

MoHURD Eco-City Implementation Guideline for Green Industries

Preamble. This Eco-City Implementation Guideline has been developed with the assistance of the Europe-Chine Eco-Cities Link Project (EC Link), and been submitted by the Chinese Society for Urban Studies (CSUS). It draws on the work done by the EC Link project in the development of sectoral toolboxes¹ which present European and Chinese best practices, urban development standards, indicators and methodologies for verification. Further, the development of this Guideline is informed by project work of MoHURD-affiliated pilot cities which are implementing eco-cities activities, and piloting innovative practices. EC Link has provided as inputs toolboxes for the following 9 sectors: compact urban development (CUD), clean energy (CE), green building (GB), green transport (GT), water management (water supply, waste water treatment and flood control) (WM), solid waste management (SWM), urban renewal and revitalization (URR), municipal finance (MF), and green industries (GI).

Objectives. The objectives of this Eco-City Implementation Guideline is to provide guidance, and to ensure compliance. The document is meant for all Chinese cities which are participating in the national MoHURD-supported eco-cities programme. Besides guidance, the document will help to ensure compliance of cities with the normative part proposed under this guideline.

Legal Basis. This Eco-City Implementation Guideline is complementary to the existing urban planning legislation of the People’s Republic of China (PRC), and other guidelines of the Ministry of Housing, and Urban-Rural Development (MoHURD), particularly those pertaining to eco-city development. The relevant legal reference documents are:

- Urban Planning Law. 1984. In 2008 updated as “The Urban and Rural Planning Law of People’s Republic of China”; latest revised in April 2015.
- Land Management Law. 1998.
And based on the law, the detailed Enforcement Regulation has been developed, and undergone revisions for several times. The latest is the 2014 version.
- Environment Protection Law. 1990. Latest revised in 2014 and applied since 2015.
- MoHURD. March. 2013. The 12th 5-Year Plan on the Green Building and Green Ecological Districts.
- CCPCC and State Council. March, 2014. National New-type Urbanization Plan 2014-2020.
- State Council. April, 2015, Suggestions on Enhancing Eco-civilization.
- CCPCC and State Council. 2016. Central Government Guideline on Urban Planning.
- CCPCC and State Council. 2016. The thirteenth Five-Year Plan (2016-2020)

Specifically for green Industries, the following legal instruments apply:

- Law for the Promotion of Circular Economy. 2009.

¹ EC Link Toolbox. 2016. *Green Industries*. Beijing. Draft English version. www.eclink.org

- State Council. 2010. Decisions on Accelerating Strategic Development of Innovative Industries.
- State Council. 2012. Development Strategies for Energy Efficiency and Environmental Protection in the 12th Five-Year Plan.
- State Council. 2013. Development Strategies and Action Plan for Circular Economy.
- State of Council. 2013. Instructions on Accelerating Energy Efficiency and Environmental Protection.

This Eco-City Implementation Guideline is *mandatory* for all Chinese cities which are participating in the national MoHURD-supported eco-cities programme. Compliance with its missions and technical targets will be monitored and reviewed by MoHURD. Compliance will be rewarded through special allocation of funding and technical implementation support.

Scope of this guideline. The geographical scope of this Eco-City Implementation Guideline are urban areas as defined by the existing legislation. The application of this Eco-City Implementation Guideline may be extended to Districts which are under the jurisdiction of a city (urban area), as applicable.

Substance of this guideline. This Eco-City Implementation Guideline is dedicated to Green Industries (GI). The implementation of eco-city development approaches concept makes it necessary to deal with the greening of industrial production, ranging from sourcing of raw materials to the waste streams generated by industrial processes. To implement a green industrial agenda it will be necessary to have committed city, district governments and companies (private or public sectors) so rules can be enforced.

Industries and cities. Industries form an integrated and important part of the fabric that cities are made of. At a national level, a country's industrial sectors pay a crucial role in moving the national economic output and growth towards achieving the objectives of sustainable development. The behaviour and decisions made in and in relation to the industrial sector form the cities, the people living in them and conditions and environment in which they live. If managed well, urbanisation and industrialisation can bring important benefits for development. Cities are an efficient way of organising populations; they enable economies of scale and reduce the need for transportation, thereby making economic activity more environmentally friendly.

Negative externalities. Higher population density, however, also creates challenges in terms of negative externalities especially if urbanisation is rapid and poorly-planned. The availability and quality of infrastructure are at the core of many of the challenges faced by rapid developing cities. Further issues that are likely not to be able to keep pace with growth and expectations of cities include air pollution, access to sufficient and clean water and dealing with wastes.

Industries and environmental degradation. China's rapid economic growth over the past decades has been accompanied by substantial exploitation of natural resources and serious environmental pollution. The increasing concern about environmental pollution in urban areas, especially air pollution from industry and energy generation, is leading to changes in the approaches to planning and integration of industries. E.g. the promotion of high tech and light manufacturing in the East of China and relocation of heavy industries to

the Mid and West China. The potential for improving the environmental conduct of the individual industries and clusters of industries remain, however, largely untapped.

Cities and high carbon consumption. Cities in China are large procurers of materials, energy and infrastructure. The cost of materials for building construction is an increasing concern, as construction activities are taking place at a high pace and little experience exists in recycling of building materials. The energy demand for cement and metals production is enormous and the rapid developing housing sector thus has a direct impact on energy demand and emissions. Improving energy efficiency in the construction sector, especially in the production of building materials and recycling of materials, will have a significant positive impact on the environment.

Justification

Development choices. In the next 15 years, China will face a series of important choices, which will shape both China's future and that of the world:

- China has the opportunity to become a high-income economy, but sustainable economic growth is needed over the next 20 years to avoid the middle-income trap.
- China has an opportunity to lead the world in developing new and renewable energy solutions, but will need major reform of the energy system to build safe, efficient, clean and low-carbon energy supply and consumption systems.
- China has the opportunity to play an important role in global low-carbon development and to move upstream in the industry chain, but will need to further limit greenhouse gas emissions and manage the risks of climate change.
- China has the opportunity to optimise economic growth through environmental improvement, but needs to improve environmental management.

