the pneumatic system for rubbish collection is supposed to increase the waste recycle ratio.⁽⁴⁾ However, its implementation raises at least two questions. Firstly, the point-based incentive to users of the system may come into conflict with the indicator on rubbish quantity, namely "below 0.8 kg per day per person." Secondly, given that the system does not allow for any separation apart from separating dry from damp,⁽⁵⁾ we wonder if this system will discourage other separation, such as plastics from glass, etc. In addition to these problems, there is the question of toxic wastes that might be mixed with other wastes in the rubbish sacks. In due course, an "intelligent platform" for separation and recycling will enhance the pneumatic collection system. How will these two systems be co-ordinated when the point system incentivises residents to throw everything into the pneumatic collection instead of sorting it?

Furthermore, here we see the emergence of one of the overlooked issues in the Tianjin eco-city, namely its technocratic vision and its failure to involve users (we will elaborate on this later). While the project may be far from the property "fiasco" declared by the press,⁽⁶⁾ it may well turn out to be a failure in transforming lifestyles, technology, and economic incentives, and therefore in developing any real concern about environmental and natural resource conservation (Faburel and Tribout 2011).

- Discordances between real performances and perceived performances

By "real performances" we mean those referring to urban sustainability and that can be measured by the KPIs. By "perceived performances," we refer to factors conducive to augmenting a city's attractiveness. Obviously, the two overlap in many cases... but not always. A fairly convincing example concerns the planting and maintenance of green spaces. The saline and alkaline land on which the eco-city is erected, together with scarce rainfall in the region, do not favour the growth of vegetation. The creation and tending of greenery represents a considerable water budget for the eco-city's Administrative Committee, which is nonetheless justified by the property purchasers' expectations of a green living environment. A number of testimonies collected during our study affirmed purchase motivations in the Tianjin eco-city that are quite similar to those in other Chinese cities. In addition to the comfort inside a property, major issues mentioned by the interviewees are: 1) the living conditions, particularly the quantity of green spaces within the separate urban sections; 2) the quality of the public amenities, foremost schools, followed by hospitals. If the quality of the living environment desired by the residents is duly taken into account in the environmental performance measured by the KPI system, the provision of schools and hospitals can hardly be considered a performance insofar as there is no indicator specifically defining it.

- Lack of stability regarding technical solutions

The success of the eco-city calls for action continuity throughout the different implementation phases. At the beginning of its construction, all the residential units had to be equipped with ecologically friendly apparatuses (ecological taps, controlled toilet flushing). But that measure was aban-

4. According to *Navigating the eco-city*, the incineration of waste to produce electricity is considered a form of recycling.

5. The suppliers offer a system for separating materials, but it was not chosen by the eco-city.

6. Harold Thibault, "En Chine, le défi des éco-cités fantômes" (In China, the challenge of the ghost eco-cities), *Le Monde*, 26 September 2016

done by the eco-city's new management team, who were "anxious to attract new investors and keen to relax the restraints imposed on the sales of the properties." This decision shows the importance of taking the specificities of the Chinese political system into account. These include: 1) the frequent turn-over of local government officials in order to avoid corruption; 2) the desire of each team or leader to stand out from their predecessors in order not to be perceived as passive; and 3) the overwhelming role of economic success for the promotion of local political appointees (Shiuh-Shen 2013). There is no criterion for good governance in the KPI system, although such an indicator would be conducive to the stability of the policies taken against political turn-over.⁽⁷⁾

- *Absence of regional co-ordination and the autarchic nature of the KPI system*

Although the eco-city is a specific entity in the Binhai xinqu and in Tianjin, which enjoys strong political and financial support (Curien 2014), its success will not be achieved without larger scale co-ordination. With regard to this, the present lack of public transportation makes it hardly possible to travel to the centre of Tianjin without exacerbating the region's carbon footprint (even if the KPI system does not assess the cost of travel in terms of fossil fuel consumption).

This transport difficulty is certainly one of the two factors contributing to the eco-city's "ghost town" image during its early years.⁽⁸⁾ The other problem is the low number of commercial enterprises, which is itself closely linked to the eco-city's transport service network. In fact, despite a dense highway network, commuting between Tianjin and the Tianjin eco-city remains costly by car and troublesome by public transport. The sole existing bus route serves the Tanggu economic zone, located 16 km south of the eco-city. As for the tramline designed to link downtown Tianjin with the eco-city, it is stuck in the planning stage.

