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Preface

During a time of environmental degradation and resource shortage, the concept of environmentalism has been used exclusively during “conference” among developed countries, and has become a hot topic for governments, enterprises, civil society organizations and citizens around the world. Policy orientation and consumer demand have become more favorable towards eco-friendly products, urging capital and technology to shift towards business which also provides environmental benefits. The circular economy, from its inception to its development, benefits from this context.

Environmental problems cannot be addressed solely by government policies and civil society measures. The circular economy not only provides a solution pathway to environmental problems but also opens the door to opportunities for the business-minded. Over-reporting by media on a newly emerging industry will usually exaggerate the potential business opportunities, or neglect the risks involved in industrial development. For entrepreneurs who are determined to break through the shortage of business model resources in China, it is necessary to accurately understand government policies, the development of the supporting market and to learn from the experiences and lessons of pioneers in the related market.

In this regard, this handbook is aimed to provide available policy-related information, market opportunities, and successful cases of pioneer entrepreneurs for those interested in starting a business in the circular economy industry. With this handbook, entrepreneurs will be able to gain a full understanding of policies in the circular economy, civil supporting resources and operational experiences from business pioneers in this industry.
Contents

Chapter 1. Background and Development of the Circular Economy...7

Chapter 2. Analysis of Domestic Policies.................................9

  2.1 New Market Opportunities Created by Government Policies.................. 9
  2.2 Financial Support........................................................................... 10
  2.3 Tax Preferences............................................................................ 11

Chapter 3. Potential for Circular Economy Enterprises.............13

  3.1 Market Opportunities for the Circular Economy Industry.................. 14
  3.2 Analysis of Potential Customers.................................................... 18

Chapter 4. Analysis of Available Resources.............................21

  4.1 Environmental Opportunities in Circular Economy Technology........... 21
  4.2 Environmentally Conscious Consumers........................................ 22
  4.3 Operation Model for Circular Economy Enterprises.......................... 23
  4.4 Powering the Circular Economy Industry with Talents..................... 24
  4.5 Building an Effective Partnership and Cooperative Network................ 25

Appendix 1: Supporting Organizations........................................27
Chapter 1. Background and Development of Circular Economy

In the process of development, humans have increasingly realized that natural resources are finite and that the environment has limited capacities. In 1962, the American economist Balding came up with the circular economy concept from an economic perspective. He compared the earth to a spaceship operating in the universe and noted that when man's irrational exploitation of natural resources exceeds earth's capacity, the earth will be destroyed and that only through a circular use of resources will humans develop sustainably. The 1970’s saw two global energy crises and prominent contradictions between economic growth and resource shortage triggered a deep reflection and critique on the prevailing mode for economic growth. During the 1980s, humankind began to explore the sustainable model of development. In the 1990s, all countries had actively undertaken the sustainable development path, while laws and regulations supporting a circular economy were established gradually.

Currently, circular economy in developed countries has been carried out on the following three levels:

First is the circular use within enterprises, exemplified by the US-based DuPont Chemical Company model. Enterprises promote clean production process and comprehensive utilization of resources and energy, extend the industrial chain, reduce material usage, waste and toxic emissions, and maximize the utilization of renewable resources to improve product durability.

Second is the eco-industry network built between enterprises or industries, exemplified by the Kalunborg Eco-Industry Park in Denmark. The network connects different factories, forming interdependent industrial groups which share resources and exchange by-products. As a result, while being recycled internally, the waste gases, heat, water and solids discharged from one enterprise can serve as resources for another enterprise.

Third is the recycling between enterprises and society, which can achieve a recycling of material and energy during and after consumption by establishing a waste reclaiming and reuse system. Examples include the dual recycling system of packaging in Germany (Dual System Deutschland, DSD) and recycling and reuse system of used electric appliances, automobiles, container packaging etc. in Japan.

The circular economy abides by the “3R principle”, including reducing resource consumption and waste emissions in the production and service process; reusing after restoration or remaking in order to lengthen product cycle and prevent product from turning into waste too early; and recycling used manufactured products into useful materials again, thus making waste useful and reduce resource
consumption and pollutants emission. The circular economy does not solely rely on the simple recycling of waste to save resources but makes a priority to reduce resource consumption and waste generation.

**Further readings:**
Chinese people came to familiarize with the concept of circular economy in the 1990’s. In 1998, China introduced the German concept of circular economy and recognized the fundamental “3R” principle. In 1999, circular economy models were consolidated by a newly industrialized aspect; in 2002, China understood the significance of circular economy from the aspect of its new industrialization; in 2003, the circular economy was included in the Chinese scientific concept of development, and the development strategy of material reduction was established; in 2004, China called for a vigorous development of circular economy on three levels: city, provincial and national.
Chapter 2. Analysis of Domestic Policies

For entrepreneurs, keeping an eye on government policies can help them foresee development trends in the industry and discover potential business opportunities. Currently there are three types of governmental policies available and applicable in China: legal (enforced) measures, financial or economic measures, and governmental action. By governmental action, it means conducting industrial restructuring and eliminating backward productivities by use of administrative power.

Our policy analysis covers both national and regional levels. This is because our country enjoys a large area and the policies of different regions can either be similar or different according to regional needs. Our regional analysis is mainly based on experiences of east coastal regions like Jiangsu province.