Commitment to reduction of fossil fuels. China's commitment to increase the share of non-fossil fuels in primary energy consumption is strong and has been confirmed through several important agreements. The US - China Joint Announcement on Climate Change of 12 November 2014 presented a commitment to increase non-fossil fuels to around 20% by 2030 and (for both sides) to increase this ambition over time. One of the measures presented in the announcement was promotion of trade in green goods through e.g. encouraging trade in sustainable environmental goods and clean energy technologies; focus on smart low-carbon cities and smart low-carbon growth technologies. The US-China joint presidential statement on climate change, released during president Xi's visit at the White House on 25 September 2015: *"China will promote green power dispatch, giving priority, in distribution and dispatching, of renewable power generation and fossil fuel power of higher efficiency and lower emission levels"*

China's new normal. The notion "China's new normal" was introduced in June 2015 to describe the Chinese shift in strategy towards structural change, better growth and peak emissions². A good example of the shift is seen in international cooperation efforts in the promotion of renewable energy that is now receiving increased attention, e.g. the cooperation agreement between China State Grid Energy Research Institute and the US

² Green, F and Stern, N. 2015. *China's "new normal": structural change, better growth and peak emissions*, Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy. Policy Brief..

Department of Energy's National Renewable Energy Department (NREL) in relation to developing mechanisms to ensure achieving the full benefits of the large investments in renewable energy already made, e.g. integration of fluctuating renewable energy sources into the grid.

Circular Economy. Circular Economy (CE) is a relatively recent economic concept, seeking to ultimately decouple global economic development from finite resource consumption. It enables key policy objectives such as generating economic growth, creating jobs, and reducing environmental impacts, including carbon emissions. The CE model is developed as a reaction to the linear 'take, make, dispose' model that relies on large quantities of easily accessible resources and energy. The model acknowledges that working towards efficiency – a reduction of resources and fossil energy consumed per unit of economic output – will not alter the finite nature of their stocks, but can only delay the inevitable depletion, wherefore a deeper change of the operating system is needed.

Circular Economy for China. Promoting a circular economy was identified as national policy in China's 11th five-year plan starting in 2006 and China's Circular Economy Promotion Law came into force in January 2009 with the purpose of promoting CE, raising the resources utilization rate, protecting and improving environment and realizing sustained development. The use of the terminology CE in China is close to the use in the EU of 'green economy' or 'sustainable development.' The CE Promotion Law aimed to decouple economic growth from resource consumption and pollution and also shifted the traditional view on solid waste treatment to the idea of closed-loop materials flows addressing reuse and recycling. Finally, the law introduced policies and instruments for controlling the total quantities of resource consumption and pollutant discharge.

The circular economy cycle. The CE is perceived as a continuous positive development cycle that preserves and enhances natural capital, optimises resource yields, and minimises system risks by managing finite stocks and renewable flows.³ In its more comprehensive version the CE is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.

Principles of Circular Economy. The Circular Economy rests on three key principles:

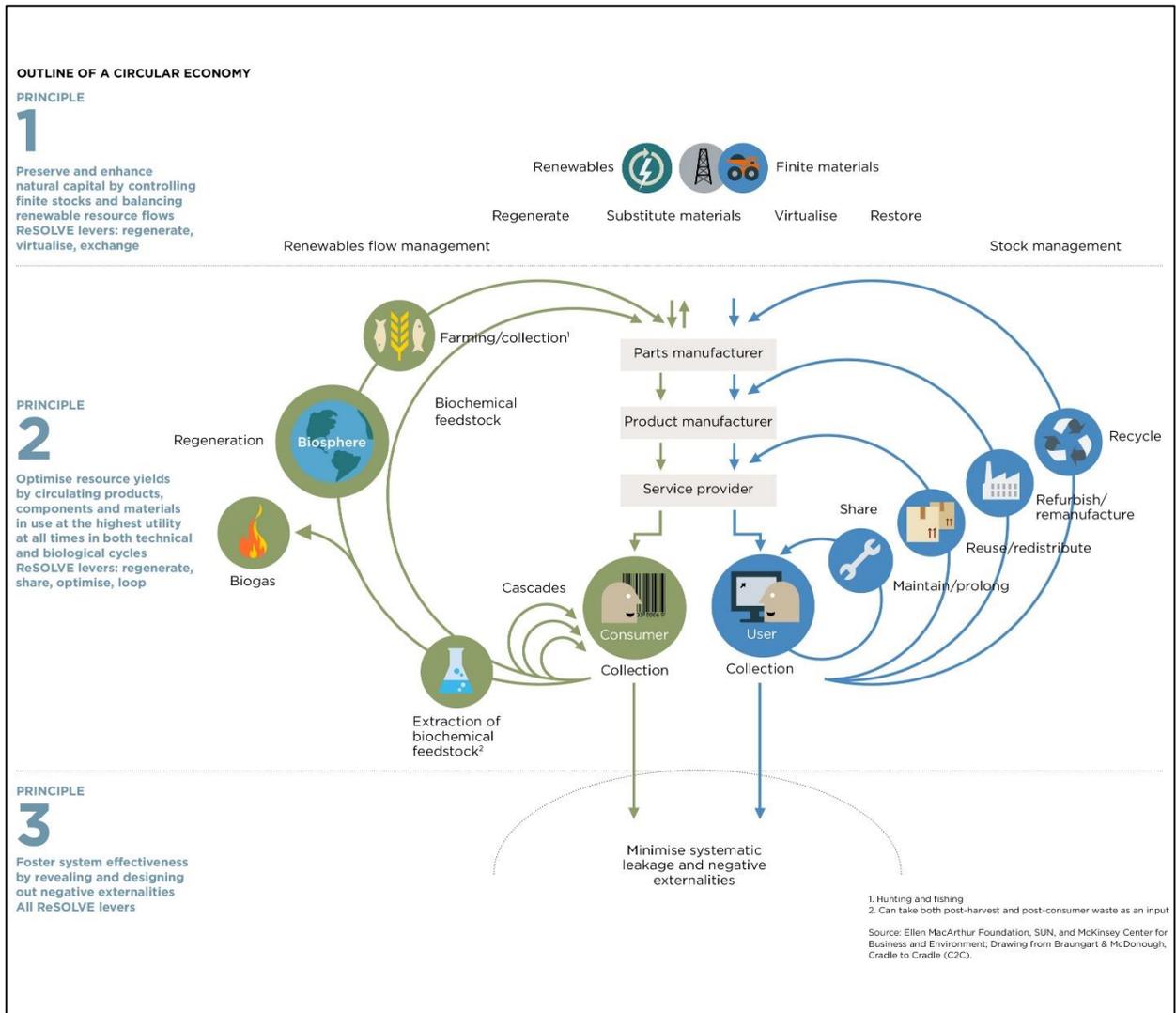
1. Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows—for example, replacing fossil fuels with renewable energy or using the maximum sustainable yield method to preserve fish stocks.
2. Optimise resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles – for example, sharing or looping products and extending product lifetimes.
3. Foster system effectiveness by revealing and designing out negative externalities, such as water, air, soil, and noise pollution; climate change; toxins; congestion; and negative health effects related to resource use.

