China Eco-Industries Park and Circular Economy
from Theory to Practice

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Abstract: As a kind of mode and stage, Eco-Industrial Parks (EIPs) is of great importance in developing circular economy. Therefore, inquiring deeply into the theory of EIPs and devoting great efforts into its practice constitute primary projects of developing circular economy. This paper analyzes the interrelationship between circular economy and eco-industry, i.e. the intrinsic quality of circular economy is eco-economy; expounds the connotations and functions of EIPs, as well as states the operational patterns and corresponding construction mechanism of EIPs.

Key Words: Circular Economy, Eco-Industrial Parks (EIPs), Eco-Economy, Operational Mechanism

1 Introduction

The development of eco-industrial parks has gone through decades of history and China has already paid increasing attention on it, though in China, eco-industrial parks are merely in their initial stage. Eco-industrial parks have displayed unparalleled advantages compared with traditional productive modes in aspects of improving economic efficiency of enterprises, reducing consumptions of natural resources as well as protecting the environment. As an important mode and stage, the development of eco-industrial parks is of great importance in promoting circular economy. Inquiring deeply into the theory of eco-industrial parks and making tremendous efforts in putting it into practice constitute significant tasks of developing circular economy.

2 Interrelationship between Circular Economy and Eco-Industry

2.1 The intrinsic quality of circular economy is eco-economy.

The term “Circular Economy” is in fact the abbreviation of “Closing Materials Cycle Economy” and in essence a kind of eco-economy that applies laws of ecology into economic activities of human society, and a brand-new economic developing mode on the foundation of materials recycle and reuse, which highly advocates a harmony between industry and environment, which calls for a feedback productive process — “Resources → Products → Regenerative Resources”. All the raw materials and energy can get full performance in these successive economic circulations in which there is only misused resource but no real waste. Therefore, the negative effects of economic activities to the natural environment can be reduced to a possible minimum and finally realize a virtuous circle between human beings and ecological system.

The theme of developing circular economy is “Eco-Industrial Chains”.

“Circular Economy” based on industry is pertinent to every trade of national economy and every facet of society, whose construction is supposed to be a magnificent and systematic project with industrial ecological chains as one of the theme[1]. The connotation of eco-industry is to establish an integral ecological mentality on the standpoint of information, following the fundamentals of “Integral Ecological Information Chains”, and to integrate systematically three hierarchies of industry, i.e. enterprise hierarchy of “minimizing waste discharge”, regional industrial ecological system hierarchy of “waste interchange among enterprises”, and material and energy circulations during the process of consumption and after consumption. In these three hierarchies, eco-industry has become an important mode in practicing circular economy, providing a solid foundation for developing circular economy. In return, the development of circular economy can directly determine the pace of constructing circular
economy. In a word, eco-industry is not only organized and developed in accordance with the fundamentals of circular economy, on the basis of pressure-bearing capability of eco-system, but also a high-efficient economic process with ecological network as well as an evolvable industrial organizational mode.

The carrier of developing circular economy is eco-industrial parks.

In traditional industrial system, to a larger degree, it is the isolation of enterprises when conducting production that results in serious pollution and over-consumption of resources. The development of eco-industrial parks is compatible with the mode of natural eco-system, stressing on realizing closing materials circulation within industrial system by adopting a very important method, i.e. establishing a horizontal coexistence among different industrial processes and trades. Through horizontal integration and resources sharing among diversified industrial processes, waste can be “disintegrated” by those in the “downstream”. Therefore, “food chain” and “food network” are formed, with the purpose to transform pollution into resources, negative effects into positive effects.

