

# Hållbara städer

Kina

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Swedish Agency For Growth Policy Analysis  
Studentplan 3, SE-831 40 Östersund, Sweden  
Telephone: +46 (0)10 447 44 00  
Fax: +46 (0)10 447 44 01  
E-mail: [info@growthanalysis.se](mailto:info@growthanalysis.se)  
[www.growthanalysis.se](http://www.growthanalysis.se)

For further information, please contact: Mats Engström  
Telephone: +46 (0)10 447 44 63  
E-mail: [mats.engstrom@growthanalysis.se](mailto:mats.engstrom@growthanalysis.se)

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## Summary

Urbanization in China over the past three decades has been unprecedented. Each year about 16 millions of China's rural residents – equivalent to the total population of the Netherlands – have been moving into cities. This trend has supported high growth and rapid transformation of the economy by allowing some 260 million migrants to move in from agriculture to more productive activities in the cities.<sup>1</sup>

China's urban landscape is expected to continue to change: the largest cities will likely become even larger and boost their role as gateways to the world, thereby also moving increasingly into services, knowledge, and innovation. Secondary cities are likely to attract more land-intensive manufacturing, benefiting from specialization and links to markets. Over the next 20 years it is foreseen that another 300 million people will move into the cities.<sup>2</sup>

The Chinese leadership has recently launched the concept of ecological civilization as the main model for further development. This should naturally also integrate a sustainable city development, where environmental objectives are placed on an equal footing with economic growth and social inclusion, and sector policies are aligned with these strategic objectives.

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<sup>1</sup> China's urban population rose from less than 20 per cent of the total in 1978 to 52 per cent in 2012, lifting millions of people out of poverty.

<sup>2</sup> China has today 124 cities with between one and five million inhabitants, ten cities with between five and ten million inhabitants and six 'mega-cities' with over ten million inhabitants. This compares with the EU-27 that has 40 cities with over a million inhabitants.

## 1 China's urbanization plan for 2014–2020 – comprehensive measures for sustainable development

China's much anticipated first national action plan for urbanization was finally released in March 2014. Compared to conventional urbanization, the plan defines a 'new-style', 'human-oriented' urbanization with emphasis on quality instead of quantity, aimed at boosting domestic demand and promoting economic restructuring. This includes, e.g., modernization, clustering and greening of cities; coordinated development of large, medium, and small cities and towns; development of green and efficient production, lifestyles and consumption patterns; strict control of energy consumption and industrial emissions; efficient and intensive use of land, water and energy resources; recycling and efficient use of resources; urban-rural integration as well as social harmony.

In 2020 all urban residents, regardless of where they are registered, should have access to basic social services – such as primary education for children and health insurance – in the city where they live. Besides income levels, affordable housing, public services, and social security, enhancing the quality of life also includes improving the ecological environment, which is also an important indicator of the improving quality of urbanization. Below we list some of the specific goals to be achieved by 2020:

- >99 per cent of migrant worker's children to have access to education
- >95 per cent of unemployed urban residents and migrant workers to get free training to upgrade their skills
- >90 per cent of urban residents to have right to pension<sup>3</sup>
- 98 per cent of urban residents to have basic medical insurance<sup>4</sup>
- Strengthen corporate responsibility payment, expanding responsibility to all urban workers so that also migrant workers have access to work-related injury insurance, unemployment insurance, maternity insurance, etc.
- >23 per cent of urban residents to have access to the affordable housing guarantee system<sup>5</sup>
- 60 per cent of travels to be by public transport in cities with more than 1 million<sup>6</sup>
- 90 per cent of the population to have access to public water supply,<sup>7</sup> and 95 per cent of the sewage water to be treated<sup>8</sup>
- 13 per cent of consumed energy in towns to be renewable energy
- 50 per cent of all new buildings in towns to be green buildings

<sup>3</sup> Compared to 67 per cent in 2012.

<sup>4</sup> Compared to 95 per cent in 2012.

<sup>5</sup> Compared to 12,5 per cent in 2012.

<sup>6</sup> Compared to 45 per cent in 2012.

<sup>7</sup> Compared to 82 per cent in 2012.

<sup>8</sup> Compared to 87 per cent in 2012.

## 1.1 Urbanising the rural migrant population and implementing social reforms

An important focus of the ‘new-style’ urbanization plan is to improve social conditions for migrant workers and their families in the cities.<sup>9</sup> The goal by 2020 is to give 100 million migrant workers who presently live in cities but are registered in rural areas an urban ‘hukou’.<sup>10</sup> An additional 100 million people who currently live in rural areas will move into cities, mostly in central and western China.<sup>11</sup> About 100 million urban dwellers will have their living conditions improved through renovation of shanty towns and villages. A new residence registration system in parallel with the ‘hukou’ system, will guarantee all migrant workers the access to basic social services which increase in size with time spent in the city. More equal service delivery across China will increase equality of opportunity for all its citizens.

The settlement in towns and small cities of less than 0.5 million will be fully liberalized, the settlement restrictions for 0.5–1 million cities will be orderly released, a reasonable release of the settlement restrictions will take place for 1–5 million cities, and strict control of the urban population will be enforced in megacities of more than 5 million.

### Factbox 1

Since 2007, China has implemented an ambitious social housing program for rural and urban residents. The program includes 7 categories and 12 varieties of social housing, including low-cost rental housing, assisted home ownership, public rental housing, and shelter improvement. By 2012, these programs offered housing to 31 million urban households, or 12.5 per cent of the total urban households, while over 5 million urban households benefited from rental subsidies. Fiscal support for social housing has rapidly increased, from 10 billion CNY in 2007 to 380 billion CNY in 2012. Despite these achievements, many challenges remain. The 12th Five-Year Plan (FYP) targets 35 million units of social housing, bringing total coverage to 20 per cent of households, which is higher than in most developed countries.