The management of water effluent provides another striking example. The non-existence of integrated planning for managing waste water at the regional level has brought about direct externalities in the eco-city: in addition to urban waste water, the eco-city's water treatment plant also receives industrial effluent, which impedes it from delivering an optimum treatment performance. Whereas formerly the waste water was already treated, however crudely, before being discharged from the factories, the building of a temporarily oversized treatment plant has simply led to a total abandonment of in-factory waste water treatment.

Last but not least, management of the quality of urban surface water relies on a form of ecological pastiche. To avoid dealing with the heavily polluted upstream, the water course has simply been diverted at the entrance to the eco-city, which then functions as a closed cycle, and allows for water management at lower cost inside the eco-city. The argument vindicating this choice was again, "Anyway we have to start with something," and the officials in charge are able to boast about even such miniscule measures.

- *KPIs unadaptable to users' on-ground situations*

At the outset, the MOHURD envisaged a "comprehensive" system of indicators, integrating the social and economic domains as well. However, the definition of the KPIs was initially entrusted to the Tianjin Academy of Environmental Sciences, which ended up partially redefining the MOHURD's demands and decided to work "solely on environmental indicators" (interview with Tianjin Academy of Environmental Sciences). Once the Academy's work was done, the MOHURD completed the system by adding several indicators with social and economic aims. The scientific and bureaucratic conditions under which the KPI system was devised reveals the lack of adequate con-

sultation with the public and with future residents of the eco-city. Our interviews with those residents show that they are hardly aware of the sustainability goals of their city. Although an interest in involving a larger number of actors in the development of cities, including the public, has begun to emerge in scientific discussions in China (Jia et al. 2002), the role of the residents in the use and adoption of the measures imposed on them remains little studied. For certain indicators, such as that for eco-transport, active participation of residents is nevertheless decisive to success. Without a radical behavioural change among the residents—even if the relevant indicator is self-fulfilling (the goal of 90% green journeys by providing pedestrian walkways within the residential zones)—it is probable that the cost in terms of greenhouse gas emissions per resident will not differ from that of other cities, given that roads and motorways are over-generously provided.

Financial incentives are a direct mechanism for shaping behaviour. They are already used for the pneumatic rubbish collection, and could also be beneficial in other sectors such as public transportation use. However, private car is a powerful factor of social recognition in China today, going beyond its travel function. During our visits, some of our interviewees openly criticised the cycle lanes in the eco-city, which they considered "oversized and a waste of space." In fact, all Chinese cities are undergoing rapid increase in the number of private vehicles (Suwei and Qiang 2013). Buying a car is often an integral factor in marital choice. There is little doubt that this cultural factor was underestimated in the case of the Tianjin eco-city, which opted for wide cycle lanes at the expense of efforts to develop public transport network.

Conclusion

As in Europe, "ecological modernisation" in China will certainly be a long and incremental process calling for deep socio-economic changes. The earlier model of urban planning, aimed exclusively towards economic growth, is giving way to a more integrationist model. However, our in-situ observations seem to confirm the entrepreneurial nature of this public activity and the technocratic character of urban development. These biases interrogate critically the truly environmental nature of the project. Moreover, while entrepreneurialism is not exclusive to city planning in China, it seems to be exacerbated in the Chinese context, where political decision-making is overwhelmingly "top-down" and subject to the influence of personal networks (*guanxi*) among elites to the detriment of citizens' interests (De Jong 2013). However, it does not seem unrealistic to try to attenuate the technocratic bias that until now has presided over the decision-making process. Such a reform presupposes an awareness of a more participatory mode of governance that would at least involve the residents in technical programs. The need for reform in the KPI system certainly testifies to the necessity of paying greater attention to residents' lifestyles and building genuine public consultations that go beyond the financial or moral obligation to comply with ecological-friendly practices.

As for the Tianjin eco-city, whether the energy-neutral buildings, the pneumatic rubbish collection, or the wastewater and rainwater management, the technical or technological systems have already been established in other Chinese urban projects, just as in the eco-quarters or other sustainable urban areas in Europe. What sets Tianjin apart is the effect of concentration and production of these technological implementations.

7. Moreover this issue was addressed by a United Nations recommendation (2007).

8. Harold Thibault, *art. cit.*; Sébastien Falletti, "Chine: les villes fantômes défient les plans du pouvoir" (China: the ghost towns challenge plans from the central authorities), *Le Figaro*, 19 August 2013.

