

# China's New Urbanisation Opportunity: A Vision for the 14th Five-Year Plan





Dockless bikes in Shenzhen. Credit: Fotos593 / Shutterstock.

## Lead authors

Qi Ye,<sup>1,2</sup> Song Qijiao,<sup>1</sup> Zhao Xiaofan,<sup>2</sup> Qiu Shiyong<sup>3</sup> and Tom Lindsay.<sup>4</sup>

## Co-authors

Cai Qin,<sup>2</sup> Dong Changgui,<sup>5</sup> Liu Daizong<sup>3</sup>, Liu Tianle,<sup>1</sup> Lu Jian,<sup>2</sup> Miao Hong<sup>3</sup>, Qin Ming,<sup>2</sup> Tie Ming,<sup>2</sup> Tu Chengyue,<sup>2</sup> Wang Ye,<sup>3</sup> Zhang Jin<sup>2</sup> and Zhu Mengye.<sup>2</sup>

<sup>1</sup> Hong Kong University of Science and Technology; <sup>2</sup> Tsinghua University; <sup>3</sup> World Resources Institute (USA) Beijing Representative Office; <sup>4</sup> Coalition for Urban Transitions; <sup>5</sup> Renmin University.

## Citation

Qi Ye, Song Qijiao, Zhao Xiaofan, Qiu Shiyong, Tom Lindsay et al, 2020. *China's New Urbanisation Opportunity: A Vision for the 14th Five-Year Plan*. Coalition for Urban Transitions. London, UK, and Washington, DC: <https://urbantransitions.global/publications/>.

---

**Coalition for Urban Transitions**  
c/o World Resources Institute  
10 G St NE  
Washington DC 20002, USA

**C40 Cities Climate Leadership Group**  
3 Queen Victoria Street  
London EC4N 4TQ  
United Kingdom

**WRI Ross Center for Sustainable Cities**  
10 G St NE  
Suite 800  
Washington, DC 20002, USA

## About this working paper

This paper summarises a research programme led by Professor Qi Ye. The research was carried out in conjunction with colleagues from Tsinghua University, Hong Kong University of Science and Technology, Renmin University and WRI China. The research programme is supported by the Coalition for Urban Transitions, the leading global initiative helping national governments unlock the power of inclusive, zero-carbon cities. The opinions expressed and arguments employed are those of the authors.

## Acknowledgements

We are grateful for insightful comments and suggestions made by Professor He Jiankun, Dr. Yang Xiu and Huang Caiwei (Tsinghua University), Ye Qing (Shenzhen Institute of Building Research), Robin King (World Resources Institute), Sun Lu (C40 Cities Climate Leadership Group); Fang Li, Wee Kean Fong, Zhao Ting, Xue Lulu, and Shi Ge (World Resources Institute (USA) Beijing Representative Office) and Sarah Colenbrander, Nick Godfrey, Manisha Gulati and Catlyne Haddaoui (Coalition for Urban Transitions). The Policy Advisory Council members provided important guidance to the research. The report was edited by Barbara Karni and Alex Glynn and designed by Jenna Park.

## Disclaimer

The research has been carried out under the auspices of Professor Qi Ye in conjunction with colleagues from Tsinghua University, Hong Kong University of Science and Technology, Renmin University and WRI China. The views reflected in the paper do not necessarily reflect the views of the wider membership of the Coalition for Urban Transitions or the UK government.



This material has been funded by the UK government; however, the views expressed do not necessarily reflect the UK government's official policies.



# Table of Contents



**Executive Summary** 7



**Chapter 1** 10  
**Introduction**



**Chapter 2** 12  
**The need for a new vision for urbanisation in China**



**Chapter 3** 20  
**Three grand challenges to China's urbanisation**



**Chapter 4** 29  
**Three new engines China can turn on to create "ecological cities"**



**Chapter 5** 37  
**Three national priorities for transforming cities and creating an "ecological civilisation"**



**Chapter 6** 44  
**Priority 1 in focus: Peaking emissions from front-running cities by 2025**



**Chapter 7** 48  
**The Way Forward**  
**Appendix A** 49  
**China's low-carbon pilot cities**

## Abbreviations

<b>APPC</b>	Alliance of Peaking Pioneer Cities of China
<b>CO<sub>2</sub></b>	carbon dioxide
<b>CO</b>	carbon monoxide
<b>IMF</b>	International Monetary Fund
<b>LGFV</b>	local government financing vehicle
<b>NDRC</b>	National Development and Reform Commission
<b>NDC</b>	Nationally Determined Contribution
<b>NEV</b>	New Energy Vehicles
<b>NO<sub>2</sub></b>	nitrogen dioxide
<b>NO<sub>x</sub></b>	nitrogen oxides
<b>O<sub>3</sub></b>	ozone
<b>PM</b>	particulate matter
<b>PPP</b>	public-private partnership
<b>SO<sub>2</sub></b>	sulphur dioxide
<b>UDIC</b>	urban development and infrastructure company
<b>WHO</b>	World Health Organization
<b>µm</b>	micrometre



Shanghai skyline at night. Credit: SnnvSnnvSnnv / Shutterstock.

## Executive summary

This is a critical moment in history, for China and the world alike. Turbulent geopolitics are creating significant uncertainty about future trade patterns. The COVID-19 pandemic is reshaping the world order of economy and politics. Economic growth in China could fall by more than half in 2020.

Urbanisation continues apace, with China's cities expected to accommodate an additional 255 million residents by 2050.<sup>1</sup> In this same 30-year period, humanity must reach net-zero emissions in order to hold the average global temperature increase to no more than 1.5°C above pre-industrial levels.<sup>2</sup> The decisions made about China's cities today could lock in future prosperity and resilience – or vulnerability and decline.

This report offers insights for China's policy-making under its 14th Five-Year Plan. It identifies opportunities from a new type of urbanisation that

can help China achieve high-quality growth in the coming decade and create an economy based on high value-added manufacturing and services while avoiding enormous environmental costs. This transformation will not be easy, but this report shows that getting China's cities right offers the best chances for success.

The report provides policy-makers with recommendations for how a new model of urbanisation can help enhance China's economic, social and environmental prosperity while avoiding climate catastrophe. The analysis and recommendations draw on an ambitious, multi-year research programme led by Tsinghua University, Hong Kong University of Science and Technology and the World Resources Institute (USA) Beijing Representative Office, as well as on the global work of the Coalition for Urban Transitions. The goals and priorities outlined in the report intend to help facilitate productive discussions with China's national decision-makers.

Over the last four decades, China's "Reform and Opening Up" has transformed the country from a largely rural to a mainly urban society, improving lives and livelihoods in the process. To transform at such an unprecedented rate and scale, China's urbanisation has relied on three interconnected engines:

- Large-scale industrialisation, concentrated predominantly in cities in the eastern coastal regions, which has encouraged the concentration of capital, labour, land and energy in urban centres.
- Marketisation: the transition from a centrally planned economy to a market economy, which unlocked demand and capacity, with cities acting as growth hubs for internal trade.
- The gradual opening up to international cooperation and trade, which provided access to the capital, technology and export markets needed to fuel urban-industrial expansion.

These three engines enabled China to meet many of the demands of its burgeoning urban populations. But more focus was put on speed and scale than the quality of urban development. Buildings in China's cities, for example, have an operational lifetime of just 35 years, compared with more than 100 years in most European cities. In addition, these engines are now slowing; they cannot be relied on to generate the type of sustainable progress China will need in the 21st century.

Overreliance on these three engines has led China's cities to face three major interconnected challenges, all which act as major brakes on prosperity:

---

**In only four decades, China, a country of 1.4 billion people, has achieved a level of urbanisation that Western countries took two centuries to achieve.**

- Basic infrastructure and services have been unable to keep pace with China's rapid urban population growth, fuelled by rural to urban migration. In only four decades, China, a country of 1.4 billion people, has achieved a level of urbanisation that Western countries took two centuries to achieve.<sup>3</sup> Cities have struggled to match this rate of growth with services that can meet basic needs.
- Urbanisation has put enormous pressure on both the natural and built environments. Critical natural resources are being depleted, the overreliance of coal is increasing air pollution and urban populations are becoming more vulnerable to the impacts of climate change. Water scarcity is a serious issue for many major urban centres; more than 95% of China's megacities suffer from water shortages. In 2018, only 121 of China's 338 cities at the prefecture level or above met the country's ambient air quality standards. Climate change will also exacerbate existing risks, with sea-level rise alone threatening the nearly 130 million urban residents in China who live in coastal areas that are less than 10 metres above sea level – the largest number of people of any country.
- Local government debt has risen unsustainably, fuelled by land sales, debt financing and capacity-constrained, short-term local planning. Excessive borrowing has compromised fiscal sustainability, severely reducing the capacity of local governments to deal with the aforementioned challenges. Urban areas expanded at a much faster pace than urban populations increased. Globally, urban areas expanded by an area of land roughly twice the size of Sri Lanka between 2000 and 2014. China alone accounted for 32% of this increase, adding an area the size of Belgium.



These three risks amplify the weaknesses of China's current urbanisation mode and are already undermining the ability of China's cities to thrive and deliver for the economy, people and planet. If a new model of urbanisation, based on a different set of engines, is not adopted, China risks locking in these risks and missing out on the future opportunities of urbanisation.

This report identifies a new vision for China's urbanisation underpinned by three new engines that can help overcome the challenges and risks inherent in the current model and create a new set of strengths and opportunities:

- **Engine 1:** Developing a new national system of cities underpinned by basic infrastructure and a world-class intercity mass transit system, to rebalance growth away from coastal areas towards the interior.
- **Engine 2:** Building compact, connected, clean cities to drive a low-carbon, climate-resilient urban transformation and tackle the degradation of critical natural resources and growing carbon emissions.
- **Engine 3:** Reforming local governance and national and subnational fiscal systems, in order to tackle debt overhang, generate sustainable financing flows for investment in sustainable infrastructure and enhance long-term urban planning.

To unleash these engines, the report recommends three priorities for national action with specific recommendations for consideration:

- **Priority 1:** Placing sustainable cities at the heart of China's 14th Five-Year Plan and second Nationally Determined Contribution (NDC), with the goal of developing a new national system of compact, connected and clean cities across the country. The system will be capable of generating a virtuous circle of green investment and manufacturing to drive future economic transformation, while providing a home for migrant labour and reducing citizens'

vulnerability to climate impacts.

- **Priority 2:** Aligning national policies behind compact, connected, clean and resilient cities by stopping the sale of fossil fuel-powered motorbikes, cars and buses, investing in mass transit, reducing the demand for energy and materials, and fuelling a clean energy revolution.
- **Priority 3:** Building a sustainable national and subnational financing system for cities alongside complementary reforms to local governance and capacities for urban planning by shifting national transport budgets towards mass transit, introducing national to subnational income tax piggybacks and property taxes, and enhancing the capacity of local governments to manage liabilities.

To bring Priority 1 and other key elements of this package of measures to fruition, this report recommends that China supports efforts by cities to peak their carbon emissions by the end of the 14th Five-Year Plan, putting this effort at the heart of its NDC. In particular, the central government should require cities to explicitly link new infrastructure development funding to carbon-reduction targets in the 14th Five-Year Plan. Doing so is feasible and would generate significant economic, social and environmental benefits. The next phase of our research will develop a more detailed action plan for implementing this recommendation.

Putting low-carbon cities at the heart of its new five-year plan would allow China to unlock not only economic growth but social and environmental advancements in line with "ecological civilisation": a concept of sustainable development with Chinese characteristics. A new form of sustainable urbanisation means a new era of urbanisation, which could act as an engine of, rather than a brake on, China's development.



A group plays mahjong in Kunming. Credit: Dan\_H / Shutterstock.

## 1. Introduction

The rate and scale of China's urbanisation in the past 40 years is unprecedented in world history. Urbanisation has brought tremendous prosperity to China – but it has also created problems, including social inequality, resource depletion and environmental degradation. Environmental and climate change risks caused by unsustainable economic growth are emerging, casting a shadow on long-term growth. China has the potential to become the world's largest economy in the next 15 years, but it faces both more opportunities and more challenges than other countries.<sup>4</sup>

The Chinese government has realised that the old, industrialisation-driven model of urbanisation can no longer meet its goals for development. A new, people-oriented model is needed. President Xi Jinping's report to the 19th National Congress of the Chinese Communist Party set forth seven national development strategies, all of which called for a new model of urbanisation.<sup>a</sup>

The National New Urbanisation Plan (2014-20) released by the central government in early 2014 outlined the basic strategy for new urbanisation. But the plan did not focus on how urbanisation could support and advance China's economic, social and environmental development. It also did not specify ways of putting words into action, bridging implementation gaps in many policy areas in China, including urbanisation.

The COVID-19 pandemic represents the greatest challenge the world has faced in decades; it has the potential to reshape the world order of economy and politics. *New York Times* columnist Thomas Friedman believes that the virus marks a new historical divide – the world "Before Corona" (BC) and the world "After Corona" (AC).<sup>5</sup> Even before the coronavirus outbreak, the world economy had faltered, with global economic growth rate decreasing from 3.6% in 2018 to less than 3.0% in 2019 – the slowest rate since the 1.7% contraction in 2009 following the financial crisis.<sup>6</sup> With the coronavirus, global economic growth in 2020 is

<sup>a</sup> The seven national development strategies are on science and education, a quality workforce, innovation-driven development, rural vitalisation, coordinated regional development, sustainable development and military-civilian integration.

projected to be well below 2.5%, widely considered a watershed in a global economic downturn.<sup>7</sup>

In response, the Chinese government is deliberating over stimulus packages on a scale much larger than the CNY 4 trillion they provided in the aftermath of the 2008 global financial crisis. According to the latest estimates, local governments in China have committed to investing CNY 40 trillion in “new infrastructure” (*xin jijian*) projects, mostly related to 5G, ultra-high voltage, intercity high-speed rail and rail transit, charging stations for electric or hybrid vehicles, big data centres, artificial intelligence and industrial networks.<sup>8</sup> Almost all of the proposed projects are high-tech, not conventional infrastructure projects, such as railways, highways, airports and hydrological projects.

The coronavirus outbreak has very important implications for urbanisation in China. On the positive side, urbanisation is believed to hold the key to economic recovery. The national government has already sent strong signals of support of urbanisation as the new economic engine of China. The government’s recently released *Decision on Authorisation and Entrusted Land Examination Right* gives provincial governments greater autonomy concerning land use and implies that the restrictions on space for development in metropolitan cities will be significantly relaxed. On the negative side, given the urgency of epidemic containment and economic recovery, climate change may become a lower priority for the Chinese government. This report demonstrates that there are important opportunities for using planned stimulus packages in ways that support a new form of urbanisation that places sustainable and resilient urban infrastructure at its core.

The coronavirus outbreak has also revealed key challenges in urban governance in contemporary China. Cities across the country demonstrated vastly diverging capacities to contain the outbreak, showcasing the urgency of modernising China’s governance system and capacity, a goal first adopted during the Third Plenary Session of the 18th Chinese

Communist Party National Congress in November 2013. The central government has emphasised top-down governance processes through plans, policies and leadership directives.<sup>9</sup> The new approach to urbanisation will require combining top-down effectiveness with strong self-governance capacity at the community level. Striking a balance between state-centred governance and self-governance for cities is critical to enhancing the national governance system and its capacity.

This report seeks to inform China’s 14th Five-Year Plan. It argues that China’s urban development should become the core driver of “ecological civilisation”, a concept that argues for the importance of promoting green, circular, low-carbon development; minimising interference with and damage to the natural environment; and conserving and making efficient use of land, water, energy and other resources. President Xi Jinping has adopted creating an ecological civilisation as one of China’s five national goals.

Ecological civilisation must be the driving concept for urbanisation, as the current path is no longer sustainable. Air and water pollution underscore the domestic importance of a sustainable urban transition. The scientific consensus is that global greenhouse gas emissions need to reach net-zero by mid-century to prevent an irreversible climate crisis.<sup>10</sup> At the Central Economic Work Conference in 2018,<sup>b</sup> China’s Central Committee stressed the need to “strive to improve the quality and efficiency of economic development without bringing about long-lasting side effects.”<sup>c</sup> As President Xi Jinping said in his address to the 19th Chinese Communist Party National Congress, in 2017:

*Comrades, what we are doing today to build an ecological civilisation will benefit generations to come. We should have a strong commitment to socialist ecological civilisation and work to develop a new model of modernisation with humans developing in harmony with nature. We must do our generation’s share to protect the environment.*<sup>11</sup>

<sup>b</sup> The Central Economic Work Conference is the highest-level economic conference convened by the Chinese Communist Party Central Committee and the State Council. Its task is to summarise the economic achievements of the year, analyse and evaluate the current international and domestic economic situation and formulate a macroeconomic development plan for the coming year.

<sup>c</sup> People’s Daily, 2018. ‘We will continue to promote high-quality economic development in China – on implementing the spirit of the central economic work conference’. People’s Daily, December 27. Available at: <http://opinion.people.com.cn/n1/2018/12/27/c1003-30489841.html>.



Solar panels on the rooftop of a housing development in Jiujiang. Credit: humphery / Shutterstock.

## 2. The need for a new vision for urbanisation in China

In four decades, China, a country of 1.4 billion people, achieved a level of urbanisation that Western countries took two centuries to achieve.<sup>12</sup> In this brief period, China transformed itself from a largely rural society to an urban society, improving people's lives and livelihoods by doing so. The pace of urbanisation and industrialisation achieved is unprecedented in world history.

To make such progress in such a short period of time, China emphasised the speed and scale of urban development over quality. The approach raised millions of people out of poverty – but the cost to the environment and society has been high, in the form of pollution, growing class and educational inequality and housing shortages, to name just a few.<sup>13</sup> Slowing population and economic growth

(projected to stabilise at 6–7% a year) are signs that China has reached a new stage of urbanisation in which it may not be able to rely on old modes.

Given the problems it faces now and will face in the future, it is imperative that China transitions towards a higher-quality, more people-oriented and sustainable form of urbanisation. Shifting to more inclusive, sustainable urban development requires new design ideas, policy instruments and planning tools. It requires a new vision for urbanisation that must be supported by institutional and systemic innovation and reforms that will unleash the development potential of urbanisation.<sup>14</sup> This new vision must also be grounded in an appreciation of the great opportunities and challenges urbanisation has presented and will continue to present in China.

This chapter describes the history of urbanisation in China. It identifies the engines behind its success and the opportunities urbanisation has unlocked.

## CHINA'S URBANISATION IS UNPRECEDENTED

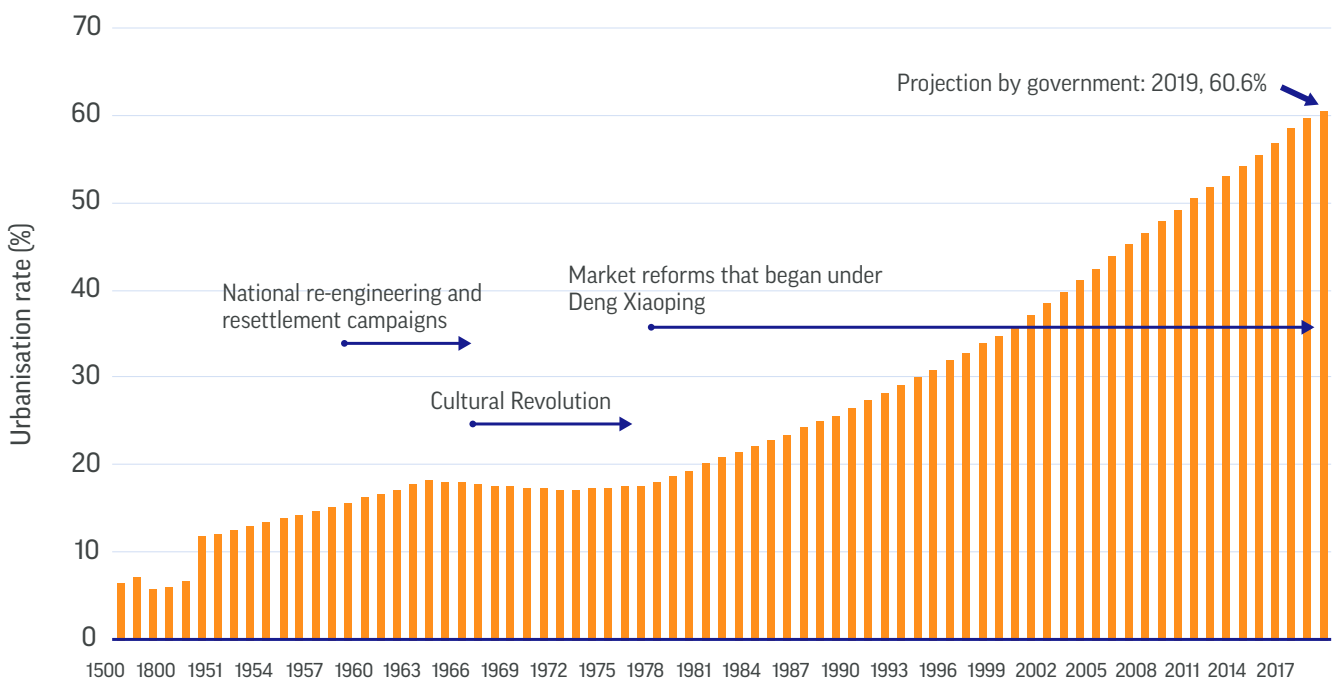
When the People's Republic of China was founded, in 1949, less than 10% of the population lived in urban areas. Over the next 30 years, the rate of urbanisation remained slow, as a result of the turbulent social environment. Urbanisation took off following China's Reform and Opening Up, which

began in 1978, particularly during the 1990s and 2000s.