<sup>9</sup> It is estimated that in 2012 one-third of China’s urban population was migrant workers and their families. It means that about 250 million people were partially without access to basic social services where they live.

<sup>10</sup> A survey done by the Chinese Academy of Social Sciences (CASS) in 2014 showed that the public cost for transforming a migrant worker into a registered urban citizen with local ‘hukou’ is about 130 000 CNY per person.

<sup>11</sup> Presently, two-thirds of China’s migrant workers live in the eastern provinces and two-thirds of these originate from the same province.

## 1.2 Optimizing the urban pattern and implementing land reform

The city clusters in Beijing-Tianjin-Hebei (Jing-Jin-Ji), the Yangtze River Delta and the Pearl River Delta areas represent the most dynamic economies in China today.<sup>12</sup> They need further urban optimization to become open, green and innovative world-class cities capable to attract sizable foreign investments and population. The planned quota for new construction in the Jing-Jin-Ji area, the Yangtze Delta and the Pearl River Delta will be gradually reduced.

The cities in the central and western parts of China will benefit from shifting the labour-intensive industries to the Midwest, to absorb some of the migrant workers from the east and to accelerate the development of industrial clusters and population concentration, as well as foster the development of several new city groups. The emphasis will be on accelerating the development of the Chengdu-Chongqing, central China, and the mid-reaches of the Yangtze River, as well as the development of the ‘new Silk Road’ to promote regional cooperation with Central Asia and Europe. The central region is an important grain producing area affected by serious water shortage. Therefore, while developing the central and western cities, arable land and water resources must be strictly protected. Generally, regional cooperation will be promoted so that different cities within a region complement each other and take advantage of their specific advantages.<sup>13</sup>

The land urbanization in China is faster than the population urbanization. From 2000 to 2011 the areas classified as urban increased by 76.4 per cent, greatly exceeding the 50.5 per cent growth rate of the urban population. This exacerbates the extensive use of land, wastes much arable land resources, and threatens the national food and ecological security.

In Chinese cities, land allocation is biased towards industry.<sup>14</sup> Rural land requisition and conversion for industrial use has been particularly inefficient because it has been largely driven by administrative decisions rather than market demand. Unlike commercial and residential land, industrial land is rarely auctioned and is usually directly allocated or sold at heavily subsidized prices, on average only 10 per cent of commercial land prices. As a result, despite the abundance of urban land, land for residential development and the services sector is limited and expensive, resulting in surging housing prices and an underdeveloped services sector. Land reforms will also likely lead to denser cities, which would reduce the energy intensity and car use in cities, thus improving environmental sustainability. And reduced land use for urbanization would leave more land for environmental services and agricultural production.

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<sup>12</sup> The combined economies of Beijing, Guangzhou, Shanghai, Shenzhen, and Tianjin amounted to 1 trillion USD in 2010 – comparable in size to Korea’s economy.

<sup>13</sup> Today, cities are often fierce competitors for investment, establishment and funding from the central government.

<sup>14</sup> China currently uses more than a quarter of its urban land for industrial purposes, even in some of its largest cities—a stark contrast with, e.g., Hong Kong, which uses 5 per cent.

**Factbox 2**

In China, urban land is owned by the state, while rural land is normally under collective ownership. While gradual reforms since the 1980s saw the trading of urban land evolve into a robust property market, land in the countryside has remained largely static as farmers generally have the right to use the land, but cannot directly trade or mortgage it.

China will pilot a set of reforms aimed at giving farmers greater property rights to allow them to enjoy more benefits of the country's urbanization drive. According to the Ministry of Housing and Urban-Rural Development (MoHURD), the plan will explore 'diversified forms of collective ownership of rural land to better protect the interests of farmers', with the pilot expected to be completed by 2017. They will essentially cover rights to lease and mortgage rural land.

**1.3 Optimizing the urban management structure**

The overall urban planning should be improved, by performing preliminary studies and coordination, as well as including experts and public participation for review, approval, implementation and management of the projects. Metropolitan districts should establish strict conditions to prevent urban sprawl. Restoration and protection should be optimized to enhance and keep the functionality of the old city. Accelerate the transformation of urban relocation of old industrial areas, and vigorously promote renovation of shantytowns.

A clear, urban agglomeration coordination mechanisms should be developed, including urban development goals for each individual city, with a well-defined spatial structure and development direction, a clear positioning and function of each division of the city. The aim is to strengthen urban system planning, land use planning, environmental planning, and planning to carry out an environmental impact assessment in accordance with law. The central city spread should be limited to 1-hour traffic circle area, to foster a commuter-efficient metropolitan development. Key towns surrounding large cities should strengthen the overall planning of urban development and function facilities, and gradually developed into a satellite city. In small towns, cultural tourism should be cultivated, trade, logistics, resource processing, and transportation hubs should be developed.

The construction of a comprehensive urban public transport network will be accelerated as the main travel system, by actively developing rapid buses, trams and other large-capacity modern public transportation systems. By 2020, conventional railway networks should cover all cities with a population of over 200 000 people, rapid rail network should cover all cities of more than 500 000 people, ordinary national highways should basically cover county-level towns, national expressways should basically cover cities with a population of over 200 000 people, the civil aviation network should continue to expand air services to cover about 90 per cent of the country's population. Walking and cycling conditions should also be improved.

