UN-HABITAT

CHINA WASTE WISE CITIES GOOD PRACTICES

Series II

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CHINA WASTE WISE CITIES GOOD PRACTICES

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Good Practice Cities
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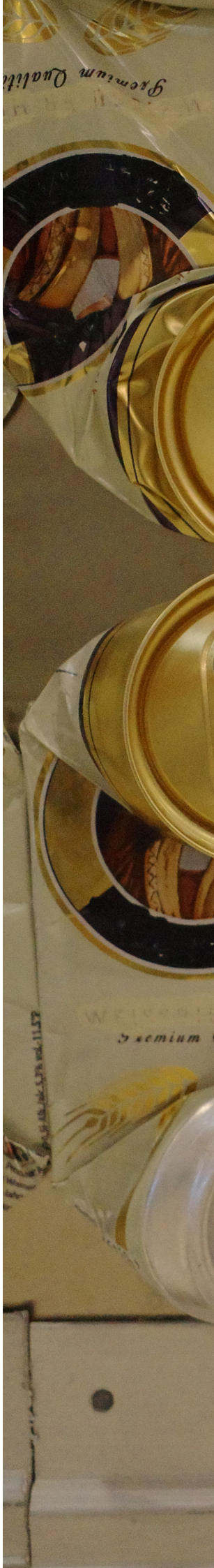
FOREWORD

As one of the essential public services that supports our society in the 21st century, waste management is a basic human need and a critical infrastructure, especially in urban areas. Waste management is a cross-cutting issue that affects many aspects of society and the economy, closely linked to many other global challenges, including health, climate change, poverty reduction, food and resource security, and sustainable production and consumption. Waste management is a key component of the Sustainable Development Goals (SDGs) and is considered as an entry point for achieving a range of SDGs.

In order to summarize the excellent experience in municipal solid waste (MSW) management and share and discuss with other cities, in December 2023, UN-Habitat China Office organized, prepared and published the China Waste Wise Cities Good Practices (Series I)[1] , which selected three representative cities/urban districts in China with reference significance, including Suzhou, Ningbo and Yantian District of Shenzhen City, and put forward the following key lessons in MSW management in China through the case studies. The main lessons learned from the case studies are: (1) clear strategic planning and target setting with the “Five-Year Plan” period are the foundation of the MSW management sector; (2) use market-based mechanisms to leverage capital investment to promote the rapid development of the sector; (3) stringent environmental emission standards, open and transparent data disclosure, and continuous communication with the public contribute to the shift from "neighbor avoidance" to "neighbor benefits"; (4) People-oriented digital governance has become the new business card of China's MSW management, and; (5) "Waste classification is the touchstone of social civilization" is an important experience provided by China's waste management practices.

On this basis, China Waste Wise Cities Good Practices: Series II continues to select another three representative cities/urban districts in China, namely Chaoyang District in Beijing Municipality, Xuzhou City in Jiangsu Province, and Fuzhou City in Fujian Province. This series of good practices summarizes the cases mainly from the perspective of diversified sustainable development, which extends the development of sustainable culture from communities and public places to the whole society, and extends concepts from waste management to the concepts of zero-carbon eco-parks further to zero waste cities, and notes the support of ecological-value orientation to the establishment of sustainable business model. The report concludes with a summary of waste wise experiences for MSW management in China from the perspectives of global environmental governance and global environmental challenges, expecting to provide more reference to the international society.

1. China Waste Wise Cities Good Practices: Series I | UN-Habitat (unhabitat.org)



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CHAPTER 01

01

CHAPTER ONE

Good Practice of MSW Management Practice in

Chaoyang District, Beijing

1.1 Overview of Chaoyang District, Beijing
1.2 Current Situation of MSW Generation, Treatment and Disposal in Chaoyang District, Beijing
1.3 Summary and Analysis of MSW Management Policies in Beijing
1.4 Flexible Governance - Building a Refined Management System with a Public Sense of Gain
1.5 Practicing SDGs - Sustainable MSW Management Practices for Commercial Complexes
1.6 Towards Zero Carbon - Zero Carbon Transformation of Urban Vein Industrial Parks
1.7 Summary of Practical Experiences in MSW Management in Chaoyang District, Beijing

1.1 Overview of Chaoyang District, Beijing

Chaoyang District is subordinate to Beijing Municipality, located in the south part of the central urban area of Beijing, with a total area of 470.8 square kilometers (km^2). Beijing has a flat topography, with the terrain gently decreasing from northwest to southeast, and a sub-humid warm temperate continental monsoon climate.

Administering 24 subdistricts, 19 townships (2,054 residential communities, about 1.39 million households altogether), Chaoyang District has a permanent resident population of 3.45 million, accounting for 15.8% of the total in Beijing (as of 2022), of which the external permanent resident population is 1.24 million, accounting for 36.1% of the total. In 2022, the Gross Regional Domestic Product (regional GDP) of Chaoyang District was Chinese Yuan (CNY) 791.12 billion, of which the added value of the primary industry was CNY 3.0 billion, added value of secondary industry CNY 51.93 billion, added value of tertiary industry CNY 738.90 billion; the structure of the three industries is 0.04:6.56:93.40; per capita GDP is about CNY 220,000.

Chaoyang District is an important window for Beijing's foreign exchanges. It is a typical international economic and cultural core area with nearly 100% of the city's foreign embassies in China, nearly 90% of the city's international institutions, and 70% of the international investment companies and regional headquarters. Chaoyang District has formed a diversified industrial pattern dominated by the finance, leasing, and business service industries, supported by the hi-tech industries, and associated with the cluster development of cultural and creative industries.

The data related to waste management involved in this case study were obtained from the Urban Management Committee of Chaoyang District, Beijing.

Figure 1-1 Urban Landscape of Chaoya
© By N509FZ - Own work, CC BY-SA 4.

ng District, Beijing
.0, https://commons.wikimedia.org/w/index.php?curid=110490462

1.2
Current Situation of MSW Generation, Treatment and Disposal in Chaoyang District, Beijing

The total volume of MSW collection, transportation and disposal in Chaoyang District, Beijing, from 2020 to 2023 is summarized in Table 1-1. In 2023, the total volume of MSW collection and transportation and disposal in Chaoyang District was 1,738,000 tons, of which 439,000 tons were food waste (including restaurant food waste and household food waste) and 1,300,000 tons were residual waste. Due to the calibre of the statistics, statistics on hazardous waste and recyclables were not compiled for the years 2020-2022. Food waste refers to the statistics of food waste entering food waste treatment plants, while residual waste refers to the statistics of the amount entering terminal treatment facilities.

Since 2023, Chaoyang District has further strengthened its statistics on recyclables, and through data collection from all subdistricts in the district, the amount of recyclables in Chaoyang District in 2023 was 509,776 tons (incomplete statistics), of which waste paper accounted for about 37% of the total amount of recyclables, and plastics accounted for 14.4% of the total amount of recyclables. In 2023, the recycling rate of MSW in Chaoyang District, Beijing (recyclables + household food waste + restaurant food waste) was 42.2%, of which the recycling rate of food waste (restaurant food waste) was 19.5% and the recycling rate of recyclables was 22.7%. It is worth noting that the current data on recyclables in most cities in China still do not include some informal or commercial recycling practices, and the actual resource utilization rate should be higher than the existing data.

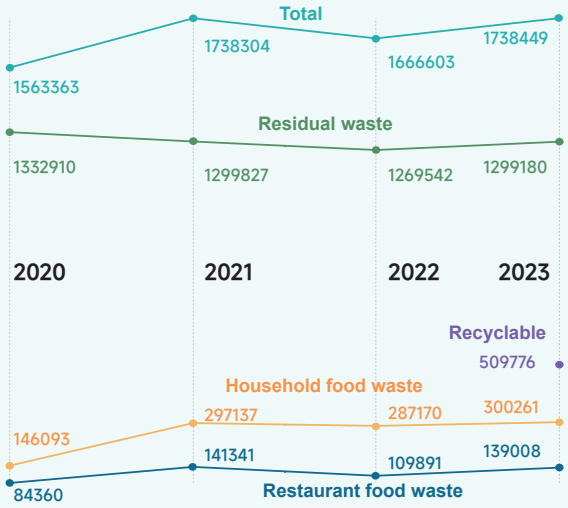
From the perspective of per capita MSW collection, in 2023, the per capita MSW collection in Chaoyang District, Beijing was 1.79 kg/day, of which per capita recyclables was 0.41 kg/day; from the perspective of MSW treatment and disposal, all residual waste in Chaoyang District is currently incinerated, and the Gaoantun Circular Economy Industrial Park in Chaoyang District undertakes the treatment and disposal of almost all MSW in Chaoyang District, including residual waste, household food waste, restaurant food waste, construction waste, and others, as detailed in Section 1.6.

MSW collection in Chaoyang, Beijing

2020 to 2023

- In 2023, the total volume of MSW collection and transportation and disposal in Chaoyang District was **1,738,000** tons
- The amount of recyclables in Chaoyang District in 2023 was **509,776** tons (incomplete statistics)
- In 2023, the per capita MSW collection in Chaoyang District, Beijing was **1.79** kg/day, of which per capita recyclables was **0.41** kg/day

Table 1-1 Collection, Transportation and Disposal of MSW by Category in Chaoyang District, Beijing (2020-2023)



Note: Food waste is categorized according to the source of waste generation into household food waste generated by household sources and restaurant food waste generated by restaurants and other catering establishments, known as restaurant food waste.

1.3 Summary of MSW Management Policies in Beijing

1 Laws and Regulations

- Regulation on Municipal Solid Waste Management in Beijing (2020 Amendment)
- Regulation on the Management of Construction Waste Disposal in Beijing (2020)
- Action Program for the Classification of Municipal Solid Waste in Beijing (2019)
- Work Plan on Further Improving the Municipal Solid Waste Classification (2023)

2 Organizational System

- Beijing Environmental Sanitation Development Plan for the 14th Five-Year Plan Period (2022)
- Notice on the Issuance of the Organizational Structure and Meeting Mechanism of the Beijing Municipal Command for the Promotion of Municipal Solid Waste Classification (2023)
- Work Plan for the Implementation of Important Livelihood Issues on Municipal Solid Waste Classification in 2023 (2023)

3 Classified Management

- Notice on the Issuance of Four Implementation Measures for Municipal Solid Waste Classification and Reduction (2022)
- Notice on the Issuance of Guidelines on Municipal Solid Waste Classification in Rural Areas in Beijing (2023)
- Notice of Beijing Municipal Housing and Urban-Rural Development Commission on the Work of Property Management Service Enterprises in Implementing the Responsibility of Responsible Persons for Municipal Solid Waste Classification Management (2020)

At the level of regulations, policies and organizational management, Beijing has also been improving and continuing to lead the policy development of the MSW management sector. The laws governing the MSW management in Beijing are the Law of the People's Republic of China on the Prevention and Control of Environment Pollution Caused by Solid Wastes, the Law of the People's Republic of China on the Promotion of the Circular Economy, and Regulation on the Management of Urban Aesthetics and Environmental Sanitation issued by the State Council. At the Beijing municipal level, a comprehensive policy management system has been formed in terms of laws and regulations, organizational system, waste reduction, waste classification management, demonstration and creation, publicity and mobilization, and guarantee mechanism, etc. Representative policies and regulations are as follows:

4 Waste Reduction

- Catalog of Disposable Tableware Not to be Provided Initiatively by Catering Service Units in Beijing (2020)
- Catalog of Disposable Items Not to be Provided Initiatively by Hotels in Beijing (2020)
- Implementation Plan for Recommending Reducing Food Waste at Source in Catering Units (2020)
- Guidance on the Progressive Promotion of Fresh-cut Vegetable on the Market (2020)
- Several Measures on Accelerating the Promotion of Green Transformation of Express Packaging in Beijing (2021)

5 Classified Waste Management

- Letter on Further Strengthening the Treatment of Food Waste (2020)
- Notice on Matters Related to Adjusting the Disposal Charge of Non-Household Food Waste in the City (2021)
- Opinions on Strengthening the Development of Recyclables System in the City (2021)
- Guidelines for Development of Recyclables System in Beijing (2021)
- Guidance on Improving Bulky Waste Management in the City (2021)

6 Advocacy and Mobilization

- Notice on the Mobilization and Launching of Municipal Solid Waste Classification in Communities (2020)
- Notice on the Setting of Staff for Law Education and Supervision on Municipal Solid Waste Classification in Beijing (2021)

7 Enforcement Guarantee

- Notice on Guidelines on Supporting Communities and Property Management Companies in Carrying out Municipal Solid Waste Classification by Grassroots Integrated Administration and Law Enforcement Teams (Trial) (2020)

As can be seen from the above, Beijing Municipal Government has been improving its policy and regulation system in all dimensions of MSW management, to make the MSW management in Beijing has laws and policies to follow, with a clear structure and a complete system. With the development of the policy system, in addition to the MSW authorities, there are more authorities of other sectors being involved and guiding the green transformation of the industry, such as the Beijing Municipal Bureau of Commerce's guideline on the listing of clean vegetables, and the Beijing Postal Administration's measures related to the green transformation of express packaging. In addition, it is worth mentioning that Beijing has always been a leader in the development of MSW management policies. Taking the charging mechanism as an example, Beijing has actively explored a good approach to promote the MSW reduction, classification and resource utilization by playing the role of the price mechanism. In 2021, Beijing Municipal Development and Reform Commission and Beijing Municipal Urban Management Committee issued the Notice on Matters Related to Adjusting the Disposal Charge of Non-Household Food Waste in the City, making it clear that since September 30, 2021, the non-household food waste disposal fee (including transportation and treatment) was adjusted to CNY 300/ton.

On this basis, Beijing Municipality has begun to implement differentiated waste management tariff for collective canteens of public institutions, troops, schools, enterprises and institutions, with specific standards: for those whose actual amount of food waste transported less than 50% of the quota standard (including 50%), the charging rate is set at CNY 200/ton; whose actual amount of food waste transported between 50% and 100% (including 100%), the rate is set at CNY 300/ton; whose actual amount of food waste transported exceeds the quota standard, the rate is CNY 300/ton for waste within the quota and CNY 600/ton for the exceeding portion of the quota standard.

The establishment of a charging mechanism for non-household food waste is an important attempt to establish a charging mechanism for waste management on a quality and quantity basis, which is positively supportive of the further improvement of the charging mechanism for MSW management.

1.4 Flexible Governance

— Building a Refined Management System with a Public Sense of Gain

As the political center, cultural center, international communication center and science and technology innovation center of China, Beijing has the urban temperament of “grace, elegance, liberality and inclusiveness”. “City management should be as fine as embroidery; the larger the mega-city it is, the finer the management should be” is the requirement for the modernized development of the governance system of mega cities. As an important element that influence the cityscape, Beijing's MSW management is characterized by "high quality and refinement", representing the mega city urban governance characteristics. In the process of refined management, public participation and the implementation of grassroots governance are at the core, and the "ask for people's needs, ask for people's advice, govern and manage together, and build and share together" is the development direction of refined management.