3 Connotations and Functions of Eco-Industrial Parks

3.1 Connotations of Eco-Industrial Parks

As a kind of brand-new industrial parks, Eco-Industrial Parks (or Eco-Industrial Symbiosis, Eco-Industrial System, Eco-Industrial Network and so on) have stricken worldwide attention. Ernest Lowe, John Warren and some people[2] perceive that “Eco-Industrial Parks form gigantic and complicated communities composed of enterprises in manufacturing and service industries, aiming at achieving the reciprocal optimization and coordinated development of eco-environment and economy through corporation of environment including basic elements like energy, water and materials, as well as resources, and finally at winning an overall result much more profitable than the sum of that of each individual enterprise earned by self-optimization. Simply set, the objects of Eco-Industrial Parks are to ameliorate economic performance of enterprises participated and meanwhile to decrease their negative effects on outer environment.” Therefore, this paper states that: As sites of gathering eco-industries, Eco-Industrial Parks are not only a kind of geographical syntheses combining nature, industry and society, but also a brand-new industrial organizational mode[3] designed under the guidance of circular-economy theories and eco-industrial fundamentals, whose goals are to realize coordinated development between economic gains and environmental benefits through exchange of byproducts and waste among member enterprises, through hierarchical utilization of energy and waste water and through infrastructure sharing. These descriptions above testify that circular-economy theories and eco-industrial fundamentals lay a primary theoretical foundation for constructing eco-industrial parks that are both important forms of eco-industry and advanced forms of industrial parks.[4]

3.2 Functions of Eco-Industrial Parks

The functions of eco-industrial parks are mainly manifested in the following aspects:

3.2.1 Function 1: Competition

One of the prerequisites of constructing eco-industrial parks is to realize to a largest degree the “decrease of resource consumption, resource reuse and resource retransformation”, which requires large enterprises to possess satellite enterprises with relevant waste disposal capability and byproducts. Since enterprises gathering in the eco-industrial parks compete with each other through corporations, the overall effects are not simple sum of that of each member, but more abundant in connotations, more beneficial in results and more perfect in operations[5]. Therefore, how to correctly deal with the interdependent relationship among all major enterprises within eco-industrial parks, between the whole and the part, as well as between market and competition, constitute significant subjects for constructing eco-industrial parks and for developing eco-industrial system.

3.2.2 Function 2: Integration

Rather than focusing on a backbone industry or several relevant industrial enterprises, eco-industrial parks are classified into several enterprise communities in terms of regional industry,
economic and natural features, so as to not only highlight the theme of development, realize integrations of technological methods and institutional regulations, but also complete waste reuse channels, upgrade “vein” industries, and establish information and technique service forum and all-inclusive management. Therefore, eco-industrial parks display the features and functions as material integration, water integration, energy integration, technology integration, community cooperation and information-resource sharing.

3.2.3 Function 3: Service

Member enterprises in eco-industrial parks can enjoy diversified services: First, obtaining environment and enterprise-marketing information, information that is creative, transcending the boundary of traditional business stereotypes, such as environmental activities, social responsibilities, marketing targets and departments, labor forces and features of labor unions, as well as changes of market demands in other areas; second, getting business opportunities; third, getting financing opportunities; fourth, enjoying world wide website and geographical information system; fifth, obtaining public training and research fruits; sixth, enjoying commercial on-line resources.

3.2.4 Function 4: Model-Setting

In order to achieve sustainable development of resources, energy and environment, coordinated development of human productive activities and wild nature, and to further push adjustment of industrial structure, optimization and reorganization of enterprise assets, to drive regional economic growth and to protect eco-environment, the construction of eco-industrial parks fully display the mentality of coordinated development of economy and environment, as well as that environment can promote economic development, setting a good example for environment-protection and sustainable development.

3.2.5 Function 5: Driving

As interrelated eco-industrial communities and organic systems, eco-industrial parks can drive the development of innovative technology and improve working skills through decrease of resource consumption and resource reuse and recycle, through application of brand-new environment-friendly technique system. Therefore, constructing industrial chains and circular economy system can guide and drive regional economic growth. Furthermore, establishing and strengthening business and organizational network are also good for making marketing strategies and attracting new businesses to enter.

4 Operational Patterns and Mechanism Construction of Eco-Industrial Parks

4.1 Operational Patterns of Eco-Industrial Parks

Eco-Industrial Parks in different regions should choose different operational pattern according to their industrial features and operational characters. Recently, most typical operational pattern is industrial circular-and-coexisting network.

4.1.1 Interdependent-Coexisting Pattern of Core Enterprises

This is a pattern that many middle and small enterprises in the eco-industrial parks attach themselves to those large enterprises to operate as if satellites circumvolve around the earth as the core. Industrial coexisting network is thus formed. Because of the existence of core enterprises, on one hand they need other enterprises to provide them large amount of raw materials and accessories, which offers huge marketing opportunities to lots of relevant middle and small enterprises; on the other hand, they can generate ample byproducts, such as water, materials and energy that are possibly productive resources for some middle and small enterprises and therefore attract them to set up factories for relevant industries. Coexisting pattern of core enterprises is the most fundamental and widely acknowledged organizational form in constructing eco-industrial parks.