³ Ellen Macarthur Foundation. *Delivering the circular economy – A toolkit for policymakers*, June 2015. <http://www.ellenmacarthurfoundation.org/publications/delivering-the-circular-economy-a-toolkit-for-policymakers> (Retrieved 13.07.2015)

Towards the circular economy. Moving towards the circular economy offers a unique chance for businesses and policymakers collaboratively to accelerate specific business opportunities while at the same time helping to achieve wider societal goals.

One of the reasons why CE receives increased political attention is the promise of CE being a lever to achieve key policymaker objectives such as generating economic growth, creating jobs, and reducing environmental impact. CE thus reflects and directly addresses key policy areas such as promotion of green employment, green innovation and product development, resource scarcity, and the climate change agenda.

Outline of a circular economy and its principles



Source: Ellen MacArthur Foundation. *Delivering the circular economy – A toolkit for policymakers*, June 2015.

<http://www.ellenmacarthurfoundation.org/publications/delivering-the-circular-economy-a-toolkit-for-policymakers>

Policymakers at government levels can play an important role in the circular economy, yet cities in particular have a key role to play. Cities have a high density of businesses (especially retailers) and consumers making them concentrators of flows. This requires and allows the creation of regeneration operations at scale. As consumption is often higher than the production of goods within the boundary of the cities, looking at local loops and increasing self-sufficiency becomes meaningful. City governments can in certain instances move faster than their national counterparts, especially when united in city networks.

Development of green industries or “greening of the industrial production”. The International Chamber of Commerce (ICC) representing global business defines green economy as “an economy in which economic growth and environmental responsibility work

together in a mutually reinforcing fashion while supporting progress on social development".⁴

Green Economy Roadmap. In 2012, the International Chamber of Commerce (ICC) published the Green Economy Roadmap, containing contributions from experts from around the globe brought together in a two-year consultation process. The Roadmap represents a comprehensive and multidisciplinary effort to clarify and frame the concept of "green economy". It highlights the essential role of business in bringing solutions to common global challenges. It sets out the following 10 conditions which relate to business/intra-industry and collaborative action for a transition towards a green economy: (i) Open and competitive markets; (ii) Metrics, accounting, and reporting; (iii) Finance and investment; (iv) Awareness; (v) Life cycle approach; (vi) Resource efficiency and decoupling; (vii) Employment; (viii) Education and skills; (ix) Governance and partnership; and (x) Integrated policy and decision-making.

Savings through resource efficiency. Improving resource efficiency in industries offers enormous potential for the reduction of production costs and for productivity gains. Low-carbon roadmaps have been elaborated by industrial sectors in the EU showing a clear need for the development and large-scale demonstration of innovative low-carbon industrial processes, as well as new high added value low-carbon production. Evidence shows that cost reductions of between 30 and 80% are expected as new energy technologies mature⁵.

To make more efficient use of resources by reducing waste and converting waste into new goods and services, eco-innovation, new intermediaries and brokerage services are required. Small and medium enterprises (SMEs) need a supportive environment to engage in new industrial relationships, enabling them to move towards a circular economy⁶. Grants and subsidies have a significant positive impact on helping SMEs to become greener⁷. Identifying and building supply capacity for commercially viable, competitive green product exports is increasingly being seen as a fundamental part of supporting green growth and sustainable development.⁸

Eco-Industrial Development. Eco-Industrial Development (EID) is a capable strategy to promote sustainable industrial development, tackling environmental, economic and social aspects in a balanced manner. The key in EID is the establishment of a park or estate community of businesses that work together to improve the environmental, economic and social performance of industries involved. The "greening of the industrial production" is

⁴ International Chamber of Commerce (ICC),. *ICC Green Economy Roadmap. A guide for business, policymakers and society* (2012; and UNDESA, *A guidebook to the Green Economy*. (2012)

⁵ European Commission, Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions, *A policy framework for climate and energy in the period from 2020 to 2030*. /COM/2024/015 final January 2014. (retrieved 27.08.2015)

⁶ European Commission, Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions *Green Action Plan for SMEs - Enabling SMEs to turn environmental challenges into business opportunities* /COM(2014) 440. July 2014 (Retrieved 30.07.2015)

⁷ European Commission, *SMEs, resource efficiency and Green Markets*", December 2013. (Retrieved 30.07.2015)

⁸ Since July 2014 the EU and 16 other members of the World Trade Organization (WTO) have been negotiating an Environmental Goods Agreement to remove barriers to trade in environmental or "green" goods by removing tariffs as this is seen as crucial for environmental protection and climate change mitigation. The member countries⁸ have so far agreed on a list of 54 products where tariffs have been reduced by 2015 to 5% or less.

meant to be achieved by focusing concrete activities and design of measures on industrial parks or clusters of industries. The geographical closeness of industries provides good opportunities for synergies between companies, competition by comparison, communication and mobilisation of resources for the “greening” process.