2.1 New Market Opportunities Created by Government Policies

- Comprehensive utilization of industrial solid wastes: Enterprises are required in governmental stipulations to make comprehensive utilization of coal fly ash, coal-gangue, waste stone, waste materials, waste gases, extra heat, extra pressure, etc, and conduct recycling and reuse of waste water. (Law on Promotion of Circular Economy and Law on Promotion of Clean Production)

- Reusing construction wastes as resources: It is encouraged to make construction materials out of innocuous solid wastes, while making fire bricks by damaging farmland is prohibited. (Law on Promotion of Circular Economy and Ordinances on Prevention and Control against Solid Waste Pollution in Jiangsu)

- Development and promotion of alternative technologies, replacement process, equipments, materials and products: It is prohibited to produce, import and sell the equipments, materials and products in the elimination list or to use technologies, process, equipments, and materials in the elimination list. State Council on Circular Economy along with State Council Supervising Department on Environmental Protection will regularly issue directories on technologies, techniques, equipment, materials and products to be encouraged, contained or eliminated. (Law on Promotion of Circular Economy and Directory of Industrial Restructuring Guidance (2010))

- Recycling and reuse of used and end-of-life products: recycling and reuse of used electrical and electronic devices, recycling and disassembling of end-of-life vehicles and vessels, remanufacturing mechanical and electrical products, reusing domestic wastes and mud as resources etc. (Law
on Promotion of Circular Economy and Regulations on Reclaiming and Treatment of Deserted Electronic and Electric Products); Remaking of engineering machinery and machine tools and remanufacturing of auto parts shall be established as two key areas for development; Large-scale retreading and repairing of old tires will be one of the leaders. (Suggestions On Advancing Remanufacturing Industry)

- Pollution-free packaging of products: Production and consumption of disposable products are restricted. Non-harmful design patterns that help comprehensive usage of resources shall be adopted for product packaging. (Law on Promotion of Circular Economy and Regulations on Reclaiming and Treatment of Deserted Electronic and Electric Products)

- Market of governmental procurement: products in line with clean production mechanisms can be made a priority in the governmental procurement list. (Law on Promotion of Circular Economy and Law on Promotion of Clean Production)

### 2.2 Financial Support

- Establishing special funds dedicated to development of circular economy; providing fiscal support to major technological breakthrough projects on circular economy; levying preferential tax to industrial activities which promote development of circular economy; orienting investment to circular economy projects; putting forth price policies, charging policies and government procurement policies which favor circular economical development. (Law on Promotion of Circular Economy)

- Establishing special supporting fund for clean production: small- and medium-sized enterprises have a chance to gain support from government funding for development if they commit to clean production process. (Law on Promotion of Clean Production)

- Government’s special fund: it is designed to support reconstruction projects which use water, energy, material and resource saving technologies; model clean production projects in key sectors and key water bodies; recycling programs in industrialization of renewable resources and remanufacture of electrical products; social service platform projects providing technical counseling and guidance. (Interim Measures on the Special Fund for Development of Circular Economy and Energy Saving in Jiangsu and Interim Measures on Management o Special Funds for Medium- and Small-sized Enterprises in Jiangsu Province)

- Credit support: focus on energy-consumption reduction projects including energy, water and material conservative and their comprehensive usage, clean production, seawater desalinization
and “zero” emission etc. Major support also goes to recycling and reuse projects including reuse of used auto parts and machine tools, retreading and repairing of tyres, and reuse-as-resource projects of waste and used materials, large-scale industrial wastes, construction wastes, agricultural and forest wastes, typical urban wastes, used water and mud, etc. Enterprises are encouraged to invest money raised from the stock market to circular economy projects; Small- and medium-sized enterprises located in circular economy experimental parks will get the chance to be financed through joint issuance of bonds; enterprises are eligible to apply for loans from international financing organizations and foreign governments with programs that support circular economy. (Notice on Investment and Financing Policies and Measures Concerning Supporting Development of Circular Economy)

- Price policies are made in favor of resource saving and comprehensive utilization, and restrictive ones are made for restricted programs in high resource consuming industry; For grid-connected electricity generation programs using extra heat, extra pressure, and coal bed methane and low-heat-value fuels like coal-gangue, coal slime and waste, their on-grid power tariffs should be settled according to the rule in favor of comprehensive utilization of resources. (Article 46 of Law on Promotion of Circular Economy)

- Policies on price subsidies could make up for the disadvantage of pollution-free products compared to traditional products. (Notice on Investment and Financing Policies and Measures Concerning Supporting Development of Circular Economy)

2.3 Tax Preferences

- Enterprises that manufacture products with waste materials and reuse waste as resources can enjoy preferential tax conditions. (Law on Promotion of Clean Production)

- Enterprises that undertake sewage treatment, public waste disposal, methane exploration, renovation of efficient energy reduction technologies, sea desalination requirements, environmental protection, energy and water conservation, etc. will receive preferential income tax incentives. (Directory for Preferential Income Tax Incentives for Comprehensive Resources-utilizing Enterprises)

- As for state encouraged investment projects, some equipments are exempt from tariffs and import value-added tax. (Directory of Industrial Restructuring Guidance, 2010)
Chapter 3. Potential for Circular Economy Enterprises

Due to occurrences of several viscous environmental accidents and food safety incidents, people’s standard for product choice has shifted from the traditional “reasonable quality, low price” to “eco-friendly, non-pollution, non-harmful”. Responsible consumption behavior is reaching maturity in developed countries. European and American consumers have voiced requirements to enterprises on aspects of resource, environment, society etc. These have affected production models in developing countries through the globalized supply chain.