4.1.2 Balanced and Equal Business Co-existing Pattern

This is a pattern that in the eco-industrial parks, all involved enterprises are in mutually balanced positions, which means, through mutual exchange of materials, information, capital and human resources, they can form a network organization to self-adjust and to maintain operation. One enterprise can at the same time communicate with many other enterprises, all of which are in equal positions when
conducting negotiations, and add value through value chains based on market adjustment system. No sooner the exchange between two enterprises cannot bring profits to either side, than the coexisting relations put to an end, and a new-round search for suitable partners begin. Generally speaking, middle and small enterprises participate in this kind of business coexisting pattern.  

4.1.3 Nested Coexisting Pattern

This is a complicated network organizational pattern in eco-industrial parks that combines advantages of both core enterprises coexisting pattern and business coexisting pattern. This multiple nested coexisting pattern is formed by many large enterprises as well as their attached enterprises through various business relations. In eco-industrial parks, large enterprises establish coexisting relationship with each other through exchange of byproducts, information, capital and human resources, forming backbone network; meanwhile, each large enterprise attracts large number of middle and small enterprises to attach, forming a sub-network with the large enterprise as the core, and those middle and small enterprises as the satellites. In addition, there are also business relations among the middle and small enterprises and therefore form a complex network integrator.

4.2 Operational Mechanism of Eco-Industrial Mechanism

As a sub-system of market economy, eco-industrial parks should not only adjust themselves into outer limited resources and severe eco-environment, but also match inner requirements of economic laws, since the development of an economic system demands certain mechanism to inspire and cultivate their growth and guarantee their self-construction. Generally speaking, eco-industrial parks in China are on their initiative stage, and mechanism and policies pertinent to them are on the way of exploration. Therefore, inquiring into mechanisms of constructing eco-industrial parks is of great importance in developing eco-industrial parks healthily and speedily.

4.2.1 Government Driving

Under market economic conditions with economic-benefit maximization as guiding principles, ecological system prevention and construction are beyond the control of market adjustment, which means, market system is unable to push forward ecological evolution. Therefore, the government should get full play their functions to drive the protection on ecological system through ways of coercion, guidance, motivation and guarantee.

4.2.2 Benefit-Driving System

Intense corporations and virtuous interactions of member enterprises within parks, of system and ecology guarantee the stable development of eco-industrial parks in the long run. Fundamental motivation of enterprises to conduct their business is economic gains. Therefore, it is not enough to setting up eco-relationship merely depending on the instructions and control of policies and regulations; not possible relying on market system, but demanding a virtuous eco-operational mechanism driven by economic gains. For example, the construction of eco-industrial parks can not only create new corporation relations and enlarge industrial sphere, but also generate new industrial systems and develop regional economy.

4.2.3 Inter and Outer Coordination Mechanism

The survival and growth of eco-industrial system demand coordination between industrial systems and outer environment, as well as an organic harmony and virtuous circulation within industrial systems. Compatibility is the key to the survival and growth of eco-industrial system.

4.2.4 Corporation and participation Mechanism

The participation and corporation of park members guarantee the conduct of eco-circulation. Therefore, we must build up a brand-new corporation and participation system, fostering and maintaining the participatory consciousness of park members, so as to create all possible conditions for the establishment of relation chains and network mechanism in which all members are interdependent, cooperating with each other.

5 Conclusion

Since the essential nature of circular economy is eco-economy and eco-industrial parks are
important developing mode and phase of circular economy, paying high attention to and probing deeply into and devoting great efforts into the practice of eco-industrial parks constitute significant tasks of developing circular economy. The eco-industrial park is not only a zonal integrator, melting nature, industries and society into a same pot, but also a brand-new mode of industrial organization designed according to circular economy theories and eco-industrial fundamentals. Through exchanges of byproducts and wastes across member industries, hierarchical utilization of energy and waste water, as well as infrastructure sharing, eco-industrial parks achieve a coordinated development between economic benefits and environmental benefits, bringing into play of its functions as competing, integrating, serving, leading and motivating. Eco-industrial parks can be conducted by different modes based on realities, such as dependent core-enterprise coexisting mode, equal business coexisting mode and nesting coexisting mode. Meanwhile, eco-industrial parks can also be operated through diversified mechanisms, such as government-driven mechanism, benefit-driven mechanism and inner-outer coordination mechanism.

Reference