If the Tianjin eco-city represents for some a breakthrough in terms of environmental protection in urban planning, that is also because its system of governance presents certain notable characteristics. The KPI system constitutes an injunction to take account of the eco-city's environmental performance. Its ongoing reform certainly corresponds to a growing awareness of the eco-city's authority that it is going to be increasingly difficult, owing to the rising numbers of residents, to implement green technologies without taking note of their conditions of use by people. However, the indicators are not evenly shared between the three pillars of sustainable development. Moreover we have shown that the imperative for sustainable construction referring to the KPI system was relative. It is applied today more to public instances (and public enterprises that bear the cost of being exemplary) than to private actors.

Compared to sustainable urbanisation in the peripheral areas of other Chinese mega-cities, the particular quality of the Tianjin eco-city is in its self-sustaining form. Indeed, the eco-city model shown here notably displays an absence of connection—or even a will of disconnecting—the eco-city from its immediate territorial surroundings. For example, is it even possible, and if so in what sense (sanitary, environmental), to improve the air quality within the restricted perimeter of the eco-city? What is the environmental significance of maintaining a high standard of surface water in an eco-city by isolating it from the watercourse nearby that continues to be polluted? These questions provide a good illustration of the particularities of design and development in the latest generation of Chinese eco-cities. In that sense, we conclude that the Tianjin eco-city belongs to an integrationist trend in Chinese urban planning—one that is strongly marked by entrepreneurialism of the local authority—but a certain variant of them. On the one hand, the pervasive technical installations in this eco-city give it the image of an “incubator” of environmental solutions that are ready to be “exported” elsewhere; on the other hand, the almost hermetically closed boundaries designed by (and within) the KPI system implicitly make this outward influence highly unlikely. It remains to be seen to what extent other eco-city projects follow in Tianjin eco-city's wake, and whether its deliberate self-sufficiency is tenable in the medium and long term. In this sense the “Chinese style” eco-city cannot escape the criticisms of eco-quarters advanced by French and other European writers, and the difficulties in establishing sustainability models that can become more than mere islets of eco-friendly technologies within their unsustainable urban spaces.

■ Translated by Jonathan Hall.

■ Yinghao Li is a researcher in the LABEX (laboratoire d'excellence) at the University of Paris-Est, and at the Laboratory for Water, Environment, and Urban Systems (LEESU) at the Ecole des Ponts ParisTech.
LEESU, École des Ponts ParisTech, 6-8 avenue Blaise-Pascal, Cité Descartes, 77455 Champs-sur-Marne, Marne-la-Vallée, France (liyinghao@hotmail.com).

■ Céline Bonhomme is an associate researcher at the Laboratory for Water, Environment, and Urban Systems (LEESU) at the Ecole des Ponts ParisTech.
LEESU, École des Ponts ParisTech, 6-8 avenue Blaise-Pascal, Cité Descartes, 77455 Champs-sur-Marne, Marne-la-Vallée, France (celine.bonhomme@enpc.fr).

■ José-Frédéric is a researcher at the Laboratory for Water, Environment, and Urban Systems (LEESU) at the Ecole des Ponts ParisTech.
LEESU, École des Ponts ParisTech, 6-8 avenue Blaise-Pascal, Cité Descartes, 77455 Champs-sur-Marne, Marne-la-Vallée, France (jfd@leesu.enpc.fr).

Manuscript received on 1 August 2016. Accepted on 29 January 2018.