In the past 40 years, the urbanisation rate in China has more than tripled, reaching almost 60% in 2018 (Figure 1) and is projected grow beyond that in 2020.<sup>15</sup> By 2030, the urban share of the population is expected to reach 70%, amounting to one billion urban residents.<sup>16</sup>

Figure 1  
Urbanisation rate in China, 1500–2019

Sources: Ritchie, H., and Roser, M., 2019. Urbanisation. Our World in Data. Available at: <https://ourworldindata.org/urbanisation>.



China National Bureau of Statistics, 2019. *Continuous improvement of urbanisation level and rapid progress of urban development*. Available at: [http://www.stats.gov.cn/tjsj/zxfb/201908/t20190815\\_1691416.html](http://www.stats.gov.cn/tjsj/zxfb/201908/t20190815_1691416.html)

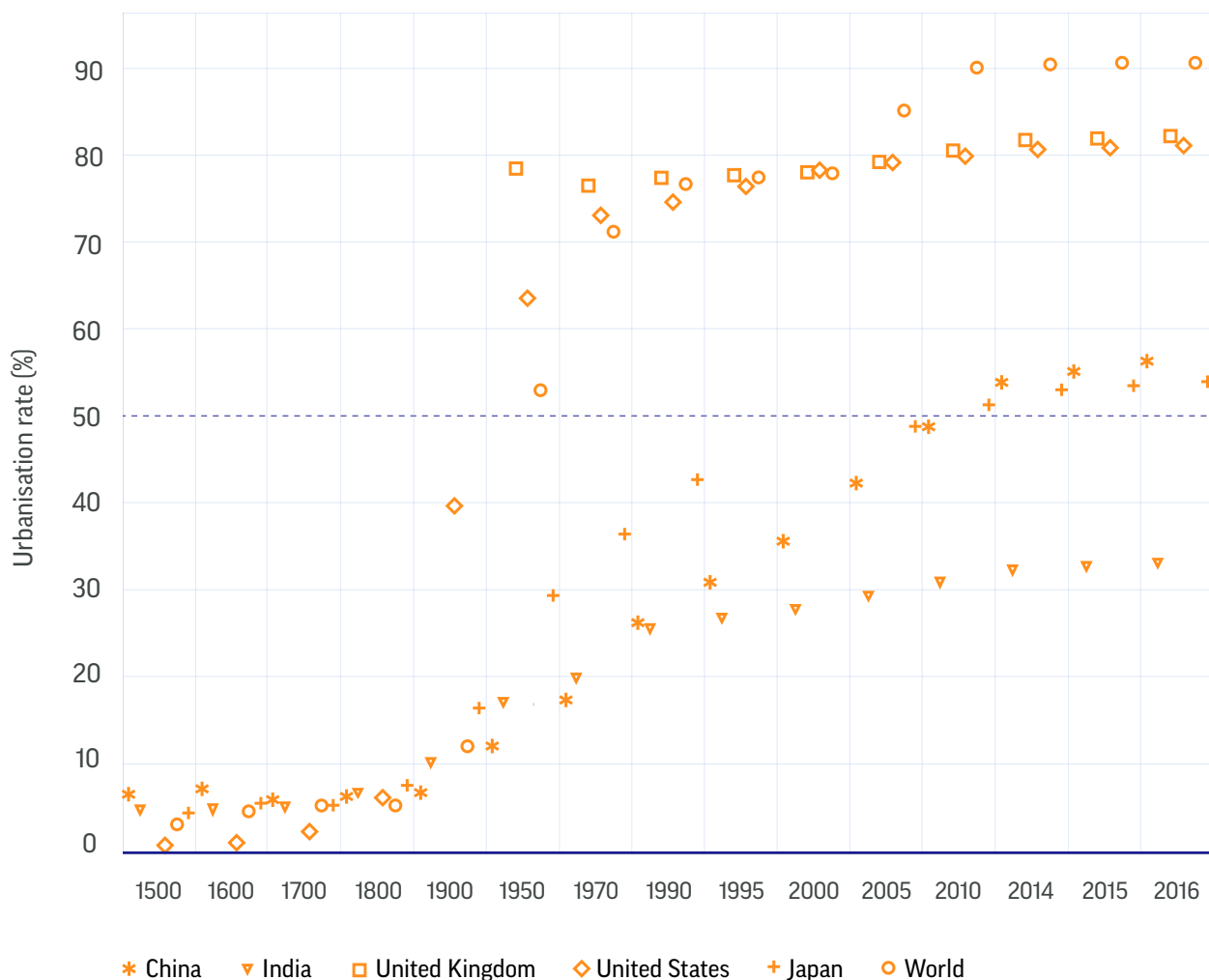
United Nations Department of Economic and Social Affairs, 2018. *World Urbanisation Prospects: The 2018 Revision*. United Nations Department of Economic and Social Affairs. Available at: <https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html>

The earliest recorded cities in China appeared in the Zhou Dynasty (1046–256 BC), but it was not until the Spring and Autumn and Warring States periods (770–221 BC) that the urban share of the population gradually increased, to about 16%. Immediately afterwards, as a result of frequent changes in dynasties, urban development was unstable, until the Song Dynasty (AD 960–1279), when the urban population reached a peak of about 30%.<sup>17</sup> Hundreds of years of social changes and turbulence followed

that period, and it was not until 700 years later that cities again became as prosperous as they were during the Song Dynasty.

Globally, urbanisation has also continued to grow (Figure 2) with only 7% of the global population living in urban areas in 1800, growing to 16% by 1900.<sup>18</sup> It was not until the 20th century that urbanisation rates began to soar globally.

Figure 2  
Global urbanisation rate, 1500–2016



**Note:** The blue line indicates an urbanisation rate of 50% to highlight the point in time when, for each country, over half of their population lived in urban areas.

Data on urban shares dating back to 1500 are available only for selected countries; global figures are estimates from Goldewijk, K., Beusen, A. and Janssen, P. 2010. Long-Term Dynamic Modeling of Global Population and Built-Up Area in a Spatially Explicit Way. *The Holocene*, 20(4): 9.

**Source:** Ritchie, H., and Roser, M., 2019. *Urbanisation*. Our World in Data. Available at: <https://ourworldindata.org/urbanisation>.

The population of the United Kingdom urbanised rapidly in the 90 years between 1760–1851; at the end of this period, more than half the population lived in urban areas. The United States experienced rapid urbanisation from 1860 to 1920; over this period, the urbanisation rate increased from about 20% to more than 50%.<sup>19</sup>

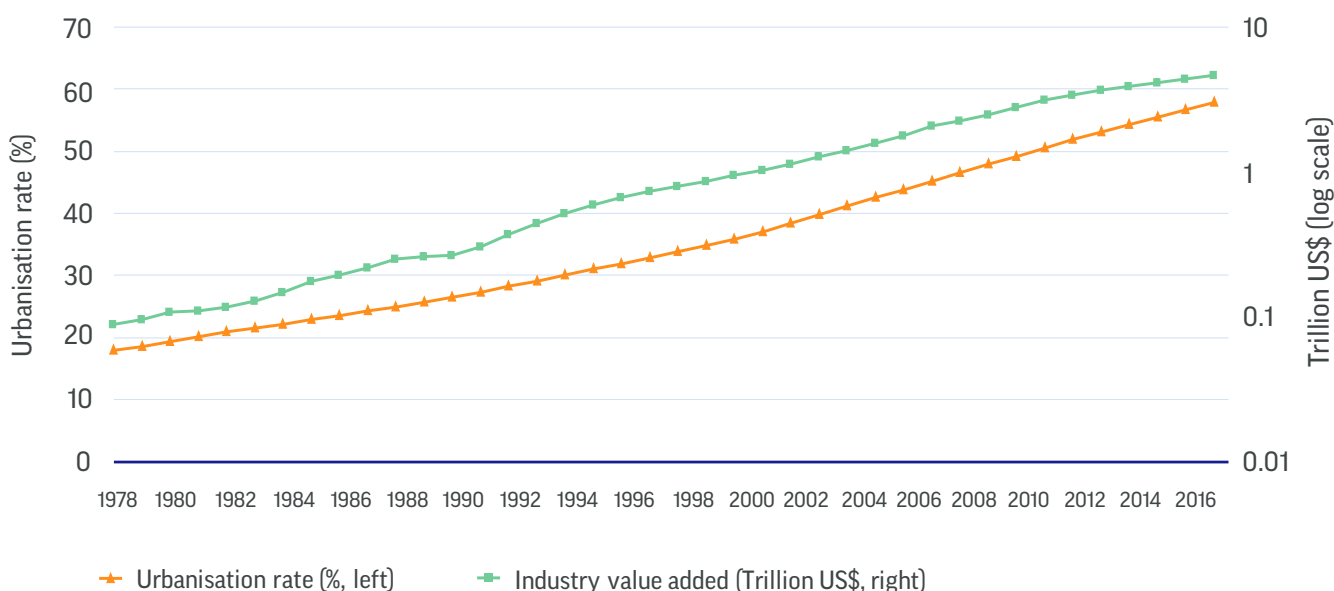
China’s recent pace of urbanisation has been much more rapid. In just 33 years – from 1978 to 2011 – the urban share of the population grew from about 18% to more than 50%. Japan also urbanised rapidly, with its urban share rising from 18% in 1920 to 58% in 1955, nearly 80% in 2000 and more than 90% in 2010.<sup>20</sup> But it has a much smaller population (about 127 million people) than China. From 1996 to 2019, 460 million rural Chinese migrated to cities – equivalent to almost four times the population of Japan. No other large country completed the transition from a largely agricultural population to a mainly urban population in such a short space of time or on such a scale.

## THE TRADITIONAL ENGINES OF CHINA’S URBANISATION ARE SLOWING

China’s urbanisation has been driven by three interrelated and mutually reinforcing engines: industrialisation, marketisation (the transition from a planned to a market economy) and globalisation. For different reasons, all three engines are now slowing, making it more difficult to overcome the challenges of urbanisation and harness cities as a positive force.

China’s large-scale industrialisation enabled urbanisation by directing capital, labour, land and energy towards industrial production centres (Figure 3). Urban centres concentrated workers and economic activity, enabling industrialisation.

Figure 3  
**Urbanisation and industrialisation in China, 1978–2016**



Source: World Bank, 2019. *Data Catalog*. Available at: <https://datacatalog.worldbank.org/>.

To be sustainable, industrialisation and urbanisation should grow at similar paces.<sup>21</sup> Disconnected growth – in which cities attract people without strong industrial growth to provide jobs – can create the type of over urbanisation that Latin America has experienced, and become a barrier to economic growth.

China's industrialisation has followed the principle of “pollute first, clean up later.”<sup>22</sup> This principle is particularly problematic given how cities concentrate not only industry but also people, exposing populations to environmental and health-related hazards.

China's transformation of its huge manufacturing-driven economy into a service- and consumption-led economy is a feat few countries have achieved.<sup>23</sup> It has done so through bold actions, such as its announcement on 17 February 2017 of its intention to set up a CNY 30 billion (US\$4.38 billion) fund to encourage high-value-added service exports. The plan reinforces China's current approach towards service sector reform, focusing on non-traditional sectors.<sup>24</sup>

Areas such as e-commerce, technology and private education are helping to achieve economic growth. From 2012 to 2018, the added value of China's service sector increased from CNY 2.44 trillion to CNY 4.70 trillion, growing at an average annual rate of 7.9% – 0.9% higher than the average annual growth rate of GDP and 1.3% higher than the rate of growth of the industrial sector.<sup>25</sup> The share of the service sector's contribution to GDP increased by even more, rising 6.7% in six years to more than 50% in 2015, then 52.2% in 2018. In addition to other modern service sectors, in 2018 the financial and real estate sectors respectively grew to 14.7% and 12.7% of the added value of the service sector. Emerging services, such as information transmission, software and information technology services, and leasing and business services are becoming increasingly important.

China's marketisation has spurred urbanisation by creating and merging larger markets and encouraging regional flows of commodities and factors of production such as labour. Cities have acted as connecting hubs between markets and regions, enabling more efficient trade.

When urbanisation is disconnected from marketisation it has had unintended negative consequences. Urbanisation encouraged by local governments without following market principles has created ghost towns, characterised by rapid real estate development that lacked the concentrations of industry and population cities require to flourish.<sup>d</sup> Industrialisation without marketisation can also result in interregional barriers and duplication of industries. Both phenomena reflect inaccurate projections of market demand and soft budget constraints by local governments and state-owned enterprises.<sup>e</sup>

China's globalisation has provided much-needed capital and technology for China's industrial development and urban economy (Figure 4). Trade and international cooperation have boosted China's economy, but China's linkages to the global economy can leave it vulnerable to external economic threats. For example, the recent rise in anti-globalisation sentiment has shrunk the market for exports. This shrinkage has had a significant effect on China's urbanised east coast regions, where industrialisation is concentrated. Predominantly export-focused industries have suffered, leading to the closure of many manufacturing factories and forcing many of the migrant workers who worked in those factories to return to their homes in the countryside.

---

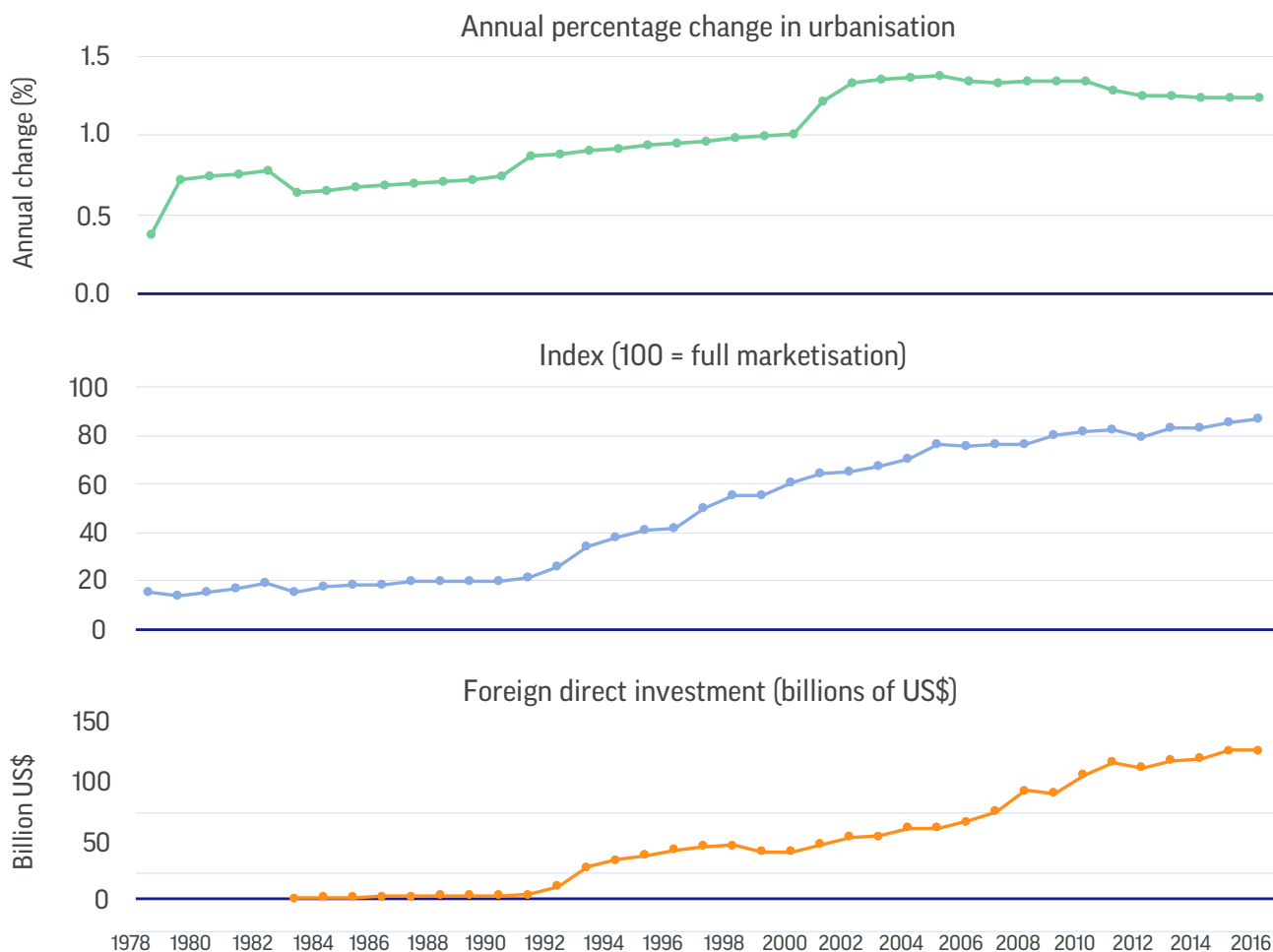
<sup>d</sup> Arguably the most well-known Chinese ghost-town is Ordos in Inner Mongolia. See (Yin et al., 2017. Living in the “Ghost City”: media discourses and the negotiation of home in Ordos, Inner Mongolia, China. *Sustainability*, 9(11).) for details.

<sup>e</sup> Soft budget constraint is when the state is in practice responsible for all the losses of local governments and state-owned enterprises, for instance by providing additional funding or compensations or cutting taxes. See (Lin, J. Y., and Tan, G., 1999. Policy burdens, accountability, and the soft budget constraint. *American Economic Review*, 89(2), 426-431.) for a detailed discussion on the soft budget constraint.



Figure 4

## Urbanisation, marketisation and foreign direct investment in China, 1978–2016



Sources: Data on urbanisation rate are from: World Bank, 2019. Data Catalog. Available at: <https://datacatalog.worldbank.org/>.

Data on marketisation index are from: Lin, Y. Guo, Z. and Wu, Q., 2019. Assessment on Marketization Reform Performance in China (1978–2016). *Journal of Beijing Normal University (Social Sciences)*, 1. 147–157.

Data on foreign direct investment are from: National Bureau of Statistics of China, 2019. Annual Data Preview. Available at: <http://data.stats.gov.cn/easyquery.htm?cn=C01>.

### CHINA'S URBANISATION HAS HISTORICALLY DRIVEN ECONOMIC GROWTH

Historically, economic growth and urbanisation have gone hand in hand. Structural change – the shift of workers and other resources from low-productivity sectors, such as subsistence agriculture, to high-productivity sectors, such as industry and modern services – was the driving force behind growth

in today's high-income countries. Urbanisation developed as a parallel process.