**Factbox 3**

A series of national policies have been introduced to promote utilization of new energy vehicles in China. For example in 2014, the Ministry of Transport (MoT) issued the notification 'Opinions on accelerating the application of new energy vehicles', which proposed that by 2020 the ratio of new energy vehicles among urban city buses, taxis and urban distribution vehicles should be not less than 30 per cent. By 2020, the new energy city buses will reach 200 000, new energy taxis will reach 50 000, and new energy urban distribution vehicles will reach 50,000. The State Council issued also the new energy automotive industry development plan, where the main objectives include: cumulative production and sales of pure electric vehicles and hybrids to reach 500 000 by 2015 and a production capacity of 2 million by 2020, cumulative production and sales of over 5 million.

**Factbox 4**

Emission reduction measures targeting the most polluting vehicles are also implemented. So-called 'yellow-label' cars, which account for 13.4 per cent of the total vehicle fleet, are responsible for 81.9 per cent of the particulate matters, 58.2 per cent of nitrogen oxides, 56.8 per cent hydrocarbons and 52.5 per cent of carbon monoxides emitted. In accordance with the implementation of the 'Atmospheric Pollution Prevention Action Plan', and under joint supervision of the Ministry of Environmental Protection (MEP), the National Development and Reform Commission (NDRC), the Ministry of Public Security, the Ministry of Finance, the Ministry of Transportation, and the Ministry of Commerce, the phase-out of yellow-label cars will be accelerated using a market-based approach.<sup>15</sup> The program to trade in old cars for new cars will also be continued.

## 1.4 Creating a dynamic economy through innovation and consumption

A major innovation of the 'new-style' urbanization plan compared to the Chinese government's previous line is that it clarifies the need for a dynamic economic development with job opportunity creation in cities to drive urbanization. In contrast, the present artificial urbanization has relied on economic development through investments in infrastructure and buildings – with negative consequences such as ghost towns and empty industrial parks.<sup>16</sup>

Economic focus will shift towards advanced manufacturing, information technology, biology, new energy, new materials, new energy vehicles and other strategic emerging industries, as well as the service sector. China's rapid growth and migration have made urban economic systems more efficient through higher concentration of production. Estimates for China suggest a 10 per cent increase in productivity for every doubling of city size.

<sup>15</sup> By the end of 2014, 6 million 'yellow-label' and old cars are planned to be phased-out.

<sup>16</sup> China's investment rate is now more than 45 per cent of GDP, constitutes almost half of demand, and over the past decade accounted for 80 per cent of growth.

Increased average income and greater choice in cities leads to increased consumption.<sup>17</sup> In 2010 a city dweller in China spent on average more than three times as much as a person in rural areas. Thus, urbanization has become an important part of the government's strategy for continued economic growth – urbanization is seen as a key to the big unsaturated domestic market. A growing consumer demand comes from an expanding middle class,<sup>18</sup> which now makes up almost a quarter of China's population and more than 40 per cent of its urban population.

## 1.5 Managing resources and environmental pressures

China's impressive economic and social gains have come at the price of significant environmental degradation and unsustainable resource use. The current urbanization path is not efficient because pollution imposes rising direct and indirect economic costs that are often not reflected by the market. Energy production is the key source of air pollution in China's cities owing to China's dependence on coal, which has remained at around 70 per cent of the total energy supply. Cities host coal-reliant industries or import coal-generated electricity, which make up a large share of China's economic structure. A large share of China's pollution can be related to exports to developed countries.<sup>19</sup>

Estimates of mortality from air pollution in China are significant. Health damages have high economic costs, estimated to range from 600–2000 billion CNY per year. According to China's Ministry of Environmental Protection, 57 per cent of the groundwater in 198 cities tested in 2012 was rated either 'bad' or 'extremely bad,' while more than 30 per cent of the country's major rivers were found to be 'polluted' or 'seriously polluted,' making their waters unfit for drinking or direct human contact. Municipal and industrial solid waste generation increased from about 1.2 billion to 2.6 billion tons between 2003 and 2010. With 20 per cent of the world's population but only 7 per cent of its freshwater, water scarcity and quality are major problems for sustainable urban development in China. Some 420 cities have insufficient water supplies; 110 of these are facing severe water shortages, the problem being most urgent in the north.

China's environmental performance is important for the whole world. China is now the largest global emitter of greenhouse gases. Beijing, Shanghai, and Tianjin have estimated per capita emissions comparable to large European cities. In recent decades China has invested heavily in infrastructure to support environmental management and has made considerable progress in reducing pollution and improving the energy efficiency of its economy.

China has already a comprehensive set of environmental laws, regulations, and standards. Many technical solutions to address pollution and increase resource use efficiency have been piloted in the last years. However, current enforcement of China's environmental regulations, institutions, incentives, and instruments are often weak because local cadres face inadequate incentives to put policy into effect

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<sup>17</sup> Between 2000 and 2010, per capita GDP rose from 35 000 CNY to 82 000 CNY in Shenzhen and from 32 000 CNY to 66 000 CNY in Shanghai.

<sup>18</sup> Those that earn 10–100 USD per capita a day.

<sup>19</sup> One estimate suggests that exports account for about one-third of China's energy use and likely a similar share of air pollution.

and to complete complementary sector reforms. Even when the regulations are enforced, their implementation is often inflexible.

For example, management of water and air quality is most effectively conducted at a regional scale. An improved data collection system with wider information dissemination will promote compliance and allow greater public participation in holding polluters accountable. Furthermore, rebalancing environmental policy instruments towards more market-based tools such as taxes and trading systems for carbon, air and water pollution, and energy use will create a greener urban environment.

