



Europe – China Eco-Cities Link Project



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中欧低碳生态城市合作项目

GREEN FINANCE GUIDELINE GREEN and COMPACT URBAN DEVELOPMENT

Achieving green city development through compact urbanisation: Many cities realize that their spatial development planning has a direct impact on the overall success of their low-carbon development. There is a direct connection between the urban form and urban efficiency, mostly represented through the need for transport and mobility. The nexus between urban form and density has far-reaching impacts for the functioning and ecological performance of cities. To capitalise on the density concept, spatial planners and transport planners have developed the transit-oriented Development (TOD) concept which can help to maximise density benefits at or around transport nodes and intersections, and can create low-carbon impacts as has been demonstrated in many countries. Compact urban development can, however, not only be seen as a (senseless) maximisation strategy but should be accompanied by improved urban quality which allows decentralised land-use and highly diversified micro-level development at neighbourhood and district level. To achieve low-carbon development of cities, the conventional master planning methodology needs enhancement and refinement. The necessary steps need to be integrated into one consolidated approach.

Compact urban development is important for the greening of city development. Better urban planning decisions and decisions concerning urban densities will be critical. Spatially, this urban expansion can be accommodated through three spatial strategies: (i) densification in existing areas; (ii) horizontal urban expansion; and (iii) new town development, or a combination of these. Densities of compact urban development that are manageable and suitable will play an important role. Achieving compact and sustainable urban forms is possible where there is strong local government and policies for urban intensification. However, often the process of densification occurs in the absence of policies and control. In China a lot of precious agricultural land has been lost to urban sprawl, and that action is necessary to contain further unplanned expansion. More compact development thus seems paramount to achieve a better nexus between urban form and urban densities.

The situation concerning compact urban development in China. Chinese cities are hovering in their average density close to the threshold of 5000 inhabitant/km², with highly dense congested cores and a vast suburban expansion where the suburban area has been multiplied by 1.8 every 10 years for the last 2 decades. While planning codes effectively mandate high rise apartments, the inefficient use of land surrounding the resultant towers reduces amenity as it generates empty, windy plazas and increases energy consumption as lower density fosters the use of the private car in transit. If the present trends continue, not only will the heavy air pollution persist, but Chinese suburban density will be around 2500 inhabitant/km² in 2030, with suburbs 36 times bigger in surface than the core (as the Shanghai case exemplifies). It would notably lead to a tripling of energy demand for transportation and contribute to increasing the infrastructure costs per capita. China needs an urgent and ambitious shift toward infill urban development to avoid the current trend of edge and leapfrog growth that feeds urban sprawl and de-densification. Concerning heat island effects due to higher densities will need to be addressed through increased neighborhood greening which can counter heat island effect.

State of the art in low-carbon urban planning in China has been provided both by some high-profile international ventures led by the central government, such as the Sino-Singapore Tianjin Eco-City (SSTEC) and Caofeidian (Tangshan), and by others that are driven primarily by local authorities and local entrepreneurs. Some are more effective in actually achieving low-carbon urban development than others – the Sino-German Ecopark in Qingdao is a good example of compact energy efficient development with high amenity.



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The term “eco-city” today appears as a catch-all phrase for a variety of new urban development models. In China, a low-carbon eco-city is described as an innovative type of urban development model based on the principle of balance with the natural environment, and an increased utilisation of urban green which can improve the natural environment and minimize the impacts of emissions. An assessment of low carbon cities in China also identified three types of low carbon eco-cities: *technologically innovative eco-city model* (which is usually neither replicable nor scalable and tends to require substantial funding); *liveable eco-city model* (which is replicable and sustainable, typically designed for population of up to 300,000, employs green building technologies, focuses on developing services industries, emphasizes urban planning is based on transit-oriented development (TOD) model and green transport modes (e.g. walking, cycling, public transport); and *progressive evolution of the eco-city model* (or “retrofit” model), which refers to rehabilitation and renewal of “old cities” towards more sustainable urban development.¹ The latter two types can be considered as “green city” models.

Policy Directions. The Government’s pronouncement of the 13th Five Year Plan objectives has stated three key objectives: (i) Increased efficiency of energy resources development and utilization; effective control total aggregate of energy and water consumption, construction land, and carbon emissions. The total emissions of major pollutants shall be reduced significantly; (ii) City development shall be in accordance with the carrying capacity of resources and the cultural context. Green planning, design and construction standards shall be applied; (iii) Support reduced emission standards and implement demonstration projects of “near-zero” carbon emission.

