

# Background, Pattern and Policy of China for Developing Circular Economy

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**Abstract:** Circular economy has become one of China's important strategies to realize scientific development and build ecological civilization at present. As in China circular economy was put forward as a new economic pattern, the international community generally holds that this is an innovative move for China's economy to realize leap-forward development and hopes to learn more about the theory, policy and practice relating to China's circular economy. This article introduces and comments on the necessity to develop circular economy in China, implications and characteristics of China's circular economy, and China's main practices and policies to promote it at present.

**Key words:** circular economy, China, Pattern C

## 1 Why does China need to develop circular economy vigorously?

The period from 2000 to 2020 is a development stage in which China will strive to build an overall well-off society and realize modernization first in the developed eastern region. China's economic growth goal by 2020 is to quadruple per-capita GDP over 2000, achieving US \$3000, four times more than that in 2000. According to China's 9–10% economic growth rate over many years, such a goal is attainable. The problem now is that China's economic growth over the past 30 years was achieved at the cost of consuming large quantities of resources and discharging large amounts of pollutants. For example, data show that China's total GDP accounted for about 5.5% of the world's total in 2006, but standard coal, steel and cement that China consumed for this accounted for 15, 30 and 54% of the world's totals, respectively. If this trend continues in China's future economic growth, the prospect would be 'worsening' instead of getting better.

Hence the solution to this problem is to decouple the economic growth from resource consumption and environ-

mental pollution. Circular economy was proposed against this situation and regarded as an important approach for China to change its development pattern and realize 'decoupling' development in the future (Zhu, 1998; Zhu, 2000). I think China's environment and development by 2020 can be roughly divided into the following three patterns, with Pattern C being what China needs to strive to realize by developing circular economy and suitable for China's current development level (Zhu, 2007).

### 1.1 Pattern A

Pattern A is the strong materialized pattern of high resource consumption and high environmental pollution. The so-called Pattern A adopts the view of American scholar Lester R. Brown in his book *Plan B: Rescuing a Planet under Stress and a Civilization in Trouble* (Brown, 2003). The strong materialized pattern is expressed as simultaneous development of economy and environmental pressure. While GDP grows, environmental pressure also grows, which is the traditional economic growth pattern. China's economic development basically followed Pattern A in the past. For example, it is said when China's per capita GDP was US \$400–1000 (i.e. in the light industry stage), its pollutant discharge level was already equal to that reached by developed countries when their per capita GDP was US \$3000–10 000 (in the high processing industry stage). It is to break away from such a resource-consuming and environment-destroying development road that we pay attention to circular economy today. When participating in researches for the state's medium and long-term sci-tech strategic plans, the author estimated with relevant experts: if China continues the current resource-utilizing method and pollutant-producing level, the influence of the economic and social development on environment will probably be four to five times of that at present in the future when population continues to grow and economy quadruples by 2020. Apparently, this



pattern not only means serious social instability and serious resource and environment problems, but economic development itself will also not be sustainable.

### 1.2 Pattern B

Pattern B is the dematerialized pattern which requires absolute decoupling of economy from environment. Pattern B is opposite to Pattern A and Lester R. Brown advocates it in his book as the future development pattern. Its target is that environmental pressure does not grow or even grow negatively when economy continues to grow positively, i.e. realizing absolute decoupling of the two. In the long run, such a target is a must for both developed countries and developing countries and it is the highest connotation of ecological modernization or sustainable development. However, can this development target be used right away in China's development in the next 15 years? The author's answer is negative. The author also estimated roughly that resource productivity must be increased by four or five times if environmental pressure is not to be increased apparently when China's economy grows by four times by 2020 and resource productivity must be increased by eight to ten times if environmental pressure is to be alleviated apparently (by half). This target is certainly encouraging, but, judging from China's current technical ability and management level, it is very difficult to realize this high dematerialized pattern. If we have to do it, it means that China's economic target must be adjusted. Obviously this will affect Chinese people's living standard and quality from the other aspect.