China is also taking its first steps towards a market-based electricity and water pricing system that more accurately reflects resource scarcity and actual costs of provision. Moreover, prices should include the indirect costs imposed on health, ecosystem damage, and the climate by the production of resources and by their use.

Incentives will be created to reduce waste and strengthen the municipal solid waste recycling and safe disposal. Recycling in China is widespread but informal. Formalization could yield revenue to finance waste management. Manufacturers are expected to take increasing responsibility for life-cycle waste generation including packaging materials and final disposal.

The most important task for achieving greener urbanization is to strengthen green governance – the institutions, incentives, and instruments that enable effective environmental management. An example is the new criteria for evaluation of officials based on their environment performance (see section 1.8). The criterion of GDP is even completely removed in areas of special ecological importance.

Structural shifts in the economy toward cleaner sectors – like green and renewable energy industry – will also help in the longer term. As China becomes more prosperous, its population is increasingly demanding a clean and healthy living environment.

## **1.6 Developing alternative energy sources**

China's renewable energy technologies have developed significantly since the introduction of China's Renewable Energy Law in 2005. Renewables – particularly wind and solar power – have since then grown rapidly and made China the world leader in installed non-hydro capacity with 70 GW at the end of 2011. For example, with the commercialization of solar water heating (SWH) over the past three decades, China has become the largest country using solar thermal power in domestic water heating. By the end of 2010, the country had installed 168 million m<sup>2</sup> (collector area) of SWHs, which accounted for more than 60 per cent of SWHs installed in the world. SWHs have general cost advantages over other types of renewable energy sources.

Scaling up of cost-effective local clean energy production complemented with energy supply from large-scale production facilities outside the city boundaries constitute the key elements of the urban energy structure in the short and medium term. China's coal-reliant district heating sector still contributes significantly to China's wintertime air pollution but small coal-fired boilers are steadily replaced

with natural-gas-fired alternatives. Higher energy efficiency in industry is also an important factor in achieving the sustainability targets.<sup>20</sup>

### Factbox 5

According to the latest statistics, China has 138 city-level waste incineration plants, having a total processing capacity of over 120 000 tons/day.<sup>21</sup> They handle more than 20 per cent of the total garbage removal and are effectively promoting waste-to-energy generation.

According to NDRC, in the next five years the total investment in waste incineration power generation technology will reach 26 billion CNY, second only to the direct-drive permanent magnet wind power technology.

## 1.7 Enhancing the overall quality of the city

According to the ‘new-style’ urbanization plan, monitoring of material quality, supervision of building design, and quality control of the whole construction process are required. This will be achieved, e.g., through implementation of a quality certification system, professional skills training for construction workers, as well as resolutely cracking down on law violations in construction project bidding, sub-contracting and materials procurement. Energy performance targets for residential and commercial buildings will be set to define ‘low-energy building’ standards. The goal by 2020 is that such green buildings should correspond to 50 per cent of all new buildings in densely populated areas.

The concept of ‘low carbon city’ was introduced in China in the run-up to the Beijing Olympics. Since then the concept has moved from being merely a political slogan to concrete development approaches for Chinese cities. In 2010 China’s NDRC announced a programme for five low-carbon pilot provinces and eight low carbon pilot cities.<sup>22</sup> In addition, more than 200 cities have adopted the goal of low-carbon development. Common elements of these local development plans are carbon emission intensity targets and energy consumption targets for buildings, transport or industry sectors for 2015 or 2020.

Smart and cultural cities will also be promoted as well as intelligent information applications and new information services. The cities’ cultural identity should be preserved and increase the population’s access to cultural institutions such as libraries and museums. All households in the cities should have access to broadband<sup>23</sup> and public wireless networks.<sup>24</sup> For example, the MoHURD announced in 2013 a national list of smart city pilots, which identified a total of 103 cities, mainly focusing on the development of applications related to Internet of Things (IoT), networking, cloud computing, big data, the Beidou navigation system, information security and other next-generation IT support functions. After project

<sup>20</sup> Energy intensity fell by 6 per cent a year on average from 1980 to 2000, and slowed consecutively to 2 per cent in 2000–2010.

<sup>21</sup> An additional of about 307 200 tons/day are being under construction.

<sup>22</sup> The five provinces taking part in the pilot project are Guangdong, Liaoning, Hubei, Shaanxi and Yunnan; the eight cities are Tianjin, Chongqing, Shenzhen, Xiamen, Nanchang, Guiyang, Baoding and Hangzhou.

<sup>23</sup> Promote FTTH to achieve a basic fibre-optic network with a broadband capacity of 50 Mbps.

<sup>24</sup> Pushing 4G network construction and speed up urban public hotspots LAN coverage.

completion and final assessment, excellent pilot cities will get additional support to promote the development of smart city technologies and standards, and to support an indigenous smart city innovation chain and industrial chain.

### **Factbox 6**

In 2014 'Alipay wallet' has together with the local government in Beijing launched a 'smart parking' pilot project. By letting a surveillance camera to identify the license plate number, 'Alipay wallet' can automatically solve the billing and payment without the use of parking passes. On one hand it simplifies parking management, and on the other it improves the efficiency of the payments.

Two popular smartphone applications, Didi-Dache and Kuaidi Dache, have revolutionized taxi-hailing in China. The applications show the real-time locations of taxis on a map using the GPS technology and enables users to find a taxi through their smartphones. The users' request will be sent to the nearest cab drivers who can decide whether to accept the order or not.