Dongfeng Subdistrict is a township under the jurisdiction of Chaoyang District, with 11 communities and 4 administrative villages under its jurisdiction. From the perspective of administrative zoning, Dongfeng subdistrict is in the urban-rural fringe area of Beijing, but its actual location is adjacent to the China World Trade Center finance area and the embassy area, with the characteristics of dense population, relatively high-quality personnel, and the international cultural fusion. Since the implementation of the new 2020 version of the Regulation on Municipal Solid Waste Management in Beijing, Dongfeng subdistrict has been actively exploring and building a waste classification system with a public sense of gain by using intelligent collection stations as a carrier.

At present, Dongfeng District Township has a total of 23 Intelligent Stations (Figure 1-2), covering 14 housing estates in 7 communities. Each Intelligent Station has four classified waste collection and recycling areas and a separate rest and education area. Once each household registered in the system, residents can throw waste by

Figure 1-2 Waste Classification Stations in the Dongfeng Subdistrict
© LIU Xiao

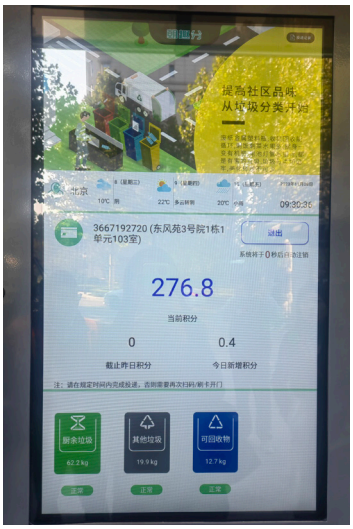


Figure 1-3 Point System of Smart Station
© LIU Xiao

classification at the intelligent stations, and the amount of waste thrown by each household can be intelligently and accurately measured. Together with the mobile phone application for waste classification, it forms "small database" of the public participation in waste classification; the "small database" of all households will becoming "big database" when aggregated into the platform terminal, and the utilization of big database will provide a scientific basis for the analysis of the waste classification effectiveness. The well-designed and maintained intelligent stations have significantly improved the public participation willingness in waste classification, and at the same time guide and constrain the public's waste throwing behaviors through scientific and technological means. "From concept to action, and from rough classification to refined classification," the classification stations is the booster of waste classification.

In order to mobilize the public enthusiasm to participate in waste classification and support the public to form the habit of waste classification, the backstage program of the intelligent station will record the points of the waste thrown by the residents (Figures 1-3), where 1 kilogram of food waste will get 1 point reward, 1 kilogram of residual waste will get 0.1 point reward, 1 kilogram of recyclables will get 2 points, no point for hazardous waste. Every 5 points can exchange for gifts with a value of CNY 0.1. The system will provide different values proper encouragement for the participating public,

and the points can be used to exchange daily necessities of different value based on the points. The points-based system can give the public intuitive feedback, motivating people to recycle more waste and dispose fewer residual waste, and ultimately improves the enthusiasm of the residents for initiatively classification. During January to June 2023, the Dongfeng station had credited a cumulative total of 838,726 points, and the expenditures related to points exchanging is paid by Dongfeng subdistrict government.

In the process of implementing waste management, the main stakeholder, in addition to the public at the frontline and the waste transportation and treatment and disposal units at the end, the property management company is serving as a bridge between the public and the municipal system. In order to actively promote the implementation of responsibilities of the property management companies, to promote the normalized and long-term management, and to continue improve the effectiveness of the waste classification and the level of refined management in Dongfeng subdistrict, Dongfeng subdistrict has issued the Evaluation Methods on Municipal Solid Waste Classification of Property Management Companies and Communities in Dongfeng Subdistrict, Chaoyang District (Trial). In addition to clear specification on key performance indicators and assessment criteria, the Evaluation Methods also stipulates the incentive mechanism for the outstanding property management companies and communities on waste classification, which gives CNY 1-3 per household per month as incentive subsidy to property management companies and communities that meet the waste classification standard, and the incentive funds are earmarked for property management companies to continue carrying out waste classification-related activities and work.

In addition, it is worth emphasizing that during the process of promoting waste management in the Dongfeng community, there was also active interactions with local social organizations, "government and society cooperation" worked together to promote the development of a sustainable environment in the community. Established in 2016, the Dongfeng Subdistrict Federation of Social Organizations is a grassroots hub-type social organization based in Dongfeng, which helps to optimize community governance by organizing diversified social work services and volunteer activities, and also supports the establishment of a better and enriched social governance structure in Dongfeng. With the support of Vanke Foundation's "Green Partnership Project", the Dongfeng Subdistrict Federation of Social Organizations has carried out in-depth exploration in waste classification and waste management, and supported the establishment of community volunteer service teams in three communities; for example, it

cooperated with the volunteer team of "Sweet Family of Old Street and Neighborhood" in Dongfengyuan Community to deliver special training and organized a team of 22 people to carry out waste classification related work; in Yingxiyuan community, a volunteer team of "Love in Our Home, Warms You and Me" was established with 15 fixed members, which could continuously and stably carry out activities related to waste management; furthermore, on the basis of team building, a rich variety of activities on sustainable development and waste classification educational activities were organized in the community, and waste management activities such as swap meets and community waste composting were carried out, which have effectively incubated and cultivated a culture of sustainability in the community, and have played a positive role in promoting the

Figure 1-4 Volunteers collecting food waste as raw material for composting
© Dongfeng Subdistrict Federation of Social Organizations

sustainable development of the community (Fig. 1-4 and Fig. 1-5).

As can be seen from the above, taking Dongfeng Subdistrict as an example, Chaoyang District adheres to the idea of "***flexible governance***" in waste management, especially in waste classification for the public. Based on the principle of "***rewards as the mainstay, penalties as a supplement, and a combination of rewards and penalties***" and "***encouraging the advanced, stimulating the underachievers, and joint promotion***", Chaoyang District focuses on cultural development and behavior guidance, leveraging stakeholder participation through grassroots community constraints and small-scale incentives, as well as strengthening the public's and stakeholders' sense of gaining, through community self-governance and grassroots governance.

Figure 1-5 Community Volunteers Group Visit to Waste Disposal Facilities in Beijing
© Dongfeng Subdistrict Federation of Social Organizations

1.5
Practicing SDG
— Sustainable MSW Management Practices for Commercial Complexes

Public space is an important place for the urban public to relax, communicate and participate in social activities. The integration of sustainable design in public spaces does not only positively impact on the quality of life, social vitality, and cultural immersion of the urban public, but also an important component of sustainable cultural development in urban areas.

Located in Jiangtai Subdistrict in Chaoyang District, Beijing, and close to high-end residential areas, international schools and top multinational corporations, **INDIGO** is a mixed-use commercial center that combines the fashionable shopping mall, business hotel and commercial office building, with a total site area of approximately 59,000 square meters (m^2) and a total gross floor area of approximately 176,000 m^2, making it a very representative commercial complex in Chaoyang District. Jointly developed by Swire Properties Limited and Sino-Ocean Commercial Property, the development of INDIGO sticked to the concept of sustainability, which was implemented throughout the entire lifecycle of the project from design, construction to operation.

1 MANAGEMENT CONCEPT

Firstly, from the perspective of management concept, Swire Properties' Sustainable Development Strategy 2030 (SD 2030) has provided leading guidance for the sustainable development of INDIGO. The strategy consists of 80 targets and more than 25 focus areas covering five strategic pillars: Places, People, Partners, Performance (Environment) and Performance (Economic). Swire Properties' sustainability goals are closely aligned with 11 out of the 17 Goals of the United Nations' Sustainable Development Goals (SDGs), as shown in Table 1-6. INDIGO has been applying the SD 2030 Strategy as the fundamental approach to manage the company in the long term, with a view of providing tenants with more efficient and environmentally friendly operational management practices. Swire Properties launched the Green Performance Pledge in 2021, which provided a platform for tenant collaboration based on green commitment framework, covering two core areas of the whole lease

cycle: tenant fit-outs and day-to-day operations. It has also been working with tenants in office building seeking for the practical ways to reduce energy consumption, water consumption and waste; and INDIGO office building also has tenants participating in the Green Performance Pledge.

Figure 1-6 Links between Swire Properties Sustainable Development Strategy and Sustainable Development Goals
© Swire Properties Sustainable Development Report 2022

During design and construction, INDIGO has obtained the certifications of ISO 14001:2015 Environmental Management System, ISO 50001:2011 Energy Management System and ISO 45001 Occupational Health and Safety System, achieving effective management of its performances on environment, energy and occupational health and safety. The INDIGO shopping malls and office buildings have been certified the LEED Core and Shell (LEED-CS) Gold and Platinum respectively at the design stage, and after INDIGO's official operation, it became the first complex in the world to be certified LEED V4.1 O+M for Existing Buildings and Places Platinum in 2019 through solid efforts.

2 DESIGN & CONSTRUCTION

3 FACILITY OPERATION

From the perspective of facility operation, INDIGO has developed a breakdown of sustainable development indicators from various perspectives, such as air quality management, energy conservation, rainwater and sewage separation and reuse, and waste reduction, and has been actively practicing the sustainable development strategy, with main practices as follows:

(1) Interior space

- Utilizing skylights and clear dome to ensure ample natural lighting;
- Air conditioning filtration system and light plasma air purification to ensure clean and fresh indoor air;
- Infrared equipment scans to find and seal leaks to ensure the leak-proofness of the building envelope;
- Precise temperature control sensation and regulation for equalizing room temperature on high space floors.

(2) Energy conservation

- Energy management cloud platform for systematic monitoring and analysis of energy-related data;
- Insulation film added to clear skylights for effective block of heat from the sun;
- LED lighting used in all public areas for electricity saving;
- High-efficiency fans installed replacing the traditional belt-driven fans to improve the efficiency of air-conditioning operation;
- Boiler flue gas recovery renovation to make full use of boiler waste heat for recycling;
- High-efficiency pumps to reduce energy consumption;
- Peak and valley energy storage to regulate peak electricity use;
- Free cooling is used to produce chilled water instead of freezers in winter months to replace refrigerating machine;
- Installation of solar photovoltaic panels on the roofs of shopping mall and office building to generate electricity and reduce carbon emissions.

(3) Reduction of waste generation

- Rainwater, reclaimed water and wastewater are recycled and used for greening irrigation, toilet flushing, etc. after treatment and purification;
- Boiler room retrofitted with low-NOx to reduce nitrogen emissions;
- Active implementation of waste classification, using intelligent weighing to record the quantity of each category of waste generated on a daily basis, and data analysis is carried out as an important basis for waste management optimization;
- Refrigeration house built for restaurant food waste and actively encourage restaurant tenants to order in moderation to reduce restaurant food waste;
- Recyclable waste of INDIGO in 2023 was close to 506 tons, with a recycling ratio of 53%.

Figure 1-7 INDIGO Sustainable Development Center
© INDIGO

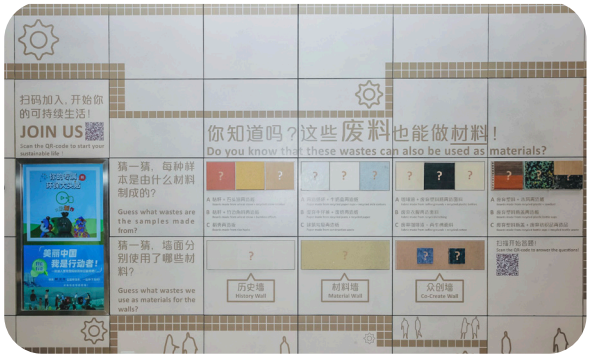


Figure 1-8 Background Wall Introducing Recycling of Waste Materials in INDIGO
© INDIGO

Figure 1-9 Background Wall Introducing Recycling of Waste Materials in INDIGO
© INDIGO

It is worth emphasizing that, in terms of cultural development, as a business public space, INDIGO has taken sustainable development as a key culture and concept for dissemination. In 2021, the INDIGO Sustainable Development Center was formally established (Figures 1-7, 1-8, and 1-9). The Sustainable Development Center was transformed from a escalator hall which connects the office building, the shopping mall, and the underground parking lot, realizing the adaptive reuse of space with a multifunction of exhibition, education and interaction. The completion of Sustainable Development Center facilitates the promotion and publicity of waste classification and

4 CULTURAL DEVELOPMENT

recycling and reuse. The entire space uses plates made from recycled waste materials, illustrating the concept of sustainable development in practical actions. In addition, a Sustainable Development Studio (Figure 1-10) has been set up at INDIGO, which carries out diversified activities related to waste classification and sustainable development, serving as a platform for multifaceted co-creation that creates value for the community, contributes to the environmental improvement, and promotes physical and mental well-being of the community.

Figure 1-10 INDIGO Sustainable Development Studio
© INDIGO

As a representative of business space in Chaoyang District, INDIGO is also a model for practicing sustainable development, which takes low-carbon energy consumption and resource conservation as the core focuses, to promote environmentally friendly sustainable lifestyles and sustainable community cultures, making them the new trends and fashions for the public in Chaoyang.

1.6 Towards Zero Carbon — Zero Carbon Transformation of Circular Economy Industrial Parks

The arterial industry based on resource development-product-consumption has always been the focus of urban development and social concern. It boosts a city's economy and promotes the prosperous development of urban economy. Rapid economic development is accompanied by the coordination and conflicts between resources and environment, which especially are more significant in mega-cities. The vein industry, which starts from waste generation from the production or consumption, to the waste collection and transportation, classification and decomposition, recycling, and the final disposal of waste, that has become the core supportive industry for environmentally friendly and sustainable development of cities.

In order to better achieve the coordination and unity between environment and development, Beijing Chaoyang District has been exploring the enhancement of the development of vein industry through the construction of industrial park since 2000, and the combination of vein industry and artery industry to form a circular economic development mechanism. Beijing Chaoyang Circular Economy Industrial Park is located at Gaoyantun of south Jinzhan Township in the east-central part of Beijing Chaoyang District, covering an area of about 3 km^2. After more than 20 years' development, the park has gradually evolved from a sanitary landfill site into a circular economy industrial park integrating comprehensive treatment of solid waste from multiple sources (Figure 1-11).

The built projects in the Chaoyang Circular Economy Industrial Park mainly include the multi-source solid waste disposal facilities for MSW, restaurant food waste, construction waste, waste materials, etc., with a daily capacity of around 8,000 tons of various types of waste, and a total accumulative treatment amount of more than 30 million tons of various types of waste. Among them, the capacity of

solid waste incineration power plant is 3,400 tons per day (Figure 1-12), restaurant food waste resourceful treatment 400 tons per day, construction waste resource utilization 1.23 million tons per year (Figure 1-13), and recycling and utilization of waste materials a total of 147,000 tons per year. The under-construction projects in the park mainly include one food waste treatment plant with treatment capacity of 800 tons per day; besides, one solid waste incineration plant phase III is planned to be constructed, with a treatment capacity of 2,400 tons per day.

