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THEMATIC REPORT 04

China Waste Plastic Recycling Industry

Edited by China-Italy Chamber of Commerce

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1. Overview of Waste Plastic Recycling Industry

1.1. Waste Plastic Related Concepts

Waste plastic refers to various waste plastic products that have been discarded, including scraps and defective products from the production and processing of plastics and its derivatives. They exist in all links of production and processing cycle. China's waste plastics mainly come from plastic films, plastic wires, woven products, foam plastics, plastic packaging boxes and containers, daily plastic products, plastic bags, and agricultural mulch films, to name a few.

The waste plastic recycling industry refers to the industry that is specialized in recycling, sorting, cleaning, roughing, or deep processing in order to reuse waste plastics that have lost all or part of their original use value during production and consumption.

1.2. Classification of Waste Plastics

In broad sense, waste plastic is divided into recyclable plastics and non-recyclable plastics. Recyclable plastics refer to all kinds of waste plastics that come out from production and daily consumption and have lost all or part of their original use value. After recycling and processing, they can regain use value. They include waste beverage bottles, waste plastic films, waste plastic sheets, waste plastic pipes, waste plastic containers, etc.

Recycled plastics can be divided into wool, crushed, and recycled granules according to their existing forms. It is difficult to divide wool and crushed materials, which lack a unified standard. Recycled granules are classified into primary, secondary, and tertiary materials according to the quality characteristics of the processed particles.

According to the different names of the raw materials, waste plastics include polyethylene (PE), polypropylene (PP), polystyrene (PS), foamed polystyrene (PSF), and polyvinyl chloride (PVC), and other terephthalic acid Ethylene glycol (PET), polyurethane (Pu), and ABS plastic. Except for a few waste plastics (such as transition materials and scraps in the processing of plastic products), which are in the form of a single plastic and can be directly recycled, most waste plastics are a mixture of multiple plastics in solid waste. Since most plastic varieties are incompatible and the mechanical properties of products made from mixed plastics are poor, waste plastics could be classified by plastic types (chemical structure) before recycling. Classification can be based on the use and properties of different plastics. For example, by using simple methods, such as visual inspection, hand feeling, weight measuring, and burning, commonly used plastics such as polyvinyl chloride, polystyrene, and polypropylene can be separated. It is also possible, based on density difference, to place different types of plastics in a specific solution (such as water, saturated salt solution, alcohol solution, calcium chloride solution, etc.) and separate them according to the ways of sinking and floating of the plastics in the solution. As another example, based on solubility difference of different plastics in a solvent, waste plastic chips can be added to a specific solution under

different temperatures so to selectively dissolve and sort various plastics or materials. In addition, when the amount of waste or impurities is large, wind screening technology can be applied. According to this method, crushed waste plastic is input from above in a gravity screening chamber with air laterally blowing in. Screening is performed based on the difference between the weight of the plastic and its resistance to the air.

Name	Production method and description	Remark, Memo
Recycled plastic	After pre-processing, such as factory molding, extrusion, use leftover materials or unqualified molded products for reprocessing in a secondary processing factory.	In some specifications, recycled plastics are limited to clean plastics, and their product quality is equivalent to products made from new materials.
Reprocessed plastic	Produced by non-initial processors from waste industrial plastics.	Can be added with or without fillers, plasticizers, stabilizers, colorants, etc.
Recycled plastic	From washed and crushed waste products.	Reuse of scrap or discarded products.
Reusable plastic	After molding, products can be reused multiple times, if the performance meets the requirements of relevant regulations.	Repeated recycling and reuse in different recycling conditions.
Recyclable plastic	After being discarded, allowed to be recycled and reprocessed after a certain treatment.	-
Non-recyclable plastic	After being discarded, not allowed to be recycled for reprocessing.	-

Table 1 Waste plastics classified by type of recycling.
Data source: GEP Research.

2. Analysis of External Environment of Waste Plastic Recycling Industry

2.1. Macro Environment Impact Analysis of Waste Plastic Recycling Industry

2.1.1. Waste Ban and Global Waste Plastic Trade Pattern

China, as the world's largest plastic producer and waste plastic processor, has cumulatively imported 106 million tons of waste plastic since 1992, accounting for 45.1% of global waste plastic imports. Ever since China stopped importing "foreign garbage", it is estimated that 111 million tons of plastic waste will need to be buried or recycled worldwide by 2030.