## **1.8 Strengthening and innovating city governance**

China's governance systems and initiatives rely predominantly on administrative measures that are driven, initiated, and executed by the government. Participation in China's policy making has traditionally been structured and institutionalized within the state and party systems. As part of China's traditionally strongly planning-oriented economy – and in contrast to the market-led, government-incentivised western approach – city-level development is also strongly planned and promoted through government targets.

However, a new model of urbanization requires a different role of the government, which should support rather than replace market forces in shaping China's urban landscape, allowing China's cities to grow more organically and efficiently in response to market forces within the context of the government's strategic development plan. The government will need to rebalance its involvement from exercising administrative control to regulating market-based allocation of people, land, and capital across China as well as provision of public services. The government will also need to increase its effectiveness in enforcing existing legislation while enhancing market pricing to reflect environmental externalities in market transactions.

Over the last decade, and especially in the field of environmental governance, some new steps have been taken and new institutional arrangements tested, which allow for further participation in China's policy making and implementation.

Environmental non-governmental organizations (ENGOS) have been increasing rapidly, including both officially registered and unregistered groups. The majority of these ENGOS are quite small and are not directly engaged in environmental policy making and implementation, but rather focus on awareness raising, education, study and research.

Public hearings represent a more institutionalized arrangement for participation in China's environmental policy making. The best-known example concerns public

hearings in the Environmental Impact Assessment (EIA) procedure, as formalized in the 2002 EIA law and its implementation measures.

In the early 1990s China set up a system of complaints to assist government monitoring and priority setting in the field of environmental pollution. The public participation in this system has grown over the years.

The performance evaluation system creates a strong incentive to elevate green objectives to the level of economic growth and social goals for local government officials. Moreover, longer tenure for local officials would also encourage urban management that focuses on the longer term, within which results on green objectives can be achieved.

At all levels, environmental management institutions would need greater authority and independence when dealing with other ministries, local governments, state-owned enterprises, and private companies.

#### **Factbox 7**

In October 2014 the first inter-ministerial urbanization joint committee meeting was held in Beijing. Representatives from 15 Ministries, led by NDRC and including the Ministries of Education, Public Security, Finance, Social Security, Land Resources, Housing, Transport and Agriculture. It identified three priorities for the current Chinese urbanization process, namely the 'hukou' reform (in particular equal access to social benefits in cities for migrant workers), land management and financial and taxation reform. Traditionally, the creation of inter-ministerial committees signals a real political commitment to carrying forward a specific reform that encompasses the competences of several ministries.

## **1.9 Creating a sustainable urban financial mechanism**

Until now, rapid urban expansion in China has been characterized by urban sprawl and extensive road network construction. One of underlying factors for this is the present system of public finance. Local governments receive only a small percentage of the country's tax revenues, while they are imposed an increasing expenditure burden. In the recent decade, land sales have therefore become a large source of local government revenue.<sup>25</sup> The consequence is an imbalance in the distribution of industrial, residential, commercial, and green areas in the city, as well as underdeveloped and costly public transport with resulting increased levels of pollution. The present situation clearly shows that urban finance reform is the cornerstone for efficient, inclusive, and sustainable urbanization.

According to the Ministry of Finance, the implementation of the urbanization plan over six years will cost a total of 42 trillion CNY, which represents nearly 75 per cent of the country's GDP in 2013. The expenditure will be mainly divided between the central and the local governments, but also companies and individuals are expected to pay their fair share. The central government will take a larger financial responsibility than in the present situation, e.g., the costs for compulsory education, employment and basic pension insurance, basic health care, affordable

<sup>25</sup> On average, some 5.5 per cent of GDP in gross revenues and 2.5 per cent after compensation and land sale preparation costs.

housing and other public social services. Small and medium-sized cities (up to 500 000 inhabitants) will be prioritized by the central government in the allocation of financial resources. Financial transfer payment mechanisms linked to the migrant rural population will be established with financial arrangements between provinces but also between central and local governments for payments according to population flow.

According to the urbanization plan, the tax system as well as investment and financing mechanisms will be reformed. To improve the revenue base of local governments, and at the same time promote sustainability, cities will impose real estate taxes; gradually charge higher prices for urban services such as water, energy, and transport to cover full costs and promote efficient use of resources; increase taxes and charges on motor vehicles to raise revenues and reduce congestion; and promote environmental tax reform.<sup>26</sup> As China grows richer, conversion of oversized industrial land into commercial and residential land could provide the main land resource for cities – and provide a new source of revenues for local governments. China's cities should be financed from local taxes so that local government decisions can be scrutinized by those that pay the taxes and benefit from public services.

In order to strengthen the ecological protection system, resource and environmental rights trading mechanisms will be established. This includes development of environmental markets; implementation of energy savings, carbon emissions, emission rights and water rights trading systems; and implementation of a third-party environmental pollution control to attract investments in ecological and environmental protection.

Finally, the private sector could play a larger role in financing and delivering infrastructure and other public services. In fact, China has already developed a policy framework for procuring services from the private sector. Since 1990, China has had more than 1 000 public-private partnership (PPP) transactions in infrastructure (transport, water, energy) for a total value of 166 billion USD. China may also shift the focus of PPP contracts from capital financing towards service provision.

### **1.10 Placing more emphasis on implementation**

The urbanization plan points out the need of stronger coordination and careful division of labour between central and local governments. Hereby, the role of the central government is to strengthen the top-level system design, coordinate major policy research and development, and guide the development of urbanization to solve major societal problems. To be noted, the role of the superministerium NDRC is to lead the advanced planning and implementation of relevant policies, as well as to supervise and inspect the work progress.

In the decentralized Chinese system, the local governments at all levels have the very important task to fully implement the plan in concrete action, by establishing a sound working mechanism adapted to local conditions, reformulating their own urbanization plans and specific policy measures in line with local conditions. They are also responsible to accelerate the training of a group of city management expert cadres.