References

- BIWEI, Su, Almas HESHMATI, and Yong GENG. 2013. “A Review of the Circular Economy in China: Moving from Rhetoric to Implementation.” *Journal of Cleaner Production* 42: 215–27.
- BOCQUET, Denis. 2013. “Singapour ville durable? Innovations et limites d'une politique environnementale et urbaine” (Singapore, a sustainable city? Innovations and limits of an environmental and urban policy). *Petits déjeuners de la chaire ville de l'Ecole des Ponts. Série Green Cities*. <https://hal-enpc.archives-ouvertes.fr/hal-00841542/document> (accessed on 1 August 2016).
- BONARD, Yves, and Laurent MATTHEY. 2010. “Les éco-quartiers : laboratoires de la ville durable. Changement de paradigme ou éternel retour du même ?” (Eco-neighborhoods: laboratories for the sustainable city. Paradigm shift or eternal return of the same?). *Cybergeo: European Journal of Geography*. <http://journals.openedition.org/cybergeo/23202> (accessed on 5 April 2018).
- CAPROTTI, Federico. 2014. “Critical Research on Eco-Cities? A Walk through the Sino-Singapore Tianjin Eco-City, China.” *Cities* 36: 10–17.
- CHRISTOFF, Peter. 1996. “Ecological Modernisation, Ecological Modernities.” *Environmental Politics* 5: 476–500.
- CURIEN, Rémi. 2016. “Services essentiels en réseaux et fabrique urbaine en Chine: verdir le développement accéléré?” (Essential services in networks and urban fabric in China: making the fast development green?). *Urbanités*. <http://www.revue-urbanites.fr/services-essentiels-en-reseaux-et-fabrique-urbaine-en-chine-verdir-le-developpement-accelere/> (accessed on 5 April 2018).
- CURIEN, Rémi. 2014. “Chinese Urban Planning: Environmentalising a hyper-functionalist machine?” *China Perspectives* 2014(3): 23–31.
- CURIEN, Rémi. 2014. *Services essentiels en réseaux et fabrique urbaine en Chine : la quête d'une environnementalisation dans le cadre d'un développement accéléré. Enquêtes à Shanghai, Suzhou et Tianjin* (Essential services in networks and urban fabric in China: The quest for environmentalization in the context of accelerated development. Field research in Shanghai, Suzhou and Tianjin). Doctoral Thesis on urban management and planning. Université Paris Est.
- DE JONG, Martin, Chang YU, Xinting CHEN, Dong WANG, and Margot WEIJNENA. 2013. “Developing Robust Organizational Frameworks for Sino-Foreign Eco-Cities: Comparing Sino-Dutch Shenzhen Low Carbon City with Other Onitiatives.” *Journal of Cleaner Production* 57: 209–220.
- DHAKAL, Shobhakar. 2009. “Urban Energy Use and Carbon Emissions from Cities in China and Policy Implications.” *Energy Policy* 37(11): 4208–19.
- DOULET, Jean-François. 2008. “Where are China's Cities Heading? Three Approaches to the Metropolis in Contemporary China.” *China Perspectives* 2008(4).
- DOULET, Jean-François. 2015. “L'urbanisme chinois et l'émergence du modèle 'intégrationniste'” (China urban planning and the advent of the “integrationist” model). *Métropolitiques* 27 April 2015. <http://www.metropolitiques.eu/L-urbanisme-chinois-et-l-emergence.html> (accessed on 5 April 2018).

