Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 104 (2016) 146 – 152

Energy Procedia

CUE2016-Applied Energy Symposium and Forum 2016: Low carbon cities & urban energy systems

China's New-Type Urbanisation Plan (NUP) and the Foreseeing Challenges for Decarbonization of Cities: A Review

Ali Cheshmehzangi[a]*

[a]*The University of Nottingham Ningbo China, 199 Taikang East Road, Ningbo, 315100, China*

Abstract

The most recent urbanisation plan in China, the New-type Urbanisation Plan (NUP) launched in March 2014, is a national plan proposed for development of a scientific and reasonable urban development model by 2020. NUP aims to connect four major plans of ecological progress, urbanisation quality, expanding domestic demand and rural-urban coordination. After almost two years, several contradictions are already in place. However, there are key challenges for decarbonization of cities in this process. This review paper explores four major challenges and suggests steps forward during and after NUP's lifespan. This study also elaborates on the processes and contradictions for decarbonization of Chinese cities.

Peer-review under responsibility of the scientific committee of the Applied Energy Symposium and Forum, CUE2016: Low carbon cities and urban energy systems.

Keywords: Decarboniszation, New-Type Urbanisation Plan, City, China.

1. China's Current Urbanisation Phase: New-Type Urbanisation Plan (NUP)

The most recent urbanisation plan that included the new face of urbanisation pattern in China, the New-type Urbanisation Plan (NUP), has initialized new approaches to urbanization in China, including, new focus on town level and small scale city development, revision of Hukou urban residency rules, environmentally-friendly approach and social development [1][2][3]. This national plan was launched in March 2014 and proposed for development of a scientific and reasonable urban development model by 2020. This is believed to be the start of a new era in China's urbanisation process, which targets 'human-centered' and 'environmentally friendly' pathways [3].

NUP aims to connect four major plans of ecological progress, urbanisation quality, expanding domestic demand and rural-urban coordination. After almost two years, several contradictions are already

* Corresponding author. Tel.: +86-1565-7876731; fax: +86-574-8818-0000.
E-mail address: Ali.Cheshmehzangi@nottingham.edu.cn

Peer-review under responsibility of the scientific committee of the Applied Energy Symposium and Forum, CUE2016: Low carbon cities and urban energy systems.
doi:10.1016/j.egypro.2016.12.026

in place. China's already unprecedented urbanisation rate and the continuing mass migration from rural to urban areas put major pressure on rural-urban coordination. This is having impact on fringe villages and urban villages [2]. The expectations are to witness more than 20% decline in rural population by 2030, which will not only segregate the rural-urban development but also puts severe pressure on the endurance of rural settlements [2]. The increasing pollution and environmental effect make the progress unsustainable from various aspects. While ecological vulnerability is already in question, issues of food securing, availability of land and agricultural loss are expected to become even more challenging in this journey to a 70% urbanised China (expected by 2030 – or 60% by 2020 according to NUP). According to Bai et al [4], arable land use has been exploited significantly for about half of urban growth, which has resulted in development of new regulations on land use and city planning. And the increasing domestic demand does not necessarily mean high quality urbanisation, the effects of which we have seen in China's rapid urbanisation of 1980s onwards. Nevertheless, economic growth of China could only continue through further urbanisation. But the essential plans – among them, decarbonisation of cities and setting up climate change actions for urban areas – are yet to be addressed in this foreseeing process. Increasing urban areas and extensive urban development are seen as the main polluting sources with significant environmental impacts because of the current pattern of China's city planning as both pro-developer and economic-oriented.

The outline of NUP indicates boosting urban growth of China through increase of consumption; despite the aim to move away from land-centered urbanization and towards people-oriented urbanization [1]. This will, once again, put further pressure on environmental quality and expected incentives for decarbonisation plans, pollution control and climate action plans. This approach may partly balance the surface of urbanisation process but would not be able to address issues of carbon management, ecological progress and environmental quality in a short term. On the other hand, China's land policies need careful revision. Currently, there is lack of integration of environmental factors into land policy; and less focus has been given to factors, such as, city expansion, ecological protection and environmental degradation as part of urban development. Chinese cities have to consider scientific understanding of urbanisation and urban growth which might then lead towards planning of further reforms in the coming years. A major forthcoming reform is the land-use reform (expected before 2020) which will have major impact on new regulations and profit motives of urban development. Furthermore, the need for institutional innovation is ever important in this process. While NUP supports marketisation as a major mechanism for solving issues of urbanisation, there remain serious concerns about the conflicting roles of multiple governments, i.e. the central government, the provincial government, the municipal government and the local government in China. This also has severe impact on the process of creating incentives at the central level and implementing them at the local level. A regional or even local approach is potentially the only way to make sure marketisation will be beneficial for cities and at the implementation phase. Moreover a regional approach is appreciated from multiple perspectives of renewable energy [5], power production [6], pollution reduction [7], ecological development for ecosystem planning [8] and etc.

