

# CLEANER PRODUCTION AND CIRCULAR ECONOMY----- NEW STRATEGY FOR ENVIRONMENT AND DEVELOPMENT IN CHINA

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## Abstract

*Rapid economic development and population growth have caused serious environmental problems, which affect human's health and become limiting factor for the further development. It is thought that the traditional ways of economy development and environmental protection are not proper, so that the change of the modes of development and environment protection is of significance. This paper will introduce the concepts of cleaner production and circular economy and experiences obtained in China and abroad to prove that they are the new strategies for environment and development.*

Rapid economy development and population growth in 20th century have caused serious environmental problems which affect peoples health badly and become limiting factor for further development. Environmental protection has attracted people's concern since 50's of last century. However, end of pipe treatment has been the major strategy for minimizing pollution for quite long period of time. Experiences and lessons from the practices around the world have proven that it is not a cost-effective way or even make conflict between development and environment severer through the higher consumption of resources and large amount of capital and operation costs needed by the end of pipe treatment. Cleaner production has been developing since 70's of 20th century rapidly and it has obtained both environmental and economical benefits in different countries. Circular economy is a rather new concept with other names of recycling economy, recycling oriented society or life cycle economy, which are developed since 90's of 20th century. Both of these two strategies have similar targets of minimizing resources consumption and pollution production aimed to sustainable development but in different scopes.

## Cleaner Production

The launch of the Pollution Prevention Pays program by 3M in 1974 is generally regarded as the first landmark on the road towards Cleaner Production. The 3P program was unique in its recognition of the importance of process and product innovation for achieving the dual objectives of enhancing competitiveness and reducing environmental impacts.

The initial concepts of cleaner production were assembled during the mid-1980s, but the establishment of the Cleaner Production Program at the United Nations Environment Program in 1989 provides a commonly recognized historical mark for the formal launch of the concept.

UNEP has been successful in proposing Cleaner Production as an overarching concept, and in building consensus on its operational definition. UNEP definition on Cleaner Production is as following: **Cleaner production is the continues application of an integrated preventive strategy applied to products, production and service for enhancing effectiveness which reduces risks to human and environment and increases economic benefits.** For production processes, Cleaner Production involves conserving raw materials and energy and eliminating toxic raw materials, reducing the quantity and toxicity of all emissions and wastes before they leave the process. For products, Cleaner Production involves reducing negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal. For services, Cleaner Production involves incorporating

environmental concerns into designing and delivering services. Cleaner Production requires changing attitudes, applying know how and improving technology.

Over the last fifteen years, a great variety of programs has been launched to facilitate the uptake of Cleaner Production in industry. Many programs had, and continue to have, a strong technical assistance component, that assist businesses with the identification, evaluation and implementation of Cleaner Production options appropriate for their operations (through on site auditing, training, information clearinghouses, etc.). Moreover, enabling policy frameworks have been set up, for instance on the basis of mandatory planning, voluntary agreements, industry environmental management codes, financial incentives, etc. In addition, cleaner production initiatives have supported or spawned a collection of new tools including facility assessments, full cost accounting, technology assessments, eco-balances and life cycle assessments. There are international conferences, national roundtables, and an international declaration on cleaner production.

An initial classification of Cleaner Production programs on two dimensions might be considered. These dimensions are:

\* *Degree of innovation*: whether or not the Cleaner Production program contains innovative elements, in terms of technologies being assessed and pilot tested, or in terms of establishing new partnerships between stakeholders, or using novel assessment methodologies and policy instruments.

\**Involvement of different policy domains*: whether the Cleaner Production program is designed and managed strictly within the environmental policy domain, or with equal involvement from other policy domains, such as business development, technology and innovation, trade and investment, etc...

If both dimensions are divided in two categories, a typology with four different Cleaner Production programs emerges, respectively: regulation (type I), marketing (type II), experimentation (type III) and integration (type IV). This is graphically depicted in figure 1.