The pooling of human resources and capital in cities is both the result of, and an enabling factor for, economic growth. Cities concentrate workers, firms and capital, generating agglomeration economies through matching, sharing and learning spillovers. As a result, levels of productivity and innovation are higher in larger, more densely populated cities,

fuelling sustained economic development.<sup>26</sup> The larger labour markets in cities allow firms to find workers with specialised skills and to benefit from demand for specialised products. A review of more than 300 studies on compactness finds that in higher-income countries, when 10% more people live and work in a city, annual gross value added per person is US\$182 higher, thanks to higher productivity, greater job accessibility and better access to services.<sup>27</sup>

## **CITIES MUST CONTINUE TO DRIVE CHINA'S ECONOMIC PROSPERITY WHILE IMPROVING THE LIVELIHOODS OF THEIR RESIDENTS**

Thanks in part to urbanisation, China's economy grew at an average annual rate of more than 10% and the share of urban GDP within the national total doubled between 1978 and 2017. Today, one-third of the world's 300 largest metropolitan economies are in China,<sup>28</sup> and some of them have GDP comparable to that of some countries. In 2017, for example, Beijing had the same GDP as the Philippines.<sup>29</sup>

The rapid expansion of urban areas created not only tremendous job opportunities but also more productive jobs, raising the incomes of China's urban workers. Wage growth has been so strong that the average salary in some Chinese cities now surpasses wage levels of some European countries.<sup>30</sup> A 2007 Urban Household Survey estimated that on average, a Chinese worker who moved from a low-density city (a city in the first decile of density) to a high-density one (a city in the last decile) experienced a wage gain of 53%.<sup>31</sup> Industrialisation and urbanisation also lifted millions of people out of poverty: China's poverty rate plummeted from 66.2% in 1990 to 0.5% in 2016.<sup>32</sup>

---

**Industrialisation and urbanisation also lifted millions of people out of poverty: China's poverty rate plummeted from 66.2% in 1990 to 0.5% in 2016.**

The increase in population density resulting from rapid urbanisation also allowed policy-makers to provide access to basic infrastructure to more people at a lower cost. According to China's National Bureau of Statistics, the share of the urban population with access to tap water increased from 53.7% in 1981 to 98.3% in 2017, and the share of the urban population with access to natural gas increased from 11.6% to 96.3%.<sup>33</sup>

Connectivity and inclusivity improved largely thanks to urbanisation, through the development of public transport and the rail network. The number of public transport vehicles per 10,000 people in cities and towns increased from 2.1 in 1978 to 14.7 in 2017, and the length of urban rail transit rose from 23.6 kilometres in 1978 to 4,570 kilometres in 2017. These improvements have led to a more integrated Chinese society.

Although urbanisation has brought better jobs and easier access to amenities to many, most Chinese cities are still grappling with informality and poverty. National urban policies that enhance mixed land use and transit-oriented development while managing the risks linked to increased density will be key to ensuring safety and prosperity for all urban dwellers.

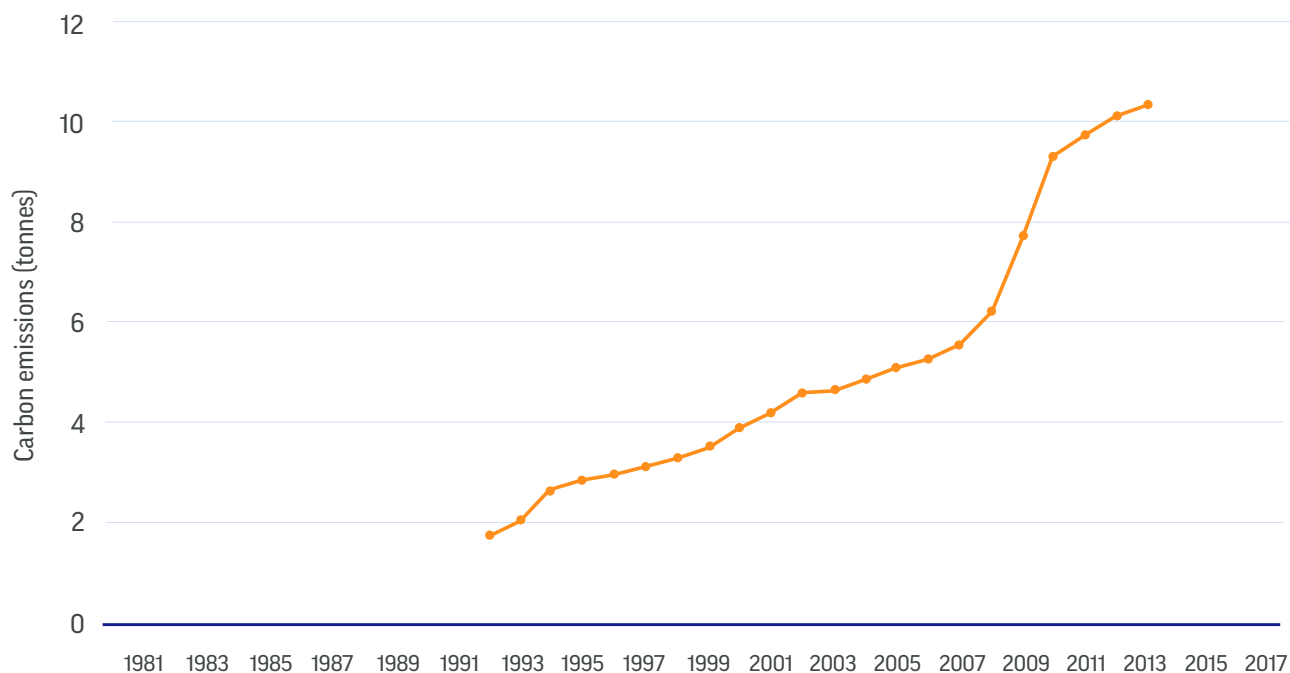
Urban centres in China have improved the livelihoods not only of urban residents but of rural people as well. Rural households can access jobs, services and critical farming inputs in local towns, helping them diversify their livelihoods and improve their living standards. Rising incomes in cities increase demand for higher-value agricultural products, increasing the incomes of farmers.<sup>34</sup>

## **CHINA'S CITIES MUST BE DRIVERS OF A SUSTAINABLE ECONOMIC TRANSFORMATION**

Maintaining economic performance is not the only goal of China's cities: despite struggling with increasing carbon emissions, cities must also improve residents' lives and become drivers of ecological civilisation (Figure 5). More sustainable forms of urban development are not just better for the environment; they are better for people, too. As President Xi recognised during a meeting on environmental protection in Beijing in 2019,<sup>35</sup> ecology and the environment are closely tied to people's well-being.

Figure 5

### Urban carbon emissions per capita in China, 1992–2013



Source: Data on carbon emissions are from: Su, W., Liu, Y., Wang, S., Zhao, Y., Su, Y. and Li, S., 2018. Regional inequality, spatial spillover effects, and the factors influencing city-level energy-related carbon emissions in China. *Journal of Geographical Sciences*, 28(4). 495–513.

Cities are often associated with uniquely urban problems, known as “urban diseases” (*chengshi bing*), such as traffic jams, air pollution and environmental degradation. But if well planned, they can be more respectful of the environment than some rural areas. When they are compact and connected, cities can apply less pressure on the natural environment than farming. Indeed, compact cities require less land, material and energy to physically connect households and businesses than any other type of human settlement. Transit-oriented development can increase convenience for commuters and reduce pollution, congestion and greenhouse gas emissions.

Cities are fertile ground for environmental and societal innovations, for three main reasons:

- Environmental challenges are perhaps more tangible in cities, where people are

often acutely aware of both the source and effects of air pollution. Being able to experience and influence challenges can inspire concrete, practical solutions.

- Population density fosters innovation, as the proximity of people makes it easier for ideas and innovation to incubate and scale.
- Cities offer rich test beds for innovative practices.

Urbanisation offers China an opportunity to enhance economic performance while boosting living and environmental standards in a resource-efficient way. Realising these opportunities requires innovative and bold national policies to harness the power of Chinese cities. Careful spatial planning and strategic infrastructure investment are needed to nurture compact, connected and clean cities.<sup>36</sup>



People on the metro. Credit: joyfull / Shutterstock.

### 3. Three grand challenges to China's urbanisation

China's economic boom has pulled millions of Chinese people out of poverty. But the sheer scale of urbanisation and industrialisation over the last half-century has meant that China has struggled to fully realise the potential benefits of urbanisation. In the next 15 to 20 years, Chinese cities will grow by about 12 million people a year.<sup>37</sup> The urban population will expand by an estimated 255 million people by 2050.<sup>38</sup>

Due to a concentration of people and activities, Chinese cities are huge contributors to climate change. Because coal fuels 70% of China's grid<sup>39</sup> and polluting industries are concentrated in urban areas, Chinese cities are responsible for 85% of the country's total carbon dioxide (CO<sub>2</sub>) emissions.<sup>40</sup> The challenges of urbanisation, industrialisation and emissions put enormous pressure on local governments, which often lack the capacity and resources to cope with them.

Domestic and international trends linked to the environment and the economy put cities at risk. The heavy dependence of the Chinese economy on primarily urban sectors makes cities vulnerable to the slowdown of the global economy. Economic growth has led to an increase in wages, in turn leading global companies looking to relocate their activities to other countries where labour is cheaper.

In cities, air pollution and the urban heat island effect pose massive threats to public health. The combination of global warming and population growth puts severe pressure on the already uneven distribution of water resources.<sup>41</sup>

This report identifies a perfect storm of three interconnected challenges that are holding China's cities back from meeting the country's developmental goals:<sup>f</sup>

- **Challenge 1:** Ensure that basic infrastructure and services keep pace with the rapid population growth of cities.

<sup>f</sup> These challenges are based on the core views of Qiu Baoxing, the former vice-minister of Housing and Urban-Rural Development Ministry of China, combined with our research team's multiple academic discussions and survey interviews with government officials in different cities.

- **Challenge 2:** Reduce climate vulnerability, the depletion of critical natural resources and rising air pollution from the use of fossil fuels.
- **Challenge 3:** Reduce the unsustainable rise of local government debt fuelled by land sales and capacity-constrained, short-term local planning.

### Challenge 1: Ensure that basic infrastructure and services keep pace with the rapid population growth of cities

#### Improve the capacity for urban disaster risk reduction

Cities are centres of economic and social activities, as well as potential crisis and risks. The size of China’s cities and the fact that China has the highest urban density of any country in the world makes coping with disasters particularly challenging.<sup>42</sup> Urban population growth will put even more pressure on coping capacity. China is making efforts to rebalance its services in order to care for its growing number of urban citizens. Medical beds and a universal index of the country’s health service capacity are a crucial resource for a functioning medical and health service. According to the Plan of National Medical and Health Service System (2015–2020), by 2020 the number of medical beds per

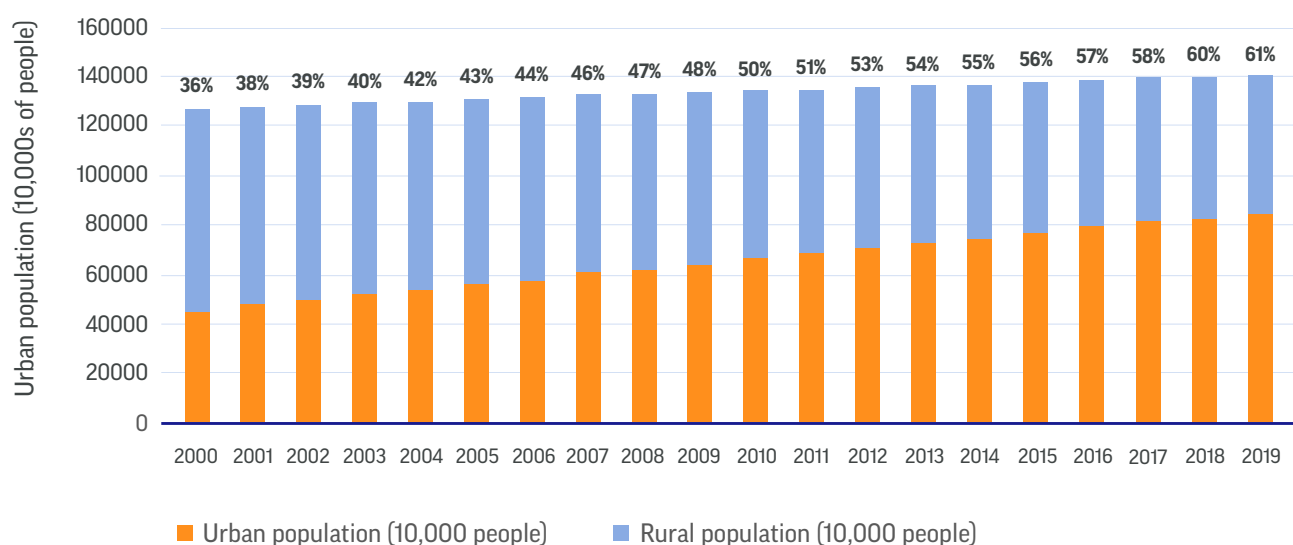
thousand people in China will reach the goal of six.<sup>43</sup> The plan marks the first time China has put forward a quantitative goal for the provision of medical beds.

Exposure to disasters is increasing in cities due to an inefficient use of land. “The failure of land use will seriously weaken a city’s ability to cope with extreme weather events, earthquakes, technology, biological and environmental hazards,” according to a high-ranking official with the United Nations Office for Disaster Risk Reduction.<sup>44</sup> Between 1981 and 2017, built-up areas in cities increased at an average annual rate of 5.8%, while the urban population increased by an average rate of just 3%. Inefficient use of land makes it more difficult to evenly distribute essential services across a city’s communities and risks exposing disconnected populations to new risks.

#### Improve the provision of basic infrastructure and services for migrant workers in urban areas

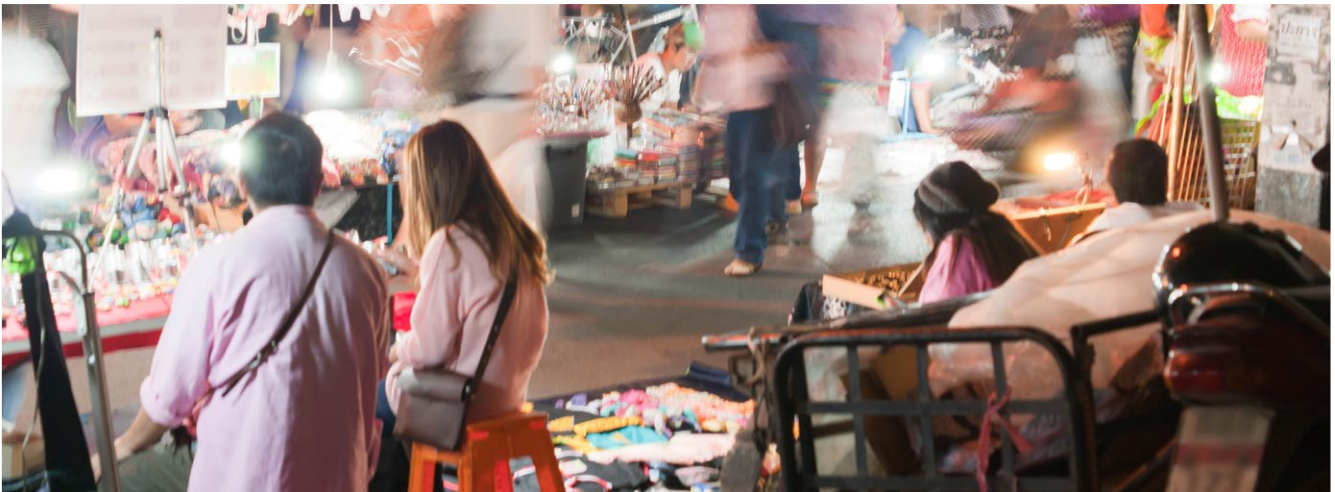
Since China’s Reform and Opening Up, millions of rural workers have moved to cities, enhancing economic and social development and industrialisation. In 2018, about 60% of China’s 1.39 billion people lived in urban areas (Figure 6).

Figure 6  
Urban population in China, 2008–2019



Note: Percentage per year indicates the percentage of urban population to total population for that year.

Source: National Bureau of Statistics of China (NBSC), 2019. *Annual Data Preview*. Available at: <http://data.stats.gov.cn/easyquery.htm?cn=C01>.



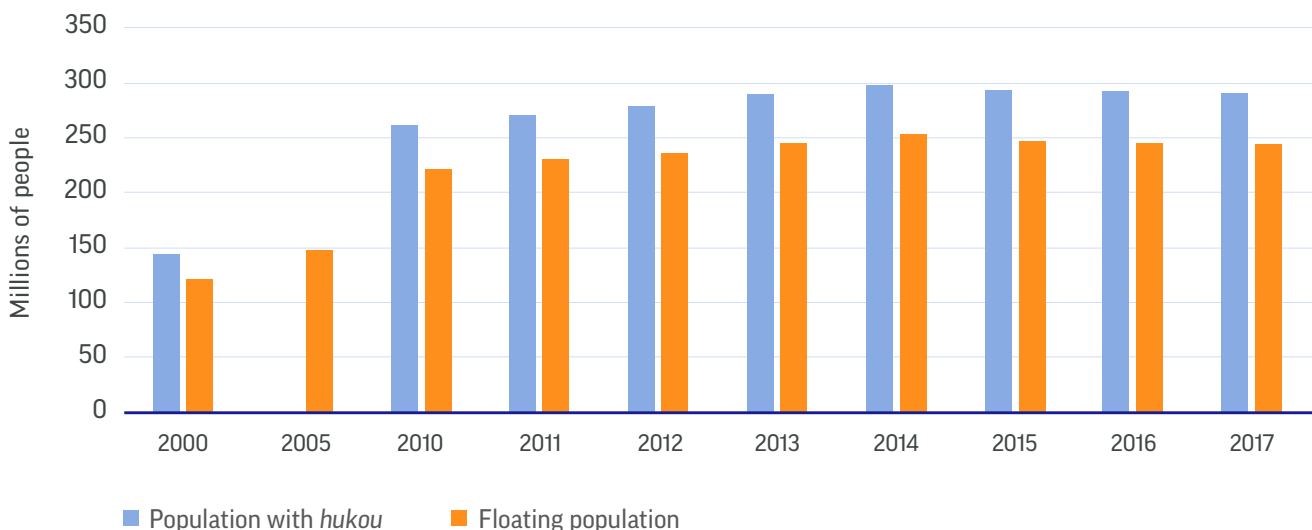
Night market. Credit / Patchanee Samutarlai / Shutterstock

Between 1978 and 2018, the permanent urban population increased from 170 million to 831 million. The number of cities increased from 193 to 672, and the number of towns increased from 2,176 to 21,297. Between 2012 and 2018, the urbanisation rate of the registered population (the population with urban housing registration, known as *hukou*) increased from 35.3% to 43.3%. However, a significant number of people have been residing in places other than

their housing registration areas, known as the “population of residence-registration inconsistency (*renhufenli renkou*). These include people who move to another city without changing their household registration, known as the “floating population (*liudong renkou*).”<sup>45</sup> In 2017, 291 million people in China’s cities resided away from the location of their official *hukou*, including 244 million floating population (Figure 7).<sup>46</sup>

Figure 7

**Population of residence-registration inconsistency and floating population in China, 2000-2017**



**Note:** Data for 2000 and 2010 are based on the national population census; data for other years are estimates based on national sample surveys of the population.