2. Decarbonization of Cities in China: A Review of Four Key Factors

China's route towards decarbonization of its cities is possibly one of the most challenging rudiments of its current urbanisation phase, and is part of the country's global image and national development. The initial initiatives were focused on offsetting carbon emissions from industrial energy use and [rather slow] progress on carbon cycle and management of urban system. Started from 2009, carbon management plans are more complicated than expected due to various material uses and climatic zones of the country. Since then, most of decarbonisation plans have undertaken various measures and methods. A recent example is the Deep Decarbonisation Pathways Project (DDPP) that introduces '*an instrumental strategy to control*

air pollution in cities' [9]. This encompasses reductions in production and consumption of energy, industry energy use and energy use in transport. However, decarbonisation of cities is a more intricate process than projected. There are four factors, embedded in NUP and the current status of China, that are foreseeing challenges for decarbonisation and climate actions of Chinese cities. These factors signify the capacity in which decarbonisation of cities will be affected in the coming years.

2.1 Preservation of the rural and small towns

NUP has introduced measures to preserve the rural and small towns and to protect the clean air quality of such areas. As part of the approach, the industrial production is expected to be kept closer to cities or at city outskirts. The new industrial production should either be within a designated industrial zone or nearby to cities. Regardless of its social and economic benefits, this will be an additional environmental pressure on cities in terms of decarbonisation transition and GHG reductions. This measure alone implies a major challenge for cities. Prior to the announcement of NUP, Ren et al proposed for local energy management based on urban–rural cooperation in China, which suggests for regional decarbonisation process through conceptualising systematic urban-rural cooperation that generates regional circulation of energy resources [10]. This may extensively solve energy issues of cities that are unlikely to expand in the future but cannot fully resolve medium to large scale cities that are expanding further towards a mega scale and beyond. With the current demand of 6 to 8% annual increase of renewable energies [11], Chinese cities will become highly dependent on the rural areas to meet the country's desired CO2 emission peak. While there seem to be contradictions with NUP's plan for preservation of the rural and small towns, decarbonisation of cities alone would turn in to a major struggle. If this is to be considered as part of NUP, the regional decarbonisation process should then be divided into two phases of carbon management balancing and carbon reduction, with a larger emphasis on maximising the capacity for city carbon reductions in a medium term. In order to speed up this process, the relations between the multi governmental actors should become mutual rather than the current one way system.

2.2 Industrialisation progress

With economic development as a priority, it seems almost impossible to avoid environmental pollution in any developing country. While NUP is seen as the new era of economic and social development in China, there is lack of environmental agenda that can fulfil the holistic sustainable form of urbanisation. One of the main pillars of NUP, "ecological progress", is also regarded as the '*transition to green social-economic development*' of China [12]. And this does not refer to the increasing industrialisation as a significant issue. Since 1978, China's industrialisation has steered the country's urbanisation growth and is expected to remain like this. By almost tripling the urbanisation rate in less than four decades, China's industrialisation rate has been steadily going up by 1% annually. Also China's economy is intertwined with the global economy, making it ever difficult to reduce its industrialisation growth. Even if the claims that several Chinese cities have reached their stage of post-industrialisation or are towards their final stage of industrialisation are true (i.e. from 2010 onwards), it is unlikely to see China divorcing industrialisation progress from its urbanisation process any time soon. NUP will rather accelerate China's industrial restructuring and will merely modernise the industries than reducing their growth. This will have severe impact on the slowing process of decarbonisation of cities.

As China's goal for its CO2 emission peak is set around 2030, NUP's role is not seen very effective. It is potentially just the starting phase of what the country will propose for its 2020-2030 strategic plan. And the current issues of urban pollution and environmental pressures will not be resolved by then. As China is expected to enter its era of post-industrialisation in the next decade, major transitions to low-carbon and decarbonisation of cities are only expected then. The industrialisation restructuring may only contribute to parts of NUP's promised urbanisation quality. And most cities will remain as industrial hubs of the

country. Therefore, at the current phase of China's industrialisation (i.e. following the 1980-2000 phase), heavy polluting and still-growing cities will struggle to set any climate change actions by 2020. And the decarbonisation transition will not start in this timeframe. This encompasses most of China's small to large scale cities.