Clean energy for the green economy. Green economies require clean energy generation based on renewable energy to replace fossil fuels as well as energy conservation and efficient energy use. There is justification for market failure to respond to environmental protection and climate protection needs with the excuse that high external costs and high initial costs for research, development, and marketing of green energy sources and green products prevents firms from voluntarily reducing their ecological footprints. The green economy may need government subsidies as market incentives to motivate firms to invest and produce green products and services.⁹ However, it is also being argued that green strategies can be highly profitable for corporations that understand the long-term business case for sustainability and can market green products and services beyond the traditional green consumer.¹⁰

Development Objectives

Policy Direction from the 13th Five Year Plan. The Government’s pronouncement of the Five Year Plan objectives has stated three key objectives:

- 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.
- 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.
- Support reduced emission standards, and implement demonstration projects of “near-zero” carbon emission.

The 13th 5-year plan addresses these challenges through an ambition of achieving “green and inclusive growth” and specifically in the environmental area of promoting clean production, setting up green and low-carbon industry systems, promoting green finance, and establishing a green development fund. Key tasks mentioned include setting up a nationwide, real-time online environmental monitoring system and an emissions permit system that will cover companies with static pollution sources as well as including environmental protection in outgoing officials’ performance evaluation.¹¹

⁹ The German Renewable Energy Act, legislation of many other member states of the European Union and the American Recovery and Reinvestment Act of 2009, all provide such market incentives.

¹⁰ Lovins, A., Lovins, H, and Hawker, P. 2000. *Natural Capitalism: Creating the Next Industrial Revolution*, US Green Building Council, Washington; and Levinson, J.C. and Horowitz, S. 2010. *Guerrilla Marketing Goes Green*, Wiley, New Jersey.

¹¹ ChinaDaily, 3 November 2015 regarding the *Adoption of the CPC Central Committee’s Proposal on Formulating the Thirteenth Five-Year Plan on National Economic and Social Development*

New Urbanization Policy 2016. Following the Central Urban Work Conference (20-21 December 2015) on 6 February 2016, the Communist Party of China Central Committee and the State Council issued a roadmap for city development, including energy conservation:¹²

- **Promote the development of energy conservation in the city.** Promote the district combined heat and power (CHP), green lighting, energy conservation in government owned buildings; improve heat production efficiency.

Industrial policy framework. Green industries form part of the general industrial policy framework, but have strong linkages to energy, housing, transport, land-use and resource policies as well. This paper looks at green industries from the perspective of urbanisation and how to promote sustainable urban development. The intention is thus not to cover all aspects of industrial policy, but to present the elements that are most relevant to city representatives, urban planners and developers in shaping an ecological and low-carbon urban development.

Green industries are not a sector as such, but are a terminology used to characterise efforts in industrial policy to optimising:

- a) the way the individual industries design their processes and deal with energy consumption, materials and waste;
- b) the way they interact with other industries and sectors for overall sustainable development, and finally
- c) the way the products are produced in relation to energy and materials consumption.

Green industries are thus vectors for a transition towards greening of the entire industrial value chain.

City level: Land-use planning, planning for industrial areas and the service provision to these areas as well as interlinkages transport wise have an important impact on how greening of industries can take place and how easily sustainability for the entire city can be achieved. The coordination at city level of this interaction of areas – transport, residential areas, energy, water and materials flow - is key to successful implementation of measures that ensure national and provincial targets for e.g. renewables, green buildings, and emissions are reached. Densification and integration of functionality enable the city to harness synergies that otherwise go wasted. The city level must look at a long-term perspective and make use of life-cycle or total economy assessments when planning and making decisions to ensure cost-effective development. Cities thereby have an effective tool to guide industries and to design support mechanisms that promote the most cost efficient way to achieve greener development.

Industrial areas and parks: At industrial park level, development of sustainable area management e.g. in the form of interest groups formed by industries, academia and local authorities or similar can make a significant impact on the development of the areas. The industrial management group should be involved in review of all decisions and terms of sustainability and provide new ideas and insights. The management of the existing and new industrial parks – innovation parks, low-carbon parks, sustainable industrial areas etc. - will need to look at water management, waste management, energy issues,

¹² Extracted and translated from: http://www.gov.cn/zhengce/2016-02/21/content_5044367.htm)

transportation services as well as interaction with the urban development in order to move towards sustainability. Efforts could also involve social issues such as health and safety, working environment, childcare, etc.

Greening of the production processes: At manufacturing level, minimising resource input to the production processes, elimination of waste and reduction of emissions to minimum emissions form part of a high-efficiency manufacturing agenda. LEAN and CSR are examples of popular tools that support and guide the businesses in their efforts and, when applied correctly, lead to increased business profitability. Business process eco-efficiency is an example of a means to measuring progress in the greening of production processes. Greening of production processes mean that industries more easily can co-exist and be integrated with urban environments. Convincing demonstration of benefits and outside pressure help management give priority to the greening process.

Green products: Products that through their design, composition and usages minimise their environmental impact throughout their lifecycle are important for achieving long-term objectives of circular economy and emission reductions. Examples of products are renewable energy technologies and components, energy efficient products and building materials, components designed for recycling, electric vehicles and trains. Environmental policies with long-term indications of environmental regulatory requirements help industries develop green products. Public innovative procurement is another means to promote design and manufacturing of green products - e.g. energy efficient building components, low emission vehicles, energy efficient appliances and renewable energy technologies.

Green infrastructure for green industry: A prerequisite for moving towards a circular economy is that the provision of energy, treatment of wastewater and waste, as well as transportation systems are based on renewable energy and designed to minimise resource usage. Constructed wetlands, making cities self-sustained with regard to water, renewable energy for heating, electricity and transport, multi-functionality of storm water and land-use are examples of means that make way for sustainability in efficient and compact cities.

Resilient industries – resilient economy: Scarcity of water and energy prices volatility are among the highest global risk factors that organisations and economies are facing in the coming 10 years¹³. Building resilience to these risks will include vigorous urban planning as well as enforcement and tightening of environmental regulations.

Policies for greening of the economy – the circular economy. In August 2008, the National People’s Congress approved the Circular Economy Promotion Law of the People’s Republic of China (Circular Economy Promotion Law). The law entered into force on 1 January 2009.