In western markets, the invention, development, production, packaging, transport, utilization and circular use of products have all gone through the check of environmental concerns and social influences. Incomplete statistics indicate that, hundreds of brand names, 5 billion dollars worth of exports from China have been banned from being produced and sold as a result of failure to meet international conventions on protection of ozone layers; 4 billion dollars worth of products face market access issues as target countries have environmental protection labeling system; every year, 7 billion dollars’ worth of exports of China are banned due to “Green Trade Barrier”.

Thus, policy and domestic and international market demand has made a positive turn for starting business in the field of circular economy. Opportunities for starting business focus on the following three levels:

- **Enterprise level**: clean production process, energy efficiency, emission reduction and enterprise environmental management;
- **Industry level**: due to limited information from enterprises, it’s difficult to find appropriate users for intermediate products or wastes. This requires the intermediate links to be capable of seeking demand and supply, logistical management and technological advancement;
- **Social level**: recycling of products and its utilization as a resource has a huge market.

Entrepreneurs must start with details and seek opportunities with low start-up capital requirements, a short initial cycle and relatively low-end technical requirements. Meanwhile, entrepreneurs must tackle management and technical problems at the initial phase of starting the enterprise, ensuring stable supply and product quality and reliable resource channels.
3.1 Market Opportunities for the Circular Economy Industry

Comprehensive use of industrial solid wastes

According to the survey made by EPA in 2010, solid wastes generated by domestic industries have reached 3.852 billion tons, 1.804 billion of which was comprehensively used, 441 million disposed of, 1.599 billion stored this year, and 49.14 million tons dumped. Dangerous industrial waste generation mounts to 45.73 million tons, 39.4 thousand tons of which dumped. Therefore reusing industrial waste as resources can be guaranteed with a huge quantity of source materials.

Furthermore, in respect of policy, according to the regulations and laws governing waste material treatment, enterprises are required to make comprehensive use of fly ash, coal-gangue, waste stone and materials and gases, which makes market demand available. Meanwhile, preferential policies in tax and finance can also help reduce operational cost for the enterprises in this industry.

In regards to technology, there are abundant technologies and equipment which are of low cost and high economic return in this industry. Large solid wastes such as fly ash, coal gangue, desulfurization gypsum etc have become the main raw materials for producing construction materials (gap between generation amount and utilization rate) and are widely used in building first-class highways and municipal utilities, while developing towards higher added-value direction. They can be used to produce Al₂O₃, special silicon aluminum ferroalloy, pulverized kaolin, high-strength plaster molds etc., showing great prospects and momentum of development. Many advanced enterprises have emerged whose comprehensive utilization yields and profits account for more than half of the total, achieving a win-win status between environmental protection and economic development.

Take a fly ash brick producing enterprise as an example, it manufactures walling materials from coal fly ash and construction wastes. This project is eligible for various preferential policies made by the Chinese government on developing new types of walling materials, including:

- Developing projects of infrastructure, expansion and technical transformation developing new type of wall materials;
- 0%-rate-of-regulatory-tax policy on fixed asset investment;
- Policy-based lending;
- Advanced equipments imported from overseas are exempt from import tariffs and value-added tax;
- Businesses producing construction materials can be exempt from income tax and value-
added tax on products for 5 years from the date of incorporation;

- They can also enjoy exemption or reduction on land use tax.

These preferential policies ensure development of projects of making bricks out of coal fly ash and construction materials. In a recent policy about wall materials reform, use of clay bricks in construction in cities and towns is prohibited, which has created a huge market for bricks made of coal fly ash and construction waste.

**Using agricultural waste as resources**

Billions of tons of agricultural waste have become both the biggest reserve of pollutants, and at the same time, a potential resource. Take stalks as an example, if we convert 500 million tons of stalks to electricity, supposing 1kg stalks generate 1 kwh of electricity, we'll end up with 500 million kwh of power; as fertilizer, they provide 22.64 million tons of nitrogen; 4.591 million tons of phosphorus and 27.157 million tons of potassium. As animal feed, there are 190-220 million tons of just corn straws. Thus, comprehensive use of agricultural wastes as resources is a huge potential resource reserve. Our current utilization rate of agricultural waste is low and inefficient, and there is huge room for reuse of agricultural waste as resources. However, current backward reusing techniques for agricultural waste lead to low efficiency and quality of waste-transformed products. Research and development of transformation technologies can potentially lead to a new market.

State policies are made to encourage comprehensive use of agricultural wastes and support agricultural producers and related enterprises to apply advanced or appropriate technology in utilization of crop straw, livestock and poultry manure, by-products of agricultural products processing and waste agricultural plastic film, and to develop and use methane and other biomass energies. Entities and individuals using plastic film shall put forth recycling and reuse measures, preventing or reducing pollution of plastic film on environment; scale livestock and poultry farms shall collect, store, and use or treat the manure to eliminate pollution. It is forbidden to burn straws in the open air around densely populated areas, airports, major roads and other restricted areas set by the local government. These measures were taken to promote comprehensive utilization of agricultural wastes while local government also introduced specific facilitating measures on comprehensive reuse of agricultural wastes.