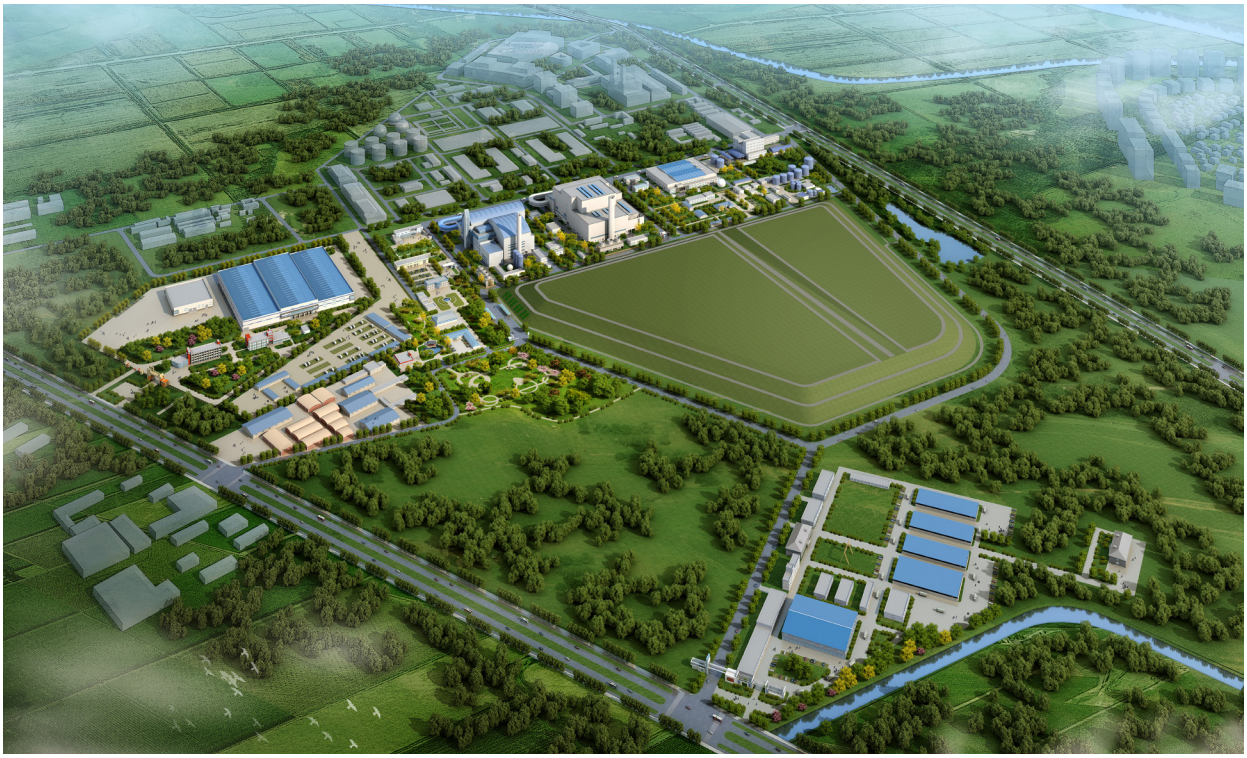


Figure 1-11 Full View of Chaoyang District Circular Economy Industrial Park
© Beijing Chaoyang District Urban Management Committee

The Chaoyang Circular Economy Industrial Park is constantly optimized and upgraded to improve the park's energy utilization efficiency and resource utilization efficiency. The Beijing Chaoyang Clean Incineration Center located in the park covers an area of 5.33 hectares, with a total investment of CNY 1.037 billion, designed capacity of 1,800 tons per day, designed annual power generation capacity of 290 million kWh, and an annual feed-in capacity of 226 million kWh to the grid, and was put into trial operation on May 18, 2016. It is one of the first batch of AAA solid waste incineration plants in China (organized and certified by the Ministry of Housing and Urban-Rural Development), representing the most advanced

construction and operation level as well as the best environmental protection technical index in China.

On this basis, Beijing Chaoyang Clean Incineration Center actively guided and participated in the release of Guideline for Clean Incineration of Municipal Solid Waste , where clean incineration refers to a higher requirement proposed for the improvement of comprehensive operational performance of MSW incineration facilities built on the existing environmental pollutant control standards. the Guideline for Clean Incineration of Municipal Solid Waste gives a clear guidance for the incineration facilities in terms of material balance, energy balance and water balance, and puts forward more systematic evaluation indicators, including incineration process and equipment indicators, pollutant control and greenhouse gas emission reduction indicators, comprehensive utilization and reliability indicators, management indicators, etc., proposing better requirements for the operation and management of MSW incineration facilities (Table 1-2). The Beijing Chaoyang Clean Incineration Center is also the only incineration facility listed in the cases of clean incineration standards.

On the basis of individual facilities optimization, Beijing Chaoyang Circular Economy Industrial Park is also focusing on material and energy synergy across facilities, and has established an ecological chain of resourceful products mainly on "renewable energy, renewable resources and renewable building materials". MSW is transported to the incineration plant in the park through sanitation vehicles for incineration and power generation; food waste and leachate are processed with anaerobic treatment to produce biogas for power generation, forming an ecological chain of renewable energy for green electricity, with a green electricity supply capacity of more than 500 million kWh/year; renewable oils and fats produced by the restaurant and household food waste treatment plants are collected for the production of bio-diesel; recyclables deliver to the material recycling center for sorting, processing and other treatments, to make recycled products, forming an ecological chain of renewable resources, and; construction waste and incinerator slag deliver to the construction waste treatment plant, and are processed into recycled construction aggregates after crushing and screening, forming an ecological chain of renewable building materials.

Looking towards the future, Beijing Chaoyang Circular Economy Industrial Park is also planning to go one step further and transform into a zero-carbon park built on the high standard of clean incineration. The Zero-Carbon Park is positioned with technological innovation and efficient energy consumption as the core, to build a zero-carbon, digital development model and practice system based

on solid waste treatment and disposal and resource utilization. Beijing Chaoyang Circular Economy Industrial Park will take green low-carbon, intelligent and efficient, and cohesive value as its strategic goal, further implement energy upgrading and transformation projects, supplement photovoltaic system, establish carbon emission accounting system and related management system, and utilize digital technology to develop systematic solutions for environmental industrial park, and; continue to build and optimize new capabilities in energy, low carbon, and intelligence, empowering business innovation and transformation, thereby forming new business models and promoting the extension and value-adding of the value chain. It is planned to achieve zero carbon or even negative carbon emission in the whole park in 2030.

The concept and practice of Zero Carbon Park also marks the voluntary emission reduction action of the vein industrial parks centered on waste treatment and disposal in China to actively practice emission reduction, actively respond to climate change, and contribute to the goal of "Carbon Peak and Carbon Neutrality".

Figure 1-12 Beijing Chaoyang Clean Incineration Center
© Beijing Chaoyang District Urban Management Committee

Figure 1-13 Chaoyang District Construction Waste Resource Utilization Center
© Beijing Chaoyang District Urban Management Committee

The Chaoyang Circular Economy Industrial Park

Table 1-2 Examples of Evaluation Indicators for the Operation and Management of MSW Clean Incineration Plant

No.	Primary indicator	Weight of primary indicator	Secondary Indicator		Unit	Weight of secondary indicator	Class I	Class II	Class III
2.1	Pollutant control indicators for CO, flue gas, odor, and noise	0.30	Daily average/hourly unit particulate matter emission (10)		mg/Nm3	100	10/20	15/30	20/30
2.2			Daily average/hourly unit HCl emission (9)		mg/Nm3		10/40	30/50	50/60
2.3			Daily average/hourly unit SO2 emission (9)		mg/Nm3		50/80	70/90	80/100
2.4			Daily average/hourly unit NOx emission (9)		mg/Nm3		180/240	200/260	250/300
2.5			Hg and its compounds (as Hg) (10)		mg/Nm3		0.05 (test mean)		
2.6			Cd/Ti and their compounds (as Cd+Ti) (9)		mg/Nm3		0.1 (test mean)		
2.7			Sb/As/Pb/Cr/Co/Cu/Mn /Ni and their compounds (as in Sb+As+Pb+Cr+Co+Cu+Mn +Ni) (9)		mg/Nm3		1.0 (test mean)		
2.9			Dioxin-like emission (10)		ngTEQ/Nm3		0.1 (test mean)		
2.10			Odor emission (GB14554 plant boundary level) (10)				Class I	Class II	
2.11			Ambient noise equivalent sound level (5)		dB (A)		Value at the factory boundary meets the standard, and that at the sensitive point meets the standard		
2.12			Daily average/hourly unit CO emission (10)		mg/Nm3		50/100	60/100	80/100
3.1	Resources and Energy Consumption indicators of waste incineration	0.05	Electricity consumption per unit of incoming waste (including leachate reclamation treatment) (14)	water cooling unit	kWh/t	100	44.00	49.00	56.00
				air cooling unit	kWh/t		46.20	51.50	58.80
3.2			Water consumption per unit of incoming waste §3.3.3.1 (14)	water cooling unit	t/t waste		2.6	3.0	4.5
				air cooling unit	t/t waste		0.6	0.7	1.2
3.3			Compressed air consumption per unit of incoming waste (10)		Nm3/t waste		6.00	6.50	8.00
3.4			Amount of 0# diesel fuel consumption per unit of incoming waste (14)		kg/t waste		0.15	0.25	0.50
3.5			Coal consumption per unit of incinerated waste (14)		t/t waste		0		0.05
			Other fuel consumption per unit of incinerated waste (4)		t/t waste		0 (when replacing 0# light diesel oil, the calorific conversion meets the light diesel oil indicator)		
3.6			Combined energy consumption per unit of waste §3.3.4 (30)		kgce/t		6.0	6.7	8.0

Note: Only 2. Pollutant control standards for CO, exhaust gas, odor, and noise, and 3. Resources and energy consumption indicators of waste incineration are taken in the table as examples, and not all evaluation indicators are listed.

1.7

Summary of Practical Experiences in MSW Management in Chaoyang District, Beijing

From Gaoantun Landfill to Gaoantun Waste Incineration Treatment Plant, to Chaoyang Clean Incineration Center, and to the Zero Carbon Park, the development of Chaoyang Circular Economy Industrial Park is a silhouette of Beijing's continuous optimization and improvement of MSW management, which reflects the style of "keeping right and innovative, striving for perfection" of the MSW management in Chaoyang District, Beijing.

Under the new development pattern of fine management with waste classification as the new starting point, the MSW management in Beijing has reflected the good interaction and joint progress with the public and diversified social entities, forming a joint force to promote the transformation and upgrading of MSW management. Given Beijing's role as China's political center and cultural center, as well as center of international communication and center of scientific and technological innovation, the urban management in Beijing further reflects its special mission and value, doing a good job in facility construction and operation management with requirements for higher quality, serving the city and the public with a more inclusive attitude, and being rigorous and meticulous to find the truth in detail are the practical experiences provided by Beijing Chaoyang District in MSW management.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CHAPTER 02

02

CHAPTER TWO

Good Practice of MSW Management Practice in

XUZHOU

2.1 Overview of Xuzhou
2.2 Current situation of MSW generation and treatment in Xuzhou
2.3 Summary and Analysis of Policies on MSW Management in Xuzhou
2.4 Sustainable Culture Development - Practicing Waste Classification and Sustainable Development Concepts At Source
2.5 From Waste Reduction to Waste Free – Iteration and Upgrading in the Waste Management Sector
2.6 Ecological Oriented Development - A New Model for Environmental Management and Transformation in Industrial Cities
2.7 Summary of Practical Experience in MSW Management in Xuzhou

2.1
Overview of Xuhzou

Xuzhou Municipality is located in the northwest of Jiangsu Province, about 210 kilometers (km) long from east to west and 140 km wide from north to south, with a total land area of 11,765 km^2. It is located at the junction of four provinces, namely, Jiangsu, Shandong, Henan, and Anhui; it is known as "the thoroughfare of five provinces" with the Huaihai Region in the east, the Central Plains in the west, the Jianghuai in the south and the Qilu in the north. Beijing-Shanghai Railway and Longhai Railway intersects here in Xuzhou, Beijing-Hangzhou Grand Canal passes by the city through the north and south of Xuzhou, and the highway is well-connected to Beijing-Tianjin in the north and Shanghai-Nanjing in the south, Lanzhou-Xinjiang in the west, and the seashore in the east, which makes Xuzhou an important land and water transportation hub and an important crossroads for east-west and north-south economic links in China.

Xuzhou is located in the mid-latitude region, belonging to the warm temperate monsoon climate zone; with the Central Canal as the dividing line, the eastern part of Xuzhoy belongs to the warm temperate humid monsoon zone, and the western part belongs to the warm temperate semi-humid monsoon zone; the total solar radiation throughout the year is about 119.4 $kcal/cm^2$, with an annual average of about 2,100 hours of sunshine, and an annual average of about 900 millimeters of precipitation.

Xuzhou municipality has an urban area of 604.8 km^2, with an urban population of 1.98 million in 2022. According to the 2022 Xuzhou National Economic and Social Development Statistical Bulletin, the gross domestic product (GDP) of Xuzhou was CNY 845.78 billion in 2022, with the proportion of the three industrial structures as 9.1:42.5:48.4; and the city's per capita GDP was CNY 93,731. Construction machinery and intelligent manufacturing are the representative industries of Xuzhou, and the output value of the construction machinery industry accounts for about 20% of the total output in China.

The data related to waste management involved in this case were obtained from the Xuzhou Municipal Urban Management Bureau.