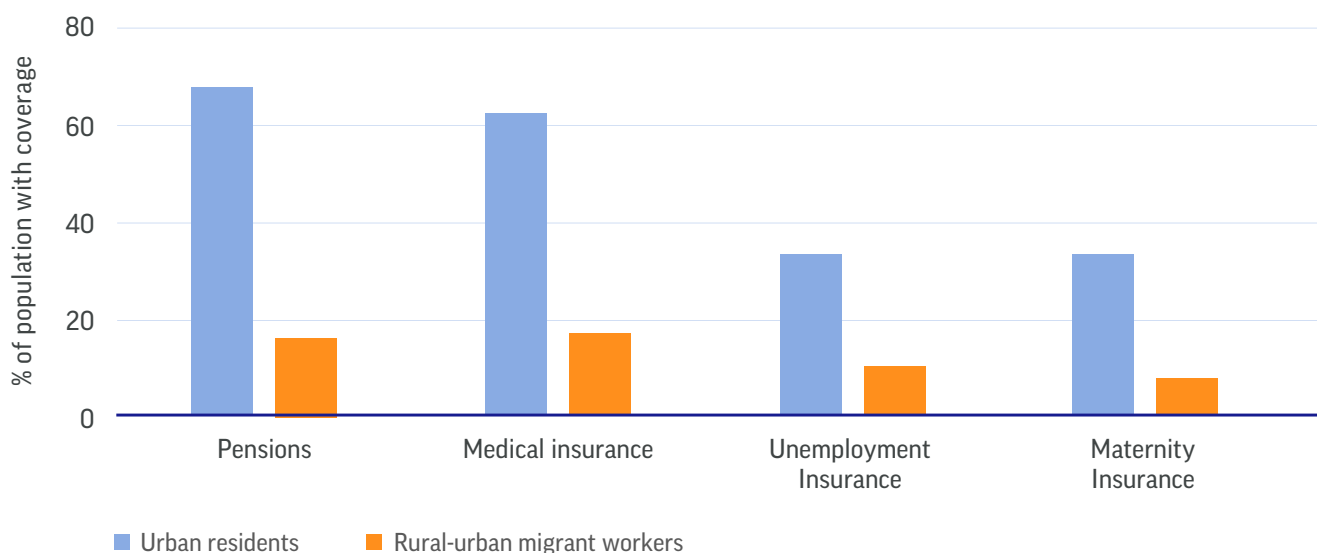
**Source:** National Bureau of Statistics of China. 2018. *China Statistical Yearbook 2018*. Available at: <http://www.stats.gov.cn/tjsj/ndsj/2018/indexeh.htm>.

This phenomenon has caused a variety of social problems, including lack of access to housing, medical care and education for the children of registered residents.<sup>47</sup> Migrant workers also have less access to safety nets than other urban dwellers, making it difficult for them to integrate into cities and become urban citizens. Their pensions, medical insurance, unemployment insurance and maternity insurance coverage are a small fraction of that of other urban residents (Figure 8).

China's cities are projected to face an influx of an additional 255 million migrant workers by 2050.<sup>48</sup> These increases will make it even more difficult for some cities to provide adequate housing, water and sanitation, public health and education. If this challenge is not dealt with, urbanisation in China will no longer act as a means for people to improve their lives and cities will not be the hubs of prosperity that they could be.

Figure 8

**Pension, medical insurance, unemployment insurance and maternity insurance coverage among rural-urban migrant workers and urban residents in China, 2014**



Sources: National Bureau of Statistics, 2015. *China Statistical Yearbook*.

National Bureau of Statistics, 2014. *National Migrant Workers Monitoring Survey Report*. Available at: [http://www.stats.gov.cn/tjsj/zxfb/201504/t20150429\\_797821.html](http://www.stats.gov.cn/tjsj/zxfb/201504/t20150429_797821.html)

## Challenge 2: Reduce climate vulnerability, the depletion of critical natural resources and rising air pollution from the use of fossil fuels

The global climate crisis makes it impossible to continue along the traditional path of urbanisation characterised by high input, high consumption and high emissions. National government support is needed to ensure that the right legal framework and economic incentives are in place to support the transition to a new kind of urbanisation.

The concentration of people and assets in cities also increases their vulnerability to environmental risks and pressures. To take advantage of trade routes to major markets, China's urban population growth – and the accompanying investment in infrastructure – is concentrated along the east coast. As a result, many cities have developed in low-lying coastal zones, where they are susceptible to floods, saltwater intrusion and storm surge. Impervious surfaces such as asphalt and concrete increase peak water flows and therefore flood risks, and the degradation of wetlands and mangroves removes important buffers against storms.<sup>49</sup> Climate change will exacerbate these risks and add the new threat of sea-level rise, potentially impacting nearly 130 million urban residents in China who live in coastal areas that are less than 10 metres above sea level – the largest

---

**The global climate crisis makes it impossible to continue along the traditional path of urbanisation characterised by high input, high consumption and high emissions.**

number of any country.<sup>50</sup> If urban development continues to expose vulnerable urban populations to climate change, it risks creating new disasters.

### Reduce air pollution

China's ambient air quality standard (GB3095-2012) has been implemented nationwide since 1 January, 2016. As China is an upper-middle-income country, the WHO recommends meeting phase 1 target values for PM<sub>10</sub>, PM<sub>2.5</sub> and other pollutants, which are lower than the standards recommended for higher-income countries.<sup>51</sup> In 2018, only 36% of the 338 cities at or above the prefecture level met the country's ambient air quality standards.<sup>52</sup> The concentration of PM<sub>2.5</sub> in China decreased to 39 µm from 43 µm in 2017, but it is still 3.9 times higher than the WHO guidance for China.<sup>53</sup>

### Reduce traffic congestion

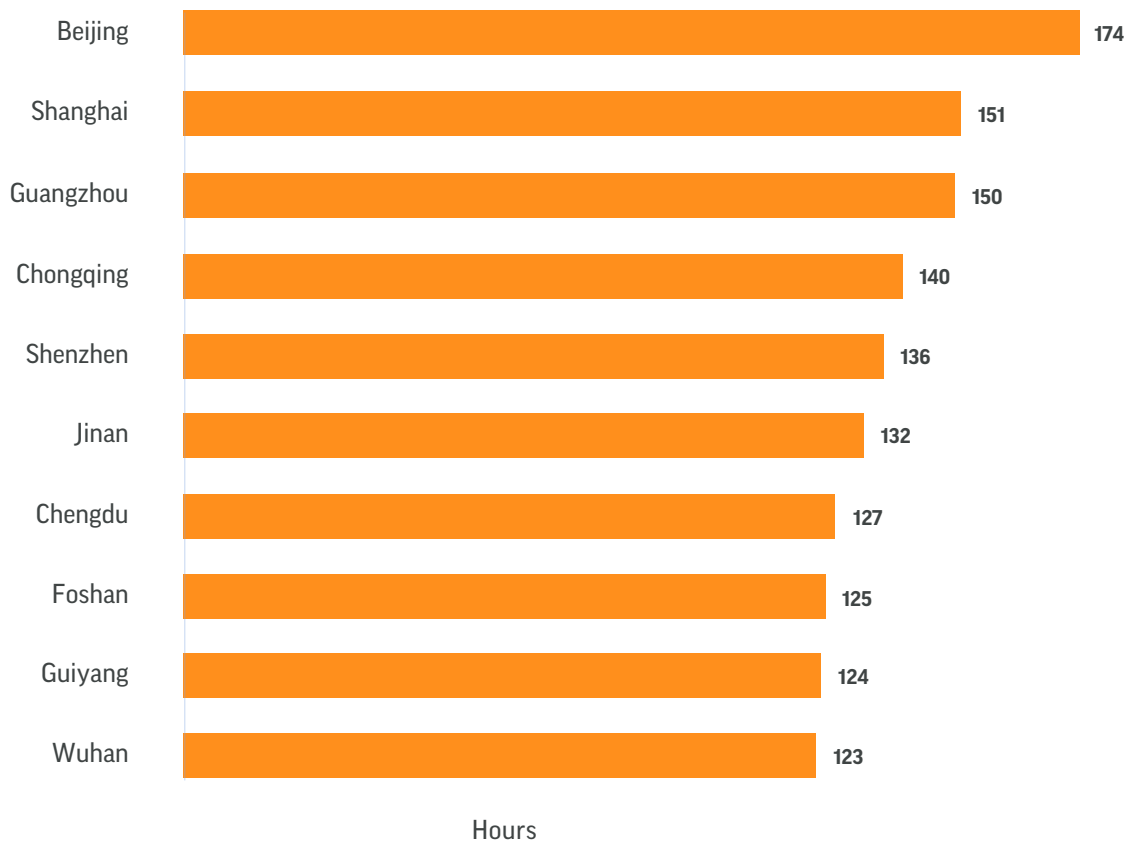
As of the end of March 2017, the number of motor vehicles in China exceeded 300 million, of which more than 200 million were cars, giving China the second-largest number of cars in the world after the United States.<sup>54</sup> The rapid growth of car ownership has put enormous pressure on the urban environment, as seen in rates of traffic congestion that is now a severe challenge in some Chinese cities.

In 2018, Beijing (which has the worst congestion in China) lost about CNY 180 billion on daily traffic commuting, the equivalent to about 6% of the city's GDP, with the average person wasting about 7.25 days a year in traffic.<sup>55</sup> The *Traffic Analysis Report of Major Cities in China* analysed 361 Chinese cities and found that 13% experienced congestion and 61% were in low speed during peak hours in 2018 (Figure 10).<sup>56</sup>



Figure 10

**Number of hours per capita spent in congestion in China in 2018, by city**



Source: AMAP, 2019. *Traffic Analysis Report of Major Cities in China in 2018*. Available at: <https://report.amap.com/download.do>.

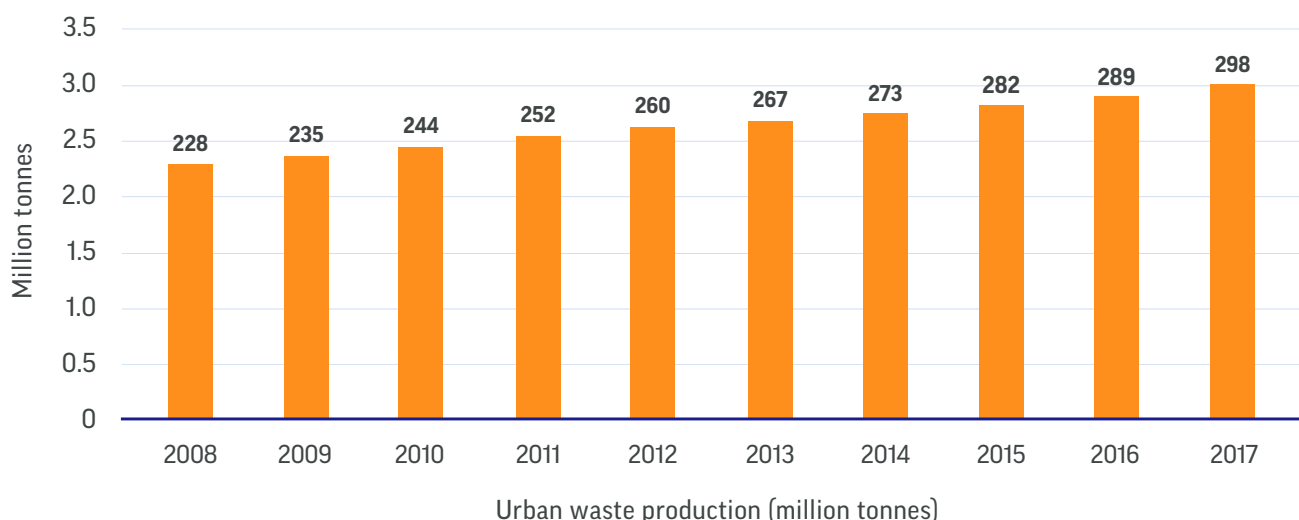
**Improve waste management**

Per capita production of solid waste in China is lower than in developed countries, but it is growing (Figure 11). Between 2008 and 2017, urban waste production increased from 228 million tonnes to 298 million tonnes, an increase of 27%.

According to the data from *Science and Technology Daily*, two-thirds of Chinese cities face waste management challenges and one quarter have no space for waste processing.<sup>57</sup> If not dealt with, a growing waste problem can have severe environmental and health impacts.

Figure 11

### Urban waste production in China, 2008–2017



Source: Lu, L., 2018. *Report of market prospective and investment strategy planning on China solid waste treatment industry (2018-2023)*. Prospective Industry Research Institute. Available at: <https://www.qianzhan.com/analyst/detail/220/180420-620fe124.html>.

### Challenge 3: Reduce the unsustainable rise in local government debt fuelled by land sales and capacity-constrained, short-term local planning

Cities and city governments play a critical role in realising national priorities. Poor planning and a lack of operational and fiscal capacity can severely limit their ability to provide for their local populations.

#### Reduce local government debt

Rapid urbanisation in China has sharply increased subnational debt. In recent decades, urban governments in China obtained massive funding through land sales, partly because of inadequate fiscal transfers from the central government and partly because of the lack of fiscal autonomy over other own-source revenues, such as road pricing.<sup>58</sup> To meet the urgent need to finance infrastructure investment and job creation, local governments borrowed heavily – often against land – via multiple platforms.

The limited supervision of, and restraint on, local land sales has had serious consequences. Urban areas expanded at a much faster rate than urban populations. Globally, urban areas expanded by an area of land roughly twice the size of Sri Lanka between 2000 and 2014. China alone accounted for 32% of this new urban extent.<sup>59</sup> Much of this sprawl was into high-value agricultural lands or along the coast, jeopardising China’s food security and reducing its resilience to environmental hazards. Widespread land speculation and the use of land as collateral by governments and investment companies distorted prices,<sup>60</sup> undermining efficient land use planning and property markets that can allow local authorities to maximise the proximity and density benefits of agglomeration.

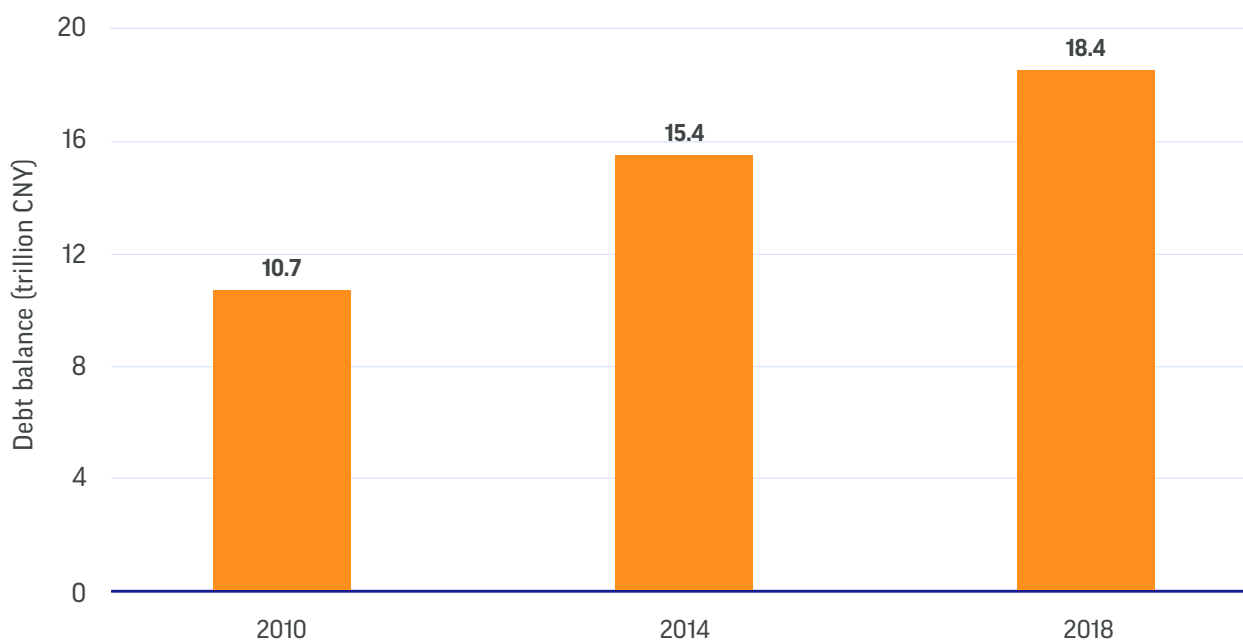
Local governments in China have borrowed far beyond what they can reasonably expect to repay. In 2011, the local debt balance in China was CNY 10.7 trillion. By the end of 2018, the figure had increased to CNY 18.4 trillion (Figure 12). This excessive borrowing has compromised fiscal sustainability at all levels of government. Local government debt

has become a lurking danger threatening China's long-term sustainable development.<sup>61</sup> The Budget Law of the People's Republic of China has restricted local government borrowing since 2015, but local governments use alternative platforms that are not closely monitored, such as urban development and infrastructure companies (UDICs) and local government financing vehicles (LGFVs).<sup>62</sup> Local debt is supposed to be used to finance productive investments – ideally investments that will generate a direct return – but it is often used for other purposes.<sup>63</sup>

In 2009, nearly 40% of counties in China were in deficit and 31 provinces, autonomous regions and municipalities had varying degrees of debt.<sup>64</sup> In 2018, the local government debt ratio (the debt balance divided by the government's comprehensive financial resources) reached 76.6%.<sup>65</sup> Although the average local government debt ratio is still below the 90–150% standard recommended by the International Monetary Fund, many local governments have debt ratios well over 100%. The risk cannot be ignored.

Figure 12

### Debt balance of local governments in China in 2010, 2014 and 2018



Source: National Audit Office of the People's Republic of China, 2011. *National government debt audit results*. Available at: [http://www.gov.cn/zwqk/2011-06/27/content\\_1893782.htm](http://www.gov.cn/zwqk/2011-06/27/content_1893782.htm).

Xinhua Net, 2019. *By the end of 2018, China's outstanding local government debt reached 1.83862 trillion yuan*. Available at: [http://www.gov.cn/xinwen/2019-01/23/content\\_5360689.htm](http://www.gov.cn/xinwen/2019-01/23/content_5360689.htm).

The potential failure of local governments to repay principal and interest on time would have serious consequences for governance. First, it would hinder the supply of local public services and reduce the quality of local public goods. Second, it would damage the social credit system, possibly triggering a social credit crisis. Local government credit is the cornerstone of social credit. Failure to repay local debts would distort signals to the market, shake the confidence of investors and consumers, and hinder investment and consumption. Third, the continuous expansion of local government debt could cause a wider social crisis, increase social instability and reduce societal harmony, because debt across levels of government must be proportionate to revenues. If total liabilities exceed the combined capacity of the government to pay, the creditworthiness of the sovereign as well as local authorities would decline.<sup>66</sup> Major fiscal imbalances or risks would hinder the sustainable development of China's economy and society, creating conflicts between immediate interests (public spending and investment in much-needed sustainable urban infrastructure) and long-term interests (maintaining low-cost access to capital markets in order to finance future spending and investments).

### **Improve long-term urban planning and construction**

Urban planning and construction in China have not been sufficiently evidence-based. Local governments

increase unplanned urban sprawl; develop large areas of cultivated land; and build high-tech zones, industrial parks and development zones.

Buildings are demolished prematurely, for various reasons. The main reason is a bias towards short-term commercial interests, followed by lack of foresight and planning. During the 12th Five-Year Plan (2011–2015), China wasted CNY 460 billion a year on the premature demolition of houses.<sup>67</sup> During the 11th Five-Year Plan (2006–2010), 4.6 billion square metres of buildings were demolished, including about three billion square metres of urban buildings. The average lifespan of a building in China is 35 years – extremely short compared with the 74-year average life span of U.S. buildings and the 132-year average lifespan of buildings in the United Kingdom.<sup>68</sup>

Premature demolition of buildings results in an additional 400 million tonnes of construction waste a year and 40% of China's annual garbage production. The carbon emissions associated with prematurely demolished buildings represent about 5% of China's total carbon emissions. If both the building materials needed for reconstruction and the carbon emissions at the time of demolition are taken into account, premature demolition increases China's carbon emissions by about 10% a year.<sup>69</sup>



Monorail in Chongqing. Credit: Stepanov Aleksei / Shutterstock.

## 4. Three new engines China can turn on to create “ecological cities”

China’s new era of urbanisation must become an engine of, rather than a hindrance to, ecological civilisation. In 2014, China’s National New-type Urbanisation Plan (2014–2020) noted that given the profound changes in the domestic and international environment, urbanisation in China must enter a new stage that focuses on the quality and sustainability of development instead of solely on rapid growth. In 2015, the Fifth Plenary Session of the 18th Central Committee of the Communist Party of China introduced five development concepts that should underpin China’s new stage of urbanisation: innovation, coordination, greenness, openness and sharing.