The Ministry of Environmental Protection (MEP) listed in 2009 some 389 counties and cities as approved National Ecological Demonstration Sites and 629 towns as Environmentally Beautiful Towns.²

Proposed Low-carbon Urban Planning Key Performance Indicators (KPI) ³

Indicator Category	Indicators: indicative values	Current achievements / Time frame for accomplishment
Average built-up area per capita (m ² /pers) [1]	≤85 m ² /pers [1] ≤100 m ² /pers [9]	
Parks within a 500m radius [1] [6]	≥80% [1] ≥100% [6]	
Coverage of green areas [6]	20-40% [6]	
Public green space [1; 3] Proportion of green areas [5]	≥12 m ² /pers [1] ≥35%	By 2013 [3]
Average land area for public facilities per capita [1] Proximity to amenities: schools, post offices, banks, retails, clinics, activity centres, restaurants, etc. [6]	≥5.5 m ² /pers [1] ≤500m [6]	
Provision of free recreational and sport facilities within walking distance of 500 m [3]	100% [3] Walking distance to parks≤400m [2]	By 2013 [3]
Mixed land-use land [4]	20% [4]	

¹ Qiu, Baoxing. 2009. Urban development trends in the CHINA– low carbon eco-city. 我国城市发展模式转型趋势 – 低碳生态城市. 城市发展研究Urban Studies. 2009 (8), pp 1-6

² Wu Xiaoping, Vice-Minister for Environmental Protection (2009, October 19). Establishing scientific development, promoting the circular economy 立足科学发展 大力推进循环经济. China Environmental News 中国环境报. Retrieved 20 July 2010 from http://www.mep.gov.cn/zhxx/hjyw/200910/t20091019_162536.htm

³ These key performance indicators were prepared and compiled by the EC-Link Project. See: EC-Link. 2016. Sino-EU Key Performance Indicators for Eco-Cities. Beijing (unpublished draft)



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Indicator Category	Indicators: indicative values	Current achievements / Time frame for accomplishment
Residential density [6] Residential blocks [6]	10,000/km ² [6] ≤ 2 ha (= 20,000 m ²) [6]	
Density : Floor Area Ratios (FAR) – 10-50 stories [7]	2.7- 8 [7]	
Transit-oriented Development (TOD) around public transit systems [7] Floor area ratio (FAR) [7] Great accessibility (pleasant walking amenities to transit system within 500-meter radius) [7]	≤ 500-800 m to major transit stations (metro or bus rapid transit (BRT) [8] ≤ 500 m of nearest bus or transit stops (in case BRT or Metro is not available) For the city as a whole: ≤ 90% within 800m of public transit station. FAR 50% higher (big cities 70%) than the average FAR of the district. 90% ≤ 500 m radius [7] [8]	
Heat island effect density	<3.0°C 70% of road, building roof areas with reflection coefficient ≤ 0.4	
Ambient noise meeting ambient noise standard GB 3096	≥80%	
Flood prevention as per national design standards GB50201 and GB50805 [5]	100% [5]	

Sources:

- [1] Qiu Baoxing. 2012. Combine idealism and pragmatism – a primary exploration of setting up and implementing low carbon eco city indicator system in China [in Chinese], China Construction Industry Publisher. Beijing
- [2] UN-Habitat and Tongji Urban Planning & Design Institute, Shanghai. 2014. Guiyang Green and Sustainable City Programme – Sustainable City Reviews. See also: Guiyang Municipality. 2015. Guiyang Eco-Civilization City Indicators System. Guiyang (unpublished report).
- [3] World Bank. 2009. *Sino-Singapore Tianjin Eco-City: A Case Study of an Emerging Eco-City in China*. Technical Assistance Report. Beijing. www-wds.worldbank.org/.../PDF/590120WP0P114811REPORT0FINAL1EN1WEB.pdf
- [4] SWECO. No date. Caofeidian - Detailed ecological indicators system [unpublished document].
- [5] MoHURD. 2015 and 2016 versions. *Appraisal Standards for Green Eco-City/District Planning (draft)*. Beijing [unofficial Translation].
- [6] China Development Bank Capital (CBDC). 2015. *12 Green Guidelines. CDBC's Green and Smart Urban Development Guidelines*. Beijing (draft). <http://energyinnovation.org/wp-content/uploads/2015/12/12-Green-Guidelines.pdf>
- [7] The Energy Foundation - China Sustainable Cities Program (ed.). 2011. *Design Manual for Low Carbon Development*. p .46. <http://www.chinastc.org/en/research/34>
- [8] MoHURD. 2014. *Green Building Appraising Standard (GB/T50378-2014)*. [EC Link unofficial translation].
- [9] State Council, Government of People's Republic of China. 2014. China's New Urbanisation Plan (2014-2020) 18th National Congress of the Communist Party of China, *Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Comprehensively Deepening the Reform*. Beijing. http://www.gov.cn/zhengce/2014-03/16/content_2640075.htm