### 1.3 Pattern C

Pattern C is the pattern for increasing resource productivity which is fit for China's current stage. China cannot continue to follow traditional Pattern A, because of the shortage of natural resources and restriction of environmental pressure; restricted by its current development stage, it cannot adopt Pattern B for the high development stage immediately either. Hence the author proposes a development pattern fit for China's development stage in the next 15 years, which is shortened to Pattern C (China). In Pattern C, China's economy will keep growing according to the established targets and growth of resource consumption and pollutant production will be stabilized after being decelerated. Such development should be acceptable for both China and

the world. For one thing, it accords with the requirements of sustainability; for another, it accords with the requirements of ecological equity because it creates safer living environment for the world while providing reasonable room for 1.3–1.5 billion Chinese people to improve life. China will probably implement a more than four times greener development strategy after 2020, i.e. the total economic quantity will continue to double but resource consumption and pollutant production will be halved to realize the above-mentioned decoupling of China's economic development from environmental pressure. However, as Shanghai, Beijing, Guangdong and other developed coastal areas in the southeast lead other areas in development levels in China, a much dematerialized strategy should be implemented for them firstly so that modernization with a win-win meaning in both economy and environment can be basically realized by 2020.

## 2 Connotations and main characteristics of China's circular economy

Although the proposal of the idea of circular economy in China (Zhu, 1998) was inspired in time by the Recycling Economic Law on Waste promulgated by Germany in 1996 (Japan proposed the idea of the recycling society in 2000 after China proposed the idea of circular economy), the contents of China's idea of circular economy include many theoretical study achievements made in the world in the fields of ecological economics and industrial ecology, etc. (Daly, 2001; Tao, 2003), since the 1990s. Therefore China's idea of circular economy has its own characteristics. The author believes at least the following characteristics are worth emphasizing. First, China's circular economy is an idea about the economic pattern in respect of nature rather than an idea about environmental management in some other countries, because China hopes to reduce resource consumption and pollutant production at sources and in the whole process by changing the economic pattern. It also hopes to achieve win-win in both economy and environment by circular economy instead of 'economy without recycle' or 'recycle without economy'; therefore the department proposed for planning circular economy as a whole in China is the State Development and Reform Commission which has a comprehensive nature instead of environmental management departments in some other countries. Second, China's circular

economy not only aims at garbage economy or 3R economy for treating solid waste in respect of objects but at all scarce resources involved in China's economic development, including water, land, energy, materials and corresponding waste; to a certain extent, it is of more urgent significance for China to develop circular economy which deals with consumption of water, land, energy and other resources and control of related pollutants. Third, China's circular economy comprises different space levels in respect of scale and includes circular economy of individual enterprises, industrial parks and regions, etc. Fourth, China's circular economy stresses progressively increased practice forms on the following three levels in respect of pattern and emphasizes the need to develop from low-level recycle of waste based on ecological efficiency (to reduce consumption and pollution) to high-level recycle of products and services based on ecological effects (to prevent consumption and pollution).

### 2.1 Recycle of waste

It mainly refers to reclamation of waste from production and consumption by technical and management means and is the concrete embodiment of the principle of recycle of resources in the 3R principle in circular economy and also an important content of circular economy in Germany and Japan. This practice reduces effectively the final quantity of waste to be treated and is a remarkable progress in comparison to the traditional treatment at terminals. Recycle of waste is applicable to three scales, i.e. enterprises, parks and regions. Specifically, a closed-loop production process should be built in individual enterprises to reduce production and discharge of waste in individual enterprises as much as possible. Next, different factories should be linked to form industrial symbiotic combinations to share resources and exchange by-products by building Eco-industrial Parks so that the principle of circular economy can be implemented in a larger scope. Finally, the centralized resource-recycling industry should be established in the treatment link in cities and regions as by turning traditional landfill sites into composite waste-recycling parks with the vein industry as the main content.

### 2.2 Reuse of products

It mainly refers to using products for as many times and in as many ways as possible instead of using them once in

the past so as to extend their useful life. As shown in the following map, products are put into maintenance centers or reclamation centers after use, but products do not need to be put into the reclamation centers if they can be reused after simple maintenance. Only if products are damaged seriously and cannot be restored and reused after simple maintenance they will be put into the reclamation centers and then returned to product manufacturers, parts manufacturers or raw material suppliers for corresponding resource recycle according to their damages. The ultimate aim of recycle of products is to realize minimum discharge of waste or even zero discharge of waste (so-called zero waste) filled in land in the end.