After China's "waste ban", major waste plastic exporting countries in Europe and the United States have lost the world's largest solid waste export market. Many of them began to find new way out in other developing countries. The pressure of environmental pollution was passed on to other countries such as Thailand, Malaysia, Vietnam, and Poland. As an environmentally-friendly industry, waste plastic recycling industry needs to take in environmental protection concerns. After experiencing rapid development in less than a year, Southeast Asian market quickly entered a recession since environmental protection policies tightened.

Generally, policies on waste plastics in various countries are constantly tightening and the control of international conventions is gradually increasing. All these will accelerate the reshaping of global waste plastics trade pattern.

2.1.2. Global Plastic Waste Volume Continues to Increase

Global plastic waste is continuously increasing, with more than 300 million tons flowing into the wild each year, making a loss of about US$ 13 billion. At present, the total amount of waste plastic worldwide is about 8.3 billion tons and only a small part can be incinerated and recycled. However, discarded and landfilled plastic waste is increasing. GEP Research predicts that it will reach about 12 billion tons by 2050.

2.2. Analysis of Industrial Policies, Laws and Regulations

Policies at national level represent the guidelines for the waste plastic recycling industry. In order to promote orderly and healthy development of the waste plastic recycling industry, China has introduced and passed a series of policies such as *the Amendment to the Environmental Protection Law* (2014), *Law on Prevention and Control* (Revised in 2016), *Measures for the Management of Solid Waste*, *Management Regulations on the Prevention and Control of Pollution from Waste Plastics Processing and Utilization*, *Management Regulations on Environmental Protection of Imported Waste Plastics*, *Action Plans for the Recovery of Agricultural Films* (2017) and *Work Plan for Rectification on Recycling and Recycling Industries such as Electronic Waste, Waste Tires, Waste Plastics, Waste Clothes, and Disassembly of Waste Household Electrical Appliances*. In 2017, the General Office of the State Council issued the *Implementation Plan for Prohibiting the Entry of Foreign Waste and Promotion of Reform on Solid Waste Import Management System (Guobanfa [2017] 70)*. It was the first time that China has declared war on imported plastic waste. In

the same year, the Ministry of Environmental Protection (MEP) implemented the *Implementation Plan for the Reform* to further strengthen import management on solid wastes, which can be used as raw materials under restricting imports. It also revised *the Regulations of Environmental Protection Management on Restricting Importation of Solid Wastes Used as Raw Materials.* In 2017, the ban on the entry of foreign garbage and the reform of the solid waste import management system played a significant role in the overall building of China's ecological civilization.

2.2.1 Industry Access: a Raised Threshold

The threshold for accessing the industry has been raised, as 1) a license system for imported waste plastics processing and utilization is applied; and 2) entry barriers for all categories of enterprises are raised.

2.2.2. Trade Policy: from "Restricted" to "Completely Banned"

In July 2017, China issued a ban on importation of household waste plastics. In April 2018, the Ministry of Ecology and Environment and other four ministries issued *a Notice on the Adjustment of the Import Waste Management Catalogue.* The announcement stated that up to 16 raw industrial waste plastics would have to be transferred from the *Catalogue of Restricted Importation of Solid Wastes* to the *Catalogue of Prohibited Importation of Solid Wastes* and would be implemented from December 31, 2018. In 2018, a total of 25 batches of publicity tables were announced. Among them, the amount of approved imported wastes and scraps of ethylene polymers were 21,730 tons, with a decline of about 98% compared to 2017. In 2019 the importation of waste plastics may become history.