Circular Economy Promotion Law. According to the Circular Economy Promotion Law the development of China’s circular economy *shall be propelled by the government, led by the market, effected by enterprises and participated in by the public*¹⁴. The aim of the law is to decouple economic growth from resource consumption and pollutant. The circular economy was introduced as a green economy measure and also as a new development model that could help China leapfrog earlier practice to a more sustainable

¹³ World Economic Forum, *Global Risks Report 2015*, 10th edition.

¹⁴ Faegre & Benson LLP, *China Law Update* (October 2008)

economic structure. The law presented a shift from a more narrow focus on solid waste treatment to the idea of closed-loop material flows – from exploitation to production, distribution, consumption and treatment of waste. The law does not assign responsibility for its administration to a specific agency, but directs governments at all levels to develop plans, policies and procedures to accomplish the goals set forth.

The Circular Economy Promotion Law identifies a number of incentives to foster the development of China's sustainable economy i.e. establishment of funds at provincial and municipal level, tax preferences, priority to loans promoting the policies, fees for waste disposal and deposits for recycling, and sustainable public procurement. Also, the law provides governments with the opportunity to punish individuals in the form of fines and revocation of business licenses.

The stated purposes of the Circular Economy Promotion Law are: to promote development of the "circular economy"; to promote the more efficient use of resources; to protect and improve the environment; and to realize sustainable development. The law uses the term "circular economy" to refer to "reducing, reusing and recycling activities conducted in the process of production, circulation and consumption." This definition has prompted reference to the "three R's": reduce (consumption), reuse (products or components) and recycle (raw materials).

The Circular Economy Promotion Law is very broad and potentially far-reaching attempt to direct and shape China's economic development in ways that conserve energy, water and materials, and that protect the environment. While most of the provisions of the law have been codified in other legislation the law is generally regarded as important in the environmental legislative development in China and as an important signal from the Chinese Government in relation to encouraging sustainable economic development¹⁵.

The 12th 5-year plan set resource productivity targets, but due to the high annual growth rates this is not seen as sufficient to curb consumption and resource usage. Circular economy considerations are gradually expanding from pilot projects to wider application and recently the Government is developing circular economy initiatives at a national level – e.g. re-manufacturing of auto-parts, machinery and product-service system.¹⁵

Other legislation on circular economy. Other legislation that have a direct impact on resource use is the Cleaner Production Promotion Law, July 2012 with the aim of promoting cleaner production, that is reduction of pollution at its source, increase the efficiency of resource use, reduce and avoid the generation of pollutants, protect and improve the environment, ensure the health of human beings and promote the sustainable development of the economy and society.

Industrial zones and parks. The Chinese authorities has set up three national certification programs for low-carbon industrial zones and eco industrial parks (EIP) to address the concerns of reducing carbon emissions and growing scarcity of natural resources necessitating increased resource efficiency including improving reuse and recycling rates.

¹⁵ Europe's world, Greener Europe – special section: Circular Economy, Article by Dajin Zhu, University in Shanghai: "China's policies and instruments for developing the circular economy, June 15, 2014

Eco-Industrial Park Demonstration Program. The Eco-Industrial Park Demonstration Program was initiated in the end 1990s by the MEP with the aim of minimizing waste generation and improve overall eco-efficiency through certification of existing industrial parks. Today, two more ministries are involved in the administration of the program, MOST and MOFCOM. The program comprises three categories i.e. sector specific EIP, sector-integrated EIP, and venous industry EIP.

Circular Transformation of Industrial Parks (CTIP). The Circular Transformation of Industrial Parks (CTIP) was initiated in 2012 by the NDRC and the MoF as the successor to the Circular Economy Pilot Zones (CEPZ) initiated in 2001 by the MEP. The program is run at three levels i.e. firm, industrial park and regional. Unlike the EIP Demonstration Program the CTIP program is a direct source of national financing. The industrial zones define a list of priority projects and associated investments within their development plans. The NDRC and the MoF then decides which projects will be subsidized and the amount.

Low-Carbon Industrial Park Program. The Low-Carbon Industrial Park Program was launched in September 2013 as a joint project by the NDRC and the MIIT. A pilot experiment will run from 2014 to 2016 with 55 zones selected. Compared to eco-industrial zones and circular economy zones the biggest difference is, that the low-carbon zones are managed by its GHG emissions data both in terms of intensity and total carbon emissions.

The three programs share the overall ambition to push Chinese local authorities and their industries to become more energy efficient, reduce emissions, and hence increase its competitiveness. Compared to international experience with EIPs, the Chinese certification programs are characterised by a strong top-down approach, adoption of unified standards and procedures, and an unprecedented scale. The programs target several levels – the individual enterprises, clusters of industries like industrial parks and symbiosis projects and a city or regional level.

Growth of accredited industrial zones. In 2014, there were a total of 1568 industrial zones in China. Of these, about 13% belong to at least one of the certification programs. The movement towards eco-efficient and low carbon industrial parks is accelerating as more and more zones are joining one or more of the national certification programs. The abrupt increase in the number of accreditations seen in 2014 is, however, partly explained by the introduction of the new Low-Carbon Industrial Park Program launched in 2013¹⁶.

Promotion of eco-industrial parks link to different entities in central government:

- National Demonstrative Eco-industrial Parks (MEP, MOFCOM, MOST)
- National Circular Economy Parks (NDRC, MOF)
- Low-carbon Parks (MOFCOM)

The programmes are used to motivate local authorities to progress in certain areas. Participation in one demonstration program will often be followed by participation in the next. Incentive schemes are highly competitive and local authorities need “references” on their CV in order to compete for funding. The risk of this approach is that the activities of a programme are not institutionalised, but are rather seen as one-off projects or a stepping stone for participating in the next programme.