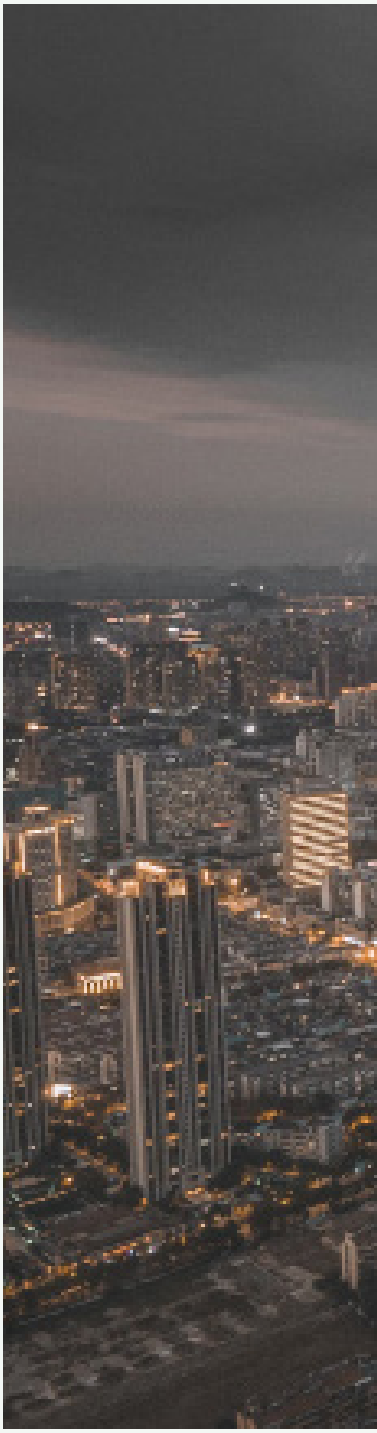

Figure 2-1 Urban landscape of Xuzhou
© Photo by famingjia inventor on Unspla

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2.2 Current Situation Of MSW Generation And Treatment In Xuzhou

Since the start of the four categories of MSW classification in March 2020, Xuzhou has gradually established a system of classified MSW collection and transportation. The MSW is collected and transported by either regular classified collection at fixed points or door-to-door classified collection based on the characteristics of the MSW generation in the service area, which has basically achieved containers, closed, mechanized collection. The city's MSW treatment has achieved full incineration and zero landfill for residual waste, while restaurant food waste, organic perishable waste from markets and household food waste have been processed in a coordinated manner.

The summary of solid waste transportation, collection, and treatment in Xuzhou from 2020 to 2022 is shown in Table 2-1. In 2022, the total amount of MSW collection and treatment in the urban area was 1.183 million tons, of which 229,000 tons was food waste (including restaurant food waste and household food waste), 199,000 tons was recyclables. The statistical boundary is the urban area of the city, and the statistical data of food waste is that entered food waste treatment plant, that of residual waste is the amount entered the incineration plant, and recyclables are the statistical data of recycling stations, sorting centers, baling stations and so on.

With the advancement of waste classification, the collection of household-sourced food waste has increased year by year. In 2022, the recycling rate of MSW in Xuzhou (recyclables + household food waste + restaurant food waste) is 36.1%, of which food waste (household/restaurant) accounts for 19.3% and the recyclables accounts for 16.8%. Compared with 2020 and 2021, Xuzhou included recyclables-related data in its statistics in 2022, which further improved the statistics on MSW management. The current data on recyclables in most Chinese cities still does not include some informal or commercial recycling practices, and the actual resource utilization rate should be higher than the available data.

From the perspective of per capita MSW collection, the per capita MSW collection in Xuzhou City in 2022 was 1.64 kg/day, of which the number of per capita recyclables was 0.28 kg/day. At present, the recycling amount of each subcategory of recyclables within the urban area has not been counted for the time being, and the recyclables in urban area are mainly recycled by some market-based private companies, such as AIFENLEI Environment Ltd. In November 2023, AIFENLEI installed an accumulative total of 1,053 recycling machines in 380 neighborhoods in 139 communities across 31 subdistricts in Xuzhou City, covering more than 1.284 million

people, and recovered a total of 1,592 tons of recyclables, of which 569 tons of paper, 238 tons of plastics, 676 tons of fabrics, 80 tons of metals, and 7 tons of glass, and the proportion of recyclables by category is shown in Figure 2-2. AIFENLEI's recycling model penetrates deeper into the community. It can also be seen that at the community level, the collection of used textiles is very high in overall, which is also the focus of urban recyclables to be paid attention to in next steps.

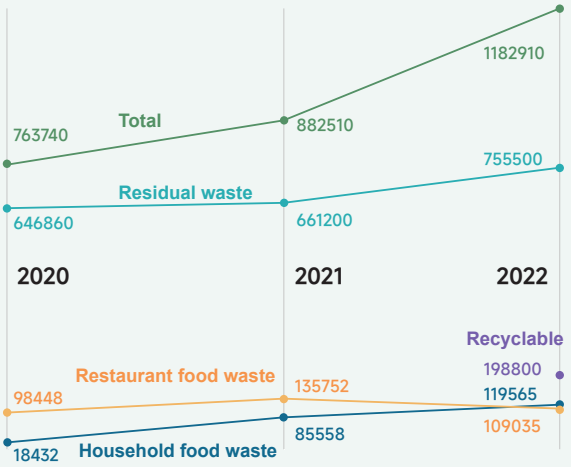
Regarding MSW treatment and disposal, all the residual waste in Xuzhou is treated with incineration currently. The city has two MSW incineration power plants, with a total treatment capacity of 3,450 tons per day, which can ensure 100% harmless treatment of residue waste. There is one existing (restaurant/household) food waste treatment facility in Xuzhou City to treat biodegradable organic waste from markets and household garbage synergistically, with a total capacity of 846 tons per day, showing sufficient food waste treatment capacity.

MSW collection data in Xuzhou

2020 to 2022

- In 2022, the total amount of MSW collection and treatment in the urban area was **1.183 million tons**
- In 2022, the **recycling rate** of MSW in Xuzhou (recyclables + household food waste + restaurant food waste) is **36.1%**, of which food waste (household/ restaurant) accounts for **19.3%** and the recyclables accounts for **16.8%**

Table 2-1 Classified collection, transportation, and treatment of MSW in Xuzhou (2020-2022)



Note: Food waste is categorized into household food waste (generated by household sources) and restaurant food waste (generated by restaurants and other catering establishments) according to the source of waste generation.

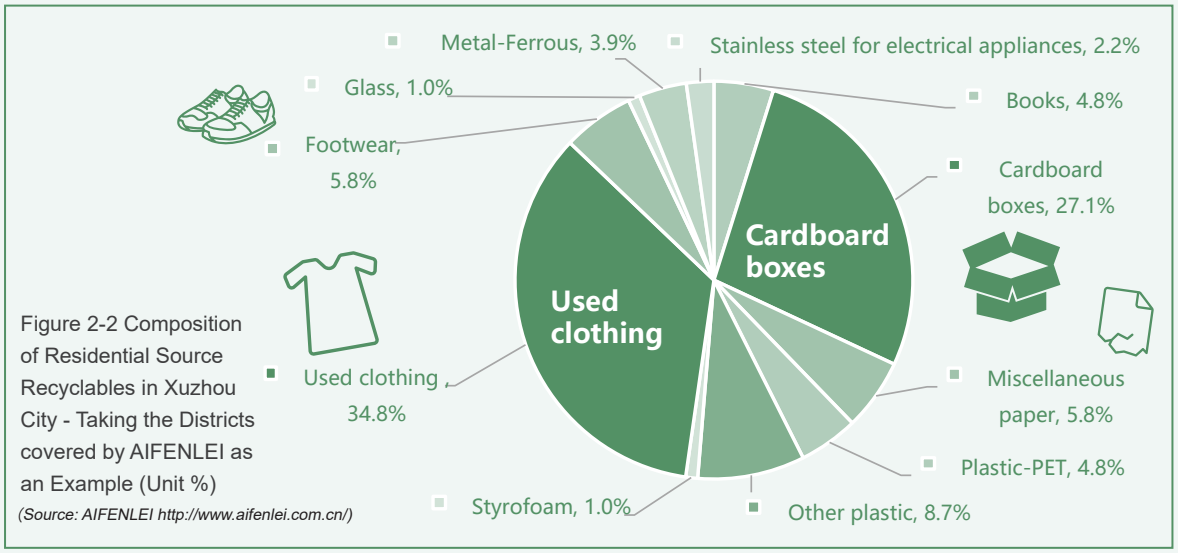


Figure 2-2 Composition of Residential Source Recyclables in Xuzhou City - Taking the Districts covered by AIFENLEI as an Example (Unit %)

(Source: AIFENLEI http://www.aifenlei.com.cn/)

2.3 Summary and Analysis of Policies on MSW Management in Xuzhou

The laws governing the MSW management in Xuzhou are the Law of the People's Republic of China on the Prevention and Control of Environment Pollution Caused by Solid Wastes, the Law of the People's Republic of China on the Promotion of the Circular Economy, and Regulation on the Management of Urban Aesthetics and Environmental Sanitation issued by the State Council. On this basis, Jiangsu Province issued the Regulations on the Management of Urban Aesthetics and Environmental Sanitation in Jiangsu Province in 2003 (amended in 2012 and 2023, respectively).

On December 1, 2020, ***Regulations on the Management of Municipal Solid Waste in Xuzhou*** formally came into effect, marking Xuzhou's MSW management entering the stage of special law, and its work of waste classification stepping into the "era of mandatory" from the "era of initiative". Xuzhou has been focusing on system development and improving the management system constantly. **Major laws and regulations, policy documents and standards and codes in Xuzhou are as follows:**

1 *LAWS AND REGULATIONS*

- ***Regulations on the Management of Municipal Solid Waste in Xuzhou*** (2020)
- ***Regulations on the Management of Construction Waste in Xuzhou*** (2023)

2 MANAGEMENT MEASURES

- ***Measures for the Management of Restaurant Food Waste in Xuzhou*** (2014)
- ***Measures for the Collection and Management of Municipal Solid Waste Treatment Tariff in Xuzhou*** (2016)
- ***Measures for the Administration of Credit Evaluation of Enterprises Operating Municipal Solid Waste Treatment Facilities in Xuzhou*** (2020)
- ***Measures for the Operation and Supervision of Municipal Solid Waste Terminal Treatment Facilities in Xuzhou*** (2020)

3 LOCAL STANDARDS

- ***Code of Practice for the Setting of Municipal Solid Waste Facilities and Equipment*** (2022)
- ***Code of Practice for the Operation and Management of Municipal Solid Waste Transfer Stations*** (2023)
- ***Code of Practice for the Operation and Management of Municipal Solid Waste Incineration Plants*** (Proposed, under preparation)
- ***Guidelines for the Configuration and Maintenance of Facilities and Equipment for the Municipal Solid Waste Classification in Jiangsu Province*** (2023) (issued and implemented by the Provincial Department of Housing and Urban-Rural Development, and the Xuzhou Environmental Sanitation Management Center is one of the main authors)
- ***Standard for Configuration and Maintenance of Facilities and Equipment for the Municipal Solid Waste Classification*** (under preparation, with the Xuzhou Environmental Sanitation Management Center as one of the main authors, jointly issued by the Provincial Department of Housing and Urban-Rural Development and the Provincial Market Supervision and Regulation Bureau)

In addition, from the perspective of strategic planning, MSW management, as an important urban infrastructure, is included in the Outline of the Fourteenth Five-Year Plan for Economic and Social Development and Long Range Objectives Through the Year 2035 of Xuzhou Municipality, Three-Year Action Plan for Improving People's Livelihoods in Xuzhou (2021-2023), Xuzhou Fourteenth Five-Year Plan for Municipal Infrastructure Development and other documents, which clarify the medium- and long-term waste management promotion goals. Xuzhou has also prepared the Xuzhou Municipal Construction Waste Treatment Plan (2017-2030), Xuzhou Environmental Sanitation Special Plan (2022-2035), of which some of the target indicators are shown in Table 2-2. In addition to the conventional harmless treatment rate and recycling rate, the plan also specifies the proportion of new energy vehicles in new vehicles, guiding the industry to practice green and low carbon from the perspective of planning.

Table 2-2 Target Indicators of Xuzhou Environmental Sanitation Planning

Primary indicator	Secondary indicator	2025	2035	Restrictive / Expected
Harmlessness (%)	Harmless treatment rate of MSW	100	100	Restrictive
	Harmless treatment rate of municipal faeces	100	100	Restrictive
Recycling (%)	Percentage of residue waste treated by incineration	100	100	Restrictive
	MSW recycling rate	35	40	Restrictive
	Treatment rate of municipal restaurant food waste	100	100	Expected
Fineness (%)	Coverage rate of neighborhoods that meet the standard for waste classification	100	100	Restrictive
	Coverage rate of the MSW separate collection and transportation system	100	100	Restrictive
	Rate of waste classification and centralized treatment and disposal	95	95	Expected
	Rate of mechanized operation for urban road cleaning	95	98	Expected
	Level of marketization of sanitation and cleaning operations	80	100	Expected
	Proportion of new energy vehicles in new or upgraded vehicles	15	80	Expected

2.4 Sustainable Culture Development

— Practicing waste classification and sustainable development concepts at source

In the parks and communities of Xuzhou, gaming facilities and interactive spaces in the theme of waste classification can often be seen. **"Immersive publicity" is an important experience of Xuzhou to carry out waste classification education and publicity.** Habit formation is the key to waste classification, starting from the community, school, and social levels, to continue to enhance the public awareness of waste classification. From actively practicing waste classification to taking root and promoting the concept of sustainable development in the, Xuzhou has formed a good community self-governance and management model at the community level.

Jinbei Manor neighborhood is located in Jinshanqiao Development Zone of Xuzhou, built in 2000, with 285 households and a population of about 800 people. Since 2021 when waste classification started, with continuous promotion, the four-category based MSW classification in the community has been basically achieved. In addition to waste classification, shared bookstore and exchange of unused items have become parts of the sustainable life of the community public. It is worth mentioning that in the Jinbei Manor neighborhood, the “Beautiful Yard” is being proactively built, for which the concepts of waste classification and sustainability are the important evaluation criteria (Figure 2-3 to Figure 2-6).

Figure 2-3 Waste Classification Drop-Off Station in Jinbei Manor Neighborhood
© LIU Xiao

Figure 2-4 Shared bookstore in the community garden
© LIU Xiao

Figure 2-5 Unused item exchange area in stairwells
© LIU Xiao

Figure 2-6 Jinbei Community - Beautiful Yard
© LIU Xiao

"We would like to keep investing in the community, based on waste classification and waste management, to create and build a sustainable atmosphere and form a culture of sustainable development", the community of Jinbei Manor puts forward the community working experience as "system, project, action, management":

① Establish a sustainable life demonstration and guidance system

Establish a demonstration team, mainly composed of activists and volunteers, in the community to take the lead in waste classification and to continuously publicize and practice sustainable lifestyles.

② Carry out abundant "Waste Classification Habit Formation Programs"

In accordance with the three dimensions of publicity and guidance, points redemption and behavioral correction, a waste classification-themed pocket park was created in the community with an area of 800 m^2. The social culture and creative team designed and drew waste classification punch card games, interacted and cooperated with the community public to draw waste classification-themed artwork, creating a strong waste classification publicity atmosphere (Figure 2-7).

③ Carry out "New Fashion Action for Waste Classification"

Waste classification facilities have been constructed and upgraded, with complete water supply, drainage, hand-washing basins and other supporting devices, and special actions such as bag-breaking for food waste, door-to-door collection of hazardous waste and code-scanning collection of bulky garbage have been carried out in phases in order to continually improve the capacity of waste classification and management.

④ Establish a continuous waste classification management system

In terms of management, the Jinbei Manor community has a complete waste classification management account, which makes a perfect record of the waste classification-related work carried out in the community; in terms of incentives for the public in the community, a certain point-rewarding mechanism has been established to promote the sustainable development of waste classification work (Figure 2-8).