Urbanisation 1.0 focused on speed; urbanisation 2.0 must focus on quality and delivering coordinated economic, political, cultural, social and ecological

advancement. A new vision should return to the essence of the city, recognising that most people choose cities not only because they are good places to work but also because they are good places to live (*anju leve*).<sup>70</sup> Cleaner air, more accessible housing and improved connectivity can enhance economic mobility, health and well-being – advantages that can lead to higher productivity. This line of thinking differs from the old model, in which China set GDP growth as the only priority and succumbed to the interests of capital.

The transition from quantity-centred to quality-centred urbanisation is an incremental process.<sup>71</sup> It is also one that requires coordinated and collaborative action. The National New-type Urbanisation Plan (2014–2020) already seeks to improve the quality of urbanisation by promoting the development of productive services to optimise urban industrial structure, compacting land to deepen the reform of land management system, and emphasising the importance of public participation to strengthen and innovate urban social governance.

This chapter proposes three engines that could help build a coordinated network of compact, connected, clean cities across China that can create jobs, attract investment and deliver a better quality of life for people.

### **Engine 1: Develop a new national system of cities, rebalance growth away from coastal areas towards the interior, and underpin urbanisation with basic infrastructure and a world-class intercity mass transit system**

Special economic zones and targeted public investments in urban infrastructure in China's coastal regions spurred both urban population and economic growth. The next wave of urbanisation requires a rebalancing of population and economic growth so that the entire population benefits from the prosperity that urbanisation can bring. Such a transition requires national-level ambition and decision-making.

#### **1a. Craft a shared vision for cities**

The transformation towards inclusive, resilient, compact, connected and clean cities will be possible only through a concerted, coordinated effort by all tiers of government working towards common goals. The central government is already looking to improve the quality of service delivery and set more ambitious emissions-reduction targets across the country. Provincial, city and other levels of local government must be able to implement these agendas.

---

**The transformation towards inclusive, resilient, compact, connected and clean cities will be possible only through a concerted, coordinated effort by all tiers of government working towards common goals.**

Cities grow and change through discrete decisions made by a wide range of stakeholders, including civil society, urban planners, property developers, architects, bankers, infrastructure providers and others. Each may bring different ideas about how a neighbourhood or city should function and national governments have unique roles to play in ensuring that all these voices are heard. China will need to craft a coordinated vision about its urban future, while creating space for local innovations and adaptations that accommodate the unique characteristics of its many cities.

By many measures, China already does this extraordinarily well. It has a long track record of supporting local governments as they experiment with innovations, learning from these pilots and then scaling across the country. Examples include new energy vehicles, sponge cities (see Box 3) and carbon trading, all of which were piloted in frontrunning cities while national and provincial governments refined the relevant governance arrangements, legislation and technologies. Other cities looked to these frontrunners to understand what their own future might involve.

#### **1b. Increase access to high-quality services across the country**

Interior cities, especially small to medium-size cities, should focus on improving equitable access to healthcare, education, housing and other essential services, to make them more attractive destinations for prospective urban migrants and ease pressure on the eastern metropolises. The COVID-19 pandemic is one example of how better access to services such as healthcare can improve not only individuals' lives but the well-being of society at large.

Chapter 2 identified the critical role rural to urban migration played in China's urban development. The new era of urbanisation should pay more attention to the "citizenisation" of migrant populations (the transformation of migrant workers into urban citizens), their integration into society<sup>72</sup> and the meeting of their basic needs. Migration can be leveraged more effectively if policy better understands and responds to the incentives, beyond

employment, that attract people to cities, first as prospective urban migrants and then as settled urban residents.

China must do more to ensure that its cities are attractive places not only to work but to live. Creating compact, connected and clean cities can be an effective way to attract and retain migrant workers.<sup>73</sup> Smaller towns and cities, not just China's megacities, should improve access to services and social security to migrant workers, recognising that these urban centres act as productive hubs for their regions.

### **1c. Industrialise the interior and affect the industrial transition**

Industrial growth can no longer be concentrated solely in major coastal metropolises: policy should promote industrial development in China's interior as well. To improve the rate of industrialisation in the interior, urban centres must provide better access to services to encourage workers to relocate. Greater labour supply, in turn, attracts firms (Goal 1b should, therefore, be considered a prerequisite to achieving Goal 1c). China should also continue to transform its huge manufacturing-driven economy into an economy driven by high-value services, through service sector reform. The shift from heavy industry to services can create millions of job opportunities.

Firms and workers will not relocate without adequate incentives. China's Belt and Road Initiative offers a tremendous opportunity to act as a catalyst; it offers China's interior cities greater access to markets in Europe, the Middle East and Africa, which can encourage manufacturing firms that depend on low-skilled labour and price competitiveness to move west. Such relocation would not only benefit western China; it would also ease pressure on eastern metropolises that are struggling to accommodate urban migrants.

### **1d. Ensure good connectivity across the country**

China should continue to invest in high-speed rail to move people and freight across the country.

Transportation should also be improved to connect regional urban hubs with smaller urban centres and those centres with rural areas, to maximise and share the benefits of agglomerations.

Achieving more spatially-even economic development and quality of life requires the development of large, medium and small cities and towns.<sup>74</sup> China has been focussing its attention on optimising and accelerating the transformation of its nine central cities, with the aim of each acting as an engine of regional development. Smaller, poorer urban areas, which are hubs for their local region, also need to be able to attract and retain talent. The government should enhance their attractiveness by helping them grow capacity and industry-supporting capabilities.<sup>75</sup>

Creating a network of smaller towns and cities with robust public transport links could provide greater economic vitality not only for urban residents but for rural residents as well. Improved rural–urban linkages would create more inclusive development, by providing rural workers with access to a wider array of economic opportunities.<sup>76</sup>

## **Engine 2: Build compact, connected, clean cities to drive a low-carbon, climate-resilient urban transformation that reduces the degradation of critical natural resources and growing carbon emissions**

People in low-carbon cities are healthier and more productive than people who live in cities with heavy emissions.<sup>77</sup> The concept of compact, connected and clean cities represents a new model that can assist in the transition to quality-centred urbanisation (Figure 13). It recognises both the importance of preventing dangerous climate change and the benefits associated with more resource-efficient, less polluting models of urban development. Compact, connected and clean cities – low-carbon and zero waste cities – can be a pillar of urban sustainable development while greening production, life and ecology.

Figure 13

**Characteristics of compact, connected and clean cities**



Source: Coalition of Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.

**2a. Create compact, connected cities**

More compact, connected cities and neighbourhoods deliver multiple benefits, including higher living standards, greater access to livelihoods and reduced environmental impacts of sprawl.

Intensive land use has been a focus of policy since the implementation of the Land Management Law of 1986. The Chinese central government first proposed compact cities in 2015, during the Urban Work Conference. One estimate suggests that China could reduce infrastructure spending by up to US\$1.4 trillion by pursuing more compact, connected cities.<sup>78</sup>

Compact, connected cities offer many advantages for China and its people. Walkable, well-connected neighbourhoods can be attractive and healthy places where workers want to live (Box 1). They can shorten commutes to work.<sup>79</sup> Reducing sprawl into arable land and natural habitats can also conserve biodiversity and protect China’s natural ecosystems, which in turn can improve resilience to the impacts of climate change.<sup>80</sup>



## Box 1

### Bike-sharing in Shanghai

---

Dockless bike-sharing schemes have become popular in recent years, with more than 17 million dockless shared bikes in use across the globe in 2017. As of 2019, three out of every four dockless bikes were in Chinese cities. Across 170 cities (and counting), more than 106 million users in China take 50 million trips every day.

Docked bike-sharing in Shanghai arrived in 2009, with stations installed in five districts of the central business district. By 2017, the city had more than 80,000 public bikes, making it one of the largest public bike systems in the world. In May 2017, the Ministry of Transportation drafted the first country-wide framework for regulating dockless bike-sharing. Later that year, Shanghai enacted the country's first urban bike-sharing regulations. Key aspects include requirements that bicycles be registered with the police (to prevent vandalism and keep track of the number of bikes) and insurance be provided to users; regulations governing bike parking; and a programme to use electronic geo-fencing to let users know where bikes are and where they can and cannot be parked.

Analysis by the University of Leeds for the Coalition for Urban Transitions suggests that bike-sharing in Shanghai has reduced PM<sub>2.5</sub> emissions by 2.7% and emissions of nitrogen oxides by 0.9% relative to business-as-usual levels. These reductions prevent an estimated 23 premature deaths a year and avoid hundreds of hospital visits and tens of thousands of respiratory events (such as asthma attacks). Extrapolating these results across cities in China with shared cycling networks suggests that as many as 1,000 premature deaths may have been prevented nationwide and millions of hospital visits and respiratory events avoided in 2016 alone. Even more important than these direct benefits may be the wider impact dockless cycling is having on mobility in Shanghai.

In conjunction with an expanded public mass transport system, restrictions on vehicle ownership and investments in pedestrian and cyclist safety, Shanghai can claim to be the world's first megacity that provides comprehensive non-motorised transport options for a majority of its residents.

Chinese cities will need to address road safety, user practices, sustainable business models and data sharing to continue the success of bike-sharing models. Planners will need to improve the physical, operational and political integration of the cycling network into the wider urban fabric, underlining the need for compact, connected and coordinated development approaches.

---

**Sources:** Spinney, J., and Lin, W. I., 2018. Are you being shared? Mobility, data and social relations in Shanghai's Public Bike Sharing 2.0 sector. *Applied Mobilities*, 3(1). 66-83.

Sudmant, A., Mi, Z., Oates, L., Tian, X. and Gouldson, A., 2020. *Towards Sustainable Mobility and Public Health: Lessons from bike sharing in Shanghai, China*. Coalition for Urban Transitions, London and Washington, DC. Available at: <https://urbantransitions.global/publications>

The Economist, 2017. *How bike-sharing conquered the world*. Available at: [www.economist.com/news/christmas-specials/21732701-two-wheeled-journey-anarchist-provocation-high-stakes-capitalism-how](http://www.economist.com/news/christmas-specials/21732701-two-wheeled-journey-anarchist-provocation-high-stakes-capitalism-how)

## 2b. Create clean, efficient cities

China needs to create clean, efficient cities by decarbonising buildings, transport and solid waste management, in order to reduce global greenhouse emissions and improve the health of societies and environments. Greater efficiency and decarbonisation will not only achieve greater ecological and environmental advancement; if planned well they can also improve public health and productivity.

Decarbonising China's electricity systems and waste management will be key to unlocking the opportunities afforded by clean, efficient cities. Reducing the carbon intensity of electricity and electrification is critical to decarbonising buildings, transport and industry, including the production of materials such as cement and steel. Worldwide, decarbonising electricity systems could contribute nearly half the total abatement potential of cities.<sup>81</sup>

It could significantly improve people's health by reducing severe air pollution, particularly if vehicles are powered by clean electricity. More efficient energy systems would also reduce energy bills.

Reducing the environmental impact of solid waste will require promoting green development and a green lifestyle, continuously promoting source reduction and resource utilisation of solid waste and reducing the use of landfills. China produces

more solid waste than any other country in the world. According to the *2018 Annual Report on the Prevention and Control of Environmental Pollution by Solid Waste in Large and Medium Cities*, 202 large and medium-sized cities in China produced 202 million tonnes of municipal solid waste in 2017.<sup>82</sup>

China already recognises the burden this puts on the environment and is setting out measures to address the challenge (Box 2).

## Box 2

### Retrofitting buildings in Changning District in Shanghai

---

Urban areas consume 80% of energy worldwide, with buildings accounting for almost half that amount. With trillions of tonnes of carbon-intensive concrete already poured and thousands of buildings that will be operational for decades to come already built, improving the energy efficiency of existing buildings through retrofit is a priority for climate action.

Changning District in Shanghai has emerged as a leader in the green building sector. The local authority established the Changning Low Carbon Office to coordinate local efforts on energy-efficiency retrofitting. The office worked with the municipal and national government to offer subsidies to incentivise retrofit investments and rolled out a retrofitting programme across almost half of the district's public commercial floor space. It also established China's first online platform for monitoring the energy performance of buildings. That platform was later rolled out across Shanghai, where it now monitors the energy consumption of 1,288 commercial and public buildings that account for 57 million square metres of floor space.

Retrofits have been rolled out across almost half the district's public commercial floor space, reducing energy use by 20–30%. These efforts prevent annual emissions equivalent to removing 65,000 cars from Shanghai's streets.

Retrofitting also generates a host of co-benefits, including improved indoor conditions for building users, new green jobs, higher real estate values and better local air quality. It has proven financially attractive, with a payback period of just four years (three after taking into account the subsidies offered by district, municipal and central governments).

Scaling up the actions from Changning would contribute significantly to China's low-carbon urban development. Analysis by the University of Leeds for the Coalition for Urban Transitions shows that extending the programme across commercial buildings in Shanghai could save nearly nine metric tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>-e) annually compared with business as usual. This reduction would be equivalent to removing three million cars from the road in China or eliminating the entire emissions of a U.S. city the size of Seattle. These retrofits would pay back their upfront costs in about eight years.

---

**Source:** Oates, L., Zhongjue, Y., Sudmant, A., He, Q., Gouldson, A. and Lee, A. D., 2020. *Improving energy efficiency for all: Lessons on sustainable building retrofits from Shanghai, China*. Coalition for Urban Transitions, London, UK, and Washington, DC. Available at: <https://urbantransitions.global/publications>.

In 2017, the 19th National Congress of the Communist Party of China put forward zero-waste cities as a key initiative for the central government.<sup>8</sup> In 2018, China piloted zero-waste city programmes in 16 cities and districts.

### 2c. Create inclusive, resilient cities

Cities should become more climate resilient while at the same time help to increase national prosperity and improve the quality of life. Many Chinese cities are located in areas that are especially vulnerable to water-related climate risks, such as low-elevation

coastal zones and floodplains. Sprawling, poorly managed urban expansion in these areas creates or exacerbates social, economic and environmental problems, particularly flooding and contamination of the water supply. Drainage in many of China's cities does not meet national flood-prevention safety standards.

Climate change will exacerbate these threats. Careful spatial planning is needed to avoid exacerbating existing climate-related risks and locking in new risks as cities and their populations expand (Box 3).

#### Box 3

### Reducing vulnerability to water-related risks through the Sponge City Programme

In response to its climate-related risks, in 2013 China's national government launched the Sponge City Programme. The programme promotes the wider adoption of measures such as absorptive roads and permeable pavements; green infrastructure, such as rain gardens, parks and wetlands; and built-environment measures such as green roofs and rainwater reuse facilities. The national government dedicated US\$3 billion for 16 pilot sponge cities between 2015 and 2017. The target is to construct 20% of each city's land to sponge city standards by 2020 and build 80% to such standards by 2030.

Wuhan, in Hubei Province, is a leading example of the benefits of this nature-based approach to increasing urban resilience to climate change. Analysis by the University of Leeds for the Coalition for Urban Transitions shows that its nature-based approach to resilience cost almost CNY 4249 (US\$600) million less than upgrading the city's drainage system. Further analysis highlights significant co-benefits, including improved air quality; support for biodiversity and conservation; positive impacts on health and lifestyle, and increased land value.

To scale up the development of sponge cities, in both China and internationally, national governments should ensure that every city has a transformative, holistic and locally appropriate climate-resilient water management plan that integrates green and grey infrastructure. Cities must explore innovative ways to incentivise investment in green infrastructure – by, for example, offering tax incentives and utility rate reductions – while at the same time mandating that all new development adheres to green building standards. They should continue to enable experimentation and city-to-city dissemination of good practice for nature-based solutions.

**Source:** Oates, L., Dai, L., Sudmant, A. and Gouldson, A. (2020). *Building Climate Resilience and Water Security in Cities: Lessons from the sponge city of Wuhan, China*. Coalition for Urban Transitions. London, UK, and Washington, DC. Available at: <https://urbantransitions.global/publications>.

<sup>8</sup> A zero-waste city is an advanced urban development and management model that promotes green lifestyles, minimises the amount of waste produced, strengthens recycling programmes and ensures that waste released into the environment is harmless.

### **Engine 3: Reform local governance and national and subnational fiscal systems to tackle debt, generate sustainable financing flows for investment in sustainable infrastructure and enhance long-term urban planning**

Enacting national policy effectively requires all levels of governance to be empowered and operational. Local governments must be afforded greater capacity and held to greater accountability to deliver high-quality urbanisation.

China decentralises spending responsibilities more than almost any country in the world. Since the fiscal reforms of 1993/94, subnational governments have been responsible for delivering healthcare, primary and secondary education, public safety, local economic development, water supply, environmental protection, and urban construction and maintenance.

Subnational governments no longer control any significant revenue sources: however, most of their funding comes from shared revenues that are set

and administered by central government. The result is that subnational governments are given spending mandates set by central government but have no meaningful capacity to increase their revenues to meet them. This problem undermines the quality of local services (as became tragically apparent with the rapid spread of the coronavirus) and incentivises unsustainable rates of borrowing.

The central government must establish tax handles for provincial and metropolitan governments. Adequate own-source revenues are critical for local accountability and hard budget constraints; they facilitate access to private finance in a sustainable manner. At the same time, there is a need to generate full information on liabilities within subnational balance sheets to reduce fiscal risks (although aggregate public debt levels are well within prudential limits given the resources of the central government).<sup>83</sup>



Hainan eco-park in Laocheng Economic Development Zone. Credit: DreamArchitect / Shutterstock.

## 5. Three national priorities for transforming cities and creating an “ecological civilisation”

In only a few decades, China lifted millions of people out of poverty and secured its position as the world’s largest economy (based on purchasing power parity). Its development was built on export-driven industrialisation, fuelled by cheap labour and cheap land in booming cities, as outlined in Chapter 2.

China’s achievement was unprecedented, but it had some unintended consequences, including rising inequality, costly urban sprawl and chronic environmental pollution, as Chapter 3 shows. China now emits more greenhouse gases than any other country, contributing to a climate crisis that threatens lives and livelihoods across the country

and the world. In addition, its development has left hundreds of millions of people behind, particularly in the central and western provinces.

This chapter lays out three priorities for national action that China needs to take if it is to achieve high-quality urbanisation and forge a network of compact, connected, clean cities that can create jobs, attract investment and deliver a decent quality of life. Under each of the three priorities for national action, this chapter identifies a toolbox of policy and governance options available to decision-makers. This report looks beyond the narrow bundle of instruments that have historically been associated with urban development and climate action, considering a much wider range of interventions that could improve the performance of China’s cities. Taken together, these measures could enable China to transform its cities to achieve an ecological civilisation.

## Priority 1: Place sustainable cities at the heart of China's 14th Five-Year Plan and second Nationally Determined Contribution, with the goal of developing a new national system of compact, connected and clean cities across the country

As it prepares its 14th Five-Year Plan and second NDC, China has a unique opportunity to secure economic prosperity and tackle climate change by pivoting towards an ecological civilisation. Cities are at the heart of this challenge. As centres for production and consumption, China's cities need a new national model of urban development. A virtuous circle of green investment, green manufacturing and green behaviour – driven by China's cities – could become the new driving force for structural economic transformation and behavioural change.

### 1a. Create urban agglomeration authorities to enable regional multiple-plan integration

Various national strategic plans have led China's urban agglomerations<sup>h</sup> to flourish. But the lack of a coordinated mechanism of urban agglomeration has meant that urban areas surrounding core cities have not developed as well as they could have. Excessive competition among local governments has led to the duplication of infrastructure, local protectionism and market segmentation, limiting the economic development of urban agglomeration.

A dedicated authority needs to be established to strengthen the coordinated development of urban agglomeration. It should hold sufficient power over the integration of plans for main functional zones, land use, and urban and rural development, while enabling multiple-plan integration at the regional level. Such integration can promote the development of more coherent strategies that link people to jobs, services and amenities in the urban agglomeration.