¹⁶ International Institute for Sustainable Development (IISD), Thieriot, H. and Sawyer, D. 2015. *Development of Eco-Efficient Industrial Parks in China: A review*. <https://cleanenergysolutions.org/resources/development-eco-efficient-industrial-parks-china-review>

Energy sector and renewable energy. China has made significant efforts over the past years in advancing its transition from a fossil-based to a non-fossil fuel-based energy system. In areas such as wind energy and solar applications, a consistent and encouraging policy environment has led to the establishment of an important renewable energy industry.¹⁷

High Renewable Energy Penetration Scenario and Roadmap Study. On 16 April 2015, Energy Foundation China, China National Renewable Energy Center (CNREC), and other key Chinese organizations jointly released the China 2050 High Renewable Energy Penetration Scenario and Roadmap Study in Beijing. The study shows that it is both technically and economically feasible for renewable energy to satisfy over 60 percent of China's primary energy consumption and 85 percent of electricity consumption by 2050. The study has attracted important media attention in China and the US.¹⁸

China Renewable Energy Outlook. In 2016 a more comprehensive and detailed system analysis will be published as part of the China Renewable Energy Outlook. This, as well as the scenario work, is inspired by the Danish experience of long-term planning and development that has demonstrated that clean energy production, blue skies, clean water and economic growth can go hand in hand.¹⁹

Corporate Social Responsibility. A study published in 2012 and conducted as part of the Sino-German Corporate Social Responsibility Project investigated the relationship between costs associated with improving the companies CSR performance and the resulting benefits. The study concluded that operating a business in a responsible way is a differentiation strategy that creates competitive advantages in terms of better and more committed employees, improved operational effectiveness, more efficient production processes, improved networking and stakeholder relationships, better publicity, increased productivity, innovation, improved quality, cost savings, risk reduction, price premiums, better capital and market access, customer satisfaction, and synergetic value creation. These benefits help firms to be better off than their less socially responsible competitors and strengthen their brand identity. Strong evidence has been shown for a positive relation between overall CSR engagement and competitiveness.²⁰

Indicators and certification. There are several areas of indicators and certification. In the following the focus is on industrial parks, but other indicator regimes exists for policy monitoring of specific areas such as air pollution, renewable energy, water usage etc. These other areas are dealt with in other toolboxes (water, energy, transport, waste, etc.) and reference is therefore made to these.

Development Plans. Under the Eco-Industrial Park (EIP) Demonstration Program the industrial zones must prepare a development plan. Once approved, the zones are entitled *National Trial EIPs*. The leading authorities organize performance evaluations every three

¹⁷ National Energy Administration, the Peoples Government of Jiansu Province and the International Renewable Energy Agency, *Suzhou Declaration of the International Forum on Energy Transitions*, 9 November 2015.

¹⁸ Information from China National Renewable Energy Center, Beijing <http://www.cnrec.org.cn/english/>

¹⁹ Danish Energy Agency and CNREC, *The Danish Energy Transformation Roadmap, Executive Summary, A roadmap for China*, November 2015. <http://www.cnrec.org.cn/english/publication/>

²⁰ Sino-German Corporate Responsibility Project. Cost and Benefits of Corporate Social Responsibility (CSR) – A company level analysis of three sectors: Mining industry, chemical industry and light industry. February 2012. Published 15 June 2012.

years resulting in a grading of the zones as excellent, good, qualified, satisfactory or unsatisfactory. When the implementation has sufficiently progressed and performance metrics are achieved, the zones can be granted the title of *National Demonstration EIP*. For the current National Demonstration EIPs, it has taken an average of three to four years to become certified after approval of the development plans.

Standards under the EIP Demonstration Program. The EIP Demonstration Program comprises three standards corresponding to the three types of EIPs²¹

- The sector specific EIP (HJ/T273-2006)
- The sector-integrated EIP (HJ/T274-2009), and
- The venous-industry EIP (HJ/T275-2006)

These standards are key documents guiding the EIPs in their certification process comprising 24 indicators across four categories. These are further described in section 3.4 below.

Guidelines for eco-industrial parks. Guidelines for eco-industrial parks have been attempted by the 2006 EIP standards (MEP, MOFCOM and MOST jointly) which define:

- Sector-specific eco-industrial parks
- Sector-integrated eco-industrial parks
- Venous industry based eco-industrial parks

The EIP Demonstration Program contains three standards comprising 24 indicators across four categories, including economic development, resource conservation and recycling, pollution control, and environmental management. Many of the indicators are similar among the three standards, however, while threshold values are explicitly defined in the standard for sector-integrated zones, the sector-specific standards refer to international advanced performance levels.

²¹ International Institute for Sustainable Development (IISD), Thieriot, H. and Sawyer, D. 2015. *Development of Eco-Efficient Industrial Parks in China: A review*. <https://cleanenergysolutions.org/resources/development-eco-efficient-industrial-parks-china-review>

Indicators for sector-integrated EIPs

CATEGORY	METRICS		UNIT	VALUE
Economic development	1.1	IAV per capita	104 RMB/P	≥ 15
Material reduction and recycling	2.1	IAV per industrial land occupancy	100 million/km ²	≥ 9
	2.2	Energy consumption per IAV	tce/104 RMB	≤ 0.5
	2.3	Coefficient of elasticity on energy consumption	--	< 0.6
	2.4	Fresh water consumption per IAV	m ³ /10 ⁴ RMB	≤ 9
	2.5	Coefficient of elasticity on fresh water consumption	--	< 0.55
	2.6	Industrial wastewater generation per IAV	ton/10 ⁴ RMB	≤ 8
	2.7	Solid waste generation per IAV	ton/10 ⁴ RMB	≤ 0.1
	2.8	Industrial water reuse ratio	%	≥ 75
	2.9	Solid waste reuse ratio	%	≥ 85
Pollution control	3.1	Chemical Oxygen Demand (COD) emission per IAV	kg/10 ⁴ yuan	≤ 1
	3.2	Coefficient of elasticity on COD emission	--	< 0.3
	3.3	Sulphur dioxide (SO ₂) emission per IAV	kg/10 ⁴ yuan	≤ 1
	3.4	Coefficient of elasticity on SO ₂ emission	--	< 0.2
	3.5	Disposal rate of hazard solid waste	%	100
	3.6	Centrally provided treatment rate of domestic wastewater	%	≥ 85
	3.7	Safe treatment rate of domestic rubbish	%	100
	3.8	Waste collection and disposal system	--	available
Administration and management	4.0	Extent of establishment of information platform	--	established
	4.1	Extent of establishment of eco-industrial information platform	%	100
	4.2	Environmental report release per year	issue/year	1
	4.3	Implementation of cleaner production audit in heavy pollution enterprises	%	100
	4.4	Extent of public satisfaction with local environmental quality	%	≥ 90
	4.5	Extent of public awareness degree with eco-industrial development	%	≥ 90