2.2.3. Industrial Policy: Support the Development of Waste Plastic Recycling Industry

For industrial policies, China has issued a number of measures to promote the development of the waste plastics recycling industry. In January 2017, the Ministry of Industry and Information Technology, the Ministry of Commerce and the Ministry of Science and Technology jointly issued *the Guiding Opinions on Accelerating the Development of Renewable Resources Industry.* It proposed to vigorously construct a waste plastic recycling system. By 2020, domestic waste plastic recycling volume will reach 23 million tons. The country will encourage the examples of recycling key waste plastic varieties, will promote some large-scale advanced and efficient production line of crushing, sorting, modifying, and pelletizing of waste plastics, and will cultivate a number of leading enterprises. It will also promote utilization and resource reuse of low-quality, polluting waste plastics, will encourage resource reuse on pollution-free waste plastics, and will gradually reduce waste plastics landfill. With the aim to demonstrate high-value and high-quality use of waste plastics, the policy proposes to focus on the development of automatic identification and sorting technologies for waste plastics, as well as separation technologies, such as paper-plastic, aluminum-plastic, and steel-plastic composite materials, and special equipment on waste plastic recycling and secondary pollution control. It also aims to build a group of leading enterprises with scale of not less

than 200,000 tons per year and support a number of waste plastic recycling demonstration enterprises focused on efficiently recycling and promoting environmental protection, in order to significantly improve the quality of plastic recycled products and improve market competitiveness.

2.2.4. Environmental Protection Policy: Tightening Environmental Protection Policy

In recent years, high-pressure on environmental protection has become normal in China. Rectification has continued in various cities. Since the beginning of 2018, domestic policies have been intensive. After the Two Sessions, the Ministry of Ecology and Environment was established, and a series of actions such as environmental protection inspections, two rounds of "look back" campaign on environmental protection, and “action to defend blue sky” has been put in operation. Since 2019 China's new round of environmental protection inspections has been fully launched. It was planned to carry out the second round of ecological environmental protection inspections by central authority in 4 years. China's waste plastic recycling industry is facing a stricter environmental protection policy. The strong promotion of environmental protection policy will directly affect the start of enterprises production and the output of domestic recycled plastics.

2.3. Analysis of Technical Policy Environment

China now has issued and implemented 13 waste plastic standards, including 6 national standards and 7 industry standards, such as standards on recycling, packaging, transportation, storage, pre-treatment process requirements, environmental protection construction requirements, and pollution control requirements. All these standards have meet the requirements on *Technical Specifications for Pollution Control of Waste Plastics Recycling and* Reuse *(HJ/ T364-2007)*, *Regulations for the Prevention and Control of Pollution from Waste Plastics Processing and Utilization* (*Joint Announcement No. 55 of 2012* by NDRC, the Ministry of Environmental Protection and the Ministry of Commerce) and *Specification Conditions for the Comprehensive Utilization of Waste Plastics Industry* (effective from January 1, 2016) as well as other technical specifications. Among them, *Technical Specifications for Pollution Control of Waste Plastics Recycling and* Reuse *(HJ/T364-2007)* stated that waste plastics should be recycled in accordance with sequence order started from direct regeneration, modified regeneration, to energy recovery.

No.	Standard No.	Title
1	*GB/T 30102-2013*	*Guidelines for Recovery and Recycling of Plastic Waste*
2	*GB/T 27873-2011*	*Technical Specifications For Waste Product Disposal Companies*
3	*GB/T 16716-2010*	*Packaging and packaging waste Part 2: Evaluation methods and procedures*
4	*GB/T 16716-2008*	*Packaging and packaging waste Part 1: General rules for handling and utilization*
5	*GB/T 16487-2005*	*Environmental protection control standard for imported solid wastes as raw materials. Waste plastics*

6	*T/CCPIA 0001-2018*	*General Rules for Recycled Plastic Particles*
7	*SB/T 11149-2015*	*Technical Specifications for Waste Plastic Recycling Sorting*
8	*QB/T 4881-2015*	*Safely technical requirements for recycled and recycled plastic products*
9	*SN/T 3059-2011*	*Transport packaging for dangerous goods. Recycled plastic*
10	*SN/T 2928-2011*	*Method for identification of types of waste polymer materials. Part 1: Waste plastics*
11	*SN/T 2293-2009*	*Classification and identification of imported solid wastes as raw materials Part 2: Waste plastics*
12	*HJ/T 364-2007*	*Technical Specification on Waste Plastic Recycling and Recycling Pollution Control*
13	*SN/T 1791-2006*	*Rules for the inspection and quarantine of imported wastes used as raw materials Part 1: Waste plastics*

Table 2 National and industry technical standards for waste plastic recycling.
Data source: GEP Research.