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Recommendations for Action by Cities

DO: To do develop your city into compact low-carbon city, decide for the following policies and investments:

Compact Urban Development – Approaches and Investments

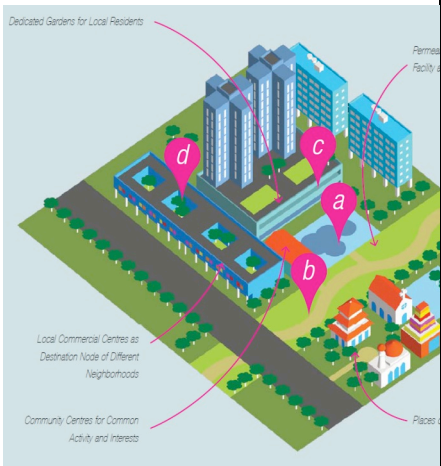

Area of Activity	Minimum requirements	Advanced approaches	High impact low carbon approaches
1. Define and enforce urban growth boundary	<ul style="list-style-type: none"> Every city should establish its urban growth boundary (UGB). Cities need to enforce it, need to work with permits and building controls to ensure compliance. 	<ul style="list-style-type: none"> Study the ecological sensitivities, environmental capacity, and the efficiency and productivities of various land uses. Ensure density does not exceed 10,000 residents per square kilometer 	<ul style="list-style-type: none"> Ensure that your city does not expand beyond the existing urban footprint, unless all suitable infill locations are utilized. Use Transit-oriented development (TOD) to enhance densities. Near transit hubs.
2. Plan and develop mixed uses	<ul style="list-style-type: none"> All residential units should be close to at least six kinds of amenities within a 500-meter radius from the building entrance. Amenities include: schools, post offices, banks, retails, clinics, activity centers, restaurants, etc. 	<ul style="list-style-type: none"> The job-resident ratio (the number of people employed divided by the number of residents) should be between 0.5 and 0.7 over every commuting district. Keeping employment within neighbourhoods reduced need for commuting. 	<ul style="list-style-type: none"> Commuting districts shall have clearly defined boundaries and physical barriers for pedestrians. Each commuting district should have a spatial area no more than 15 km².
3. Small blocks	<ul style="list-style-type: none"> Blocks should be less than or equal to 2 hectares. 70% of the blocks should comply with this standard. 	<ul style="list-style-type: none"> Exceptions are made for mixed areas with industrial land uses. 	<ul style="list-style-type: none"> Create environments which are walkable and well connected to other blocks.
4. Public green spaces	<ul style="list-style-type: none"> Develop accessible public and well usable green spaces. Green spaces shall account for 20-40% of the neighbourhood area. In dominantly residential areas, 	<ul style="list-style-type: none"> All residents should have accessible public space within 500 meters.⁴ The more direct social control over public green spaces exist, the better its utilisation and its maintenance by resident users. 	<ul style="list-style-type: none"> Vegetation will help to store CO₂, and contribute to cleaner and healthier environment.

⁴ China Development Bank Capital (CBDC). 2015. *12 Green Guidelines. CBDC's Green and Smart Urban Development Guidelines*. Beijing (draft). <http://energyinnovation.org/wp-content/uploads/2015/12/12-Green-Guidelines.pdf>





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	open green spaces shall be 30-49%.		
5. Urban density targets - as per the Design Manual for Low Carbon Development⁵	<ul style="list-style-type: none"> Recommended to mix different floor areas ratios (FAR), or floor space indexes (FSI), for diverse type of developments. Define a good mix of mid-rise residential to highly compact commercial developments. 	<ul style="list-style-type: none"> The range covers up to 10 storey developments: = FAR of 2.7. Plan for higher densities along transport stations. Use transit-oriented development (TOD) to generate hubs of economic activities and higher densities. 	<ul style="list-style-type: none"> Up to to 50 storey developments, or FAR of 8.0 which dramatically reduced need of commuting, and increase low-carbon benefits.
Examples	<p>Inclusive mixed-use high-density residential neighbourhood</p>  <p>http://uli.org/press-release/10-principles-singapore/</p>	<p>Singapore's 50+ story Pinnacle at Duxton, the biggest public housing complex in the world, looms above earlier development</p>  <p>Source: http://www.livablecities.org/articles/high-density-livability-question</p>	
	Eco-City Hammarby Sjöstad, Stockholm	Hammarby Sjöstad, Stockholm - canals	

⁵ The Energy Foundation - China Sustainable Cities Program (ed.). 2011. Design Manual for Low Carbon Development. p .46. <http://www.chinastc.org/en/research/34>





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	 <p>http://www.plataformaarquitectura.cl/cl/799017/estocolmo-ya-tiene-su-primer-barrio-sustentable-y-desde-los-90?utm_medium=email&utm_source=Plataforma%20Arquitectura</p>	 <p>http://www.plataformaarquitectura.cl/cl/799017/estocolmo-ya-tiene-su-primer-barrio-sustentable-y-desde-los-90?utm_medium=email&utm_source=Plataforma%20Arquitectura</p>
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DON'T: Further, as a mirror image of the above, don't undertake action which undermines green policies and investments.