Source: International Institute for Sustainable Development (IISD), Thieriot, H. and Sawyer, D. 2015. *Development of Eco-Efficient Industrial Parks in China: A review*. <https://cleanenergysolutions.org/resources/development-eco-efficient-industrial-parks-china-review>

Additional requirements for the zones to obtain certification under the EIP Demonstration Program comprise reaching a higher GDP growth level than the average provincial and municipal zones, setting up an environment management system in accordance with the ISO 14001 norm, and establishing a local environmental agency. Further, all national and local environmental regulations must be enforced within the park and no pollution accidents should have occurred within the past three years²².

²² International Institute for Sustainable Development (IISD), Thieriot, H. and Sawyer, D. 2015. *Development of Eco-Efficient Industrial Parks in China: A review*. <https://cleanenergysolutions.org/resources/development-eco-efficient-industrial-parks-china-review>

The indicators for the CTIP comprises no benchmarks with threshold values. Instead, participating zones submit their own values in their work plans which serves as basis for the performance reviews.

Indicators for the CTIP program at industrial park level

DIMENSIONS	NO.	INDICATORS	UNIT
Resource output indicators	1.1	Output rate of main mineral resources	
	1.2	Output rate of land	RMB/km ²
	1.3	Output rate of energy	RMB/tce
	1.4	Output rate of water	RMB/m ³
Resource consumption indicators	2.1	Energy consumption per unit of production value	tce/RMB
	2.2	Energy consumption per unit of production in the key industrial sector	tce/RMB
	2.3	Water consumption per unit of production value	m ³ /RMB
	2.4	Water consumption per unit of production in the key industrial sector	m ³ /RMB
Integrated resource utilization	3.1	Utilization rate of industrial solid waste	%
	3.2	Recycling rate of industrial wastewater	%
	3.3*	Disposed natural resources	Ton
Waste generation indicators	4.1	Industrial solid-waste disposed	Ton
	4.2*	Industrial solid-waste handled	Ton
	4.3	Industrial wastewater discharge	Ton
	4.4	SO ₂ emissions	Ton
	4.5	COD emissions	Ton
	4.6*	Ammonia emissions	Ton
	4.7*	Ammonia compounds	Ton
	4.8*	Carbon dioxide emissions per unit of GDP	ton/RMB
Others	5.1*	Association degree of the industrial zone	%
	5.2*	Share of non-fossil fuels in primary energy-consumption	%
	5.3*	Share of renewable energy	%

Source: International Institute for Sustainable Development (IISD), Thieriot, H. and Sawyer, D. 2015. *Development of Eco-Efficient Industrial Parks in China: A review*. <https://cleanenergysolutions.org/resources/development-eco-efficient-industrial-parks-china-review>

To date, no standard for target indicators under the Low-Carbon Industrial Park Program has been published, however, a first version is being drafted by the NDRC and the MIIT.

Proposed Green Industries KPIs ²³

Green Industries			
	Indicator Category	Indicators: indicative values	Current achievements / Time frame for accomplishment
1	Investment in Clean Industries	(¥ bn)	
2	Relevance of Clean Industries	Value of industrial production (¥ bn) Value of commerce (¥ bn)	
3	Share of green industry [1]	≥20% [1]	
4	Rate of reuse of industrial water [2][3]	≥90% [2] ≥80% [3]	
5	Use of non-fossil energy [2] Use of new energy [4]	≥15% [2] ≥3% [4]	
6	Rate of reuse of industrial solid waste [2] [3] [4] Hazardous waste treated [1]	≥90% [2] [3] ≥95% [4] ___ % of hazardous waste treated	
7	Environmental impact of industries	___ (as per Env. Impact Assessment)	

Sources:

[1] MoHURD. 2015 and 2016 versions. *Appraisal Standards for Green Eco-City/District Planning (draft)*. Beijing [Unofficial Translation].

[2] 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

[3] Ministry of Environmental Protection (MEP). 2008. *Indices for Eco-County, Eco-City and Eco-Province*. In: 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](http://www.wds.worldbank.org/.../PDF/590120WP0P114811REPORT0FINAL1EN1WEB.pdf).

See also 2013 version. http://www.mep.gov.cn/gkml/hbb/bwj/201306/t20130603_253114.htm

[4] CSUS. 2015. *Zhuhai Indicator System for Livability*. Beijing. [unpublished report].

The National Development and Reform Commission, working with the State Environmental Protection Administration and National Bureau of Statistics, has published an index system for appraising four aspects of the circular economy: resource productivity or material intensity, waste discharge, the comprehensive utilisation of resources and waste treatment.

The resource productivity or material intensity index refers mainly to GDP produced by per unit of resource; the discharge of waste index reflects waste generation per capita; the comprehensive utilisation of resources index concerns reclamation and utilisation of solid waste, wastewater, urban household garbage; and the waste treatment index mainly describes the treatment rate of solid waste, wastewater and could reflect the finally reduced discharge (disposal) quantity of waste. In future years, these indicators will be studied, improved and linked more closely with circular economy targets to measure more effectively the degree of decoupling economic growth from resource consumption and pollutant discharge and raising the ecological efficiency of economic growth.