The enterprises specialized in utilizing agricultural waste as resources in our country develop mainly towards turning it into energy, fertilizer, animal feeds, and raw materials. Utilizing agricultural wastes to generate biomass energy (for bio-ethanol, methane, electricity generation etc.) and biomass materials (for architectural construction, furniture material etc) has wide prospects in terms of market potential.
Current comprehensive use of agricultural wastes is on the way of factorization, mass production, commercialization and standardization, shifting from being small in scale and scattered to being large in scale and centralized. Mass production and commercialization of waste material products will also intensify.

It could be exemplified by the methane-generating tank which is gradually developing from a self-supporting scale towards large and medium scale operations. In rural areas of Zibo, large and medium sized methane-generating tanks are emerging. Both state and local governments encourage the development of new energy sources in rural areas, by providing multiple channels of funding, for example, 7,500 yuan from the central budget and another 7,500 yuan from the local budget will be available to support constructing a methane generating tank of 50 cubic meters, which means only 10,000 yuan needs to be raised by oneself to meet the capital requirements. Poultry, livestock and manure provides rich sources of methane, and building a large sized methane tank inside the farm to provide commercialized methane has become another way to generate revenue. A large volume of income from methane, dregs, and methane liquid are helping large sized methane tanks make profit. These conveniences created possibilities for the development of commercialized methane in rural areas.

**Industry of utilizing urban waste as resources**

We are one of the countries which see the biggest burden of garbage, with an average garbage generation amount of 440 kilos per year. Generation of urban waste is steadily increasing at a rate of 5-8% per annum in recent years. Yet, the current utilization rate of garbage as a resource is less than 5%. Utilization of urban waste as resources, as an industry of immense potentiality, such as recycling and reprocessing of waste paper and glass, turning waste plastic into petroleum and diesel, making compound fertilizer from organic waste etc can all guide the direction of development. Furthermore, domestic waste home appliances in the country have reached a peak amount. By the end of 2010, the number of domestic appliances reaching lifespan in cities and towns will amount to an estimated 1.3 billion.

Regulations on Treatment of Waste Electrical and Electronic Devices has become the driving force in making recycling and disassembling industry of waste and used appliances larger in scale and more standardized. Five types of products which are television sets, air-conditioners, refrigerators, washing machines and miniature computers will be the first electrical products to be recycled and dismantled in accordance with national standards. Market upgrading and transition relies on the advent of modernized enterprises which will enjoy development opportunities in recycling and utilization market of used electrical appliances.
Renewable resource enterprises in our country have reached a considerable scale. Manufacturing and technology utilization levels have gradually enhanced. Some enterprises have installed advanced production lines introduced from overseas, while some enterprises are cooperating with scientific research institutes home and abroad to develop and produce waste treatment equipments that cater to Chinese characteristics, some of which have been exported to foreign countries; some are joint ventures or foreign direct investment enterprises, which have adopted advanced technologies. These enterprises reflect the development trend for the renewable resource industry in China. However, there are still a large number of medium- and small-sized enterprises with low-end techniques, most of which are small workshops or rely mainly on hands-on labour. With further development of the industry, these workshops which produce secondary pollution will be replaced by more standardized enterprises with higher comprehensive utilization level.

The regulations on treatment of end-of-life electrical and electronic devices played a positive role in standardization of related industry. For instance, motivated by the “old-for-new” measure, the amount of waste home appliances surged, especially that of the five categories covered by the subsidy, which are TV sets, refrigerators, washing-machines, air-conditioners, and computers. This measure not only provided a convenient channel for recycling of used home appliances, but also meant extensive business opportunities as well as technical and capacity challenges for home appliance dissembling enterprises.

**Room for development in the remanufacturing industry**

Remanufacturing helps to form a circular economic pattern of “from resource, product, used product till remanufactured product”, thus to utilize resources to the full extent and protect the environment. It is imperative for China to develop its remanufacturing industry. Currently, our country has reached a peak period of various machines, machine tools, automobiles and domestic appliances becoming scrapped. How we increase the lifespan of photocopier machines, fax machines, printers, automobiles and other electrical devices through remanufacturing has become a key subject in development of green economy in China.

The government has stepped up its efforts on developing remanufacturing industry, and related government organs are drawing up <Blueprints for Development of Remanufacturing Industry>, restating goals, missions and measures to promote healthy development trend for remanufacturing industries set in Twelfth Five Year Plan. Not long ago, eleven commissions including National Development and Reform Commission jointly issued <On Boosting Remanufacturing Industry>, specified the work required to promote the remanufacturing industry from nine respects. It is expected that as more supporting policies come into place, technologies develop and consumer acceptance grows, the remanufacturing industry in our country will have great market potential. With its rapid development
in recent years, remanufacturing automobiles, computers, cell phones, engineering machinery and tool machines can all become circular economy industries with huge possibilities.