The authority should also take the lead in coordinating the improvement of a regional transportation network. Measures to improve that network should include:

- building intercity railways to promote rail travel between cities
- improving intercity shared mobility and public transportation systems, to provide seamless connectivity for green transportation
- establishing a regional integrated transportation information platform that can integrate the travel demand of residents in the urban agglomeration
- integrating a transportation payment system.

Funding for these efforts can come from the reallocation of capital expenditure (see Priority 3a).

### 1b. Decarbonise the energy mix

Sustainable cities should be at the heart of China's 14th Five-Year Plan, which could include a pledge to peak greenhouse gas emissions from cities by 2025. The central government should require cities to explicitly link new infrastructure funding to carbon-reduction targets in their planning under the 14th Five-Year Plan. Such a pledge would demonstrate the government's attention to urgent domestic issues such as energy security, air pollution and traffic congestion. It would also stimulate green industry and empower local governments to go further and faster. Such a pledge would also enable China to demonstrate its climate ambition with a bold announcement at the 26th Conference of the Parties (COP26). Doing so would allow China to fill a global leadership vacuum at a critical moment for the planet.

Many of China's largest cities are poised to support this effort. Beijing, Chengdu, Dalian, Fuzhou, Guangzhou, Hangzhou, Hong Kong, Nanjing, Qingdao, Shanghai, Shenzhen, Wuhan and Zhenjiang have all pledged to deliver on their shares of the Paris Agreement. Delivering this ambitious vision for China's cities will need every department and agency to proactively consider how its decisions may affect urban performance and shape their sector-specific strategies accordingly.

<sup>h</sup> According to the Guidance on Cultivating and Developing Modernized Urban Agglomerations by the National Development and Reform Commission released in February 2019, an urban agglomeration refers to an area centred around one or more metropolitan cities and includes a batch of small towns within a one-hour commute to the metropolitan cities. The term is often used interchangeably with metropolitan circles or city clusters.

The rest of this chapter identifies some of the key policy levers, fiscal reforms and infrastructure investments needed to deliver ecological urbanisation. Chapter 6 explains in more detail why a pledge in China's 14th Five-Year Plan could have economic, social and environmental benefits.

## **Priority 2: Align national policies behind compact, connected, clean and resilient cities by stopping the sale of fossil fuel-powered motorbikes, cars and buses; reducing the demand for energy and materials; and fuelling a clean energy revolution**

### **2a. Stop the sale of fossil fuel-powered motorbikes, passenger cars and buses beginning in 2030**

China is at the forefront of vehicle electrification, thanks to far-sighted national policies such as the New Energy Vehicles (NEV) programme.<sup>i</sup> Its commitment to electric vehicles is grounded in their potential to improve air quality, reduce noise and enhance energy security. The national government has also supported local government efforts to act and craft regulation, providing incentives and offering technical support for innovation and public procurement.

The results are impressive. China is home to nearly half of all electric passenger vehicles and 99% of the world's electric buses and electric two-wheelers.<sup>84</sup> Shenzhen was the first city in the world to operate an entirely electric bus fleet. China also has a booming electric vehicle manufacturing sector.

There is still much to do to make electric vehicles the norm in Chinese cities, including building charging stations, developing energy storage

equipment and implementing policies to promote household consumption of renewable energy. To maintain momentum and consolidate its dominance in the global electric vehicle market, the national government could ban the sale of fossil fuel-powered vehicles beginning in 2030. Doing so would incentivise subnational governments, manufacturers, retailers and households to preferentially invest in electric vehicles and their associated infrastructure, consolidating China's position as an international leader in the industry.

### **2b. Reduce demand for energy and materials in buildings**

Consumption of both materials and energy can be reduced by improving the efficiency of buildings. Stringent performance standards for new buildings, appliances, lighting and vehicles are important in China, particularly as urbanisation continues and incomes rise. Retrofitting the building stock is also important – and can be economically attractive (see Box 2).

Changes to physical infrastructure need to be accompanied by changes to behaviour and culture. Simple actions such as turning off lights upon leaving a room and turning down thermostats can cumulatively save significant amounts of energy, reducing greenhouse gas emissions.<sup>85</sup>

Digital technologies play an increasingly important role in optimising energy performance, complementing improvements to the building envelope to achieve ultra-low energy use. China's position as a high-tech manufacturing hub means that it is well-positioned to upgrade and automate its electricity infrastructure and integrate innovations into new, smart cities (Box 4).

---

<sup>i</sup> The NEV programme was launched in 2001. It initially focused on research and development (R&D) in three technologies: powertrain control systems, motor control systems and battery management systems. In the last few years, the government of China channelled most of its R&D towards integrating NEVs into cities, particularly by improving and expanding charging infrastructure

## Box 4

### Driving high-quality urbanisation through smart cities

---

Smart cities are likely to play an important role in optimising the allocation of urban resources and enhancing the efficiency of urban operations. They may be a key model for realising the new urbanisation.

The smart city model “utilises the next generation of information technology, such as the Internet of Things (IoT), cloud computing and big data, to promote smart urban planning, construction, management and services for cities.”

It can improve and promote new network infrastructure, public platforms and information sharing, urban construction management, public services and other aspects of functioning city systems.

China has prioritised smart cities in multiple policy documents. It implemented 611 smart city pilot projects between 2013 and 2016. In 2017, it incorporated smart cities into its national strategy, and the report of the 19th National Congress of the Communist Party of China (issued in 2017) proposed building a smart society. As of March 2017, more than 500 cities (95% of China’s cities at or above the deputy provincial level and 83% of cities at the prefecture level) had clearly identified ways to become a smart city, or were already in the process of building them, according to the 13th Five-Year Plan.

To spur on the development of smart cities, China should speed up the development of big data technologies for use in urbanisation, build a shared technology platform for cities and towns, achieve the full potential of smart and multi-scenario applications, form data-driven multi-objective smart cities and enhance the governance of national urbanisation.

---

**Sources:** Chan, J. K. S., and Anderson, S., 2015. *Rethinking smart cities: ICT for new-type urbanization and public participation at the city and community level in China*. United Nations Development Programme, Beijing, China.

EO-Intelligence, 2019. *Report on the development of smart cities in China*. Available at: <https://www.iyiou.com/intelligence/insight100847.html>

National Development and Reform Commission, 2014. *The guidance on promoting healthy smart city development*. Available at: <http://www.sdpc.gov.cn/gzdt/201408/W020140829409970397055.pdf>

China can also reform its building standards to enable the use of low-carbon materials such as earth, processed wood, bamboo and stone.<sup>86</sup> Where buildings are demolished, there is scope for much greater recycling and reuse of materials. China could strengthen its professional certification processes to ensure that architects, engineers and other built-environment professionals are trained to use new materials and seek resource efficiency at all times.

Effective spatial planning is also key, as multi-family dwellings use much less material and energy than detached single-family housing. Such planning demands effective, accountable local governments that are incentivised to pursue compact, connected and clean growth.

### 2c. Accelerate the urban energy transition by phasing out coal

Urban areas in China already account for 85% of China’s energy consumption. Coal accounts for more than 38% of urban energy consumption in China – a much higher figure than in Paris, London or Singapore, where coal accounts for about 1% of the urban energy mix. Electricity accounts for 24% of final energy consumption in urban China; a share expected to increase as incomes rise and urbanisation continues. Electricity represents a much larger share of the energy mix in Paris (33%), London (31%) and Tokyo (35%).<sup>87</sup>



China faces the dual challenge of increasing total electricity supply while reducing the amount of electricity generated from fossil fuels. Renewable energy technologies offer significant advantages. They produce little or no air pollution, which is responsible for 1.1 million premature deaths a year in China.<sup>88</sup> Renewables are also increasingly economically attractive: the levelised cost of electricity<sup>j</sup> generated from solar photovoltaics and offshore wind is often competitive with fossil power, and the capital costs of these types of energy are projected to fall by 25–40% between 2018 and 2023.<sup>89</sup> Reducing dependence on coal, oil and gas imports by harnessing domestic renewable resources can also enhance energy security.

China leads the world in renewable energy installation and investment. In 2015, China's investment in renewable energy contributed to more than a third of the global total.<sup>90</sup> However, China is also one of the largest investors in coal-fired power plants. A national commitment to phase out coal would both stimulate investment in renewable energy and tackle urgent environmental challenges, including domestic air pollution and global climate change. Harnessing digital technologies, such as smart grids, offers scope to support decentralised (renewable) energy generation and more efficient energy use.

### **Priority 3: Build a sustainable financing system for cities, enhance local governance and capacities for urban planning, and introduce national to subnational income tax piggybacks and property taxes**

#### **3a. Shift transport budgets to fund mass transit, cycling and walking infrastructure**

Urban land is expensive. As most public space in urban areas is devoted to streets, their design fundamentally shapes a city's identity, appearance and connectivity. Too often, transport departments' narrow remit of facilitating movement and lack of coordination with other departments, such

as housing, means that transport policies and investment leads to sprawl and congestion, hindering access to jobs, services and amenities.

Two-thirds of global transport experts recommend reforming national transport budgets to shift spending from roads (and other infrastructure that benefits private cars) to public transport, walking and cycling.<sup>91</sup> China spends 77% of its national transport budget on roads.<sup>92</sup> Some road-related spending is needed to maintain existing networks to serve (electric) public transport, emergency vehicles and cyclists, and to fill gaps in road networks within and among cities – but intra- and intercity rail and high-capacity bus systems are more attractive long-term investments for promoting compact cities and cutting emissions from freight and aviation. The national government should reallocate its capital budgets towards rail networks within and among cities while retaining its rigorous new standards for transit investment, including robust feasibility studies, clearer cost recovery plans and realistic projections of passenger flow.<sup>93</sup>

Another way to shift public budgets is by introducing road pricing, or the “user pays” principle. Through congestion charging, parking management and other measures, car users can be forced to bear what would otherwise be the external costs of car travel.<sup>94</sup> To encourage the use of electric vehicles, owners of such vehicles could enjoy discounts on these charges. Over time, these charges would reduce demand for motor vehicles and incentivise a shift to public and active transport. Road pricing is especially promising because the funds collected can serve as own-source revenues for local governments, potentially funding low-carbon transport infrastructure projects.

#### **3b. Reform the personal income tax from shared revenue arrangements to a surcharge or piggyback**

Local governments need funding to pursue lower-carbon, more climate-resilient urban development. Subnational governments need the authority and capacity to control a range of own-source revenues,

<sup>j</sup> “Levelized cost of electricity (LCOE) represents the average revenue per unit of electricity generated that would be required to recover the costs of building and operating a generating plant during an assumed financial life and duty cycle. LCOE is often cited as a convenient summary measure of the overall competitiveness of different generating technologies.” – U.S. Energy Information Administration, 2019. Levelized Cost and Levelized Avoided Cost of New Generation Resources AEO2019. Available at: [https://www.eia.gov/outlooks/aeo/pdf/electricity\\_generation.pdf](https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf).

including the ability to set rates at the margin. They need such authority to protect local budgets from variations in national tax rates and to anchor access to private finance in a sustainable manner. In the absence of own-source revenues, local governments depend on land sales and borrowing to fulfil their spending mandates.

One approach to this challenge would be to authorise a surcharge or piggyback on the personal income tax. Currently, revenues from personal income tax are shared by the national and subnational jurisdictions, with the amount accruing to local governments determined by amounts collected in each province or city. These revenues do not count as own-source revenues, as subnational governments cannot change the tax rate. It would be straightforward for the National People's Congress to replace this sharing arrangement with a surcharge on a national tax, with subnational governments authorised to set the rate within a legislated band. The tax could still be administered by the central government, avoiding any capacity gaps at the local level.

A surcharge on the personal income tax would have two additional advantages. First, it would allow provincial and city governments to more aggressively tackle interpersonal inequality by adopting a rate in the upper ranges of the prescribed bracket. Second, it would create incentives for the local government to share information on the lifestyles of taxpayers that can be used to diversify the tax base (e.g. to tax assets such as property and nonwage income, such as profits). Doing so could improve the efficacy of the central tax administration while helping achieve distributional goals.

---

**Local governments need funding to pursue lower-carbon, more climate-resilient urban development.**

### **3c. Introduce a property tax to stop land sales and enhance equity**

A significant share of China's GDP is generated as local revenue from land sales. The scale of land sales has distorted urban development by incentivising inefficient land use and enabling inefficient local spending and rent-seeking behaviour. A simple property tax based on occupancy, property size and location is an attractive alternative to land sales. Such a tax would provide local governments with own-source revenues that lay the basis for access to private finance (on a fiscally sustainable basis) and achieve greater socioeconomic equity by strengthening China's taxation of assets. Linking such a property tax to local benefits – such as education or preventive healthcare – would further enhance local governments' accountability to citizens while improving the quality of services for everyone.

Such a property tax might be slightly regressive in several of the sample cities.<sup>95</sup> To redress inequalities, the revenues could be directly linked to local benefits such as education or social housing. A property tax that raised about 2% of GDP would roughly cover current education spending in most cities (except Shanghai, which has unusually high levels of education spending). The Gini coefficients of many cities reveal that a property tax linked to an education benefit would effectively reduce average inequality within all of the cities.

### **3d. Improve the recording and monitoring of subnational liabilities**

Responsible fiscal decentralisation can enhance accountability for local service delivery and underpin the creditworthiness of subnational governments so that they can access capital markets. However, access to credit needs to be firmly grounded in a government's ability to pay. Local governments and state-owned enterprises in China are heavily indebted. Many liabilities are not systematically or transparently recorded, making it difficult to assess the full scale of local liabilities. For example, public-private partnerships (PPPs) may not be included on balance sheets. A case study

of an anonymised city with a population of fewer than 300,000 people in a central Chinese province suggests that explicit debts (e.g. from municipal bond issuances) are twice as high as they appear on official balance sheets and that implicit liabilities (hidden in local government financing vehicles and PPPs) are four times higher.<sup>96</sup>

Financing a sustainable urban transition will depend on determining the overall resource package for government over the medium term and then apportioning and enforcing debt limits across lower levels of government. Such a shift will in turn depend on ensuring full information on actual and possible liabilities. Therefore, urgent priority for the national government is to introduce and enforce good budgeting, accounting and reporting standards across jurisdictions. This will ensure the disclosure of actual and prospective liabilities, so the national government can monitor total borrowing relative to total revenues, which it must do to avoid a macroeconomic crisis.

In 2001, China introduced the IMF's *Governance Finance Statistics Manual* framework (GFSM2001/14) for central and provincial governments. It modernised its treasury systems by establishing a nested system of Treasury Single Accounts for the central and provincial governments. Local operations are, however, still mainly managed on a cash basis, and liabilities are not recorded effectively in the budget and treasury systems or on local balance sheets. Significant work is needed to generate full information on arrears and liabilities within local balance sheets as a precondition for future access to credit.<sup>97</sup> Strengthening local balance sheets and repaying existing debts would help enable provincial and city governments to undertake responsible borrowing and investment in the future.

### **3e. Support the efforts of local governments in smaller cities to develop a pipeline of climate-safe transport infrastructure projects and develop robust funding strategies**

Under China's new, unified planning system for national territorial space,<sup>k</sup> all towns are required to

prepare territorial spatial plans. This requirement offers local governments an opportunity to promote compact, connected and clean development by emphasising mixed land use and high-density development along public transport routes.

However, few local governments in small towns have the resources necessary to fund mass transit projects (particularly without land sales or debt financing). Moreover, the central government has rightly introduced more stringent criteria for infrastructure investment, to ensure that new projects offer value for money. With these new standards, metro plans in 13 cities, including Guiyang, Kunming, Lanzhou and Xi'an, are under threat.

The National Development and Reform Commission (NDRC) is carefully rolling out a string of city-scale infrastructure projects that will support ecological urbanisation, planned in partnership with local governments and centrally-financed. It has issued bonds worth CNY 78.7 billion to finance a light rail system in Jilin, a provincial capital in the northeast rust belt. These efforts should reduce fiscal risks and stimulate regional economic development. Until subnational liabilities are clearly under control (see Priority 3c), this financing strategy can be used to support local governments in smaller cities in their efforts to deliver much-needed infrastructure projects.

The private sector can also play a key role in supporting such projects. Companies can be attracted to and benefit from the comprehensive use of resources bundled with urban public construction projects in the form of PPPs and X-orientated developments (X-OD) (where X includes, but is not limited to, transport, services, technology and "industrial new towns"). PPPs and X-ODs can ensure the necessary investment and more effective management of public resources. They also allow the harnessing of private sector expertise and experience in project implementation. Encouraging this kind of participation could greatly increase cities' potential to move towards green, low-carbon and compact forms.

<sup>k</sup> National territorial space refers to the territorial space under the jurisdiction of national sovereignty, including territorial land, water and airspace.



Solar panels on a rooftop in Shanghai. Credit: crystal51 / Shutterstock.

## 6. Priority 1 in focus: Peaking emissions from front-running cities by 2025

Under the Paris Agreement, China committed to peak its economy-wide carbon emissions by around 2030. China's cities are expected to account for more than 80% of the country's carbon emissions by 2030, therefore curbing the growth of urban emissions is critical to achieving the national goal.<sup>98</sup>

Many cities around the world have already taken action to mitigate the potential impacts of climate change.<sup>99</sup> The C40 Cities Climate Leadership Group – a network of 94 cities committed to tackling climate change – committed to investing US\$375 billion over a three-year period in low-carbon infrastructure to ensure that their emissions peak in 2020 and fall by nearly half by 2030.<sup>100</sup> Almost 80 cities in China, mostly low-carbon pilot cities, have put forward carbon emission peaking schedules. These pilot cities are actively exploring low-carbon development

and carbon-emission peaking. They are leading the country in energy conservation, energy efficiency improvement and renewable energy development.<sup>101</sup>

Despite their carbon-peaking targets, many cities lack a roadmap and their peaking goals are still relatively conservative. Shanghai, for example, one of the most economically developed cities in China, has proposed peaking its emissions by 2025. Many other cities have adopted the national target of 2030. At the same time, there is a mismatch between the peak targets of some cities and their corresponding provinces. For instance, Yunnan Province proposed a peaking target that is ahead of the targets of many cities within its jurisdiction, so the supporting measures for carbon reduction at the city level might not support the achievement of the provincial target.

China's economy has entered a new phase. Supply-side structural reforms have made remarkable progress, and energy and industrial structural adjustments have accelerated. These changes may make it possible for China to start reaching peak carbon emissions before 2030 across its cities.<sup>102</sup>

The Chinese government has adopted several top-down approaches to strengthen total carbon emissions control and accelerate the carbon emission peak. It needs to design more policies to help the low-carbon pilot cities achieve early peaking.

For China to achieve its target of peak national carbon emission by 2030, economically developed regions of the country must take the lead and set an example for other cities.<sup>103</sup> This report recommends that a group of Chinese cities peak their carbon emissions within the period of the 14th Five-Year Plan, at least five years earlier than committed under the Paris Agreement. The central government could provide guidance on energy reform, industry development, governance innovation, financial reform and transportation system optimisation to support early peaking. Experiences from pilot cities that have good track records of CO<sub>2</sub> reduction and are on schedule to peak carbon emissions could be summarised and shared throughout the country. Information exchange and communication mechanisms could be designed to help cities design their own pathways to reach emissions peaks.

## **BENEFITS OF EARLY PEAKING**

Peaking urban carbon emissions early is conducive to creating synergistic benefits for the economy, the environment and the society as a whole.<sup>104</sup>

### **Economics benefits**

A zero-carbon economy is an attractive new strategy for growth. China's economic transition towards high-quality urbanisation provides a great opportunity for cities to peak emissions before 2030. China should formulate medium- to long-term CO<sub>2</sub> emission-reduction targets as soon as possible. It should then use the targets to drive the transformation of economic and social development pattern and accelerate energy conservation and carbon reduction.<sup>105</sup>

Achieving early peaking of urban carbon emissions can consolidate the current trend of lower energy consumption and carbon emissions growth that is part of the new normal. As China's economic growth further decouples from coal consumption and carbon production, control will start to move from relative to total declines in carbon emissions.<sup>106</sup>

The climate-friendly path of development can combine economic reforms with ambitious climate policies, mobilise the necessary investments and stimulate economic growth while achieving long-term climate goals.<sup>107</sup> Peaking early facilitates the transformation of the economic growth model. It forces cities to accelerate the development of green, low-carbon, innovation-oriented industries, such as information technology, environmental protection and new energy services, biotechnology, financial services, tourism, convention and exhibition services (providing services such as convention and exhibition organising, stand construction and exhibition centre management), cultural and creative industries, health services and logistics.<sup>108</sup> These industries will extend the value chain and become the leading engines of economic growth.<sup>109</sup> The shift from heavy industry to services also creates jobs. By providing services and support to the industrial sector, the service sector also improves economic efficiency.