Area of Activity	Key Non-actions	Explanations
1. Define and enforce urban growth boundary	<ul style="list-style-type: none"> Do not forget urban growth boundaries when attractive new developer schemes are presented. Do not permit residential urban sprawl. Rather, let developers pay extra for low-rise developments which are inefficient and expensive to the environment. 	<ul style="list-style-type: none"> Important to aim for more compact urban development, not 'villa' type low-density suburbs.
2. Plan and develop mixed uses	<ul style="list-style-type: none"> Do avoid planning for mono-functional areas – “sleeping towns”, pure factory areas, or 100% shopping districts without local residents nearby. 	<ul style="list-style-type: none"> Mono-functional districts are not only monotonous, but generate unnecessary commuting needs.
3. Small blocks	<ul style="list-style-type: none"> Do not underestimate comfort. Do not ignore the walking and non-motorised mobility of residents. 	<ul style="list-style-type: none"> Large blocks become uncomfortable as services are too far away
4. Public green spaces	<ul style="list-style-type: none"> Do not conceive green spaces as large public isolated areas. 	<ul style="list-style-type: none"> Better to integrate with residences and make these accessible for day-to-day activities.



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<p>5. Urban density targets</p>	<ul style="list-style-type: none"> Do not forget to target maximum densities as established by the development or master plans. Do not ignore the strong benefits of TOD. 	<ul style="list-style-type: none"> Density will permit the creation of good levels of commercial services. TOD is a highly beneficial well-proven model.
<p>Example</p>	<p>Don't do this</p> <p>Mono-functional housing estate limits mixture of functions and use</p>  <p>Source: Salat, S. and Bourdic, L. 2014. <i>Spatial Planning Principles & Assessment Framework for Climate Adaptive & Resilient Cities in China</i>. International Workshop NDRC – MoHURD – ADB 5 September Beijing.</p> <p>http://www.urbanmorphologyinstitute.org/resources/conferences/spatial-planning-principles-resilient-cities-china/</p>	

Outlook and future sector agenda. China's cities will densify with about 1 billion people by 2030. With the proliferation of new cities in China, thousands of skyscrapers are expected to be built, illustrating the drive for higher densities. Green city development in China is still very much at an early stage. China's decisions about land use will have a huge impact on energy consumption and carbon emissions. If China's cities will live at high densities and use public transit, then the whole world will benefit. If they sprawl, then we will all suffer from higher energy costs and higher carbon emissions. The Eco-City experience in China, with these beginnings, will bear visible benefits in the next 30-50 years. True green cities will be a work for the medium-term. Short-term challenge is to get it right on energy, transport, densities, and the building technologies, and to "leapfrog" to achieve at least the same results as their European peers. Better urban planning, with more mixed land-use and TOD can enhance the urban form-urban density nexus and strengthen low-carbon development. Eco-city low-carbon urban planning will have to take into account the positive contribution of more compact urban development.

China's cities will densify. 30 billion sqm of housing will be built and a population of additional 800 million people will be urbanised over the coming 20 years through the creation of 200 towns, each housing over two million inhabitants.⁶ With the proliferation of new cities in China, thousands of skyscrapers are expected to be built, illustrating the drive for even higher densities. Green city development in China is still very much at the

⁶ Salat, S. 2006. *The Sustainable Design Handbook China: High Environmental Quality Cities and Buildings*, Urban Morphology Laboratory CSTB, Editions Hermann.





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experimental stage.⁷ Appropriate management and policies to drive and support green city development are as important as technology or financing factors.

- This trend of cities becoming more compact, coordinated and connected is mainly driven by the concern for the ecology of cities, and their performance in terms of carbon or emission reduction. The notion of more compactness, of higher transport efficiency is transforming the way the future of cities is being seen.
- Cities in China will have to become more compact and efficient. Changes in lifestyle will contribute to changes in the city: These changes in lifestyle are related to mobility, use of means of transport, and the walkability within cities.

⁷ Woetzel, J. 2011. How Green Are China's Cities?. McKinsey Quarterly, January. http://www.mckinseyquarterly.com/How_green_are_Chinas_cities_2734



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