Still in an early phase of remanufacturing development, our domestic remanufacturers mainly work on automobile parts and worn-out machine tools. Currently, market demand for remanufacturing is booming in China and remanufacturers have already possessed mature technology and market. Compared with manufacturing new products, remanufacturing can save cost by 50%, energy by 60%, and raw materials by 70%, which could be a substantial in relieving the stress on resources and the environment, to enhance energy saving and emission reduction and finally to enable transformation of economic growth patterns. Thanks to strong support from governmental policies, state-of-the-art techniques and consumer awareness, new opportunities for development have emerged for remanufacturing enterprises. Three types of enterprises will be benefited from development of remanufacturing: the first type is those who possess or will possibly possess remanufacturing techniques; the second type is spare parts manufacturers which are able to manufacture complete sets of equipment; and the third type is those who have channels for retrieving and sales.

3.2 Analysis of Potential Customers

Thanks to government policy orientation and awakening of public consciousness, circular economic industry sees an increasing number of potential customers.

Government procurements

It is pointed out in related policies that, in each procurement with government funding, each department shall take priority in products and recycle products that are power saving, water saving, material saving, and in favor of environment protection. This ensures products are in line with the fundamental principles of circular economic development, and are more competitive than traditional products in government procurement.

Increasing awareness among consumers

With living standards increasingly improving, consumers are gradually turning their attention from prices, when selecting commodities, to their quality and even to the environmental and social factors behind them. For example, consumers intentionally started to purchase eco-friendly organic agricultural products. On the other side, the state government guided in upgrading of industrial structure by regulating on green products via policy making, which helped make up their disadvantage in higher price compared to traditional products and could guarantee bigger consumer group for green products.
**Enterprises’ rigid demand**

Government control on waste dumping of enterprises urges those with heavy pollution and emission to make comprehensive use of industrial waste, to enhance efficiency of resource utilization, so as to minimize discharge of waste. These enterprises will show a strong demand for equipments for processing industrial waste or for comprehensive utilization, and services in energy saving and emission reduction.

**Commercial risks**

For a start-up enterprise, any alteration in policy could exert substantial influence on small-sized enterprises owing to the policy-driven market structure.

Firstly, our policy system which could promote circular economy is not yet sound. Funding is a major factor that hinders the development of enterprises. Although government bodies have taken proactive financial measures with the intention of helping enterprises solve their funding problems, it is nonetheless very difficult to access the benefits of that policy. When resources are centralized in large- and medium-sized enterprises, especially in State-owned Enterprises (SOEs), start-ups have a smaller chance in acquiring fund support.

Secondly, the legal environment in which circular economic development can be boosted is not yet sound. In many cases, circular economy is developed in accordance with Law on Promotion of Circular Economy, and Law on Promotion of Clean Production, yet they are not very operable. Developing circular economy is part of the stipulation in a series of laws and regulations issued by related government bodies, such as Energy Conservation Law, Environmental Impact Assessment Law, and Renewable Energy Law, but it is not systematic enough. Current laws and regulations on environment protection focus on prevention and control of pollution and end-of-pipe treatment, which does not fit in with the need of circular economy development. Additionally, there exist some other issues such as when related laws and regulations do not complement each other, and that some supporting measures are not available.

Thirdly, information is not readily available. In the developing process of circular economy industry, there exists information asymmetry between enterprises in upstream and downstream, consumers and producers, and manufacturing enterprises and government bodies, which meant risks facing enterprises developing circular economy in aspects of raw material supply, product sales, and financial support. When stable green logistics is established, credibility of green industry among consumers is enhanced, and stable funding is supported by state policy can it be possible to ensure development of circular economic enterprises.
Chapter 4. Analysis of Available Resources

Development of circular industry means providing alternatives with new production mode and new combinations of resources. Before large-scale production is realized, circular industry has to rely on policy support from the government owing to its absence of scale merit. Secondly, products of circular economic enterprises have no obvious competitive strength in price and quality compared with traditional products, and they are waiting for the transition in consumer awareness and incentives from public policies.

Presently, resources available for the circular economy include policy support, increasing environmental consciousness of consumers, technological innovation, reserve of talents, and so on. Yet, it is undoubted that how resources are located and made best use of is of great significance to an enterprise in start-up stage.

4.1 Environmental Opportunities in Circular Economy Technology

Technology in support for circular economic development mainly consists of clean production, green products, resource recycling, re-manufacturing techniques, and so on. Its environmental opportunities are described in the following four aspects:

External opportunities

Owing to the rising cost of many imported raw materials caused by massive consumption of resources, enterprises feel the necessity to make use of circular economic technology to improve resource recycling and reuse rate. For example, due to increased cost of original wood pulp in recent years, many manufacturers opened up a new path for growth by developing techniques in manufacturing recycled paper. Furthermore, manufacturing techniques of green products have been an important part of circular economic technology. Some developed countries have had several decades of experience in research and development of green technology and have started to use their technical advantage to form a new trade barrier. In double-green directives issued by European Union (“EU”), or Directive on Waste Electrical and Electronic Equipment, WEEE, and the Restriction of the use of certain hazardous substances in electrical and electronic equipment, ROHS, almost all our major electromechanical products for export were covered, ranging 10 categories and 200,000 varieties. Green trade barrier
has become a problem faced by enterprises, while research on and producing products conforming to circular economic rules must also become the target of business development.