The experience of the Alliance of Peaking Pioneer Cities of China (APPC) shows that cities can achieve both climate goals and economic benefits by transforming and upgrading their industrial structures. APPC is a network of 23 cities and provinces, including Beijing, Qingdao, Shenzhen and Wuhan, that are committed to achieving peak carbon emissions ahead of schedule. The Alliance's purpose is to enhance experience-sharing among cities and promote best practices in low-carbon development. In most APPC cities, the contribution of the service sector to city-level GDP has been steadily increasing (exceptions are the few cities with low levels of industrialisation).<sup>110</sup> In 2015, for example, Shenzhen proposed taking the lead in achieving peak carbon emissions by 2022. Through economic transformation and upgrading and structural optimisation, it has made significant progress in achieving the goals of peaking carbon emissions, raising air quality standards and achieving high-quality economic growth.<sup>111</sup> It expects to peak its carbon emissions by 2020, two years before its original commitment.

### **Environmental benefits**

Experience in China – and elsewhere – has shown that climate change action brings environmental co-benefits, particularly improvement in air quality.

Air pollution is responsible for half a million annual deaths in China, according to researchers from the Ministry of Ecology and Environment.<sup>112</sup> Most air pollution results from fossil fuel combustion, which also emits greenhouse gases. Reducing fossil fuel use cuts emissions of CO<sub>2</sub> and other air pollutants. If China achieves its full range of NDCs by 2030, it will reduce its SO<sub>2</sub>, NO<sub>x</sub> and PM<sub>2.5</sub> emissions by 79%, 78% and 83%, respectively.<sup>113</sup>

In recent years, China's central government launched a coal-cap policy that sets strict limits on coal use, initially in the most polluted regions, then over a much greater geographical area, and eventually across the whole country. Since 2005, China's phase-out of small thermal power units has avoided more than 950 million tonnes of coal

consumption, worth CNY 616.9 billion. The phase-out reduces SO<sub>2</sub> emissions by about 15 million tonnes and CO<sub>2</sub> emissions by more than 2 billion tonnes.<sup>114</sup>

The Chinese government has long recognised the importance of co-governance of the climate and the environment (Box 5). It has crafted a series of policies, including the Air Pollution Prevention and Control Action Plan, the Three-Year Plan on Defending the Blue Sky, and the Comprehensive Work Plan for Energy Conservation and Emissions Reduction, all during the 13th Five-Year Plan Period (2016–2020). These policies aim to reduce fossil fuel use by optimising the energy structure; developing clean, renewable energy; and improving energy efficiency.

## Box 5

### Success stories: using co-governance to reduce emissions in key regions and cities

China's approach to co-governance focuses on regions and cities of special significance, such as the Beijing-Tianjin-Hebei area and Shenzhen. Co-governance allows these regions and cities to dramatically cut both carbon intensities and pollutant emissions, putting them on track to reach early emissions peaks. The Beijing-Tianjin-Hebei area is politically significant because it is home to the nation's capital. It has the most polluted air and the highest carbon intensity of any metropolitan area in China.

Limiting the overall use of coal and reducing the share of energy-intensive industries have proved to be the most effective strategies for cutting carbon emissions and improving air quality. The annual average concentration of atmospheric PM<sub>2.5</sub> in Beijing decreased from 89.5 µg/m<sup>3</sup> in 2013 to 51 µg/m<sup>3</sup> in 2018, a drop of 43% in five years. Through these synergetic actions, Beijing hopes to achieve peak carbon emissions by 2020, 10 years earlier than the national target.

The city of Shenzhen leads the change in the Pearl River Delta region. This rapidly growing city experienced some of the worst air pollution and carbon emissions in the 1990s and early 2000s; environmental monitoring data shows that the city was choked by smoggy air for half of the year in 2004. By 2018, the annual PM<sub>2.5</sub> concentration had reduced down to 26 µg/m<sup>3</sup>, lower than the national standard of 35 µg/m<sup>3</sup>. In part, this was due to a plan announced in 2013, that Shenzhen would end coal-fired power generation.

Today, more than 90% of electric power in Shenzhen is from renewable energy or gas-fired power plants. Almost all vehicles for public transportation, including taxis and buses, are electric. Fossil fuel use is strictly limited for industry, transportation and buildings. The city has announced that it will peak its overall carbon emissions by 2022.

The experience of the Beijing-Tianjin-Hebei area and Shenzhen prove the feasibility and efficacy of co-governance of climate and the environment, setting an example for other cities in China and around the globe.

**Sources:** The Xinhua News, 2019. *What is the effect of 6 years of smog governance? China's air quality improvement report (2013–2018)*. Available at: [http://www.gov.cn/xinwen/2019-06/05/content\\_5397821.htm](http://www.gov.cn/xinwen/2019-06/05/content_5397821.htm).

UNEP, 2019. *Synergizing action on the environment and climate: good practice in China and around the globe*.

## Social benefits

The peaking of urban carbon emissions can promote low-carbon lifestyles in urban communities.<sup>115</sup> Low-carbon cities and communities are conducive to the formation of healthy, economical and low-carbon production and consumption patterns. They will eventually change the mode of social development by transforming economic development modes, consumption modes and lifestyle.<sup>116</sup>

The 13th Five-Year Plan for Controlling Greenhouse Gas Emissions requires the promotion of around 1,000 low-carbon community pilots and establishment of 100 national low-carbon demonstration communities. More than 20 provinces and 400 communities have carried out low-carbon community construction in China.<sup>117</sup> Prominent low-carbon community cases include the China-Singapore Tianjin Eco-City, the Dongtan Eco-City and Chongming Eco-Island (Shanghai), the Guangming New Area and the Vanke City Garden of Shenzhen.

Peaking urban carbon emissions is also beneficial for collaborative governance – governance that meets the needs of participation from all sectors of society. Low-carbon transformation requires cooperation within and by government, enterprises and non-profit organisations.

At the local government level, climate change governance involves many government departments, including development and reform commissions, the energy management agencies and environmental protection bureaus. The overlapping of management functions of multiple departments can cause management confusion and deviation from goals. Problems in one sector slow progress and reduce effectiveness – and eventually cause fragmentation of policy implementation.

To solve this problem, the government needs to strengthen horizontal cooperation and collaborative governance by relevant departments. It needs to strengthen unified leadership in addressing climate change, by, for instance, establishing a leading group for climate change that reports directly to the mayor to coordinate the objectives and actions of all climate-relevant departments within the government.

---

**The Chinese government has long recognised the importance of co-governance of the climate and the environment.**



A cyclist in Shanghai. Credit: TonyV3112 / Shutterstock.

## 7. The Way Forward

This report lays out a bold vision of compact, connected and clean cities that can anchor equitable and sustainable economic development in China. Creating such cities requires the alignment of fiscal, energy, housing, land use and transport policies. Alignment across so many policy siloes will be possible only if this vision for cities is placed at the heart of China's development strategy, with the full endorsement of the national leadership. Only then will all branches of the central government and all levels of local government have a clear mandate to work towards this common goal.

The next phase of work will identify the programmes and actions needed to achieve the new urbanisation. It will explore the rationale and feasibility of having a group of Chinese cities peak their carbon emissions before the end of the 14th Five-Year Plan. A more in-depth report will consider how the central government could provide guidance on energy reform, industry development, governance innovation, financial reform and optimisation of the transportation system. It will examine how information exchange and communication mechanisms could be designed to help cities design their own pathways to reach emissions peaks.



## Appendix A: China's low-carbon pilot cities

Table A.1

### Declared emissions-peaking year by national low-carbon pilot cities in China

YEAR	CITY	PROVINCE	PEAKING YEAR COMPARED WITH PROVINCIAL TARGET
2017	Yantai	Shandong	-10
2018	Ningbo	Zhejiang	
2019	Dunhuang	Gansu	-11
	Wenzhou	Zhejiang	
2020	Huangshan	Anhui	
	Beijing	Beijing	
	Xiamen	Fujian	
	Guangzhou	Guangdong	
	Jiyuan	Henan	
	Zhenjiang	Jiangsu	
	Suzhou	Jiangsu	
	Wuzhong	Ningxia	
	Qingdao	Shandong	-7
	Hangzhou	Zhejiang	
	Jinhua	Zhejiang	
2021	Yining	Xinjiang	-9
2022	Shenzhen	Guangdong	
	Nanjing	Jiangsu	
	Wuhan	Hubei	
	Quzhou	Zhejiang	
2023	Changzhou	Jiangsu	
	Jingdezhen	Jiangxi	
	Ganzhou	Jiangxi	
	Ji'an	Jiangxi	
	Jincheng	Shanxi	-7
	Jiaxing	Zhejiang	
2024	Hefei	Anhui	
	Zhongshan	Guangdong	
	Daxing'anling	Heilongjiang	
	Xunke	Heilongjiang	
	Lhasa	Tibet	

YEAR	CITY	PROVINCE	PEAKING YEAR COMPARED WITH PROVINCIAL TARGET
2025	Huaibei	Anhui	
	Xuancheng	Anhui	
	Nanping	Fujian	
	Jinchang	Gansu	-5
	Lanzhou	Gansu	-5
	Sanya	Hainan	-5
	Qiongzong	Hainan	-5
	Shijiazhuang	Hebei	
	Qinhuangdao	Hebei	
	Changyang	Hubei	
	Changsha	Hunan	
	Zhuzhou	Hunan	
	Huai'an	Jiangsu	
	Nanchang	Jiangxi	
	Liuzhou	Jiangxi	
	Jilin	Jilin	
	Dalian	Liaoning	
	Chaoyang	Liaoning	
	Wuhai	Inner Mongolia	
	Yinchuan	Ningxia	
	Xining	Qinghai	
	Weifang	Shandong	-2
	Jinan	Shandong	-2
	Shanghai	Shanghai	
	Chengdu	Sichuan	
	Tianjin	Tianjin	
	Alar	Xinjiang	-5
	Changji	Xinjiang	-5
	Hotan	Xinjiang	-5
	Pu'er	Yunnan	
2026	Fuzhou	Jiangxi	
2027	Sanming	Fujian	
	Chenzhou	Hunan	
	Gongqingcheng	Jiangxi	
	Shenyang	Liaoning	

YEAR	CITY	PROVINCE	PEAKING YEAR COMPARED WITH PROVINCIAL TARGET
2028	Xiangtan	Hunan	
	Hulunbuir	Inner Mongolia	
	Ankang	Shaanxi	
	Yuxi	Yunnan	+3
2029	Yan'an	Shaanxi	
2030	Chizhou	Anhui	
	Lu'an	Anhui	
	Guilin	Guangxi	
	Guiyang	Guizhou	
	Zunyi	Guizhou	
	Guangyuan	Sichuan	
	Ürümqi	Xinjiang	
	Kunming	Yunnan	+5
	Chongqing	Chongqing	

Sources: NCSC, 2019. *Research and analysis report on carbon emission peaking in some regions*. Available at: <http://www.ncsc.org.cn/yjcg/dybg/201904/W020190424561852321323.pdf>.

Statistical bulletin of provincial and municipal governments.

## References

1. United Nations Department of Economic and Social Affairs (UN DESA), 2018. *World Urbanisation Prospects 2018*. New York. Available at: <https://population.un.org/wup/>.
2. Intergovernmental Panel on Climate Change (IPCC), 2018. Summary for Policymakers. In *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. World Meteorological Organization, Geneva, Switzerland. Available at: <https://www.ipcc.ch/sr15/>.
3. Fuzhan, X., 2018. 'On the road to quality urbanization'. *China Daily*, June 19. Available at: [http://www.chinadaily.com.cn/a/201806/19/WS5b283bc5a310010f8f59d788\\_1.html](http://www.chinadaily.com.cn/a/201806/19/WS5b283bc5a310010f8f59d788_1.html).
4. Morgan, J., 2014. *The Global Commission on the Economy and Climate: New Climate Economy Report*. World Resources Institute, Washington DC.
5. Friedman, T., 2020. 'Our new historical divide: B.C. and A.C. - the world before corona and the world after', *New York Times*, March 17. Available at: <https://www.nytimes.com/2020/03/17/opinion/coronavirus-trends.html>.
6. International Monetary Fund (IMF), 2019. *World Economic Outlook, October 2019: Global Manufacturing Downturn, Rising Trade Barriers*. IMF, Washington, DC. Available at: <https://www.elibrary.imf.org/view/IMF081/28248-9781513508214/28248-9781513508214/28248-9781513508214.xml?redirect=true>.
7. Zhang, M., 2020. *The global financial turbulence: phenomena, causes and prospect* (in Chinese). Available at: <http://sike.news.cn/statics/sike/posts/2020/03/219555015.html>.
8. Yang, S., 2020. 'Interpreting the 40 trillion "New Infrastructure" list'. *China Times*, March 7. Available at: <http://money.163.com/20/0307/10/F740AQ6M00259DLP.html>.
9. Zhao, X., Young, O.R., Qi, Y. and Guttman, D., 2020. Back to the future: Can Chinese doubling down and American muddling through fulfil 21st century needs for environmental governance? *Environmental Policy and Governance*, 30(2). 59-70. Available at: <https://doi.org/10.1002/eet.1884>.
10. Intergovernmental Panel on Climate Change (IPCC). (2018). Summary for Policymakers. *Global Warming of 1.5°C*. World Meteorological Organization, Geneva, Switzerland. Available at: <https://www.ipcc.ch/sr15/>.
11. Read the full text of Xi Jinping's report at the 19th CPC National Congress at: [http://www.chinadaily.com.cn/china/19thcpcnationalcongress/2017-11/04/content\\_34115212.htm](http://www.chinadaily.com.cn/china/19thcpcnationalcongress/2017-11/04/content_34115212.htm).
12. Fuzhan, X., 2018. 'On the road to quality urbanization'. *China Daily*, June 19. Available at: [http://www.chinadaily.com.cn/a/201806/19/WS5b283bc5a310010f8f59d788\\_1.html](http://www.chinadaily.com.cn/a/201806/19/WS5b283bc5a310010f8f59d788_1.html).
13. McGranahan, G. and Martine, G., 2014. *Urban Growth in Emerging Economies: Lessons from the BRICS*. Routledge, Oxon.
14. Development Research Center of Urban and Small Town Reform and Li, T., 2010. 'The status quo, obstacles and promotion strategies of China's urbanisation'. *China Party and Government Cadres Forum*, 482(1). 3-34.
15. China's National Bureau of Statistics, 2020. *The national economy is well on track; all anticipatory development goals have been achieved in 2019*. January 17. Available at: [http://www.stats.gov.cn/tjsj/zxfb/202001/t20200117\\_1723383.html](http://www.stats.gov.cn/tjsj/zxfb/202001/t20200117_1723383.html).
16. UN DESA, 2015. *World Population Prospects: The 2015 Revision*. United Nations Department of Economic and Social Affairs, New York.
17. Skinner, G.W., 1977. Introduction: Urban development in imperial China. *The City in Late Imperial China*. Stanford University Press, Stanford, CA.

- 
18. Ritchie, H. and Roser, M., 2019. 'Urbanisation'. *Our World in Data*. Available at: <https://ourworldindata.org/urbanisation>.
- 
19. Forstall, R. L., 1996. *Population of states and counties of the United States: 1790 to 1990 from the twenty-one decennial censuses*. Population Division, US Census Bureau. Available at: <https://www.census.gov/population/censusdata/table-4.pdf>.
- 
20. UN DESA, 2018. *World Urbanisation Prospects: The 2018 Revision*. Department of Economic and Social Affairs, New York. Available at: <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>.
- 
21. Shao, M., 2015. 'A full review of the relationship between urbanisation and industrialisation'. *Regional Economic Review*, 4. 151-60.
- 
22. Qiu, B., 2018. *Challenges and countermeasures in the second phase of urbanization in China*. Available at: <http://sike.news.cn/statics/sike/posts/2018/10/219538258.html>.
- 
23. Matsangou, E., 2018. 'China's transitioning economy'. *World Finance*, April 23. Available at: <https://www.worldfinance.com/markets/chinas-transitioning-economy>
- 
24. Hsu, S., 2017. 'China takes another step towards a service economy'. *Forbes*, February 21. Available at: <https://www.forbes.com/sites/sarahhsu/2017/02/21/china-takes-another-step-towards-a-service-economy/#6a9c003928c1>.
- 
25. National Bureau of Statistics, 2019. *70 years of hard work in the service industry leading the way in the new era: the Sixth Report Series on the achievements of economic and social development in the 70th anniversary of the founding of new China*. September 22. Available at: [http://www.stats.gov.cn/tjsj/zxfb/201907/t20190722\\_1679700.html](http://www.stats.gov.cn/tjsj/zxfb/201907/t20190722_1679700.html).
- 
26. Glaeser, E., 2012. *Triumph of the city: How urban spaces make us human*. Macmillan, Basingstoke, United Kingdom.
- Turok, I. and McGranahan, G., 2013. 'Urbanisation and economic growth: The arguments and evidence for Africa and Asia'. *Environment and Urbanization*, 25(2). 465-82.
- 
27. Ahlfeldt, G. and Pietrostefani, E., 2017. *Demystifying Compact Urban Growth: Evidence From 300 Studies From Across the World*. Coalition for Urban Transitions, London and Washington, DC. Available at: <https://newclimateeconomy.report/workingpapers/workingpaper/demystifying-compact-urban-growth/>.
- 
28. Bouchet, M., Liu, S., Parilla, J. and Kabbani, N., 2018. *Global Metro Monitor 2018*. Brookings Institution. Available at: <https://www.brookings.edu/research/global-metro-monitor-2018/>.
- 
29. Trujillo, J. L. and Parilla, J., 2016. *Redefining Global Cities: The Seven Types of Global Metro Economies*. Brookings Institution.
- 
30. Rapoza, K., 2017. 'China wage levels equal to or surpass parts of Europe'. *Forbes*, August 16. Available at: <https://www.forbes.com/sites/kenrapoza/2017/08/16/china-wage-levels-equal-to-or-surpass-parts-of-europe/#2b462a553e7f>.
- 
31. Combes, P., Démurger, S. and Li, S., 2013. *Urbanisation and Migration Externalities in China*. Centre for Economic Policy Research, London.
- 
32. World Bank, 2018. *Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)*. Available at: <https://data.worldbank.org/indicator/SI.POV.DDAY?locations=CN>.
- 
33. China National Bureau of Statistics, 2019. *Continuous improvement of urbanisation level and rapid progress of urban development*. Available at: [http://www.stats.gov.cn/tjsj/zxfb/201908/t20190815\\_1691416.html](http://www.stats.gov.cn/tjsj/zxfb/201908/t20190815_1691416.html).
- 
34. Tacoli, C., McGranahan, G. and Satterthwaite, D., 2008. 'Urbanisation, Poverty and Inequity: is Rural-Urban Migration a Poverty Problem, or Part of the Solution?' *The New Global Frontier: Urbanisation, Poverty and Environment in the 21st Century*, Earthscan, London.
- World Bank, 2009. *World Development Report 2009: Reshaping Economic Geography*.
- 
35. Beijing Review, 2018. 'Boosting ecological advancement'. *Beijing Review*, May 31. Available at: [http://www.bjreview.com/Nation/201805/t20180525\\_800130794.html](http://www.bjreview.com/Nation/201805/t20180525_800130794.html).