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<sup>26</sup> Cities like Shanghai already auction car license plates, which limits car use to sustainable levels.

Following a well-established Chinese tradition, pilot cities in different regions will be created, where specific challenges related to urbanization can be studied and solutions developed. Governments on all levels are expected to promote the development of innovative city, smart city and low-carbon city pilots. Cooperation with foreign governments and international partnerships are also strongly promoted.

**Factbox 8**

The central government has chosen 62 pilot locations across the country as experimental areas for 'new-style' urbanization, in an attempt to further define this broad concept of an urbanization that is environment-friendly and people-centred with specific policy measures. The 62 pilots will be given a certain degree of freedom to put into practice innovative local solutions to problems defined in the overall plan by the central government. The pilot program will focus on some key issues such as the attraction of private capital for urbanization-related public investments or the mechanisms of cost-sharing to give migrant workers access to urban public services.

## 2 Case studies of sustainable city development in China

China has invested billions of dollars in several large eco-city projects, which are intended to serve as practical, replicable and scalable models for green urban design. In these efforts, China often looks to the international community to understand best practices in planning and development, as well as access advanced technologies. In 2007, the Chinese central government created such a flagship city, the Sino-Singapore Eco-city in Tianjin (here called the Tianjin Eco-city), under a partnership with Singapore.<sup>27</sup> This eco-city project has been identified as a ‘national green development demonstration area’ and ‘green building base.’ The project is not emphasising technical advancement but is instead based on existing practices, utilizing the best technology currently available and affordable to minimize harmful environmental impacts. In the first case study we take a closer look at some concrete aspects of planning and implementation of this on-going project.

The second case study was performed in Dezhou, Shandong province, where large-scale utilization and production solar power shows that even small municipal-level cities in China are entering the competition to become leaders in urban sustainability.

### 2.1 An eco-city project – the Chinese way

#### 2.1.1 Overview

Tianjin Eco-City is located in the Bohai Rim region, one of China’s foremost industrial areas.<sup>28</sup> Accordingly, the area suffers from significant environmental externalities, mainly due to the presence of a large concentration of heavy industries throughout the region. The eco-city occupies a total area of 30 square kilometres and will be home to 350 000 residents when completed in 2020. The location was chosen to be on non-arable, alkaline wasteland contaminated with mercury and DDT, which was restored at a cost of one billion CNY. This indicates the focus of the project on dealing with ecological challenges and shrinking availability of land resources. The primary use of the eco-city is residential, but there will also be business centres in each neighbourhood, as well as some industries.

#### 2.1.2 City planning

The city layout is based on an integrated mixed-land-usage system to create variety in the landscaped ‘eco-neighbourhoods’ with green ‘eco-valley’ corridors that will serve as main public open spaces. Tianjin Eco-City is built on a structure of large urban residential blocks separated by wide, multi-lane highways flanked by pedestrian pavements and protected cycle lanes. The eco-buildings are significant in size, being mostly over 25 stories in height. The existing wetlands around the city are to be protected to enhance biodiversity.

<sup>27</sup> Previously, the two countries have collaborated in successful development of the Suzhou Industrial Park started in 1994.

<sup>28</sup> The total population in this region is over 240 million and includes one of the country’s largest urban agglomerations. In 2010 it produced 25.3 per cent of China’s GDP.

In order to guide the construction of the eco-city, a comprehensive set of 22 quantitative and 4 qualitative Key Performance Indicators (KPIs) have been set. The KPIs focus on the natural and built environment, urban lifestyle and the city's economy, e.g., air and water quality targets (like potable tap water), 90 per cent green travel rate, 20 per cent renewable energy utilization, 100 per cent green buildings, 60 per cent recycled waste, 50 per cent water from non-traditional sources (such as desalination and recycled water), etc.

However, when one takes a closer look at its planning and architecture, Tianjin Eco-city turns out to be quite conventional. The residential neighbourhoods reflect the gated-community mentality that dominates modern Chinese towns, they are designed as clusters of free-standing towers laid out on super blocks along wide avenues where cars are apparently the dominant means of transportation, and cyclers and pedestrians are barely considered. In future, a light-rail transit system is supposed to run along the 12 km-long valley across the eco-city. It will be supplemented by a secondary network of trams and electric buses as the main mode of transportation.

### 2.1.3 Environment

All buildings in the eco-city should meet stringent energy efficiency standards that include advanced water-saving and waste management systems with particular emphasis on reduction, reuse and recycling of waste.

The drainage wells for storm water are embedded in the curbs and the pavement is laid with pervious sand bricks for efficient drainage. Rainwater and wastewater are collected separately, and submersible pumps divert the rainwater to artificial wetlands.

Integrated waste collection, transportation and processing are also being implemented, such as the advanced sanitary technologies using pneumatic collection of garbage provided by the Swedish company Envac. In order to enhance the quality of waste source separation, the residents are provided with garbage bags issued free of charge, 'green bonus points', and other economic means. This also helps to improve social participation and enthusiasm.

However, it is obvious that air quality standards are difficult to be met in this eco-city, due to the close proximity to densely industrialized areas of the Bohai Rim. Some critics even argue that the project is more a propaganda instrument than a comprehensive ecological project.