Figure 2-7 Jinber Manor Waste Classification Pocket Garden (Ground: Waste Classifiction Hopscotch Game)
© Xuzhou Municipal Urban Administration Bureau

Figure 2-8 Points Redemption for Waste Classification in Jinbei Manor Neighborhood
© LIU Xiao

In addition to the community, waste classification and culture of sustainability have been deeply integrated into the primary and secondary education system in Xuzhou. Whether discarded nutshells can be equated with art was vividly answered by the "Zero Waste Campus and Charity Sale" activity of Xuzhou Qiushi Primary School (Figures 2-9); the nutshells were turned into flowers, trees, forests, and beetles under the whimsical ideas of those children. Organized by the school, some of the works were exhibited in the Xuzhou Art Museum and a "charity sale" was held, with a total of CNY 2,129 obtained from the sale, all of which was donated to students from poor families. "From waste to fashion", "from waste to art", the activities enabled young students to rethink the relationship between waste and art, and sowed the seeds of sustainability in their minds.

Figure 2-9 Artistic Travels of Nutshells (Xuzhou Qiushi Primary School)
© Xuzhou Qiushi Primary Scho

Jinbei Manor community and Xuzhou Qiushi Primary School is a microcosm of Xuzhou's efforts on waste classification and education on the culture of sustainable development. With the development of waste classification, ***Xuzhou now has a total of 8 bases for publicity and education, more than 100 street publicity stations, over 60 "doorstep" publicity positions, and 50,200 building publicity positions****. Continuous investment and influence to create a cultural atmosphere of waste classification and sustainable development, enabling the public to "immerse" in the culture, feel the call of culture, take actions actively and create a culture of sustainable development, is the positive experience of Xuzhou's MSW management.*

2.5

From Waste Reduction to Zero Waste

— Iteration and Upgrading in the Waste Management Sector

MSW is a part of urban waste, but for the city, waste has a broader extension. Extension from MSW management to the development of a zero waste city, which is the positive practice of the iteration and upgrading of MSW management sector in Xuzhou.

"Zero waste city" is an urban development model led by the new development concept of innovation, coordination, greenness, openness and sharing, which promotes the formation of a green development mode and lifestyle, continuously promotes the waste reduction at the source and the recycling and resources utilization, minimizes the amount of landfill, and reduces the environmental impact of solid waste to the minimum, and it is also an advanced urban management concept. In 2019, the Ministry of Ecology and Environment announced the first batch of "11+5" "waste-free cities" pilots; and, in 2022, the second batch of 100 "zero waste cities" pilots was announced.

Since being selected as one of the first batch of "11+5" pilot cities for the construction of a zero waste city in 2019, Xuzhou has been actively trying to explore a Xuzhou model for building a zero waste city. Under the framework of zero waste city, Xuzhou focuses on improving the comprehensive utilization rate of industrial and agricultural waste, promoting "zero landfill" for urban MSW, recycling transformation and upgrading of industrial parks, and safe disposal of hazardous waste in full quantity. It has made positive efforts in promoting waste reduction at source, resource utilization and

harmless treatment, promoting the transformation of the green urban development, and improving the quality of ecological environment in the city. Especially from the perspective of solving the regional solid waste outlet and resource recycling, Xuzhou has proactively put forward the strategic plan of building a circular economy industrial park, through which the integrated treatment of solid waste can be realized, not only to realize the normative treatment of solid waste, but also to realize the aggregation effect, to build a green and innovative industrial cluster of circular economy.

Xuzhou Circular Economy Industrial Park is located in Dapeng Town, Tongshan District, Xuzhou, with a total planning area of 545.38 hectares (Figure 2-10). The Circular Economy Industrial Park contains six circular economy featured industries, which are solid waste treatment and disposal industry, waste resource recycling industry, research and development and manufacturing industry of environmental protection equipment, new energy industry, environmental protection scientific research, education and training industry, environmental protection cultural creativity, and tourism industry. The total planned investment is CNY 7.15 billion, and construction will be in phases according to the vision of 2030. Key projects and construction scale are shown in Table 2-3.

Table 2-3 Planned Key Projects of Xuzhou Circular Economy Industrial Park

Type	Project Name	Construction Scale
Municipal solid waste treatment	MSW incineration and power generation project	4,000 t/d (2,250 t/d has been built)
	Municipal sludge disposal center	800 t/d (60 t/d for sewer sludge has been built)
	Restaurant food waste treatment project	396 t/d (300 t/d has been built)
	MSW classification and collection center	4,000 t/d (planned)
	Bulky waste treatment center	100 t/d (planned)
	Food waste resource treatment Center	1,000 t/d (300 t/d has been built)
	Resource utilization of construction waste and slag	1 million t/y (1 million t/y has been built)
Environmental science education and publicity	Solid Waste Exhibition Hall, R&D, publicity center, pilot test Platform	A scientific research and education area, China "Zero waste City" Culture Exhibition Hall and China Circular Economy Industry Expo Hall have been built
Resource recycling	Waste rubber and plastic processing	Waste tires: 524,000 t/y (of which 100,000 t/y under construction) Waste plastic: 900,000 t/y (20,000 t/y has been built)
	Dismantling and treatment of waste electrical and mechanical products	647,000 unit/year (under planning)
	Electronic waste treatment center	9.108 million piece/year (under planning)
	Scraped car dismantling center	720,000 car/year (under planning)
R&D and manufacturing of environmental protection equipment	Solid waste equipment R&D and manufacturing center	(under planning)
New Energy	Photovoltaic power station	15MW (under planning)

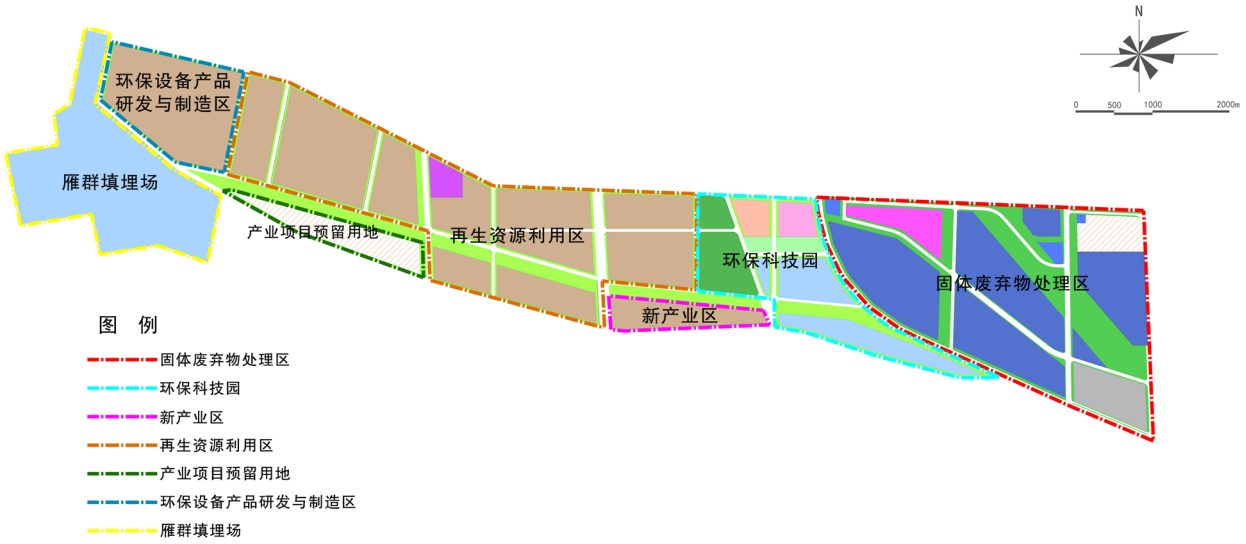


Figure 2-10 Planning and Design of Xuzhou Circular Economy Industrial Park
© Xuzhou Municipal Urban Administration Bureau

So far, the food waste treatment plant in the park has been put into operation in 2018, and the MSW incineration power generation project has been connected to the grid in 2020; five industrial projects, namely, the wastewater treatment plant, comprehensive material disposal (hazardous waste), waste medical plastics reuse, saturated waste activated carbon reuse, and construction wastes, have been completed and put into use.

In addition, a "Managing Waste with Intelligence" Smart Management Platform (Figure 2-11) has been established in the park to integrate the management of material flow and energy flow, which can effectively improve resource utilization efficiency in the park, and is conducive to collaborative treatment and disposal to reduce pollutant and greenhouse gas emissions.

In addition, on the basis of the key construction projects, research has been carried out synchronously for the emerging waste management problems generated in the process of current economic development, for example, lithium battery resource utilization, fly ash resource utilization, circular economy industry research institute, carbon economy platform, and judicial appraisal of environmental damages have started the preliminary preparation; the construction of the circular economy industrial park has become the hardware foundation of MSW management in Xuzhou, and also provides sufficient facilities and development space for the further improvement of the subsequent MSW management (Figure 2-12 and Figure 2-13).

Figure 2-11 "Waste Management with Intelligence" Smart Management Platform
© Xuzhou Municipal Urban Administration Bureau

Figure 2-12 Medical Plastics Waste Harmless Treatment and Utilization Project
© Xuzhou Municipal Urban Administration Bureau

Figure 2-13 Saturated Activated Carbon Regeneration Project
© Xuzhou Municipal Urban Administration Bureau

It is worth mentioning that the China "Zero waste City" Culture Exhibition Hall and the China Circular Economy Industry Expo Hall (Figure 2-14) have been planned and constructed in the Circular Economy Industrial Park, which is the first culture exhibition hall themed on waste management and circular economy in China.

China "Zero waste City" Culture Exhibition Hall mainly displays the background, significance, objectives and main tasks as a pilot city to build the "Zero waste City", the current situation of the "Zero waste City" development, the Xuzhou "Zero waste City" model, overview of Xuzhou Circular Economy Industrial Park, general development ideas and patch, and the treatment and disposal of different wastes (MSW, hazardous waste, solid waste ecological remediation, agricultural solid waste, etc.)

China Circular Economy Industry Expo Hall displays and introduces the general overview, history, development sequence and key initiatives, modules and core technologies of circular economy; and also the current situation of circular economy development in China, the history and development of circular economy in Jiangsu Province and Xuzhou Municipality, 50 national resource recycling bases, etc.

With the perspective of "culture development", the exhibition hall and expo hall utilize the professional communication approach of "big data + new media" to deeply and systematically demonstrate what is a "zero waste city" and what is "circular economy"; and combined with the Circular Economy Industrial Park itself, it practically demonstrates how to integrate the functions of green recycling, energy saving and environmental protection, intelligent management, and ecological integration to create a recycling city concept of mutual benefit, integration, and harmonious coexistence, further highlighting the cultural soft power of waste management in Xuzhou.

Figure 2-14 China "Zero waste City" Culture Exhibition Hall and China Circular Economy Industry Expo Hall

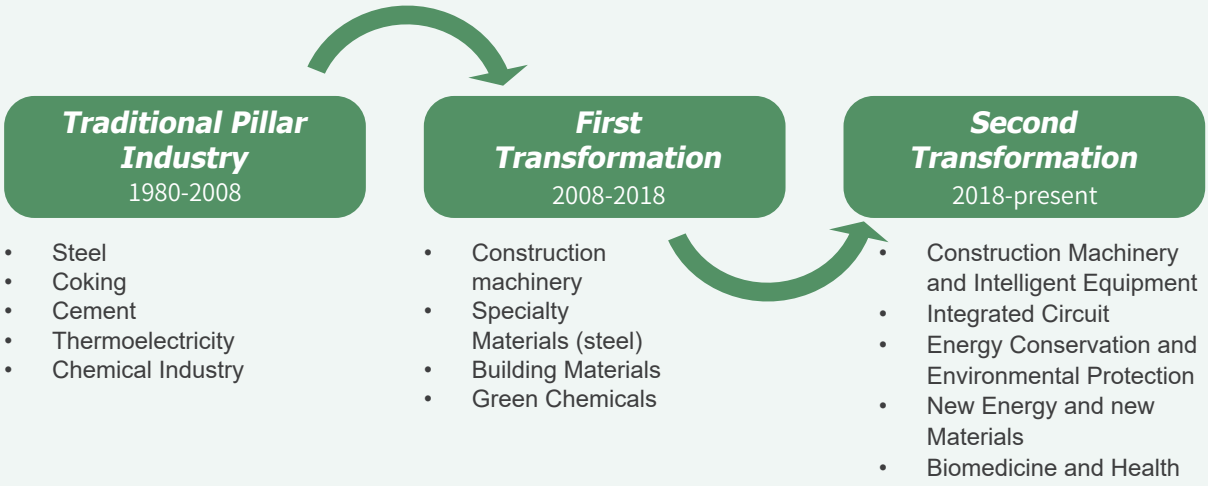
2.6 Ecological Oriented Development

— A New Model for Environmental Management and Transformation in Industrial Cities

As mentioned above, from MSW management to the development of zero waste city is the positive practice of the iterative upgrading of the waste management sector in Xuzhou; furthermore, in the urban dimension, waste management is also an important part of the city's ecological civilization construction, and an important carrier for the embodiment of ecological values. As a typical representative of China's old industrial base and resource-based cities, Xuzhou is actively exploring the road of industrial transformation and green transformation. From the 1980s to the beginning of this century, the average annual coal mining production in Xuzhou was over 20 million tons; during the peak of the coal industry development, Xuzhou City contributed more than 80% of the coal and more than 60% of the electricity for the whole Jiangsu province, which made a significant contribution to the economic development of Jiangsu and even the East China region. The industrial structure and people's life of Xuzhou are all "coal-based " extended development; iron and steel, coking, cement, thermoelectricity, chemical industry are the five traditional pillar industries in Xuzhou.

With the gradual decrease of resource exploitation and the ecological environment management problems brought by resource exploitation, Xuzhou began to actively attempt transformation since 2008, relying on the resource advantages of a resource-based city to start the process of industrialization, and at the same time, also put forward the systematic sustainable development ideas of "industrial transformation, urban transformation, ecological transformation, and social transformation". The representative industrial structures of Xuzhou at different stages are shown in Table 2-4.