### 2.3 Cycle of services

It mainly refers to enterprises dealing in and managing products manufactured by them as assets, promoting the concept of developing from 'selling products to providing services' and realizing recycle of assets by establishing a product service system (shortened to PPS). Its basic premise is 'the value of products lies in the benefit and utility they bring for consumers', i.e. the real value of products should be their 'utilization value' instead of their 'exchange value'.

This is in fact the difference between the emphases of

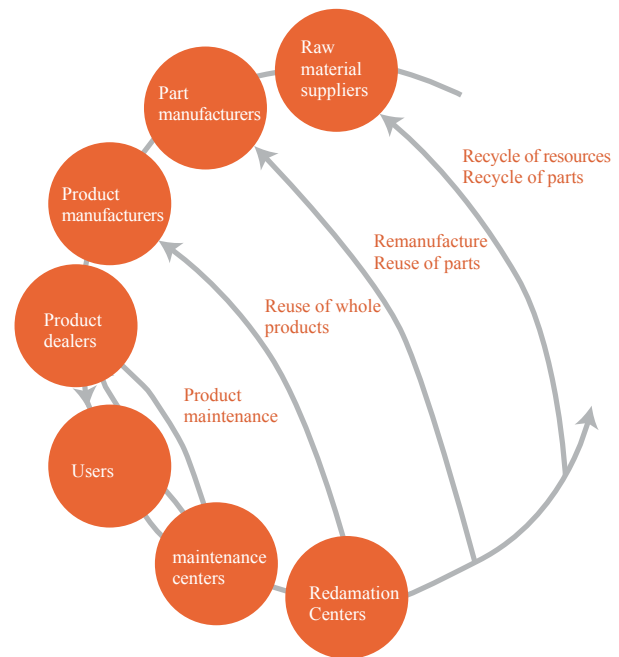


Fig. 1 China's circular economy stresses multi-cycles of materials

linear economy and circular economy. Exchange value is the central concept in linear economy while use value is the central concept in circular economy. There may be three kinds of economic types from products to service: pure products, product services and pure services. Reasonable combination of products and services constitutes the so-called product-service system and profits of enterprises, satisfaction of consumers' needs and lower social influence on environment can be realized by it. For example, consumers are no longer inclined to have their own washing machines or cars through recycle of assets but are inclined to use washhouses on streets and means of public transport.

### 3 China's systems and policies to develop circular economy

The development of China's circular economy has mainly undergone three stages since 1998. The first stage is the period from 1998 to 2000 in which relatively academic concept was introduced and theoretical studies were conducted. Researchers and scholars in institutions of higher learning and scientific research institutions played the role of ideological enlighteners in this stage. The second stage is the period from 2001 to 2005 in which clean production in enterprises and Eco-industrial Parks were emphasized in experimenting on circular economy. The national environmental protection department played an important role in this stage (Xie, 2005). Circular economy was advocated as a national strategy in 2006 and China entered the stage of promoting the development of circular economy systematically at all levels (Li and Qi, 2004; Wang, 2004; Wu, 2005). Apart from theoretical studies and practical promotion, the Chinese government mainly took systematic actions in the following four aspects in this stage:

#### 3.1 Drafting an economic law on China's circular economy

Under the support of the NPC of China and the State Development and Reform Commission, China is busy designing an economic law on circular economy and the relevant draft may be passed officially at the NPC meeting in February 2008. The draft of the economic law on China's circular economy emphasizes: first, China should stick to the prin-

ciple of giving priority to quantity reduction in developing circular economy. Particular attention should be paid to quantity reduction because China is in the high-speed development stage of industrialization, energy and material is consumed too much, waste of resources is serious and the potential for quantity reduction at front ends are great; second, key points should be highlighted and special efforts should be made to put an end to high energy consumption, heavy pollution and problems that affect the development of China's circular economy and hard restrictions should be available to control high consumption and high discharge; third, the roles of the government, enterprises, public and industrial associations should be highlighted in major economic processes, i.e. all links in production and consumption, so as to constitute synergy for pushing forward the development of circular economy; fourth, basic systems favorable for development of circular economy should be established, including the system for planning circular economy at the national, provincial, municipal and county levels, the systems for controlling the total quantities of resource consumption and pollutant discharge, the system for extending mainly manufacturers' product responsibilities and the appraising and examination system based on indexes of resource input, recycle and pollutant discharge. Although the drafting of the law on circular economy should solve the outstanding problems in development of China's circular economy at present, the author thinks the nature of the law on circular economy as a general guideline and its strategic significance should be made clear in explaining the connotations and characteristics of China's circular economy. It should also be stressed in particular that this law is an economic law instead of an environmental law, and its objects are mainly scarce resources and pollutants, it covers all stages from exploitation, production, consumption to treatment of waste and its forms include recycle of waste, recycle of products and recycle of services.