In addition to national and industrial waste plastics standards, in 2014 six ministries, including NDRC, the Ministry of Science and Technology, and the Ministry of Industry and Information Technology, have jointly issued *the Implementation Plan for Recycling Engineering projects of Important Resources (Technology Promotion and Equipment Industrialization)*. The implementation plan proposed the goal and task of the recycling projects. It included the development of high-valued utilization technologies, such as waste plastic modification, secondary pollution-control technologies, and special equipment for waste plastic recycling. It also proposed the development of separation technology on flame-retardant materials, paper-plastic, aluminum alloy, and steel composite pipes, and an increase of production lines for waste plastic crushing, sorting, modification and granulation, so to promote automatic identification and sorting technology of waste plastics. The document recommended to put more effort on R&D of sorting and processing technologies of waste plastics, such as PET bottles, PS foam plastics, and agricultural film. *The Implementation Plan for Recycling Engineering projects of Important Resources (Technology Promotion and Equipment Industrialization)* have thrown light on the technical direction of waste plastics recycling industry.

3. Demand and Forecast of China's Waste Plastic Recycling Industry

3.1. Market Demand Capacity of Waste Plastic Recycling Industry

China's waste plastic recycling industry has a relatively large market volatility, which is closely related to the volume of recycling, imports, and price fluctuations of recycled plastics. Affected by the sharp decline in importation and price surging of recycled plastics in 2018, the overall market size of China's waste plastics recycling industry has shrunk. In 2018, the market size of China's waste plastic recycling industry was worth about RMB 139.19 billion, with a year-on-year decrease of 4.2%.

With the transformation and upgrading of China's waste plastics recycling industry and the high pressure on environmental protection, recycling rate of waste plastics will be increased. The market scale of the waste plastic recycling industry is expected to grow at a compound annual growth rate of 10% in the next 5 years. It is estimated that by 2020 the market size of China's waste plastic recycling industry will reach RMB 168.41 billion, and by 2023 it will reach RMB 224.16 billion.