**Internal opportunities**

China now sees low efficiency of resource energy utilization and excessive pollutant emissions. Although techniques in energy saving and emission reduction have achieved remarkable results, there still exit issues of high consumption of energy, and high emission of pollutants in a large number of medium- and small-sized enterprises with out-dated equipment. Development of circular economy calls for emergence of new technology to improve energy utilization efficiency and to reduce pollutant emission. Techniques of end-of-pipe treatment, clean production, comprehensive utilization of waste, re-manufacturing of waste and used materials, and so on, have become necessary for developing circular economy.

**Government promotion effect**

To promote innovation of circular economic technology, the government provided circular economic enterprises with better financial environment by giving policy support in finance and taxation. Related standards and technical norms in favor of circular economic development are also under organization and formulation, such as spread of energy-saving logo and environment logo, implementation of green procurement among government bodies.

**Catalysis effect of social organizations**

Social organizations work as catalysts to promote development of circular economic technology. Industrial institutions and associations have pushed forward programming of science and technological development and routing of industrial techniques; they can also provide an exchange platform and importation channel for circular economic technology. Various social groups, campus, and advocacy organizations have become the main force of popularization of environmental protection science and green education with an aim to cultivate mass consciousness on green consumption.

**4.2 Environmentally Conscious Consumers**

Circular economy can only develop with public support. Recycled and remanufactured products produced under the guidance of the “3R principle” have certain differences with traditional products in price and quality, and their producers can maintain continuous development only when they receive
public recognition.

The development strategy we have taken formerly for our economy, which was “Remediation after pollution”, caused malignant damage and pollution to the environment, which brought about emergence of active environmental protection groups and expedited fostering public consciousness of environmental protection. Ecological education has been spread in campus and society, making those people educated with environmental protection and with environmental awareness potential consumers of energy-saving, recycled and re-manufactured products.

With a considerably high recognition on green products, these consumers easily trend to choosing green products when purchasing, such as energy saving lamp, recycled paper, waste plastic goods, and so on. According to a survey conducted in 5 cities in the mainland by Social Resources Institution, a Beijing-based research institution in 2010, among 1000 surveyed tea consumers, 95% expressed willingness to buy or to consider buying tea products with social and environment certification, which showed Chinese consumers no longer made purchase decisions based solely on price and quality but have also started to consider products’ environmental and social effects in the supply chain.

To win more customers in favor of circular economic products, it is necessary for enterprises to take active part in public education activities on environmental protection. Considering weak financial position in the start-up stage, enterprises can take on collaborative publicity work within its industry. Then, they can choose their target cooperative partners and arrange target-oriented public activity on environmental protection on the basis of their business plan.

Currently, domestic associations of environmental protection are very active in various subdivided areas, such as water pollution, recycled paper, sustainable forest administration, and garbage collection and sorting. Therefore, collaborative advocacy on the concept of circular economy with environmental protection associations can help enterprises not only save the cost but understand diversified demands of the general public.

4.3 Operation Model for Circular Economy Enterprises

Basically, circular economic development requires enterprises to operate from three sectors: eco-friendly design, green technology, and waste management.

Eco-friendly design requires giving priority to product’s environmental property within its life cycle, considering not just a product’s performance, quality and cost, but also its collection and treatment.

Green technology advocated in circular economy means improving efficiency of resource utilization by
Circular Economy

using resources rationally and reducing waste as much as possible. Clean production is the key to green technology.

Any design and green technology are all relative, and there are always waste materials discharged during production. As far as circular economy is concerned, waste management includes utilizing waste as a resource, exchanging waste for comprehensive utilization between enterprises, and so on.

Although the cost of raw materials in circular products is lower than that in traditional products, the processing cost of the former is far higher than that of the latter, and additional and necessary expenses on environmental protection and environment consumption shall be reasonably accounted as cost and be part of the product price.

Finally, enterprises need to set up a special department or turn to a consulting company to collect various information on policy support for circular economic development, launch investigation and projection on demand in circular economic industry and give analysis on the market scale for circular economy before making any business strategic decision to fit in with their own strength and applying and developing circular technology for purpose of better operation in the circular economic model.

4.4 Powering the Circular Economy Industry with Talents

Development of circular economy needs abundant labor resources as a guarantee, especially in some labor-intensive industries. Take resource utilization of electronic waste as an example, while technology improvement is a prerequisite, a large number of human resources is needed to disassemble electronic waste and complete the complicated procedure of recycling and reuse; in the process of collection and recycling of urban refuse, a bountiful labor resource is also required.

As for talent supply, the number of graduates of science and engineering degrees from Chinese four-year universities ranks the top in the world, and all colleges and universities offer related courses to cultivate talents of environmental protection. However, the circular economic industry needs a huge number of talents who have had related vocational education and are competent for skilled workers’ roles, while in our current education system, students are over-qualified theoretically but inexperienced in practical skilled work. Hence there exists a huge gap between what is taught in school and what is needed at work.