2.3 Chinese city scale and management

Chinese cities are planned at large scale, often with high density pattern; and are continuing to grow beyond their existing capacity. High density development does not necessarily mean energy efficient or low-carbon, particularly that there are fewer opportunities for renewable energies and passive strategies in such pattern. The on-going process of densification of cities in China, in most cases, increases the energy load of districts by four to six times. This challenges the carbon management process from both perspectives of embodied and operational energies. The compactness in planning is already in question from various perspectives of transportation provision, dispersed development and zoning planning. Also, there are often no clear green buffer zones around Chinese cities. And various approaches of leapfrog development and satellite cities are negatively contributing towards this unmanageable pattern of expansion. All these city development patterns put NUP under severe pressure, and highlight the common issues of pace and scale of city development as part of the urbanisation process [13]. And going back is ever difficult that a new form of urbanism is already emerging. This typification process cannot be low-carbon and nor can it contribute towards climate change actions, including the increasing urban heat island effect (UHIE) as a result of temperature increase in the urban areas. NUP's path is under debate and there has been minimal effort in commencing its key principle of 'optimised city layouts'. This cannot occur unless Chinese planning system goes under extensive reforms. But this is unlikely to occur during the short lifespan of NUP's initial framework.

For the forthcoming years, it is unlikely to witness major transition of Chinese cities towards non-industrial sectors. As the world's second largest economy since 2011, China's current three financial cities [14] are only less than 1.8% of the existing +1million (in population) Chinese cities. All three (Beijing, Shanghai and Shenzhen) are still heavily dependent on industrial production. For other cities, the race towards sectoral transitions has resulted in unimaginable and unmanageable city expansions. Two significant examples are central cities of Changsha and Wuhan, capital cities of Hunan and Hubei provinces respectively. Both cities are recently under debates for their patterns of growth and development. Decarbonisation is most vulnerable in cities in such pathways, where national priorities are currently more important. The institutional transitions have increasingly drawn on infrastructure development such that almost half of China's GDP comes from industry and construction sectors. Cities have large share of this and are not slowing down before 2020. The on-going renewal of cities and the modernisation process have, in fact, just started in some small scale cities. The top-down approach of NUP, at large scale and national policy level, would not be as effective when it comes to municipalities and the local governments. Although the move towards low carbon economy (LCE) and low energy is now embedded in most Chinese cities' target plans, it cannot be implemented by the end of NUP's timeframe in 2020. The problem is more a planning management than of planning pattern. In addition, the lack of city-level transitions means that cities are far behind decarbonisation process when regional measures are inadequately in place for climate change actions.

2.4 The Increasing domestic demand and consumption

The continuous urbanisation progress is sustained by China's government and is utilised as NUP's backbone for economic growth. It justifies rural-to-urban migration which for long has slowed China's ambitions for modernisation. And it severs the interests of many stakeholders, particularly China's state-owned city developers whom have completely reshaped many cities of China in recent three decades. We

believe the increasing urbanisation is reasonable for economic growth and gradual social stability. But there are several critical environmental and resource-use problems that not only need to be addressed but also need significant improvement. NUP poses risks in this dimension. China's increasing domestic demand and consumption is possibly the most worrying element that is appraised in NUP. This constitutes significant lifestyle changes from rural to urban; more dependency on private car; more embodied carbon; more operational energy and more resource use. All of which are interweaved with the perception of modern living. And this may only be economically viable.

For years, Chinese economists are warning about the growth of emerging-middle and middle classes population, their increased prosperity and their increased demand and consumption. NUP's focus on promoting intensification of domestic demand hides the fact about environmental unsustainability of the urbanisation process. In the past decade, China's consumption growth has shifted drastically. The current figures indicate more increase in the forthcoming years. Any climate change actions are more likely to be on halt until 2020 because of an increase in the number of urban population, as well as the effects of steadily increasing urbanisation and air pollution. In 2014, China's per capita carbon emissions overtook the EU's, producing 7.2 tonnes per person. BCG's analysis, released in December 2015, also indicate the current status and the notable future growth of consumption of China, even if GDP growth slows to 5.5%8. Also the upwards mobility and potential generational shift in China are likely to have impact on the country's consumption figures. The role of NUP is therefore important in: how the increasing domestic demand is optimised as part of the urbanisation process? And how it can promote or even support decarbonisation of cities? By 2020, many Chinese growing cities of medium to large scales would face critical air quality situations and increasing consumption load until a new global climate deal takes effect.

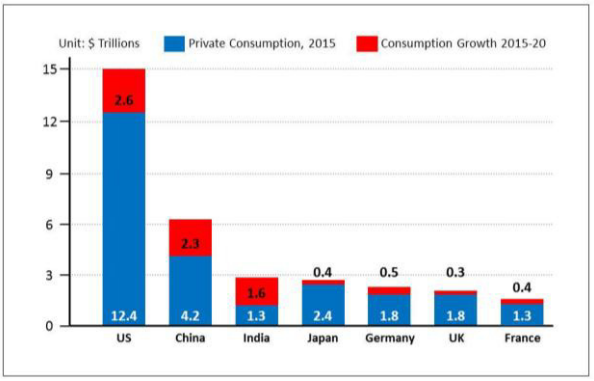

Fig. 1. Estimate consumption increase in China by 2020 (adapted from BCG Analysis) [15]

NUP's lack of adequate coordination with local governments in terms of managing national-level investments, incentives and initiatives, is likely to remain in place in the next four years. Solutions will remain at pilot studies and implementation will be at development of ineffective models. The development behaviour should partly shift from national to local and from state-owned to private developers. NUP's effectiveness for any changes in decarbonisation of cities would only be visible if the government responds to environmental challenges, climate change issues and the increasing domestic demand. Given China's global status, its significant role in the global economy and remaining as the largest emitter, carbon management of cities can no longer be neglected in the national policies and measures.