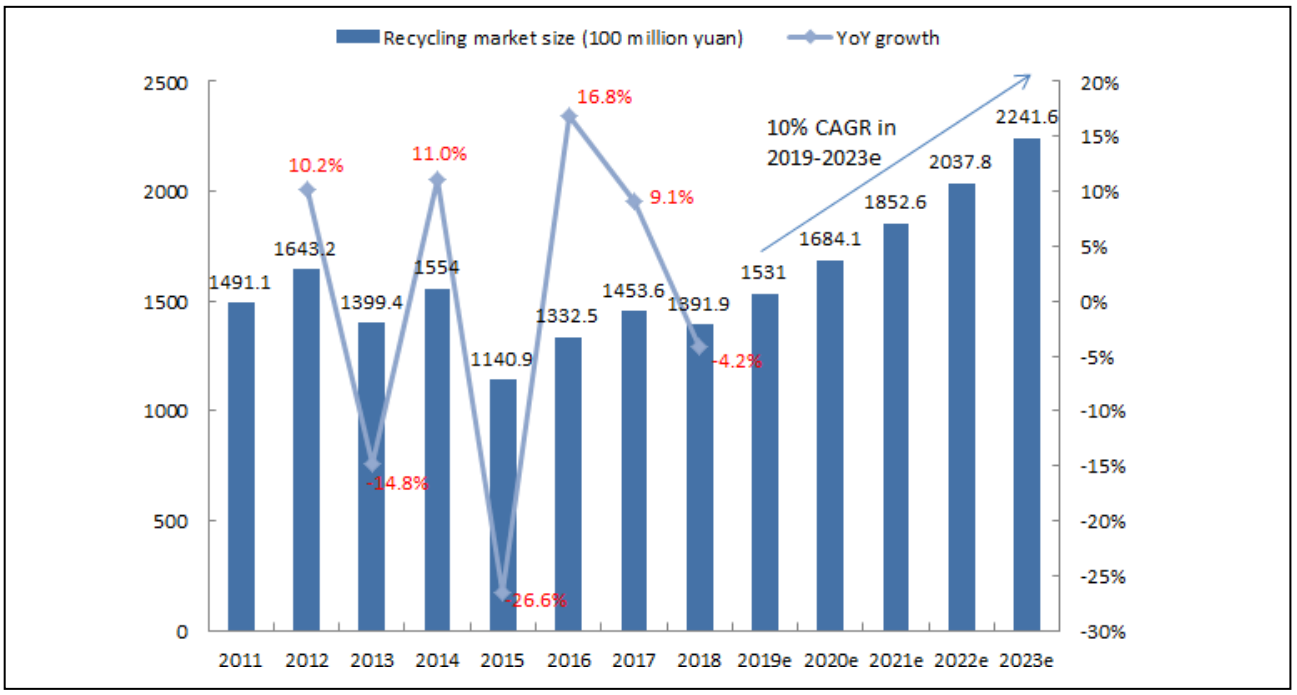

Figure 1 Market size and forecast of China's waste plastic recycling industry, 2011-2023.
Data source: Ministry of Commerce, National Bureau of Statistics, General Administration of Customs, GEP Research.

3.2. Demand Trends and Driving Factors

3.2.1. Huge Market Space for Waste Plastic Recycling

The overall recycling rate of waste plastics in China nowadays is still quite low. The annual plastic waste volume is about 35 million tons, leaving much room for recycling efficiency. With the introduction of relevant industrial policies and measures, waste plastic recycling industry continues to develop rapidly and steadily. As industries have developed for decades, China is currently in a period of high growth of waste production. Scraps of electrical and electronic products will reach a 20% CAGR in the next five years.

Automobiles leftovers have entered a peak period. In 2018, industry competition gradually penetrated mid-to-high-end fields, and industry's development potential further showed. This has led to the continuous improvement of the domestic waste plastic recycling system. Recycling volume will increase slightly compared to the previous year. It is expected that the annual amount of waste plastic recycling will reach 18 million tons, with a year-on-year increase of 6.35%. Waste plastic recycling volume will maintain a 10% compound growth rate in the next five years, reaching 21.78 million tons by 2020 and 28.99 million tons by 2023.