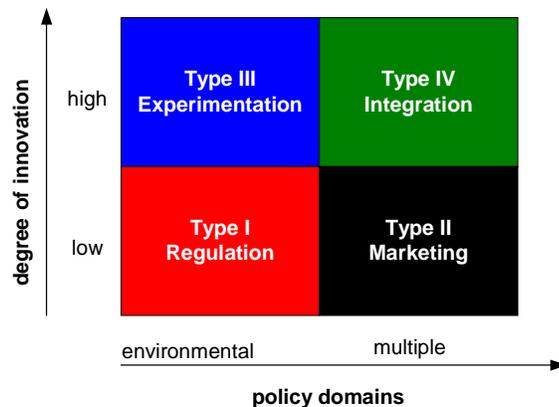


Figure 1: Typology for Cleaner Production Programs

Many good examples from different countries can be listed and it is for sure that the implementation of cleaner production has led to a new industrial revolution which is the only way for realizing sustainable development. Take China as an example, the new strategy of implementing cleaner production were proposed and endorsed by the Chinese Government at the Second National Conference on Industrial Pollution Prevention and Control in 1993. Promotion of cleaner production was listed as one of the nine top priorities in China's Agenda 21 issued in the same year. A series of efforts have been made since then for implementing cleaner production in China:

- (1) To encourage cleaner production implementation in laws and regulations related to environmental protection while they are modified. There are articles to encourage cleaner production

implementation added to the modified “Law of Air Pollution Prevention and Control for PRC” in 1995, to the modified “Law of Solid Waste Pollution Prevention and Control for PRC” in 1995, to the modified “Law on Water Pollution Prevention and Control for PRC” in 1996. A new law named: Law of Promoting Cleaner Production of PRC was issued in 2002 and put into effect in Jan 1, 2003.

- (2) To set up cleaner production centers at national and provincial levels and industrial sectors for providing technical support to the cleaner production implementation programme.
- (3) To carry out training and education program for capacity building on cleaner production implementation.
- (4) To conduct cleaner production implementation projects in China with the help of UNEP, the World Bank, UNIDO, UNDP, and other foreign countries, including Canada, USA, Norway, Australia, UK, European Union, etc. The major contents of these projects include:
  - ◆ Development of the Chinese cleaner production audit manual for enterprises;
  - ◆ Raising awareness on cleaner production;
  - ◆ Training of cleaner production auditors;
  - ◆ Execution of cleaner production audits in demonstration plants and implementation of cleaner production options requiring low cost or no cost;
  - ◆ Policy study and recommendation.

It is shown by the experiences of the enterprises who adopt cleaner production concept that the implementation of cleaner production can yield both environmental and economic benefits. Most of the enterprises can get the investment back with 2-3 years from the reduction of cost and reduce the pollutant discharge with much lower cost than end of pipe treatment.

## **Circular Economy**

The circular economy concept, and many similar theories practiced in different countries are evolved from decades of worldwide efforts in searching for economic development that is in harmonization with our natural environment.

### **1) Circular economy is a revolution on linear economy**

From the angle of material flow patterns, traditional industrial economy is a one-way linear economy consisted of “resource – production – consumption - disposal”. In this kind of open-loop linear economy, people extensively drain all kinds of materials and energy from the planet, then release them as pollutions and wastes to air, water and soil, treating the earth as “sewer” or “garbage can”. Economic activities are characterized by “high exploitation, low utilization, and severe pollution”. Circular Economy, which is different, promotes an economy development pattern harmonious with the earth. The main purpose of it is to organize the economic activities to a close-loop process of “resource-production-consumption-regenerated resource”. All materials and energy can be used rationally and continuously in sustained economy cycles, hence the harmful effect to natural environment can be reduced to a possibly minimized level.

### **2) “3R” is the working principles of circular economy**

The principles of circular economy are “reduce, reuse and recycle” (also called “3R” principles). Every principle is vital for the successful implementation of circular economy.

(1) Reduction is method concerning input, aiming at reducing the input material flows and energy flows into the production and consumption process, so it can also be called material reduction. In another word, we should learn more about how to produce the essential products with as little resource as possible. We should learn to prevent the waste from generation instead of dispose of them after production.

(2) Reuse is a method concerning processing. We should try to use natural resources and products in every possible ways. By reusing them, we can prevent them from becoming wastes, thus prolong the life span of products and services.