Therefore, star-up enterprises need to take up personnel training from the very beginning by offering long-term and continuous vocational education, and if conditions permit, they can cooperate with vocational schools to fit in with special training, so as to ensure continuity and stability of talents.
4.5 Building an Effective Partnership and Cooperative Network

Circular economy calls for cooperation between enterprises within the industry, to improve efficiency of resource utilization and to reduce waste generated. A green ecological circular chain is necessary to link the upstream, middle stream and downstream in the industry. In terms of circular economic enterprises, effective partners can provide a stable source of raw materials. Only when a stable supply of raw materials (including quality and price) is secured can an enterprise in comprehensive utilization of resources sustain long-term and stable development. In terms of remanufacturing enterprises, they need channels for the supply of waste and used materials. Moreover, when effective cooperative partnership is established, enterprises can pass usable resources discharged during their production process while unable to be absorbed to their neighbor enterprises, which on one hand may ease pressure of waste treatment and may lower the cost of production and bring economic benefit to them. Circular economy calls for building up a stable cooperative relation network which can help form a virtuous cycle in resource reuse. In addition, a stable sales channel is also an important element to secure development of circular economy.

Green industry associations, industry unions, non-government organizations (“NGO”) and other related bodies also played a facilitator’s role in circular enterprise development. In working with these organizations, enterprises can on one hand understand the direction towards which circular economic industry shall develop and timely adjust their strategy to go with market change, on the other hand, they can forge their own green brand and expand market by obtaining suitable green certification and taking part in appraisal activities. Participation in public welfare activities organized by these organizations can help improve corporate image and gain increasing influence. Moreover, as government organs play a decisive role in the development of circular economic industry, networking with government bodies can help gain governmental support and timely understanding of policy orientation.
**SWOT Analysis on Hui’an Paper Co., Ltd. (Hui’an Paper)**

SWOT Analysis is a powerful technique for analyzing competitive situations by understanding strengths and weakness and by looking at opportunities and threats faced by enterprises, in order to give in-depth and overall analysis and find out competitive edge before working out development strategy. We take “Hui’an Paper” as an example which is specialized in promoting use of recycled paper to give SWOT analysis on establishment of green enterprises.

<table>
<thead>
<tr>
<th></th>
<th>Helpful to reach target</th>
<th>Unhelpful to reach target</th>
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<tbody>
<tr>
<td><strong>Internal (Organization)</strong></td>
<td>Mature techniques of manufacturing recycled paper, improved its quality continuously and nearly made it no difference with original pulp paper in appearance and performance; Business operators innovatively combines eco-friendly products made of recycled paper with model of waste paper exchange; Design of recycled paper and its promotion played a key role.</td>
<td>Processing of recycled paper is more complicated than that of original pulp paper, which has raised cost of recycled paper and thus weakened its competitive edge in price; Specifications and varieties of recycled paper are not rich enough, which puts a limit on its promotion scope.</td>
</tr>
<tr>
<td><strong>External (Environment)</strong></td>
<td>Knowledge spreading by government and its policy orientation encouraged promotion of recycled paper; Government bodies are perfecting its preferential taxation policy aimed to promote use of recycled paper; Public consciousness of environment protection enlarged consumer group of recycled paper; Rise in price of raw materials of original pulp paper narrowed the cost gap between recycled paper and original pulp paper.</td>
<td>Currently, promotion of recycled paper is only limited to government organizations, environment protection organizations, companies, factories and other groups, while individual consumers are not included. Government regulation on price and tax subsidy of recycled paper is not yet sound.</td>
</tr>
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</table>
Appendix 1: Supporting Organizations

Currently, the main driver in supporting circular economic development is the overall administrative department of each government level, and their implementation of rules and regulations may play an important part. Secondly, industrial associations have contributed a lot to the development of circular economic industry, by actively assisting government to make favorable policies and standards, and by providing enterprises with relative information, technological consultation and training. In addition, various NGOs have also taken on activities with a purpose to promote circular economic development, such as giving green entrepreneurial training and providing training programs on business development.