Table 2-4 Representative Industrial Structures of Xuzhou at Different Stages



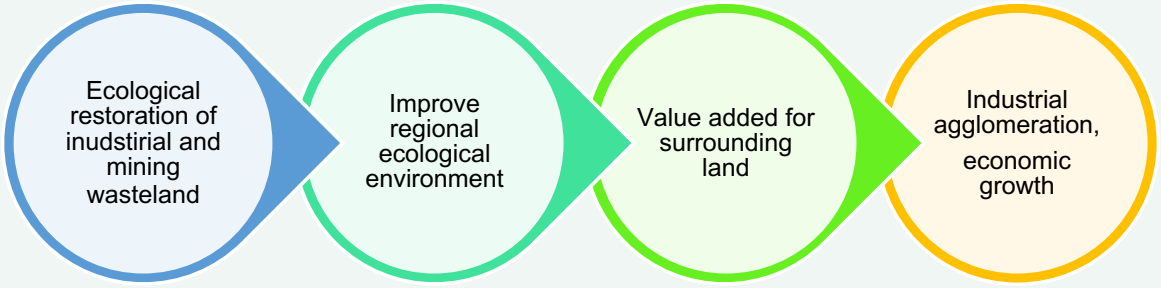


Figure 2-16 Transformation Path Based on Ecological Oriented Development in Xuzhou
© LIU Xiao

In the process of transformation, ecological transformation was a major part of Xuzhou's efforts, especially in urban environmental improvement and waste management. Long-term and large-scale mining has created 282.2 km^2 of coal mining subsidence land and more than 400 quarrying pits in Xuzhou, which has brought a series of ecological and environmental problems such as infrastructure damage and mountain breakage. Xuzhou has pioneered the ecological restoration and diversified development model of industrial and mining wasteland in resource-exhausted cities, and put forward the transformation path based on the ecological value-oriented approach, i.e., through the ecological restoration of industrial and mining wasteland, improve the regional ecological environment, drive the value increase of surrounding land, activate regional industrial agglomeration, and promote urban development into a virtuous cycle. (Figure 2-16).

By the end of 2022, the city had managed 190.9 km^2 of coal mining subsidence land and more than 100 quarrying pits accumulatively. Meanwhile, adhering to the concept of "zero waste", in the process of ecological restoration and management, 11 million tons of solid waste such as coal gangue, waste rock slag, and 2.7 million m^3 of municipal construction waste have been eliminated and utilized; and a number of representative practice cases oriented to ecological value have been formed.

1 "Ecological Restoration + Land Reclamation And Utilization" Mode

With the goal of increasing arable land and returning land to cultivation for food, Xuzhou adopted the technical approaches of "layered stripping, staggered backfilling and soil restructure" to carry out land reclamation and soil improvement for the land with shallow subsidence that can be reclaimed, and then carried out centralized management of the continuous land in accordance with the high-standard farmland. Xuzhou City has implemented land reclamation projects in the land subsidence area of coal mining with an area of 108.7 km^2 in total, effectively improving food production and farmers' income.

2 "Ecological Restoration + Construction Land Transformation" Mode

For the coal mining subsidence area which has been stabilized and sunk but is difficult to be reclaimed, land leveling is carried out after survey and justification, and the supporting infrastructure is improved simultaneously, for the construction of industrial parks and industrial projects, which not only realizes the secondary development and utilization of the land, but also adds a new impetus for the transformation and upgrading of industries. Xuzhou Economic and Technological Development Zone, Xuzhou Industrial Park and Quanshan Economic Development Zone make full use of the coal mining subsidence area for park planning, and has been managing the subsidence area of nearly 26.7km^2, all of which are used for the construction of industrial projects after the treatment, realizing the high-efficiency and comprehensive use of the subsidence land. Xuzhou Pan'an Lake Science and Education Innovation Zone, with a planned area of 20.6 km^2, is also a large coal mining subsidence area.

3 "Ecological Restoration + Landscape Development" Mode

For contiguous waterlogged coal mining subsidence areas located in or close to urban areas, through digging lakes to divert water orderly, land shaping, landscape redevelopment, Xuzhou gradually transformed waterlogged areas into wetland parks and scenic lakes with different characteristics. On the quarrying pit site, approaches such as refurbishment and re-greening, rock wall landscaping, heritage protection and other techniques are used to create ecological landscapes according to local conditions. Pan'an Lake was once the largest and most serious subsidence area in Xuzhou, with a total area of 11.6km^2 and an average subsidence depth of 4 meters, but after ecological restoration, it has been transformed into a national wetland park and a national ecotourism demonstration area with beautiful scenery and crowded tourists (Figure 2-17 and Figure 2-18).

4 "Ecological restoration + cultural tourism development" mode

For industrial and mining wastelands with the unique value of inheriting the region's outstanding history and culture, guided by the theory of ecological economy, further excavation of cultural connotations on the basis of landscape restoration has been carried out to realize the coordination and unity of ecology, landscape, history and culture, and to create a new type of urban park and ecological landscape tourism area. Jawang District, Xuzhou, through ecological restoration of Pan'an Lake, South Lake, Dadong Mountain and other ecological restoration, creates a "regional overall tourism", making industrial and mining restoration and cultural tourism a new business card of the city.

Figure 2-17 Pan'an Lake before restoration
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Figure 2-18 Pan'an Lake after restoration
© Xuzhou Municipal Urban Administration Bureau

From "a city covered with coal ash and dust" to "a city covered with green mountains and lakes", Xuzhou respects nature, adapts to nature, protects nature, and walks out of the road of ecological restoration, green transformation and sustainable development, practicing wise waste reduction and smart ecology in a wider perspective, and proving in practice that "Lucid waters and lush mountains are invaluable assets". Thanks to such efforts, Xuzhou successfully won the "United Nations Habitat Scroll of Honour Award" in 2018, and the theme of the 2018 World Habitat Day was "Municipal Solid Waste Management", when Xuzhou City was recognized as one of the five winners of the award for "Smart Management of Municipal Solid Waste, and Holistic and Wide-ranging Ecological Restoration".

2.7

Summary of Practical Experiences in MSW Management in XUZHOU

To summarize the practical experience of waste management in Xuzhou with one word, it should be "transformation". Adhering to the spirit of "active exploration and bold innovation", Xuzhou has been trying to transform itself into a healthier and more sustainable direction in terms of MSW management. The transformation from waste classification at the source to the development of a sustainable community culture, from the traditional MSW management to the integrated MSW management towards the vision of zero waste, and from the environmental management of traditional industrial cities to the realization of ecological values, all of these practices are reflecting Xuzhou's proactive pursuance for the innovation and reform in MSW management.

Transformation does not mean the abandonment of the past and traditions, but rather strategic and dynamic adjustments and innovations based on the actual needs and judgment of future development. The objective understanding of its own basic conditions and resource endowment, scientific and rigorous working attitude of seeking truth from facts, and the understanding, acceptance, embracing and changing of new concepts and trends are the best practices demonstrated by Xuzhou under the perspective of MSW management.

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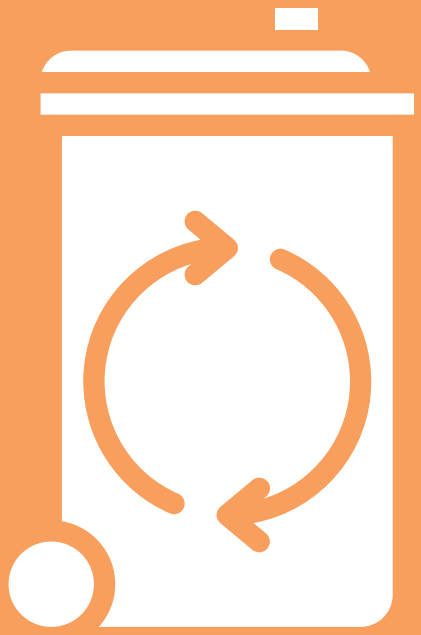
CHAPTER 03

03

CHAPTER THREE

Good Practice of MSW Management Practice in

FUZHOU



3.1 Overview of Fuhzou

Fuzhou is the capital city of Fujian Province, located in the eastern part of Fujian Province, the lower reaches of the Minjiang River and coastal area. Its landscape is a typical estuarine basin, dominated by mountains and hills. The climate in Fuzhou is typical subtropical monsoon climate, which is warm and humid, with four seasons of evergreen, an average annual precipitation of 900-2100 millimeters and an average annual temperature of 20-25°C . The water system in Fuzhou is well-developed with a dense network, and the Minjiang River crosses the city, bringing rich water resources. Fuzhou is a typical coastal city with a total coastline of 1,137 km.

Fuzhou has a total area of 11,968.53 km^2. As of the end of 2022, the permanent resident population of Fuzhou is 8,448,000 people; the local GDP in 2022 is CNY 1,230,823 million, of which, the added value of the primary industry is CNY 68,338 million, the added value of the secondary industry is CNY 465,690 million and the added value of the tertiary industry is CNY 696,795 million, and the structural proportion of the three industries is 1.6:37.8:60.6, and; the per capita GDP of Fuzhou in 2022 is CNY 145,936.

As of 2021, Fuzhou administers six districts in its jurisdiction, including Gulou District, Taijiang District, Cangshan District, Jin'an District, Mawei District, and Changle District, plus six counties, namely, Minhou County, Lianjiang County, Luoyuan County, Minqing County, Yongtai County, and Pingtan County. The data related to MSW management involved in this case is the data of five districts in the core urban area of Fuzhou City, including Gulou District, Taijiang District, Cangshan District, Jin'an District, and Mawei District, and the permanent resident population of these five urban areas in 2022 is 3,363,000. Relevant data in this case are from Fuzhou Municipal Urban Management Committee.

Figure 3-1 Urban landscape of Fuzhou
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3.2 Current Situation Of MSW Generation And Treatment In Fuzhou

The amount of MSW transportation and treatment in Fuzhou City from 2020 to 2022 is summarized in Table 3-1. In 2022, the total volume of four categories of MSW transportation and treatment in the urban area was 1.95 million tons, of which 158,641 tons were food waste (including restaurant food waste, household food waste, and organic perishable waste from the farmers' market), 429,784 tons were recyclables, and 75 tons were hazardous waste. The statistical boundary is the urban area of the city, amount of food waste (including restaurant food waste, household food waste, organic perishable waste in farmers' markets) is the statistical data of food waste that went into the food waste treatment plant, the residual waste is the statistical data of waste that went into the incineration plant, and recyclables are the statistical data of recycling stations, sorting centers, baling outlets and so on.

With the advancement of waste classification, the collection of household-sourced food waste has been increasing year by year. The recycling rate of MSW in Fuzhou (recyclables + household food waste + restaurant food waste) in 2022 is 30.4%, of which the recycling rate of food waste (household and restaurant) is 8.1% and the recycling rate of recyclables is 22.1%. Compared with 2020 and 2021, Fuzhou has further improved its statistics on MSW management by including data related to recyclables in 2022. It is worth stating that the current data on recyclables in most cities in China still do not include some informal or commercial recycling practices, and the actual resource utilization rate should be higher than the available data.

In addition, Fuzhou also collects and transports other waste streams within the city in accordance with the principle of "diversion and classification", and the amount of construction and demolition wastes, landscaping wastes and bulky wastes are shown in Table 3-2. It can be seen that the collection and transportation of construction and demolition wastes is also an important part of urban waste management, and the amount of wastes generated is basically the same as that of traditional MSW, which needs special attention in urban waste management; however, the amount of construction and demolition wastes generated is directly related to the progress of urban construction and renewal, for example, the volume of construction waste transportation in Fuzhou in 2022 was less than that in 2020 and 2021, which also reflects different stages and progress of urban development.

From the perspective of per capita solid waste collection, the per capita waste collection in Fuzhou in 2022 was 1.59 kg/day, of which the per capita recyclables was 0.35 kg/day; in terms

of recyclables category, the amount of metal and paper is relatively higher in the collected recyclables currently, which account for 42.6% and 30.3% of the total amount of recyclables, respectively (Figure 3-2). In the process of waste classification, Fuzhou is now vigorously implementing the one-bag collection model at the community level, which can better implement the integrated management of high-value and low-value recyclables, therefore the recyclables recovery rate in Fuzhou will be further improved in the future.

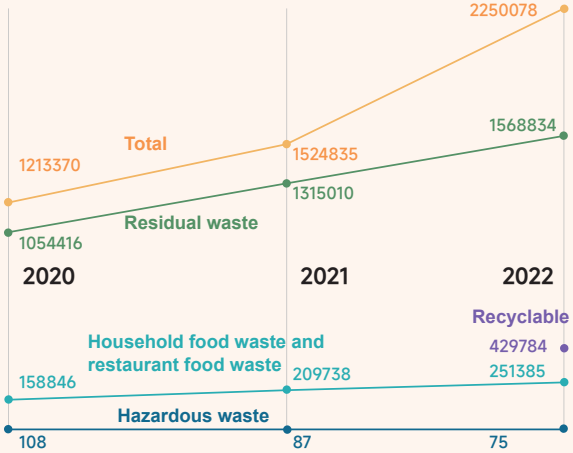
From the perspective of solid waste treatment and disposal, Fuzhou achieved zero landfill of primary MSW in 2020, and all residual waste is currently incinerated. Taking Hongmiaoling Circular Economy Industrial Park as a solid waste treatment service base, the total capacity of solid waste incineration is 4,200 tons per day, which ensures 100% harmless treatment and disposal of residual waste. The park also has one household food waste treatment facility and one restaurant food waste treatment facility, with a treatment capacity of 400 tons per day and 250 tons per day respectively, indicating sufficient capacity for household food waste and restaurant food waste treatment.

MSW collection data in Fuzhou

2020 to 2022

- In 2022, the total volume of four categories of MSW transportation and treatment in the urban area was **1.95 million tons**
- The recycling rate of MSW in Fuzhou (recyclables + household food waste + restaurant food waste) in 2022 is **30.4%**, of which the recycling rate of food waste (household and restaurant) is **8.1%** and the recycling rate of recyclables is **22.1%**

Table 3-1 Separate Collection, Transportation and Treatment of MSW in Fuzhou (2020-2022)



Note: According to the source of waste generation, food waste is categorized into household food waste generated by household sources and restaurant food waste generated by restaurants and other food service establishments.