3. Steps Forward: A Review of the Process

While there was "no plan B" suggested during Paris Climate Talks, the push towards decarbonisation of cities is undoubtedly not without its challenges. Given we have four years before the next global agreement on climate change, China is anticipated to be one of the key players. Providing more accurate data on city pollution, monitoring data and carbon management of city environments – as well as setting up city-level climate change action plans – would promote possibilities for speeding up the expected decarbonisation process in the next decade (i.e. 2020-30). Local authorities and relevant bureaus should take these steps and impose pollution standards, including targets for setting up carbon caps, energy load caps and limitations on city expansion, density and new development areas. The rural-urban relations must build up the capacity for regional decarbonisation processes that can later speed-up the city-level decarbonisation process. The ecological progress should include the environmental side of the urbanisation plan and refrain from ecological engineering. Knowledge transfer should be carefully monitored and occur in a more transparent business environment. And the expansion of domestic demand should go under careful revision before 2020. These will be costly if to be partially developed by the end of NUP's timeframe.

In city development, new incentives must be introduced to low-carbon and optimised cases and possibilities. This is highly important now as it will be more difficult and costly to reverse any of the problems later. It appears that what may be ignored by 2020 will certainly become challenges of the next decade. Moreover, the coordination between national-level policies and local-level policies should be promoted towards a better planning management, which seems to be a major struggle for many Chinese growing cities. A gradual moving back towards climate finance should occur in these four coming years. This will eventually help the potential establishment of multifaceted monitory systems, including systems to separate regional and city level data, regional and city level carbon emissions, and improve the institutions and mechanisms that are key players later on. It is also suggested that city managers and local authorities develop context-specific performance targets and comprehensive frameworks, as well as pathways to avoid large expansion of domestic demand and consumption. As its lifespan is very short, NUP can play a more precise and effective role and establish the basis of what can be the most challenging decade of China in the global arena next.

References

[1] Chen M. et al. Challenges and the way forward in China's new-type urbanization. *Land Use Policy*, 2016. 55: 334-339.
[2] Lang W. et al. A new style of urbanization in China. *Habitat International*, 2016, 55: 1-9.
[3] Wang X. R. et al, The new urbanization policy in China: Which way forward?, *Habitat International*, 2015, 47: 279-284.
[4] Bai X. et al. Realizing China's Urban Dream. *Nature* 2014;**509**: 158-160.
[5] Li Z. et al. Minimizing carbon footprint using pinch analysis: The case of regional renewable electricity planning in China, *Applied Energy*, 2016, in press.
[6] Sun Y. et al. Spatial planning framework for biomass resources for power production at regional level: A case study for Fujian Province, China, *Applied Energy*, 2013, 106: 391–406.
[7] Li D. et al. Regional risk assessment approaches to land planning for industrial polluted areas in China: The Hulunbeier region case study, Environmental International, 2014, 65: 16-32.
[8] You L. et al. A relative interval-regret analysis method for regional ecosystem planning – a case study of Dongying, China. *Ecological Engineering*, 2015, 81: 488-503.
[9] Ribera T. et al, DDPP Report; 2015..
[10] Ren H, Wu Q, Ren J, and Gao W. Cost-effectiveness analysis of local energy management based on urban–rural cooperation in China. *Applied Thermal Engineering* 2014; **64** (1-2): 224-232.
[11] He JK. China's Target for Peaking CO_2 Emissions, *Advances in Climate Change Research* 2014; **5** (4): 155-161.
[12] Chai QM, Xu HQ. Modeling and emissions peak in China around 2030. *Advances in Climate Change Research* 2014; 169-180.
[13] Cheshmehzangi A. The Urban and Urbanism. *The Intnl. J. of Interdisciplinary Environmental Studies* 2015; 1-12.
[14] Chen K. & Chen G. The rise of international financial centers in mainland China. *Cities* 2015; 10-22.
[15] Economist Intelligence Unit. BCG Analysis; 2015.

Biography

Dr Ali Cheshmehzangi has qualifications, practice experience and a research profile in urban design, sustainable urban planning and development. He currently works at The University of Nottingham Ningbo China. He is also a founder member and director of International Network for Urban and Rural Research (INURR) in China.