### 2.1.4 Energy

According to the initial master plan, the eco-city is to derive energy mainly from a waste incinerator plant complemented by renewable sources. When the eco-city project is completed, all energy consumers and suppliers, including wind, solar PV, ground source heat pumps, deep geothermal, solar water heaters and other renewable energy will be connected and monitored in real-time through a smart grid. Tianjin Eco-City is the first national smart grid pilot area, promoting renewable energy integration and micro-grid construction. Currently, the investment in renewable energy facilities at Tianjin eco-city totalled about 800 million CNY and provide about 19 million kWh/year of electricity, 450 000 GJ/year of heat, which is equivalent to about 23 000 tons of standard coal.

The Tianjin eco-city approach is rather pragmatic, even a bit low-key in terms of environmental performance. Renewable energy is planned to account for only 20 per cent of the total energy consumption, compared to China's national plan that requires 15 per cent for renewable energy by 2020.

The green buildings fully apply heat pumps to recover waste heat, thermoelectric cooling supply, solar collection on roofs and balconies, and other technologies to achieve comprehensive utilization of energy. Passive design – such as natural lighting and ventilation – as well as double glazed isolation further reduces energy consumption and carbon emissions. Photovoltaic power generation is also installed on rooftops of public, industrial and sewage treatment plant buildings. Along all the roads, LED street lights are supplied by wind or solar energy. Electric vehicle charging stations are also available.

However, it should be noted that the majority of buildings in Tianjin Eco-city only reach the basic level of the Green Building standards. LEED (American), BREEAM (British), and other national evaluation standards such as Singapore's green building evaluation were used to formulate the 'Sino-Singapore Eco-city Green Building Evaluation,' which is more stringent than the national Chinese standard. Another KPI calls for 20 per cent of residential development to be subsidized affordable housing, but the number of affordable housing units is expected to be much higher.<sup>29</sup> The main objective of this state funding, however, is quantity and not quality.

By establishing a unified eco-city basic data platform to achieve a high degree of information sharing, Tianjin eco-city can provide urban information management services and intelligent urban management.

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<sup>29</sup> 50 per cent of the total number of new housings in Tianjin since 2011.

### 2.1.5 Economy and finance

Except for residential areas, an eco-industrial park is being built to host innovative industries such as Tianjin Huaqiang 3D stereoscopic film base. 125 companies have registered by 2010 in the eco-city, including Hitachi, Philips, Siemens, ST Engineering and two leading property developers in Asia which have signed an agreement with Tianjin eco-city to develop ‘green central business districts.’ It is expected that by 2020, the eco-city will create 80 000 to 100 000 jobs, contributing a total of 40–50 billion CNY to GDP.

The total investment in the Tianjin eco-city project has not been disclosed, but project officials say that as of 2012, 40 billion CNY have been invested in fixed assets. For example, the Ministry of Finance granted more than 200 million CNY in special funds,<sup>30</sup> and the State Council has granted 500 million CNY annually between 2011 and 2015 for environmental optimization.

### 2.1.6 Comments

Despite high expectations induced by the official rhetoric, Tianjin eco-city looks remarkably like any other modern Chinese residential development: tall residential apartment blocks and a clear focus on car transportation. Solar panels can be seen on slanted roofs, but one wonders how much energy these panels can really produce when they sit atop thirty-storey buildings with the sun dimmed by thick smog. Air conditioning units can be seen outside many apartments, with large air filters inside them. There are some wind turbines as well, but very few in comparison to the size of the city. The solar arrays along the streets are all thoroughly coated in a layer of dust.

Since 2012 only 20 000 people have moved in, a fraction of the 350 000 the city is designed to house by 2020. The overall effect is of having arrived to a large but yet empty city, driving past completed but not yet occupied residential blocks. It seems that by building an eco-city from scratch, one creates a city that is disconnected from reality and without the human touch.

Besides showcasing uses of environmental technologies, Tianjin eco-city could play a more important role in changing the present urbanization pattern towards a more sustainable and holistic development of society, economy, and environment. As it is now, the brand of eco-city largely becomes a form of technical legitimization of a conventional solution.

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<sup>30</sup> Including 80 million CNY in subsidy for the sewage pipe network construction.

## 2.2 'China's Solar Valley' shows local initiative

### 2.2.1 Overview

Dezhou (population 5.5 million) has become known in China as 'China's Solar Valley', 'China's Sun City', 'China's New Energy Capital' or the like. By taking advantage of an ongoing policy programme in Shandong province to support research and development in the solar industry, the city committed itself to solar energy and has become an inspiring example for many other Chinese cities. There are an estimated half-million meters of installed solar water heating (SWH) panels, and the city also boasts the world's largest solar building, a distinctive structure designed in the shape of a sun dial.

In February 2014, Dezhou was selected by the National Energy Administration (NEA) among the first group of 81 new energy demonstration cities. Dezhou took also part in the National Torch Program. Starting in 2010, the city has successfully organized four international fairs on new energy technology innovations, which has helped to further consolidate its brand, and effectively promote development of its solar and geothermal equipment and applications. The new energy industry is increasingly becoming the main driver of the city's economic and social development.

### 2.2.2 Energy

Despite fundamental developments in China's SWH market over the last decade, the world's largest producer and consumer of SWHs has yet no national policy tool to facilitate their adoption. One possible reason could be the multi-administration of energy governance in China, relying on eight separate ministries. Such segregation tends to increase bureaucracy and conflicts when introducing renewable energy policies.

In practice, some efforts have been made to promote the diffusion of SWHs in recent years. By 2009, China added SWH products to the subsidy list under a comprehensive incentive program entitled 'Home Appliances Going to the Countryside Program' (HAGCP), which provides subsidies equal to 13 per cent of the purchasing price of SWHs and other conventional heating devices.