Figure 3-2 Composition of Recyclables from Household Sources in Fuzhou (Unit: %)

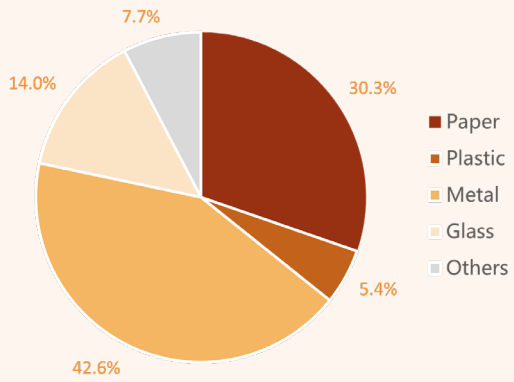


Table 3-2 Separate Collection, Transportation and Treatment of Other Municipal Waste in Fuzhou (2020-2022)

Unit/ton	2020	2021	2022
Construction and demolition waste	1831500	1953600	2075700
Landscaping waste	11214	9096	9060
Bulky waste	7020	13569	11492

3.3 Summary and Analysis of Policies on MSW Management in Fuzhou

The laws governing the MSW management in Fuzhou are the Law of the People's Republic of China on the Prevention and Control of Environment Pollution Caused by Solid Wastes, the Law of the People's Republic of China on the Promotion of the Circular Economy, and Regulation on the Management of Urban Aesthetics and Environmental Sanitation issued by the State Council. Fuzhou has been focusing on system building and constantly improving its management system, and it has formed a relatively complete system of waste management, that **its main laws and regulations, policy documents and standards related to waste management are as follows**:

1 Laws and Regulations

- *Regulations on the Management of Solid Waste Classification in Fuzhou* (2019)
- *Measures for the Management of Construction Waste Disposal in Fuzhou* (2017)
- *Regulations on the Management of Construction Waste in Fuzhou* (2018)
- *Regulations on the Collection, Transportation and Disposal of Restaurant Food Waste in Fuzhou (Trial)* (2022)

2 Action Plan

- *Three-Year Action Plan and Implementation Program for Solid Waste Classification and Reduction in Fuzhou (2018-2020)* (2018)
- *Three-Year Action Plan for Special Consolidation and Enhancement of Waste Classification in Fuzhou (2022-2024)* (2022)
- *Implementation Plan for Comprehensive Implementation of Solid Waste Classification in Urban Areas in Fuzhou in 2019* (2019)
- *Implementation Program for the "Four Categories" of Solid Waste Classification in Urban Areas in Fuzhou* (2019)

- *Implementation Program for Continuous Promotion of Solid Waste Classification in Fuzhou in 2020* (2020)
- *Implementation Program for the Development of Recyclables Recovery System for Solid Waste in Fuzhou* (2020)
- *Program for Improving the Solid Waste Classification in Fuzhou in 2021* (2021)
- *Program for Consolidation and Enhancement of Solid Waste Classification in Fuzhou in 2022* (2022)
- *Program for Consolidation and Enhancement of Solid Waste Classification in Fuzhou in 2023* (2023)

3 Exploration of Tariff Mechanism

- *Administrative Measures for the Collection of Solid Waste Disposal Fee in Fuzhou* (2023)
- *Program on the Collection of Solid Waste Disposal Fee for Non-residential Households in Urban Areas in Fuzhou* (2023)
- *Program of Progressive Incremental Charge for Non-Residential Food Waste in Urban Areas in Fuzhou City* (2024)

4 Policies Related to Construction Waste Management

- *Implementing Opinions on Further Strengthening the Management of Construction Waste Consumption and Utilization in Fuzhou (Trial)* (2017)
- *Implementation Rules for the Resource Utilization of Construction Waste and the Promotion of Recycled Products Application in Fuzhou (Trial)* (2022)
- *Implementation Plan for Resource Utilization of Construction Waste in Fuzhou* (2023)

5 Other Relevant Policies, Plans and Programs

- *Outline of Actions for Building a Sustainable City in Fuzhou* (2023)
- *Special Plan for Ecological Civilization Construction in Fuzhou during the 14th Five-Year Plan Period (2021-2025)* (2023)
- *Implementation Program for Building a Zero waste City in Fuzhou* (2023)

It is worth mentioning that, on the basis of comprehensive waste management and waste classification, Fuzhou has also paid early attention to the issue of construction waste treatment and disposal. Along with the continuous promotion of urban infrastructure construction and urban renewal, the amount of construction waste generated has been increasing, and the management of construction waste has also become a key topic of urban management. In order to promote the standardized treatment and disposal of construction waste and resource utilization, Fuzhou Municipal Urban Management Committee continues to deepen and promote the policy implementation. In 2022, the ***Implementation Rules for the Resource Utilization of Construction Waste and the Promotion of Recycled Products Application in Fuzhou (Trial)*** was issued, which clarified the application scenarios of recycled products made

from construction waste. In 2023, the ***Opinions and Public Announcement of the Resource Utilization Enterprises and Recycled Products in Fuzhou (Trial)*** was formulated, and the declaration and public announcement of qualified resource utilization enterprises were organized to help promoting the application of recycled products; in the same year, the General Office of the Municipal Government issued the ***Implementation Plan for Resource Utilization of Construction Waste in Fuzhou***, which put forward the requirements for various departments, the whole process and all aspects of improving the resource utilization of construction waste. Based on the documents mentioned above, in 2023, the ***Measures for the Management of Construction Waste in Fuzhou*** (Draft for Review) was formed formally, which is currently being reviewed by the municipal government.

The development process of above-mentioned policies and legislation systems for construction waste management reflected the policy management ideas of Fuzhou in waste management, which are identifying the core barriers of the management process from the perspective of problem solving, providing policy support and establishing the corresponding legal restrictions, and supporting the formation of a completely closed loop of policies.

3.4
Hidden in Plain Sight
— Finding the Trace of Waste Management in the Garden City

When it comes to waste, "mess", "sewage" and "odor" are always the first impressions of the public, which makes it challenging to put waste collection and treatment facilities in place. The "Not in My Back Yard (NIMBY)" is a common phenomenon in the field of waste management. Waste is generated in thousands of households, and waste collection points and transfer stations are scattered in every corner of the city. **How to improve the impression of front-end waste collection facilities and realize a harmonious coexistence with the urban environment is an important topic for the high-quality transformation of waste management.**

There are 37 existing transfer stations (23 in use, 14 out of use or under renovation) and 320 back-end waste transportation vehicles in the five districts in Fuzhou, which can meet the current transportation demand of about 4,500 tons (of which about 2,500 tons are for transfer and 2,000 tons are direct transport) of solid waste in the five districts, and the waste is transferred on a daily basis. With the continuous improvement of the technical system of waste collection and transfer, and the continuous equipment upgrading, since 2017, Fuzhou has been actively promoting the construction of urban management complexes, exploring the possibility of moving the waste transfer station from the ground to the underground space, **adopting the concept of de-industrialized and non-traceable design, maximizing the hiding in urban landscape, and integrating into the urban spatial environment; "no visible waste, no visible place, and no smelly odor" is the standard of "Hidden in Plain Sight" for waste management in Fuzhou**. A total of 13 urban management complexes are planned and constructed (including renovation) to replace the original transfer system, and currently 5 (Fuma, Wushan West, Huangshan, Yangli, Sanjiangkou Qingliang

Mountain) have been completed, and 2 (Lianjiang North, Feitou) are under construction, and it is expected that most of them can be completed in 2025, with a total investment of CNY 930 million.

Figure 3-3 Urban Management Complex in Wushan West
© Fuzhou Municipal Urban Management Committee

Fuzhou Wushan West Urban Management Complex

Formerly known as Dafeng Transfer Station, Fuzhou Wushan West Urban Management Complex is located at the southwest corner of the intersection of Wushan West Road and West Second Ring Road in Gulou District, Fuzhou, which is a city center area where each inch of land values, about one kilometer away from Fuzhou Municipal Government. The Wushan West Complex was renovated and put into use in August 2018, covering an area of 2,851.2 m2, with a front-end service of 18 small trucks weighted1.5 tons each, and a back-end connection of 5 transfer trucks weighted 8 tons each, totaling a daily waste transfer capacity of about 80 tons, serving the surrounding Gudong, Guxi, Nanjie, and Dongjie sundistricts, and is the first underground waste transfer station in Fujian Province (Figure 3-3).

The surface greening rate of Wushan West Waste Transfer Station reaches 67%. Looking from the upper ground, its appearance is no different from the park green space, the entrance and exit are similar

to the entrance of an underground parking garage, while only after entering the two-story underground space of total 12-meter high, then the mystery would be seen. After the waste collection vehicles stop at the unloading port to dump the waste according to instructions, the spraying, dust reduction, deodorization, negative pressure air extraction system and ionized air delivery system are activated synchronously, and the whole process will not emit obvious odor; in the compression area, the waste container can be automatically compressed in circulation when it is full, and the vacuum suction system will extract sewage synchronously. The fully compressed waste will be moved to the lifting platform according to instructions, then moved to the ground, and finally transported to the waste treatment site through the closed container, completing the waste transfer in the core urban area.

Figure 3-4 Yangali Urban Management Complex
© Fuzhou Municipal Urban Management Committee

Fuzhou Yangli Urban Management Complex

Fuzhou Yangli Urban Management Complex, located in east of the National Goods Interchange in Gushan Town, Jin'an District, is the first semi-underground large-scale urban management complex in Fuzhou. The project covers an area of 11,476 m2, with a total investment of CNY 223 million, and a designed capacity of 800 tons per day for solid waste transfer. It is the largest modernized solid waste transfer station in Fuzhou, with a service area covering the entire Taijiang District, the east of Jin'an River and south of Fuxin Middle Road and Fuxin East Road in the Jin'an District (Figure 3-4).

The above-ground part of the Yangli Urban Management Complex is designed with three-dimensional greening, turning the site into an urban leisure square and integrating it with the neighboring Gushan Scenic Area, making it a good place for the public to take a rest and walk in their daily life, which upgraded the urban living environment. The project realizes fully automated and closed operation from unloading to sorting, compressing, and transferring through advanced automation control system, and it is equipped with mature and reliable sewage and odor collection and treatment equipment to ensure that all environmental protection indicators are meeting the standards, making it a typical representative of the management of large-scale transfer stations in Fuzhou.

Figure 3-5 Waste Collection Point in Zone A of Sunny Wushan Rongyu, Hongshan Town, Gulou District, Fuzhou
© Fuzhou Municipal Urban Management Committee

Waste Classification Houses (kiosk) in the Community

In addition to the domestic waste transfer station, one step forward, the community level waste collection has also undergone a qualitative change. With the continuous advancement of waste classification, in order to create a convenient environment for classification, Fuzhou has been promoting the establishment of waste classification houses (kiosk) in each community, which are equipped with air ventilation and disinfection equipment, as well as hand-washing stations, in addition to the four-category classification waste bins, and classification administrators to assist in guiding the proper classification and placement. Taking Zone A of Sunshine Wushan Rongyu in Hongshan Township, Gulou District as an example, there are a total of 440 households in the community, and after the implementation of

waste classification, an intelligent waste collection house has been established, which contains a waste classification collection point, recycling equipment, and points redemption equipment (Figure 3-5). In addition, the organic combination of waste classification houses/ kiosks with self-service vending machines and material recycling stations has gradually become a new scene of comprehensive community services; the combination of waste classification houses/ kiosks and convenient service facilities, such as providing resting places for sanitation workers and providing free drinking water, etc., endows the front-end scene of waste collection with more public service content, making it a new carrier of community activities.

MSW management in Fuzhou is also a microcosm of general waste management in China. Over the past decade, when looking at waste management from the perspective of general public, people's feeling is that the waste has disappeared, which does not mean that the waste has actually disappeared from life, but indicates the achievement of a cleaner and more efficient MSW management system. "Hidden in Plain Sight" of solid waste management facilities means more stringent environmental management requirements, more advanced technologies and equipment, more rigorous operation and management processes, more ecologically friendly design concepts and aesthetic expression, as well as more powerful industry capital investment. Behind the "Hidden in Plain Sight", it is also a practical manifestation of continuous improvement of the comprehensive urban environment and better city life.

3.5
Making the Best Use of Everything
— A Simple Philosophy of MSW Management in Fuzhou

The waste management hierarchy is the most common principle used to guide the solutions and technical pathways in the waste management process (Figure 3-6). Ideally, it should follow the top-down approach, which is generation prevention – waste minimization at source - reuse - material recycling - energy recovery - sanitary landfill; however, from the development history of waste management, the typical MSW treatment system has usually optimized continuously according to the bottom-up situation. Along with the continuous improvement of economic development level and the increasing enhancement of environmental protection requirements, the MSW management system evolves as informal landfill - sanitary landfill - incineration facilities - recycling system construction, and then systematic production revolution; especially the upgrading process from energy recovery to higher level, is not an issue of pure waste treatment or environmental management in most cases, but implies the integration of the concepts of waste management and sustainable development in the whole production and living system, which is also the key focus of the United Nations Sustainable Development Goals (SDGs) as well as the European Green Deal, on **how to realize closed-loop of waste reduction and circular economy, from design - production - consumption**.

MSW Resource Utilization

In Fuzhou, the urban management authorities have incorporated resource utilization into waste management planning, effectively promotes the transformation and upgrading of waste management to a higher level, pays attention to the application scene of recycled products, and promotes the establishment of a closed loop of material regeneration and recycling.

Fujian Yongfu Environmental Protection Science and Technology Group Co., Ltd. is the permanent slag acceptance site in Fuzhou, and it is also the first urban construction waste resource utilization project, with a total project investment of more than CNY 200 million. The company is located in Chuangxia Village, Nanyu Town, Fuzhou High-

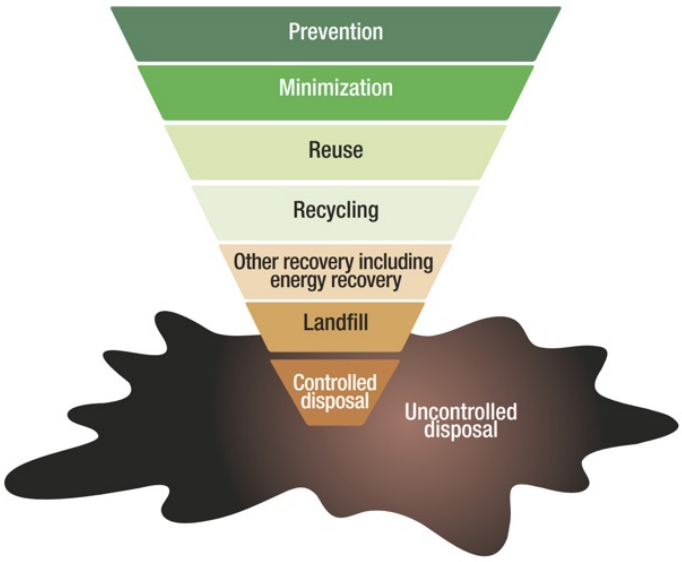


Figure 3-6 Waste Management Hierarchy
© Global Waste Management Outlook, UNEP, 2015

tech Industrial Development Zone, covering an area of 139000m^2, and has achieved the annual consumption of 1 million cubic meters (m^3) of slag and annual treatment of 600,000 m^3 secondary renovation construction waste, 1 million m^3 gravel and machine-made sand, and 500,000 m^3 engineering slurry. Now the company has a number of production lines: sintered brick production line, machine-made sand production line, engineering slurry treatment line, sinter-free slag product series production line, planting soil, nutrient soil and ceramic mud production line, secondary renovation construction waste treatment line and so on. The company mainly produces new environmental-friendly construction materials, and the products are: sintered brick series, sinter-free product series, antique-model green bricks, aggregate, all kinds of raw materials soil, planting soil, potter's clay, machine-made sand, gravel, fuel rods and so on (Figure 3-7).