#### 3.2 Setting goals for development of circular economy

China's Eleventh Five Year National Economic and Social Development Plan passed in 2006 set national goals with binding significance for development of China's circular economy in the next five years in light of China's main problems in resource consumption and pollutant discharge at that time. It requires energy consumption per unit GDP

to be lowered by 20%, the total discharge quantity of such main pollutants as chemical oxygen content and sulfur dioxide to be lowered by 10% and the total area of farmland not to be less than 1.8 billion mu (1 hectare is 15 mu). The so-called restrictive indexes are what the government must realize and fulfill and they have legal force and should be put into the system of all regions and departments for appraising economic and social development comprehensively and examining performance. This shows that the government has regarded realization of circular economy as a public affair which it must do. However, looking from a more systematic angle, I think it's not enough to just list a few control indexes in the comprehensive economic and social development plan to develop circular economy. China needs to make a more detailed and more scientific plan for circular economy and dematerialization in line with economic growth. Its contents should include indexes for controlling the total consumption of water, land, energy and materials, as well as the total discharge of main pollutants so as to adjust the economic growth speed and scale in the future and realize transition from the development pattern of economic growth advancing the scale of resource consumption to the development pattern of the scale of resource consumption controlling economic growth.

### 3.3 Making experiments on circular economy

China adopts the method of experimenting in experimental units and expanding gradually in development of circular economy and expects to form circular economy of a certain scale by 2010. Hence the State Development and Reform Commission started to experiment on circular economy in the first group of experimental units in 2006 and these units are divided into four categories. The first is represented by enterprises in high-consumption and high-discharge key industries; the second by Eco-industrial Parks; the third by waste-recycling enterprises or the vein industry; the fourth by cities and regions with comprehensive nature, which include some resource-dependent cities in the central and western regions and super-large cities with scarce resources. In the author's opinion, the focus of these experiments is still mainly low-level recycle of waste with recycle of resources in waste as the main contents and it is necessary to further study and develop high-level recycle of products and services with more quantity reduction

nature because this is the fundamental reason for China to develop circular economy. To our pleasure, the Comprehensive Work Plan for Energy Saving and Reduction of Discharge worked out by the State Development and Reform Commission together with other relevant departments has mentioned that China will experiment on circular economy in the second group of experimental units and recycle of waste and old household electric appliances and remanufacture of auto parts and machinery will be included so as to further develop the practice of circular economy.

### 3.4 Making appraising indexes for circular economy

The State Development and Reform Commission, State Environmental Protection Administration and National Bureau of Statistics have compiled and published an index system for appraising circular economy in four aspects, i.e. output of resources, consumption of resources, comprehensive utilization of resources and discharge of waste. Therein the resource output index mainly refers to GDP produced by consumption of unrenovable resources (including coal, oil, iron ore, non-ferrous metal ore, rare earth ore, phosphorus ore, sulphur ore, limestone and gravel, etc.); the resource consumption index mainly describes resources consumed by creating per unit products or per unit GDP and it reflects reduction of resource consumption, i.e. 'quantity reduction', at sources; the comprehensive utilization of resources index mainly reflects reclamation and utilization of solid waste, wastewater, urban household garbage and traditional waste and old materials and embodies the effect of recycling waste; the waste discharge (disposal) index mainly describes the final discharge (disposal) quantity of solid waste, wastewater, SO<sub>2</sub> and COD and reflects the finally reduced discharge (disposal) quantity of waste through development of circular economy. The author thinks study and implementation of statistic indexes should be linked more closely with the targets of circular economy as the fundamental aim of developing circular economy is to realize dematerialized economic development, i.e. reduced resource consumption and pollutant discharge, and raise the ecological efficiency of economic growth.

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