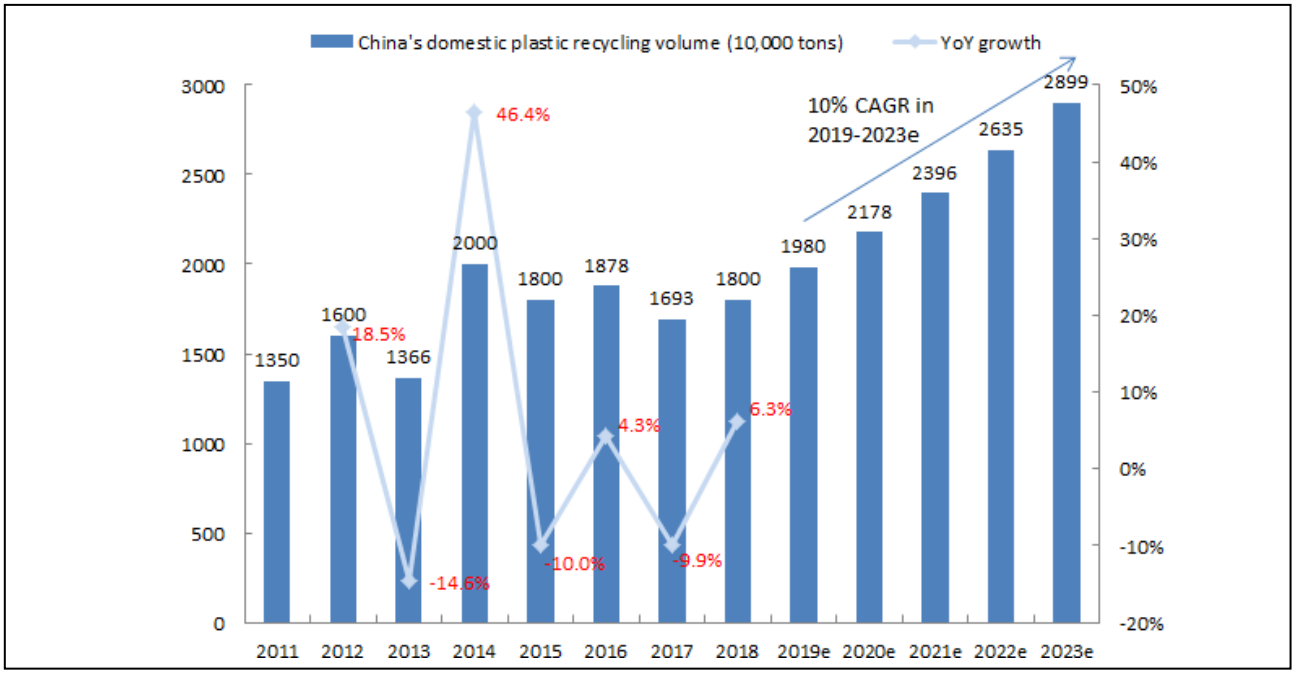

Figure 2 China's domestic waste plastic recycling volume and forecast from 2011 to 2023.
Data source: Ministry of Commerce, GEP Research.

3.2.2. Policy-Driven Development of Waste Plastic Recycling Industry

In recent years, China has issued a number of policies to promote the development of the waste plastics recycling industry. *The Industrial Plan for Green Development (2016-2020)* requires to reach 23 million tons of recycled domestic waste plastic by 2020. Since 2019, China has implemented a comprehensive ban on the import of waste plastics. In the future, the comprehensive waste plastics recycling industry in China will adapt to new policies, will speed up adjustments of production structure, and will gradually move to a new stage of development focusing on processing domestic waste plastics. It will promote domestic waste plastics purchase, and will establish a high-efficiency, multi-variety, and multi-channel domestic recycling system, expanding the domestic waste plastics recycling demand market.

3.2.3 Applications Continue to Expand

The field of plastic recycling applications will be constantly expanding, and different types of products with higher use values will be developed. With the improvement of plastic processing technologies, more types of recycled plastics will be subdivided, which will lead to market specialization and segmentation. Therefore, the overall level of the recycling industry will be improved.

3.3. Analysis and Forecast of Regional Market Demand

China's waste plastics recycling demand is mostly connected to major plastic production areas, mainly located in East China, South China, and Central China. In 2018, the size of the waste plastics recycling market in East China was worth RMB 49.09 billion, accounting for 43.8% of total. The market in South China was evaluated to be RMB 21.72 billion, accounting for 19.4% of the country. Finally, the market in Central China was worth about RMB 15.84 billion, accounting for 14.1% of the country.