²³ 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)

Institutional Responsibility of Green Industry Development

Criteria	Primary responsibility	Secondary responsibility
Land Use Planning: location of industries	MoHURD	MEP
Reduction of impacts on neighbouring land use	MoHURD	MEP
Monitoring of environmental performance	MEP	MoHURD
Infrastructure requirements	MoHURD	MEP
Employment impacts	MoFCOM	

Note: MEP – Ministry of Environmental Protection, MoFCOM – Ministry of Commerce, MoHURD – Ministry of Housing, Urban-Rural Development

Source: EC Link

Indicators. In the concept of green industries lies the goal of decoupling economic growth from that of environmental impacts and material use. While indicators for economic growth are well defined, greener industries, environmental impacts and material use are not. Indicators for achieving greening of the industries or the economy as such are complicated and require data on the environmental impacts as well as the multitude of different materials that are used by industry. This complexity makes it difficult to develop a simple set of indicators as both environmental impact and resource use need to be reduced, and obviously decoupled to that of economic growth. The Ecologic Institute²⁴ has proposed 10 indicators for assessment of green industries:

1. EMC: Environmentally Weighted Material Consumption – based on 32 materials and their respective environmental effects;
2. Energy intensity by sector;
3. Production-based CO₂ productivity;
4. Water consumption by sector;
5. SPI: Sustainable Process Index, a measurement of how much area of the earth's surface a service or product requires. (Due to the complexity of calculation this index is hardly used outside universities and research institutions);
6. Water abstraction rates and water stress;
7. Economic performance of the environmental goods and services sector. This indicator is widely used in the EU and three fundamental indicators are collected by Eurostat: the revenue, value added and exports of defined green goods and services.
8. Resource productivity and material productivity;
9. Total material consumption.²⁵
10. Ecological footprint – the amount of biologically productive land and water area that is required to meet resource consumption needs and absorb the wastes generated by a human population.

The institute recommended on this background the following to form part of the Millennium Development Goals:

- Resource productivity and material productivity;
- Sustainable Process Index (SPI);

²⁴ <http://www.ecologic.eu/7562> (retrieved 30.10.2015)

²⁵ Data at country level is available at www.Materialflows.net and is based on the SERI/WU Global Material Flows Database; The database comprises data for more than 200 countries, and more than 300 different materials aggregated into 12 categories of material flows.

- Sector-specific or resource-specific indicators;
- Energy intensity by sector;
- Water consumption by sector;
- Water Abstraction and Stress
- CO₂ Productivity.

Outlook. Important work is ongoing in greening the industrial sector that will benefit from the involvement of MoHURD, especially with regards to planning for new industrial development and its interaction with traditional urban planning.

Any tightening of environmental regulations should be seen as an opportunity for developing new green industries and technologies. The more firm the commitment is to promoting tighter environmental regulation the less the risk will be involved or companies of taking up the challenge to develop or adopt new technologies and practices. Promoting circular economy requires many stakeholders to work together – industry, authorities, utilities and consumers. MoHURD is in a good position to take the lead on CE issues in e.g. the construction sector and handling of construction waste.

The transformation of China’s energy system will have global impact. Today, greenhouse gas emissions represent more than 30% of global emissions and reduction of these emissions will consequently significantly reduce the global carbon footprint and reduce the impacts of global warming. The large transformation to renewable energy technologies in China will also have significantly impact of the future development of these technologies, increasing the efficiency and lowering the cost of energy. This will further stimulate the global demand for renewable energy and the demand for green jobs.¹⁹ MoHURD and CNREC share a common interest in developing renewable energy solutions for the housing industry. Public innovative procurement could be one way to work together.

Verification methodology. The above parameters and values will be used for verification of the adoption of green industry practices.

Expected impact. The application of the green industry approaches and technologies are expected to achieve a substantially higher, measurable impacts on energy-efficiency in the industrial. It will trigger increased investment, reduce energy consumption and CO₂ emissions, and augment the number of jobs in the sector.

Responsibilities for Implementation. The responsibility for use and application of this Eco-City Implementation Guideline rests with the city administrations, provincial agencies, and the local MoHURD offices. MoHURD and CSUS will provide technical support and specific guidance where required. In its intention to pursue consistency of eco-city development, MoHURD is committed to verify the achievement of targets and to ensure improved performance on an annual basis.

Monitoring and review. MoHURD will monitor and review periodically (i.e. annually) the results of the application of this Eco-City Implementation Guideline. For monitoring and periodic review it will utilize indicators as provided above. The city administrations (and district administrations), supported by the local MoHURD offices, will make regular use of these indicators as a means to measure performance.

Date issued: 201

ANNEXES

Annex 1 – Technical Annex

(still to be added, once work in EC-Link cities completed)

Annex 2

MoHURD. 2015. *Appraisal Standards for Green Eco Districts. Beijing. (draft).*

Excerpt

Industry & Economy	Controlled Criteria	Compile the specific plan for industry development, clarify the low carbon development goals, determine the development direction & industry structure, develop industry permission & elimination measures.			
		Control the category of industry and the land use scale, strict control on the permission of 3 categories of industrial enterprises.			
		Job-resident ratio is controlled between 0.8 and 1.2 for the district larger than 10 km ² .			
	Priority Criteria	Resource Utilization Efficiency	1. The energy consumption per unit GDP is lower than the local appraising target, keeps reduced in comparison with basis year	>0.3% / reduction rate <0.5%	10
				>0.5% / reduction rate <0.8%	15
				>0.8%	20
			2. The water consumption per unit GDP is lower than the local appraising target, keeps reduced in comparison with basis year	>0.3% / reduction rate <0.5%	10
				>0.5% / reduction rate <0.8%	15
				>0.8%	20
		Optimization of Industrial Structure	3. Proportion of the added value of 3 rd industry(a), of new technology industry (b), and of strategic new industry (c).	a>55%, or b>20%, or c>8%	10
				a>60%, or b>30%, or c>11%	15
				a>65%, or b>35%, or c>15%	20
			4. Set up production chain of green circular economy	The complete mid/long term industry chain of green circular economy is set up, and it suits the local characteristics and feasible	4
				Industries are correlated, or the byproducts are exchanged and utilized	3
		Relatively complete green industry & circular economy system is established		3	
		Industry Permission & Elimination	5. 100% of industry waste gas & water meets the standard, hazardous solid waste is 100% harmless treated.		10
				6. The investment density of industry land is higher than <controlling indicators of construction land for industrial projects>	10% higher
15% higher	7				
20% higher	10				

			7. For newly constructed, modified, and enlarged projects, the appraising on energy saving, water saving and carbon emission is carried out; for key projects, the energy consumption, water consumption and carbon emission reach the lower limit of national or sector quota.	10
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