- HALD, May. 2009. "Sustainable Urban Development and Chinese Eco-City." *Report to Fridtjof Nansens Institute*. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.730.8055&rep=rep1&type=pdf> (accessed on 5 April 2018)
- CHENG, Hefa, and HU Yuanan. 2010. "Planning for Sustainability in China's Urban Development: Status and challenges for Dongtan Eco-City Project." *Journal of Environmental Monitoring* 12(1): 119-126.
- HEIMER, Maria, and Stig THOGERON. 2006. *Doing Field Work in China*. Hawaii: University of Hawaii Publishing.
- EMELIANOFF, Cyria. 2008. "L'éco-quartier peut servir de levier à un changement de mode de vie" (The eco-neighbourhood can serve as a lever to change the way of life). *Territoires* 487.
- FABUREL, Silvere Tribut. 2011. "Les quartiers durables sont-ils durables ? De la technique écologique aux modes de vie" (The eco-neighbourhood are they sustainable? From ecological technique to way of life). *Cosmopolitiques* 19. <http://www.cosmopolitiques.com/sites/default/files/Quartiers%20durables%20et%20modes%20de%20vie%20GF%20et%20ST%20Mars%202010%20final.pdf> (accessed on 5 April 2018)
- WU, Fulong. 2012. "China's Eco-Cities." *Geoforum* 43: 169-171.
- HU, Mei-Chih, WU C. Y., SHIH T. 2015. "Creating a New Socio-Technical Regime in China: Evidence from the Sino-Singapore Eco-City of Tianjin." *Futures* 70: 1-12
- HUBER, Joseph. 2004. *New Technologies and Environmental Innovations*. Cheltenham, Northampton: Edward Elgar Publishing Limited Inc.
- JIA, He, BAO C. K., SHU T. F., YUN X. X., JIANG D., BRWON L. 2011. "Framework for Integration of Urban Planning, Strategic Environmental Assessment and Ecological Planning for Urban Sustainability within the Context of China." *Environmental Impact Assessment Review* (31)6: 549-560.
- JIANG, Xu. 2016. "Environmental Discourses in China's Urban Planning System." *Urban Studies* 53: 978-999.
- LA BRANCHE, Stéphane. 2015. "Gouvernance et jeux d'acteurs dans les écoquartiers" (Governance and actors game in eco-neighbourhood). *La Revue* 2. <http://innovacs-innovatio.upmf-grenoble.fr/index.php?id=138> (accessed on 5 April 2018).
- LI, Yu. 2014. "Low Carbon Eco-City: New Approach for Chinese Urbanisation." *Habitat International* 44: 102-110.
- REN, Liying. 2002. "环境保护中的公众参与" (*Huanjing baohu zhong de gongzhong canyu*, Citizens' participation in environmental protection). *环境问题与环境意识* (*Huanjing wenti yu huanjingyishi*): 89-133.
- LOW, Sui Pheng, LIU Jun Ying, and WU Peng. 2009. "Sustainable Facilities: Institutional Compliance and the Sino-Singapore Tianjin Eco-city Project." *Facilities* 27: 368-386.
- MILANEZ, Bruno, Ton Bührs. 2007. "Marrying Strands of Ecological Modernisation: A Proposed Framework." *Environmental Politics* (16)4: 565-583.
- OHSHITA, Stephanie B., PRICE L., ZHOU N., KHANNA N., FRIDLEY D., and LIU X. 2015. "The role of Chinese Cities in Greenhouse Gas Emission Reduction." Briefing prepared by the China Energy Group, Lawrence Berkeley National Laboratory, for Stockholm Environment Institute and Bloomberg Philanthropies. September 2015. <https://repository.usfca.edu/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=1016&context=envs> (accessed on 5 April 2018).
- POW, C. P., and H. NEO. 2013. "Seeing Red Over Green: Contesting Urban Sustainabilities in China." *Urban Studies* (50)11: 2256-2274.
- POW, C. P., and H. NEO. 2015. "Modelling Green Urbanism in China: Modelling Green Urbanism in China." *Area* (47)2: 132-40.
- RENAULD, Vincent. 2012. "Fabrication et usages des écoquartiers français: éléments d'analyse à partir des quartiers De Bonne (Grenoble), Jinko (Bordeaux) et Bottière-Chenaie (Nantes)" (Creation and uses of French eco-neighbourhood: analysis elements from the neighbourhoods of Bonne (Grenoble), Jinko (Bordeaux) and Bottière-Chenaie (Nantes)). Doctoral Thesis at the Lyon INSA in Geography, Urban Planning and Management.
- Research Team of Tianjin Eco-city KPI. 2009. *导航生态城市 中新天津生态城指标体系实施模式* (*Daohang shengtai chengshi - Zhongxin Tianjin shengtaicheng zhibiao tixi shishi moshi*, Piloting the eco-city – implementing the KPI system for the Tianjin eco-city).
- CHIEN, Shih-shen. 2013. "Chinese Eco-Cities: A Perspective of Land-Speculation-Oriented Local Entrepreneurialism." *China Information* (27)2: 173-96.
- SOUAMI, Taoufik. 2009. *Écoquartiers, secrets de fabrication. Analyse critique d'exemples européens* (Eco-neighbourhoods, creation secrets. Critical analysis of European examples). Paris: Éditions les Carnets de l'info.
- STOCK, Mathis. 2004. "L'habiter comme pratique des lieux géographiques" (Living as a practice of geographical places). *Espaces Temps.net*. <https://www.espacestemp.net/articles/habiter-comme-pratique-des-lieux-geographiques/> (accessed on 5 April 2018).
- FENG, Suwei, and LI Qiang. 2013. "Car Ownership Control in Chinese Mega Cities: Shanghai, Beijing and Guangzhou." *Journeys*. 40-49.
- United Nations. 2007. "Indicators of Sustainable Development: Guidelines and Methodologies." New York.
- VERHAGE, Roelof, and Marie LEROY. 2014. "Développement urbain durable : Comment apprendre des expériences d'écoquartiers ?" (Sustainable urban development: how to learn from eco-neighbourhoods experiences?). *Géocarrefour* 894: 1-21.
- World Bank. 2009. "Sino-Singapore Tianjin Eco-City: A case study of an emerging eco-city in China." *Technical Assistance Report*.
- XU Jiang. 2016. "Environmental Discourses in China's Urban Planning System: A Scaled Discourse-Analytical Perspective." *Urban Studies* (53)5: 978-99.
- GUO, Yanhua. 2004. *走向绿色文明* (*Zouxiang lüse wenming*, Towards a green civilisation). Beijing: China Social Sciences Press.