(3) Recycle is a method concerning output. By turning wastes to secondary resources, it reduces the wastes for final disposal in volume and decreases the consumption of natural resources. Producers should try to use secondary resources to displace natural resources. Consumers should buy the products containing the maximum raw materials made by secondary resources. These will help to close the economy loop.

The priorities of these 3R principles are not equal. Some may simply regard circular economy as the recycle of wastes. Actually, the fundamental goal of circular economy is to systematically prevent and reduce the wastes in economy process. Thus, according to the CCICED Task Force on Circular Economic and Cleaner Production, cleaner production is the cornerstone of circular economy.

### **3) Circular economy is the economic pattern for sustainable development**

When judging the rationality of economic development in 21th century, we should consider all the three dimensions of sustainable development, i.e. the integration of economic, social and environmental dimensions. According to the need of sustainable development pattern, first, we should try to make more values in economy aspects. It is the matter of effective distribution of resource, which can be regulated by price. Second, we should try to reduce bad influences in environment aspects. It concerns the maintenance of a healthy eco-system, of which the prevention of ecologic degeneration can be the major policy goal. Third, we should try to solve the problem of employment in social aspects. It is regarded as the problem of a fair distribution of social wealth, of which tax can be the major policy tools.

Traditionally, economic growth and environment protection are the two sides of a coin in the traditional industrialization pattern. They are separated instead of integrated in solving economic, social and environmental problems. Traditional economy solely pursues GDP growth. On one hand, it makes growth at the cost of natural capital consumption, thus lead to the antagonism between economy and environment; on the other hand, it reduces employment positions by increasing the level of automation, thus lead to the conflict between economy and society. Traditional environmental

protection strategy lays great emphasis on terminal recovery, thus triggers violent contradiction between pollution recovery, economic growth, and social employment. For example, the “close, stop, merge, shift” policy towards pollution companies to solve environmental problems has brought with the problem of unemployment, and effected people’s livelihood and social stability.

Instead, circular economy is a “triple-win” economy; it combines economic growth, environmental protection and social employment all together, leading the three-dimensional separated development to an integrated one. In every aspect of development, circular economy means a revolutionary change. In the aspect of promoting economic growth, it brought the revolution from material growth in volume to service growth in quality. In the aspect of solving environmental problems, it brought the revolution from open-loop terminal recovery to close-loop process control. In the aspect of promoting social employment, it brought the revolution from employment-downwards society to employment-upwards society.

We have long follow the linear growth pattern of the three-dimensional separated traditional linear economic growth. As the result, economic growth accelerated at the cost of ecological deterioration. So we must find a new economic pattern for China’s future development, i.e. the organic integration of economic growth, environment and resource protection, and social employment achieved by circular economy.

Some municipalities and provinces in China have lunched programs of promoting circular economy at different levels. To promote cleaner production is the lowest level inside enterprises for circular economy development. Ecological industrial park has been developing rapidly in China which links several enterprises for obtaining higher utilization efficiency of materials and energy. There are several ecological industrial parks with different characteristics planned and operated, which have shown great potential in reducing material consumption and pollution emission. To set up master plan and carry out all kinds of activities for circular economy at municipality or provincial level have been taken in Liao Ning Province, Jiangsu Province and GuiYang city and Shanghai Municipality. Industrial, agricultural and social aspects are included. Wastewater treatment and reuse, solid waste composting and reuse, industrial waste exchange and reuse are encouraged and well organized. Economy structure adjustment is also taken high importance in the master plan of circular economy development. It is expected that a Law for promoting circular economy will be drafted and issued in near future.

Circular economy is a new mode of economy development which not only concerns the change of production pattern but also the change of consumption pattern. For using limited natural resources to support mankind, people should realized it is the responsibility of the present generation to save

natural resources as much as possible for the benefit of future generation. Conservation of water, energy and mineral resources should be important part of the ethics of people in the world. People at different posts including government officers, enterprises managers, scientist or engineers, workers and peasants etc., should take responsibility at their own positions.

At the beginning of a new century, mankind has already found a new strategy for developing economy while protecting environment. The urgent need is implementation, which needs the coordination of different institutes and the combination of different measures, educational, legistical, instructional, financial, technological etc. The long march of thousands kilometer starts from the first step. We'd better to start the first step as soon as possible.

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