List of Supporting Organizations

<table>
<thead>
<tr>
<th>Supporting government organs</th>
<th>Business scope</th>
<th>Featured program</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Committee of Circular Economy, China Environmental Protection Industry Association</td>
<td>Set the stage for communication and exchange between public, enterprises and government, and maintain members’ legal rights and interests; Provide information and technological consulting service on circular economy for associations and committee members.</td>
<td>Hosted “On-the-spot Meeting of Recycling Technique of Waste Electrical and Electronic Products, “Symposium on Circular Economy and Environmental Protection in ‘12th Five-Year Plan’”</td>
<td><a href="http://www.caepi.org.cn/">http://www.caepi.org.cn/</a></td>
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<tr>
<td>Industrial associations</td>
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<tr>
<td>Green Industry International Association (GIA)</td>
<td>Provide GIA certification service; organize all types of green forum and exhibition, and so on.</td>
<td>GIA is a green label which gained recognition of governments, enterprises, and consumers of countries in Europe and America. It will provide a chance for its member to apply for “Green Product” and “Green Label”.</td>
<td><a href="http://www.giacn.org/">http://www.giacn.org/</a></td>
</tr>
<tr>
<td><strong>China Association of Metal-scrap Utilization</strong></td>
<td>Provide related service for enterprises specialized in metal scrap collection, processing, sales and utilization, those specialized in metallurgical residue, and those in manufacturing and sales of scrap steel and metallurgical residue processing equipments.</td>
<td>Provide statistic analysis of data on purchasing and import &amp; export of metal scrap</td>
<td><a href="http://www.chinascrap.org.cn/">http://www.chinascrap.org.cn/</a></td>
</tr>
<tr>
<td><strong>China Tyre Retreading, Repairing and Recycling Association</strong></td>
<td>Provide related service for members engaged in repairing and retreading used tyres and recycling of waste tyres; maintain fair play and members’ lawful rights and interests.</td>
<td>Evaluate credit rating of tyre retreading and repairing enterprises and reclaimed rubber and rubber powder enterprises, compiled “National Vocational Qualification Training Course—on Tyre Retreading”, and give training on quality test of retreaded and repaired tyres.</td>
<td><a href="http://www.ctra.org.cn/">http://www.ctra.org.cn/</a></td>
</tr>
<tr>
<td><strong>Plastics Recycling Committee of China Plastics Processing Industry Association</strong></td>
<td>Undertake national standardization management on plastic recycling industry; develop industrial information and provide statistics; take on industrial results appraisal, talent exchange, business training, management consultation, corporate evaluation, and argumentation and supervision on critical investment, technical transformation and project development; organize technical coordination and exchange and so on.</td>
<td>Host China plastic recycling conference, and training on waste plastic recycling technique and transformation techniques of reclaimed materials.</td>
<td><a href="http://www.env.tsinghua.edu.cn/lab/indexlab.asp?mnid=22377&amp;type=7312#">http://www.env.tsinghua.edu.cn/lab/indexlab.asp?mnid=22377&amp;type=7312#</a></td>
</tr>
</tbody>
</table>

**Technical supporting organization**

| **Beijing Modern Research Institute of Recycling Economy** | Undertake tasks of planning and design, programming, monographic study and so on; act as “guide” for enterprises, cities and towns, communities, and industrial zones who carry out circular economic model, providing consultation services and personnel training, organizing exchange and promotion of advanced technology, making subject research, instructing on implementation of plan, setting up demonstration sites, and so on. | Qingyuan Huaqing Recycling Resource Investment & Development Co., Ltd.—“State Circular Economic Pilot Program”; Resource Reclaiming & Recycling Corporation of Shijiazhuang—“Shijiazhuang Pilot Programme of Reclaiming & Utilization of Recycling Resources” and “Project Proposal”, Fangyuan Group Co., Ltd. of Shandong—“Circular Economic Pilot Programme of Dongying Fangyuan Non-ferrous Metal Co., Ltd.”, and so on. | [http://www.riore.org/](http://www.riore.org/) |

**NGO**

| **Global Environment Research Institute** | Sustainable development of rural areas: spread renewable energy and organic agriculture; energy and global warming; improve efficiency of energy utilization by commercializing cleaner energy and energy-saving techniques and developing new business and financing model; environmental improvement; make environmental policies for outward investments. | Cooperative project of GEI-Asia Fundation—Environmental Entrepreneurial Training Project Capacity Building on Business Opportunities for Clean Development Mechanism (CDM) Projects in China | [http://www.geichina.org/](http://www.geichina.org/) |
### Supporting Organizations

<table>
<thead>
<tr>
<th>Organization</th>
<th>Activities</th>
<th>Website</th>
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<tbody>
<tr>
<td>Environment and Development Research Institute</td>
<td>Provide training to leaders with a view of sustainable development and planning to practice this developing strategy; Strengthen public ability to acquire environmental information and knowledge by means of information and communication technology.</td>
<td><a href="http://www.ied.org.cn/">http://www.ied.org.cn/</a></td>
</tr>
<tr>
<td>Beijing Tianheng Sustainable Development Research Institute</td>
<td>Commercial development of renewable energy; media promotion and public education of renewable energy; energy and sustainable development in rural area; sustainable transportation, policy research and consultation in environment vs. development field.</td>
<td><a href="http://www.snisd.org.cn/">http://www.snisd.org.cn/</a></td>
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<tr>
<td>Tsing Capital</td>
<td>A venture capital firm with a focus on cleantech field.</td>
<td><a href="http://www.cefund.com">http://www.cefund.com</a></td>
</tr>
<tr>
<td>DT Capital Partners</td>
<td>DT Capital provides growth capital to Chinese businesses.</td>
<td><a href="http://www.dtcap.com">http://www.dtcap.com</a></td>
</tr>
<tr>
<td>China Project of New Economy:</td>
<td>provide related service to enterprises, enhance efficiency of corporate management, provide overall support to entrepreneurs in financing and project demonstration; provide web service for sustainable development enterprises.</td>
<td></td>
</tr>
<tr>
<td>Training Programme on Commercial Development of Renewable Energy of China</td>
<td>Provide training to entrepreneurs on state-of-the-art techniques regarding renewable energy; help them improve their capability in business development, operation and management; provide training on skills in market development, financing and project appraisal.</td>
<td></td>
</tr>
<tr>
<td>DT Capital Partners</td>
<td>DT Capital provides growth capital to early and expansion stage companies in the consumer, technology, industrial and energy/clean energy sectors in China.</td>
<td>[<a href="http://www">http://www</a>. cefund.com](<a href="http://www">http://www</a>. cefund.com)</td>
</tr>
</tbody>
</table>