- 
36. Coalition for Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
37. People's Daily, 2019. 'Grasping the essence of people's livelihood and painting the beauty of life: Review of 70 years of employment development in new China'. *People's Daily*. September 23.
- 
38. United Nations Department of Economic and Social Affairs (UN DESA), 2018. *World Urbanisation Prospects: The 2018 Revision*. Department of Economic and Social Affairs, New York.
- 
39. U.S. Energy Information Administration, 2017. 'Chinese coal-fired electricity generation expected to flatten as mix shifts to renewables'. *Today in Energy*, September 27. Available at: <https://www.eia.gov/todayinenergy/detail.php?id=33092>.
- 
40. Liu, Z. and Cai, B., 2018. *High-resolution carbon emissions data for Chinese cities*. Environment and Natural Resources Program, Belfer Center. Available at: <https://www.belfercenter.org/publication/high-resolution-carbon-emissions-data-chinese-cities>.
- 
41. IPCC, 2001. *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge and New York. Available at: [https://www.ipcc.ch/site/assets/uploads/2018/03/WGI\\_TAR\\_full\\_report.pdf](https://www.ipcc.ch/site/assets/uploads/2018/03/WGI_TAR_full_report.pdf).
- 
42. Qiu, B., 2018. 'Challenges and countermeasures in the second half of China's urbanisation'. *News.cn*, October 15. Available at: <http://sike.news.cn/hot/2018/10/22/index.html>.
- 
43. General Office of the State Council, 2015. *Notice of the General Office of the State Council on Issuing the Outline for the Planning of the National Medical and Health Service System (2015–2020)*. March 6. Available at: [http://www.gov.cn/zhengce/content/2015-03/30/content\\_9560.htm](http://www.gov.cn/zhengce/content/2015-03/30/content_9560.htm).
- 
44. Suri, S. N., Johnson, C., Lipietz, B. and Brennan, S. 2020. *Words into Action Guidelines: Implementation Guide for Land Use and Urban Planning*. United Nations Office for Disaster Risk Reduction, Geneva. Available at: <https://www.preventionweb.net/publications/view/67430>.
- 
45. Liang, Z., 2004. China's floating population: new evidence from the 2000 Census. *Population and Development Review*, 30(3). 12. DOI:10.1111/j.1728-4457.2004.00024.x.
- 
46. UNICEF, 2018. *Number of floating population in China, 1982–2017*. Available at: <https://www.unicef.cn/figure-118-migrant-population-19822017>.
- 
47. Arrasmith, P., 2017. 'Urban visions: the rising cities of a new China'. *Harvard Political Review*, April 3. Available at: <https://harvardpolitics.com/world/urban-visions-china/>.
- Hu, B., 2012. *Education for migrant children: policy implementation in the changing urban education system in China*. The London School of Economics and Political Science (LSE), London.
- Démurger, S., Gurgand, M., Li, S. and Yue, X., 2009. 'Migrants as second-class workers in urban China? A decomposition analysis'. *Journal of Comparative Economics*, 37(4). 610–628.
- 
48. UN-DESA, 2018. *World Urbanisation Prospects 2018*. United Nations Department of Economic and Social Affairs, New York. Available at: <http://esa.un.org/unpd/wup/>.
- 
49. McGranahan, G., Balk, D. and Anderson, B., 2007. 'The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones'. *Environment and Urbanization*, 19(1). 17–37. Available at: [https://www.researchgate.net/publication/237555988\\_The\\_Rising\\_Tide\\_Assessing\\_the\\_Risks\\_of\\_Climate\\_Change\\_and\\_Human\\_Settlements\\_in\\_Low\\_Elevation\\_Coastal\\_Zones](https://www.researchgate.net/publication/237555988_The_Rising_Tide_Assessing_the_Risks_of_Climate_Change_and_Human_Settlements_in_Low_Elevation_Coastal_Zones).
- 
50. Coalition for Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.

- 
51. Dapeng New Area Government, 2016. *Interpretation of China ambient air quality standard and WHO air quality standard*. Available at: [http://dpxq.gov.cn/mobile/xxgk/zcjd/201611/t20161129\\_5470900.htm](http://dpxq.gov.cn/mobile/xxgk/zcjd/201611/t20161129_5470900.htm).
- 
52. Ministry of Ecology and Environment, 2018. *China's ecological environment bulletin 2018*. Available at: <http://www.mee.gov.cn/hjzl/sthjzk/zghjzkgb/201905/P020190619587632630618.pdf>.
- 
53. China Science Daily, 2019. 'Speech at the fourth annual conference on ecological (green) design and green manufacturing of industrial products in China by Ren Shuben, director of the Department of Resource Conservation and Environmental Protection of the National Development and Reform Commission'. *China Science Daily*, December 17. Available at: [http://gdee.gd.gov.cn/hbxw/content/post\\_2719719.html](http://gdee.gd.gov.cn/hbxw/content/post_2719719.html).
- 
54. Ministry of Public Security of the People's Republic of China, 2017. 'By the end of March, the number of motor vehicles exceeded 300 million for the first time'. *China News*, April 17. Available at: <http://www.chinanews.com/cj/2017/04-17/8201800.shtml>.
- 
55. AMAP, 2019. *Traffic Analysis Report of Major Cities in China in 2018*. Available at: <https://report.amap.com/download.do>.
- 
56. AMAP, 2019. *Traffic Analysis Report of Major Cities in China in 2018*. Available at: <https://report.amap.com/download.do>.
- 
57. Science and Technology Daily, 2018. 'Two-thirds of more than 600 large and medium-sized cities in China are surrounded by Garbage'. *Xinhuanet*, February 13. Available at: [http://www.xinhuanet.com/city/2018-02/13/c\\_129811962.htm?wm=3292\\_9007](http://www.xinhuanet.com/city/2018-02/13/c_129811962.htm?wm=3292_9007).
- 
58. Ahmad, E., 2020. *Financing a Sustainable and Inclusive Urban Transition in China*. Coalition for Urban Transitions, London and Washington, DC.
- 
59. Coalition for Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
60. Ahmad, E., 2020. *Financing a Sustainable and Inclusive Urban Transition in China*. Coalition for Urban Transitions, London and Washington, DC.
- 
61. Li, T., 2015. Research on local government debt problem from the perspective of urban governance model. *Urban and Environmental Studies*, 2. 10-17.
- 
62. Development Research Centre of the State Council, 2014. *China: Promoting efficient, inclusive and sustainable urbanization general report*. Available at: <http://www.drc.gov.cn/xsyzcfx/20140326/4-459-2879185.htm>.
- 
63. Ahmad, E., 2020. *Financing a sustainable and inclusive urban transition in China*. Coalition for Urban Transitions, London and Washington, DC.
- 
64. Li, X., 2009. 'Management of Chinese local governments' debt risks'. *Reform and Opening*, 8. 65-67.
- 
65. Shen, C., 2019. 'By the end of 2018, the debt balance of local governments in China reached 18386.2 billion Yuan, and the risk could be controlled as a whole'. *Baidu*, January 19. Available at: <https://baijiahao.baidu.com/s?id=1623451482302571104&wfr=spider&for=pc>.
- 
66. Ahmad, E., Dowling, D., Chan, D., Colenbrander, S. and Godfrey, N., 2019. *Scaling up investment for sustainable urban infrastructure: A guide to national and subnational reform*. Global Commission on the Economy and Climate. Available at: <https://urbantransitions.global/en/publication/scaling-up-investment-for-sustainable-urban-infrastructure-a-guide-to-national-and-subnational-reform/>.
- 
67. People's Net, 2015. *China wastes more than 460 billion Yuan annually by demolishing houses prematurely*. Available at: <http://house.people.com.cn/n1/2015/1219/c194441-27949212.html>.

- 
68. China Economic Review, 2013. *How will a slowing China cope with rapidly ageing buildings?* Available at: <https://chinaeconomicreview.com/unstable-foundations-part-2/>.
- 
69. Sina, 2014. 'Ministry of Housing and Construction wants to clean up large-scale demolition and construction: 460 billion Yuan is wasted every year'. *China Economic Review*, September 26. Available at: <http://finance.sina.com.cn/china/20140926/132120423581.shtml>.
- 
70. Lin, Y., 2019. 'China has fully entered the era of secondary urbanization. What is the future fate of third-tier cities?' *Shan Chuan Net*, July 22. Available at: <https://mp.weixin.qq.com/s/v9vUVjp6QBVP0kF3bDNB9g>.
- 
71. Fang, C., 2014. *China's New Urbanisation Development Report*. Science Press, Beijing.
- 
72. Chen, X., 2012. 'The issue of 'agriculture, rural areas and farmers (sannong)' in the process of urbanisation in China'. *Journal of National School of Administration*, 3. 3-4.
- 
73. Coalition of Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
74. Chen, X., 2012. 'The issue of 'agriculture, rural areas and farmers (sannong)' in the process of urbanisation in China'. *Journal of National School of Administration*, 3. 3-4.
- 
75. Wei, H., 2016. 'China's urban-rural integration pattern and promotion strategy under the new normal'. *China's Rural Economy*, 91(1). 2-16.
- 
76. Coalition of Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
77. Coalition of Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
78. World Bank, 2014. *China: a new approach for efficient, inclusive, sustainable urbanization*. Available at: <https://www.worldbank.org/en/news/press-release/2014/03/25/china-a-new-approach-for-efficient-inclusive-sustainable-urbanization>.
- 
79. Carruthers, J. I. and Ulfarsson, G. F., 2003. 'Urban sprawl and the cost of public services'. *Environment and Planning B: Planning and Design*, 30(4). 503-522.
- 
80. Alberti, M. and Marzluff, J. M., 2004. 'Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological functions'. *Urban Ecosystems*, 7(3). 241-265.
- 
81. Coalition for Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity>.
- 
82. Ministry of Ecology and Environment, 2019. *2018 annual report on the prevention and control of environmental pollution by solid waste in large and medium cities*. Available at: <http://www.mee.gov.cn/hjzl/sthjzk/gtfwwrfz/201901/P020190102329655586300.pdf>.
- 
83. Ahmad, E. and Colenbrander, S., 2020. *Financing a sustainable and inclusive urban transition in China*. Coalition for Urban Transitions, London and Washington, DC. Forthcoming.
- 
84. IEA, 2018. *Global EV outlook 2018: towards cross-modal electrification*. International Energy Agency, Paris. Available at: [http://centrodeinnovacion.uc.cl/assets/uploads/2018/12/global\\_ev\\_outlook\\_2018.pdf](http://centrodeinnovacion.uc.cl/assets/uploads/2018/12/global_ev_outlook_2018.pdf).



- 
85. Thaler, R.H. and Sunstein, C.R., 2008. *Nudge: Improving decisions about health, wealth and happiness*. Penguin.
- 
86. Energy Transitions Commission, 2018. *Mission possible: Reaching net zero carbon emissions from harder-to-abate sectors by mid-century*. London. Available at: [http://www.energy-transitions.org/sites/default/files/ETC\\_MissionPossible\\_FullReport.pdf](http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf).
- 
87. State Grid (Suzhou) Urban Energy Research Institute, 2019. *A report of China urban energy report (2018) - General characteristics and sample findings*. Available at: [http://paper.people.com.cn/zgnyb/html/2018-10/22/content\\_1888009.htm](http://paper.people.com.cn/zgnyb/html/2018-10/22/content_1888009.htm).
- 
88. Massachusetts Institute of Technology, 2019. *In China, a link between happiness and air quality*. Available at: [https://www.eurekalert.org/pub\\_releases/2019-01/miot-ica011619.php](https://www.eurekalert.org/pub_releases/2019-01/miot-ica011619.php).
- 
89. IEA, 2018. *World Energy Outlook 2018*. IEA, Paris. Available at: <https://www.iea.org/reports/world-energy-outlook-2018>.
- 
90. Dong, W., Gao, J., Liu, X. and Zhang, Z., 2018. 'China's renewable energy investment under the background of green finance'. In: Qi, Y. and Zhang, X (Eds.) *Annual Review of Low-Carbon Development in China (2018)*. Social Sciences Academic Press, Beijing.
- 
91. Rode, P., Heeckt, C. and da Cruz, N., 2019. *National transport policy and cities: Key policy interventions to drive compact and connected urban growth*. Coalition for Urban Transitions, London and Washington, DC. Available at: [https://urbantransitions.global/wp-content/uploads/2019/08/CUT2019\\_transport-paper\\_FINAL-FOR-WEB.pdf](https://urbantransitions.global/wp-content/uploads/2019/08/CUT2019_transport-paper_FINAL-FOR-WEB.pdf).
- 
92. Coalition for Urban Transitions, 2019. *Climate emergency, urban opportunity: How national governments can secure economic prosperity and avert climate catastrophe by transforming cities*. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group, London and Washington, DC. Available at: <https://urbantransitions.global/urban-opportunity/>.
- 
93. Xue, L., 2018. As China's rail transit systems boom, public-private partnerships face reckoning. *The CityFix*, May 24th. Available at: <https://thecityfix.com/blog/chinas-urban-rail-transit-systems-boom-public-private-partnerships-face-reckoning-lulu-xue/>.
- 
94. Rode, P., Heeckt, C. and da Cruz, N., 2019. *National transport policy and cities: Key policy interventions to drive compact and connected urban growth*. Coalition for Urban Transitions, London and Washington, DC. Available at: [https://urbantransitions.global/wp-content/uploads/2019/08/CUT2019\\_transport-paper\\_FINAL-FOR-WEB.pdf](https://urbantransitions.global/wp-content/uploads/2019/08/CUT2019_transport-paper_FINAL-FOR-WEB.pdf).
- 
95. Ahmad, E., Dowling, D., Chan, D., Colenbrander, S. and Godfrey, N., 2019. *Scaling up investment for sustainable urban infrastructure: a guide to national and subnational reform*. Global Commission on the Economy and Climate. Available at: <https://urbantransitions.global/en/publication/scaling-up-investment-for-sustainable-urban-infrastructure-a-guide-to-national-and-subnational-reform/>.
- 
96. Ahmad, E. and Zhang, X., 2018. 'Towards monitoring and managing subnational liabilities in China: lessons from the balance sheet for County K'. In *Fiscal Policies for Sustainable Development in China—Rebalancing in Guangdong*. Ahmad, E., Niu M., Xiao, K. (eds.). Springer 2018.
- 
97. Laboratory of Low Carbon Energy, Tsinghua University. Available at: [https://www.canon-igs.org/event/report/20190905\\_presentation\\_1.Jiankun%20He.pdf](https://www.canon-igs.org/event/report/20190905_presentation_1.Jiankun%20He.pdf).
- 
98. Wang, Z. (2019). *Reaching urban CO<sub>2</sub> peak and air quality standards synergistically*. Energy Foundation. Available at: <http://en.aplctsummit.com/Uploads/201910/parallelsession2-WANGZhigao.pdf>.
- 
99. Rosenzweig, C., Solecki, W., Hammer, S. A. and Mehrotra, S., 2010. 'Cities lead the way in climate-change action'. *Nature*, 467(7318). 909–911.  
 Duren, R. M. and Miller, C. E., 2012. 'Measuring the carbon emissions of megacities'. *Nature Climate Change*, 2(8). 560–562.  
 Weiss, K., 2015. 'Cities bask in spotlight at Paris climate talks'. *Nature News*, December 10. Available at: <https://www.nature.com/news/cities-bask-in-spotlight-at-paris-climate-talks-1.19006>
- 
100. Watts, M., 2017. 'Cities spearhead climate action'. *Nature Climate Change*, 7(8). 537–538.  
 Wang, H., Xi, L., Yu, D., et al., 2019. 'China's CO<sub>2</sub> peak before 2030 implied from characteristics and growth of cities'. *Nature Sustainability*, 2(8). 748–754.

- 
101. Wang, Y., Xu, Z. and Zhang, Y., 2019. 'Influencing factors and combined scenario prediction of carbon emission peaks in megacities in China: Based on Threshold-STIRPAT Model'. *Acta Scientiae Circumstantiae*, 39(12). 4284–4292.
- 
102. He, J., 2019. *China's energy transformation situation and medium and long-term low carbon emission strategy*.
- 
103. NCSC, 2019. *Research and analysis report on pushing carbon emission of some regions to reach peak first*. Available at: <http://www.ncsc.org.cn/yjcg/dybg/201904/W020190424561852321323.pdf>.
- 
104. He, J., 2019. *China's energy transformation situation and medium and long-term low carbon emission strategy*. Laboratory of Low Carbon Energy, Tsinghua University. Available at: [https://www.canon-igs.org/event/report/20190905\\_presentation\\_1.Jiankun%20He.pdf](https://www.canon-igs.org/event/report/20190905_presentation_1.Jiankun%20He.pdf).
- 
105. Institute of Energy, Environment and Economy, 2014. *China and New Climate Economy*. Tsinghua University, Beijing.
- 
106. Qi, Y., Stern, N., Wu, T., Lu, J. and Green, F., 2016. 'China's post-coal growth'. *Nature Geoscience*, 9. 564–566. DOI:10.1038/ngeo2777.
- He, J., 2019. *China's Energy Transformation Situation and Medium and Long-Term Low Carbon Emission Strategy*. Laboratory of Low Carbon Energy, Tsinghua University. Available at: [https://www.canon-igs.org/event/report/20190905\\_presentation\\_1.Jiankun%20He.pdf](https://www.canon-igs.org/event/report/20190905_presentation_1.Jiankun%20He.pdf).
- 
107. OECD, 2017. *Investing in climate, investing in growth*. OECD, Paris. Available at: <https://www.oecd.org/environment/cc/g20-climate/synthesis-investing-in-climate-investing-in-growth.pdf>.
- 
108. Alliance of Peaking Pioneer Cities of China, 2017. *Carbon Emission Peaking in China's Pioneer Cities and Their Progress*.
- 
109. Institute of Energy, Environment and Economy, 2014. *China and New Climate Economy*. Tsinghua University, Beijing.
- 
110. Alliance of Peaking Pioneer Cities of China, 2017. *Carbon Emission Peaking in China's Pioneer Cities and Their Progress*. Available at: <http://appc.ccchina.org.cn/archiver/APPC/UpFile/Files/Default/20160707172658171492.pdf>.
- 
111. Energy Foundation, 2019. *Achieving triple goals of carbon emissions peaking, air quality standard attainment, and economic prosperity at the city level: the Shenzhen case*. Beijing and San Francisco, Energy Foundation. Available at: <http://www.efchina.org/Reports-en/report-lccp-20191015-en>.
- 
112. UNEP, 2019. *Synergizing action on the environment and climate: good practice in China and around the globe*. UNEP, Nairobi. Available at: <https://ccacoalition.org/en/resources/synergizing-action-environment-and-climate-good-practice-china-and-around-globe>.
- Wilde, O. 2014. 'Chen Zhu: Air pollution causes 350,000 to 500,000 premature deaths in China every year'. *21st Century Business Herald*, January 7. Available at: <http://news.sciencenet.cn/htmlnews/2014/1/287188.shtm>.
- 
113. Yang, J., Li, X., Peng, W., Wagner F. and Mauzerall D. L., 2018. 'Climate, air quality and human health benefits of various solar photovoltaic deployment scenarios in China in 2030'. *Environmental Research Letters*, 13(6). 064002.
- 
114. Yang, X. and Teng, F., 2018. 'Air quality benefit of China's mitigation target to peak its emission by 2030'. *Climate Policy*, 18(1). 99–110.
- 
115. Huang, W., Ge, Y. and Zhou, Q., 2010. 'Research progress of low carbon urban community planning'. *Journal of Anhui Agriculture*, 38 (11). 5968–5970, 5922.
- 
116. Dai, Y., 2009. 'A study on low-carbon city development: concept formation and measurement setting'. *Modern Urban Research*, 24(11). 7–12.
- 
117. Fu, L., Zhang, D. and Yang, X., 2019. 'Study on evaluation index system of low-carbon community'. *Environmental Protection*, 47(15). 39–46.



# COALITION FOR URBAN TRANSITIONS

## Find us

🌐 [urbantransitions.global](http://urbantransitions.global)

🐦 [@NCECities](https://twitter.com/NCECities)



Copyright 2020 World Resources Institute. This work is licensed under the Creative Commons Attribution 4.0 International License.  
To view a copy of the license, visit <http://creativecommons.org/licenses/by/4.0/>