Dezhou is one of China's leading cities in adoption of SWH, with urban and rural installation rates of 75.4 and 15 per cent, respectively. Energy saving technologies such as SWH or ground heat pumps are estimated to play an important role in the low-carbon transition of China's cities. Except for SWH utilization, public street lighting is powered almost exclusively by solar PV. Solar energy is not only used in municipal and home applications, but also in industries such as paper making, machinery and textiles; it has become an integral part of Dezhou's economy.

Recently, the central government announced support for the development of so-called distributed solar power projects to be built on abandoned land, lakes, fish-ponds and greenhouses in China's north-eastern region. The policy will also encourage distributed solar power to be generated at industrial and commercial

facilities with large rooftops. The push may help China to reach its target of 12 GW of new installed solar generation for 2014, with 8 GW of distributed generation and 4 GW in utility-scale facilities.

In 2013 the State Council approved the ‘Green Building Action Plan’ designed by NDRC together with MoHURD, which further clarifies the national green building development goals and green building requirements. In April 2014, MoHURD approved the ‘Green Building Evaluation Standard’ as the national standard to be implemented from January 1, 2015. These measures together with local government action plans to implement green building programs, mandatory green building development policies and incentive policies, will further promote the development of green buildings in China, and will also bring enormous market opportunities for the new energy industry.

In 2014, Dezhou municipal government issued a special notice to promote green building development, which requires all governmental office buildings, schools, hospitals and other government buildings as well as affordable housing, to fully implement green building standards.

### 2.2.3 Local policies

Dezhou municipal government has shown large enthusiasm to adopt SWH innovations, mainly driven by SWH deployment promising job opportunities and increasing local revenue. This has several explanations:

- China’s decentralization since the 1980s has meant that local governments are less dependent on central government for funding. Instead, encouraged to seek new financial channels and sources of development, they mix entrepreneurial and bureaucratic roles. The need to develop local business has made policymakers focus support on what they consider a promising industry, such as SWH deployment. In Dezhou about 30 per cent of employments in the city are solar related.
- Although China’s SWH technology and production are developing rapidly, there is also great competition. There are over 2800 SWH manufacturers across China. By popularizing SWHs in its jurisdiction, Dezhou municipal government helps industries to expand market share, making them more competitive. This industry in Dezhou has created clusters of SWH manufacturers.

The local government utilized four instruments to promote local SWH deployment:

- The building regulation ‘Notice of Fully Popularizing Solar Water Heaters on Newly Constructed Buildings’ enacted in 2005 by the local construction bureau requires SWHs to be installed in new or renovated apartment buildings.
- In 2006 economic incentives to decrease the investment barrier were offered to rural households. In addition to the 13 per cent discount provided by HAGCP, Dezhou municipal government hands out an additional subsidy of 1000 CNY to rural households purchasing SWHs. The total subsidies reduce initial capital costs of SWHs by two-thirds, which is much lower than conventional systems, consequently expanding the rural market.
- Dezhou municipal government has provided a major and stable customer base for local solar industries through the public procurement instrument and its control over infrastructure investments and municipal construction. For

instance, the local government has built public bath-houses powered by centralized SWH systems in more than 200 villages and installed over ten thousand PV solar lights on main streets.

- Through the implementation of the ‘Million Roofs’ program, the city has expanded the solar collector area over eight million square meters. SWHs in new urban solar integration applications have now reached more than 95 per cent.

Obviously, SWHs popularization policies in China are initiated and implemented by the local government, with support from relevant bureaux. Since popularization policies involve several instruments, implementation requires multiple bureaux to work and collaborate together. Information exchange, communication, sharing of economic and human resources are therefore essential for effective local implementation.

Although local bureaux in China are led by superior-level administrations, local governments appear to have far more authority over them. Dependence on local revenue and the decisive role local governments play in appointment and promotion of senior officials in local bureaux seem to be important. Consequently, on the local level the implementation mechanism seems to efficiently overcoming conflicts and pooling resources. In the case of popularizing SWHs, smooth cooperation between relevant bureaux has helped promoting their wide adoption.

### 2.2.4 Solar power industry

Himin Group, the world's largest SWH manufacturer, is based in Dezhou and has significantly contributed to the wide deployment of SWH throughout the city. However, not only Himin, but around 100 other companies related to the solar PV and SWH industry value chains, have been established in Dezhou and its economic development zone. The sales revenue in the solar industry last year was 15 billion CNY.

To support further development of the solar industry in Dezhou, the municipal government offers preferential tax benefits and other supporting policies. A variety of solar products are manufactured, ranging from simple flat plate collectors to high-end vacuum pipe collectors and high-tech solar collectors. Many products are exported worldwide. Company-led R&D and innovation is thriving in Dezhou.<sup>31</sup> Particularly in the building sector, many applications have been developed for integration of solar PV and SWH into building design. This has created an architecture and building design industry focusing on how to fit and integrate SWH and solar PV aesthetically into building design.

It should be noted, however, that there might be discrepancies between being a 'low-carbon' city and having (or planning to have) large manufacturing capacity in renewable energy equipment. Fortunately, Dezhou seems to have combined both in a successful manner.

### 2.2.5 Comments

While energy demand and future projections for China are daunting, and currently some 70 per cent of the energy is generated by burning coal, examples like Dezhou are encouraging and guide towards future urban priorities and practice. The Dezhou example also shows compellingly the job-generation potential of commitments to renewable energy.

In the application of SWH technologies, Chinese cities have leapfrogged over their international counterparts. In contrast to other renewable energy technologies, where national policies are driving the development, in the case of SWH local support policies have played a crucial role.

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<sup>31</sup> With more than 600 solar-related patents, participation in 863 projects on solar energy research, as well as the National Torch Program.