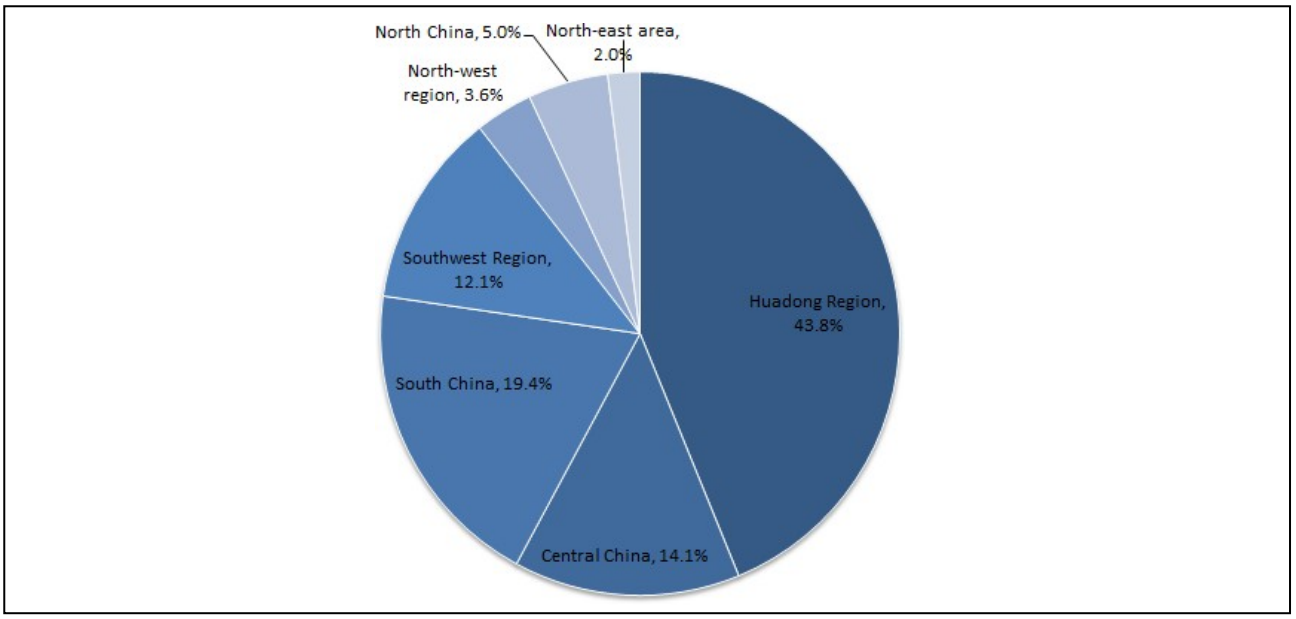

Figure 3 Distribution of China's Regional waste plastic recycling market 2018.
Data source: Ministry of Commerce, GEP Research.

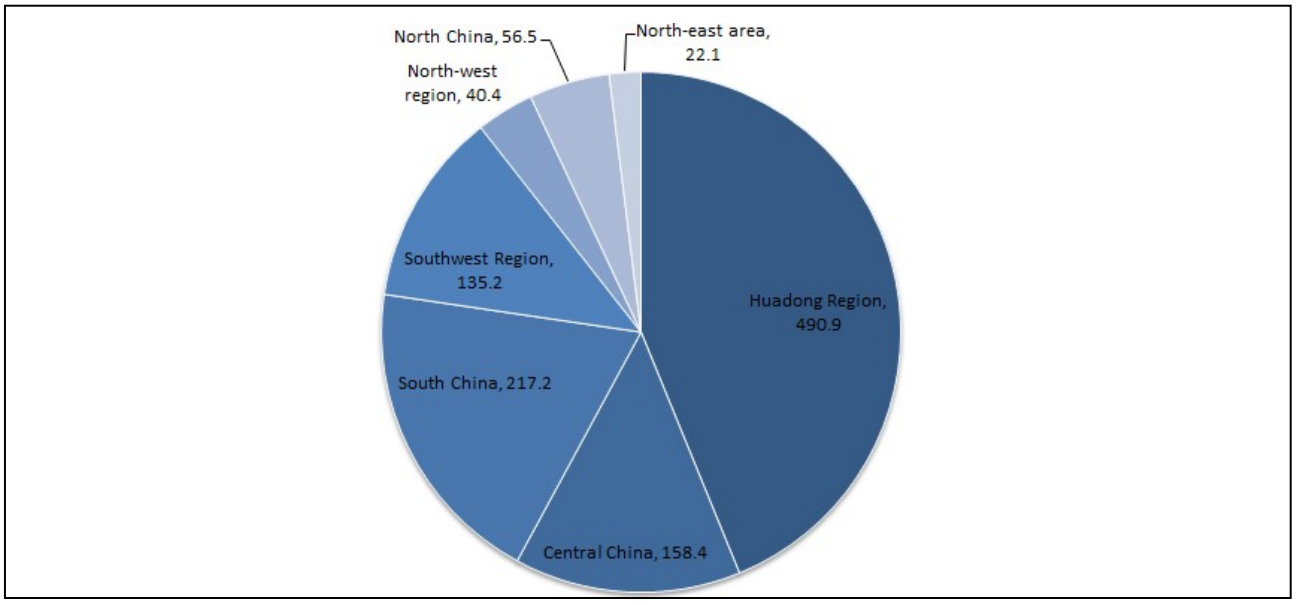

Figure 4 China's Regional waste plastic recycling market share in 2018 (RMB 100 million).
Data source: Ministry of Commerce, GEP Research.

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