Figure 3-7 Products from Construction Waste Resource Utilization
© Fuzhou Municipal Urban Management Committee

Figure 3-8 Actual Application Case of Products from Construction Waste Resource Utilization in Fuzhou
© Fuzhou Municipal Urban Management Committee

Market Application Of Recycled Products Of Construction Waste Resources

To support construction waste treatment enterprises to establish a sustainable business operation model and support the market application of recycled products of construction waste resources, Fuzhou has introduced a series of tax preference policies, financial support, financial incentives, and product use. The ***Implementation Rules for the Resource Utilization of Construction Waste and the Promotion of Recycled Products Application in Fuzhou (Trial)*** issued in 2022 specifies the application scenes of recycled products, requiring that "for municipal projects, landscaping projects, road projects, and water projects, recycled products from construction waste shall be used where applicable, and the proportion of recycled products used shall be no less than 15%; for housing and building construction projects, recycled products from construction waste shall be used where applicable, and the proportion of recycled products used shall be no less than 5%; encourage other types of construction projects to partially or fully use recycled products from construction waste in their foundation brick mold, masonry walls, sidewalks, outdoor green parking lots and roadbed padding and other parts; support enterprises who produce ready-mixed concrete, ready-mixed mortar, prefabricated components to use recycled aggregates from construction waste and other products", and; ***Opinions and Public Announcement of the Resource Utilization Enterprises and Recycled Products in Fuzhou (Trial)*** has clearly defined the quality control of recycled products from construction waste, requiring that "the content of construction waste in recycled products shall be no less than 70%".

During the process of creating a national level garden city, Fuqing County in Fuzhou applied the recycled products from construction waste resource utilization to 8 projects in total, including the Huxi West Park, Swimming Training Center Renovation Project, the carriageway and parking lot renovation project of Tianbaopi north side, and so on, which have cumulatively used 2,731.5 m^3 machine-made sand, 200 m^3 aerated bricks and 613.4 m^3 air bricks.

Under the guidance of various policies and the active cultivation of the market, there are 13 existing enterprises for construction waste resource utilization in Fuzhou, with a total processing capacity of 6.971 million m^3/year, mainly dealing with of demolition waste, renovation waste, and a small amount of engineering slag and slurry; main products include recycled aggregates, recycled green bricks, permeable bricks, sintered bricks and so on. As of December 2023, Fuzhou (including the five central districts and other counties and districts) disposed a total of 27.41 million m^3 of construction waste, and recycled 4.11 million m^3 for resource utilization, achieving a resource utilization rate of 15% (Figure 3-8).

Figure 3-9 Fuzhou Food Waste Treatment Plant
© Fuzhou Municipal Urban Management Committee

The Return Of Treated Food Waste Products To The Land

In addition to its active practice in the field of construction waste, Fuzhou is also committed to promoting the return of treated food waste products to the land, to achieve the circulation of materials. Fuzhou Hongmiaoling Food Waste Treatment Plant (Figure 3-9) was constructed in 2019, with a designed capacity of 800 tons per day and a total investment of CNY 622 million, mainly dealing with food waste generated by household source waste classification and organic fruits and vegetables waste generated by farmers' markets and supermarkets, etc. The project adopts the treatment process of "pre-treatment -- dry anaerobic digestion -- biogas power generation -- aerobic composting of digestate" (Figure 3-10), which achieves higher comprehensive resource utilization efficiency as well as emission reduction benefits. At present, the first phase of the project has been put into operation, treating 500 tons of food waste per day, generating about 30,000 m^3 of biogas per day, and producing about 50 tons of nutrient soil per day on average (Figure 3-11). The composted products of the Fuzhou Food Waste Treatment Plant are used as nutrient soil in cooperation with the municipal system and neighboring planting areas, which not only realized a closed material cycle of returning of organic matter to land, but also effectively improves the soil structure and soil quality, making it the optimal choice for environmental friendliness and natural sustainability.

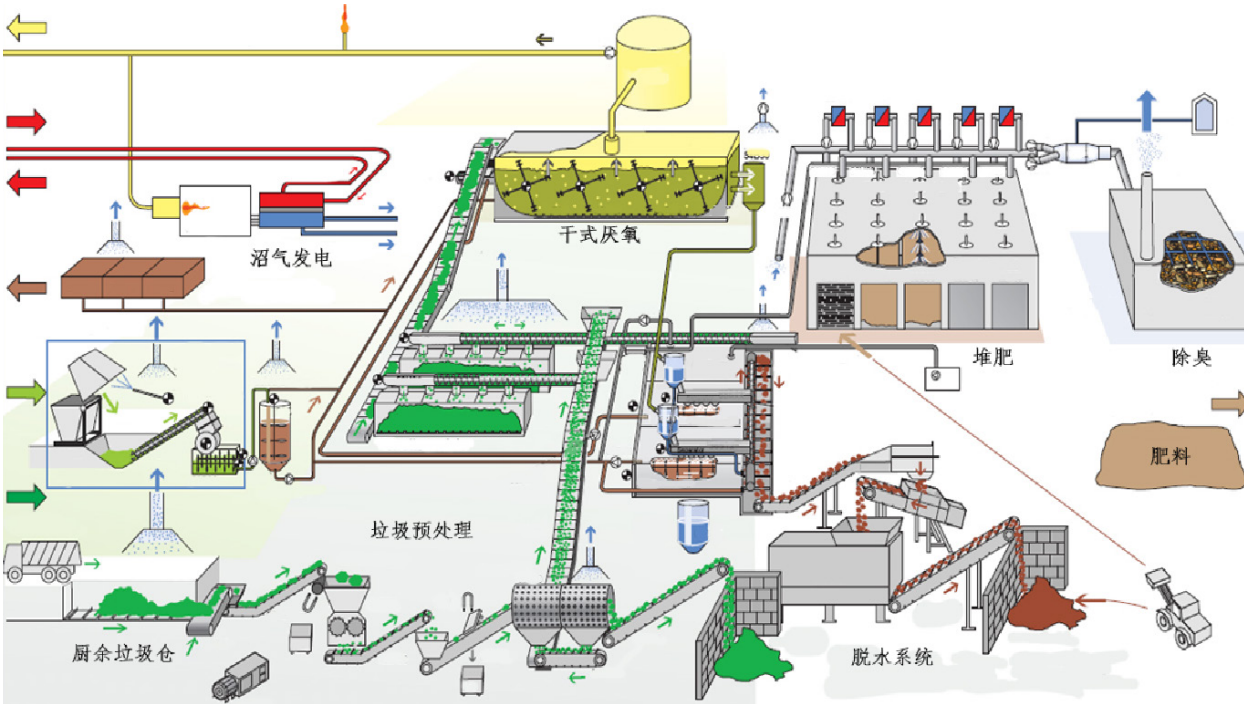


Figure 3-10 Process Roadmap of Fuzhou Food Waste Treatment Plant
© Fuzhou Shouchuang Haihuan Environmental Protection Technology Co., Ltd

- 沼气发电 Biogas Power Generation
- 干式厌氧 Dry anaerobic digestion
- 堆肥 Composting
- 除臭 Deodorization
- 厨余垃圾仓 Food Waste Storage
- 垃圾预处理 Waste Pre-treatment
- 脱水系统 Dewatering system
- 肥料 Manure

Figure 3-11 Compost Product of Food Waste Treatment Plant - Nutrient Soil
© Fuzhou Municipal Urban Management Committee

"***Making the Best Use of Everything***" is a direction that Fuzhou has been actively exploring in the process of waste management. In addition to construction waste and food waste, Fuzhou plans to further strengthen the recycling and high-value utilization of recyclables, especially plastics. As a longstanding simple living habit and universal philosophy of life in Chinese society, " Making the Best Use of Everything" has been recognized and promoted in the new era and across history, acting as a perfect complement to the concept of sustainable development.

3.6 Harmonious Development — Fuzhou's Expression of Beautiful China

"Promoting green development, fostering harmonious coexistence between human and nature, respecting nature, adapting to nature, and protecting nature" is the core idea of China's ecological civilization. Urban sanitation and human settlement are directly related to life of the general public, as well as urban economic development and one city's attractiveness, which are the overall reflection of the comprehensive civilization degree of a city. **Reviewing the development history of MSW management in Fuzhou is the most representative perspective to reflect the construction of ecological civilization in the urban dimension.**

Transformation And Upgrading Of The Hongmiaoling Comprehensive Waste Treatment Site

In the early 1990s, Fuzhou began to explore a systematic solution to the problem of MSW treatment and disposal, when planning the site selection, it reserved sufficient expandable land with an advanced vision, laying a solid foundation for later expansion. Over the past 20 years, Fuzhou comprehensively promotes the transformation and upgrading of the Hongmiaoling comprehensive waste treatment site, and has built the Hongmiaoling Circular Economy Ecological Industrial Park, covering waste incineration, incineration fly ash stabilization pre-treatment, bulky (landscaping) waste treatment, food waste treatment, hazardous waste treatment and other treatment facilities, thoroughly solved the problem of MSW treatment and disposal in Fuzhou, and has also provided strong support for the follow-up solid waste classified treatment, as well as coordinated treatment and disposal with other MSW in Fuzhou, cracking the problem of " City Besieged by Waste" in the big cities.

Summarizing the development history of Hongmiaoling Circular Economy Industrial Park, which can be divided into the following stages:

01//

Harmless Landfill Disposal Phase

Hongmiaoling Sanitary Landfill (Phase I) project was completed and put into use in October 1995, covering an area of 250,000 square meters, with a designed capacity of 7.15 million m3, following the most advanced sanitary landfill standards at that time; the landfill site was expanded and renovated later, and stopped use in 2015, with a cumulative total of nearly 10 million tons of solid waste being disposed of during the 20 years. In December 2019, the landfill plant was closed and covered, completing the ecological restoration and management projected.

02//

Comprehensive Treatment Phase

In 2007, Fuzhou Waste Incineration Power Plant (Phase I) was completed, transforming Fuzhou's MSW treatment from single landfill to comprehensive treatment. When it came to 2016, biogas power plant, incineration power plant (Phase II), fly ash treatment plant, slag treatment plant, leachate treatment upgrading, and reconstruction projects had been completed and put into use successively.

03//

Classified Resource Treatment Phase

From 2017 to 2020, with the continuous implementation of waste classification and the increasing demand for fine management of urban waste, Hongmiaoling systematically further constructed and improved treatment facilities for different waste streams, including waste incineration (Phase III), coordinated disposal, bulky (landscaping) waste treatment, fly ash stabilization pre-treatment, slag treatment, biogas recovery and utilization, and restaurant food waste treatment, household food waste treatment, hazardous waste treatment, leachate treatment and other treatment facilities, etc., and completed the landfill closure cover and ecological restoration. A complete residential and industrial production waste treatment system was established, ensuring the harmless, minimized, resourced and classified one-stop treatment in the park for MSW generated in urban areas of Fuzhou.

Since 2020, on top of completing the basic function of MSW treatment with high quality, Hongmiaoling Circular Economy Industrial Park has further upgraded to an "ecological civilization base", adhering to the idea of in-situ ecological restoration, carried out the renovation of vegetation and ecological environment of the whole park, improved the park's overall landscape, and restored the original look of lucid waters and lush mountains. In addition, a comprehensive management service center and a publicity and education center are built to demonstrate the green transformation of the industrial park.

04//

Ecological Civilization Base Development Phase

Figure 3-12 Panorama of Hongmiaoling Circular Economy Industrial Park
© Fuzhou Municipal Urban Management Committee

Figure 3-13 Publicity and Education Center in Hongmiaoling Circular Economy Industrial Park (Lucid waters and lush mountains are invaluable assets)
© Fuzhou Municipal Urban Management Committee

From 1995 to now, Hongmiaoling Circular Economy Industrial Park experienced continuous development and evolvement, with the cumulative construction capital investment exceeding CNY 5.3 billion and an existing capacity of more than 5,000 tons per day covering various types of waste treatment. The development of Hongmiaolng is an important support for the sustainable development of Fuzhou, and also a vivid sample of conceiving and inheriting the concept of ecological civilization in Fuzhou (Figure 3-12, Figure 3-13).

Figure 3-14 Jin'an Lake after restoration
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1995 - 2024

Hongmiaoling,Fuzhou

The Cumulative Construction Capital Investment

exceeding

5.3 billion

The Cumulative Construction Capital Investment

exceeding

5,000 tons per day

Hongmiaoling
Sanitary Landfill Plant

Hongmiaoling
Circular Economy Industrial Park

"Lucid waters and lush mountains are invaluable assets". Fuzhou City is the origin of the ecological civilization idea, but also a sustained practitioner of ecological civilization construction. Over the past 30 years, Fuzhou has continued to make efforts in the sustainable development, and came up with a number of influential, innovative and replicable integrated solutions in the aspects of economy, society and the environment. Not only targeting the end treatment and disposal of MSW treatment, but also from perspective of overall urban environmental health improvement and human settlements optimization, Fuzhou continues its efforts and investment to implement of a series of projects such as "Inland River Improvement Project", "Wastewater Treatment Construction Project", "Minjiang River Basin Pollution Management Project", "Afforestation and Greening Project". It is committed to creating a "clean, beautiful, neat, green, comfortable" living environment. With "clearer water, greener city, and better life", the city scape has undergone fundamental changes, while in the process of urban environment improvement, the public has gained a sense of happiness and the city has gained a sense of belonging, and the "Beautiful Fuzhou" is built by the joint efforts of people, the city, and nature (Figure 3-14, Figure 3-15).

Overall Urban Environmental Health Improvement And Human Settlements Optimization

3.7

Summary of Practical Experiences in MSW Management in FUZHOU

"Continuous improvement" is the core of Fuzhou's experience in MSW management and sustainable transformation. 30 years of change did not happen overnight, but rather led by strategic and forward-looking planning and continuous input. After 30 years of efforts, sustainable development in Fuzhou is not only an urban management complex “Hidden in Plain Sight” and recycled materials making the best use of everything, but also a cultural concept integrated into each aspect of urban management. Culture of sustainability is not only embedded in the local provincialism, in the city’s hustle and bustle, in the continuation of the ancient capital vein of the “Three Lanes and Seven Alleys”, but also a new color of people’s life, and the inexhaustible source of urban development.

In 2023, Fuzhou was honored with the first-ever UN-Habitat Global Award for Sustainable Development in Cities, becoming one of the five winners around the world. The Global Award for Sustainable Development in Cities selects cities from four dimensions: economic vitality and urban prosperity, ecological construction and green development, urban safety and resilient development, and capacity building for sustainable development. Winning the award means that the city has innovative development and leading demonstration in all four areas with positive significance for reference. Practicing sustainable development, Fuzhou City has become an international model.


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CHAPTER 04

04

CHAPTER FOUR

Waste Wise Experience of China in Global Environmental Governance

A Microcosm Of The Practice Of Msw Management In China

The China Waste Wise Cities Good Practices (Series I) and China Waste Wise Cities Good Practices (Series II) introduce the practical experience of six typical Chinese cities (urban areas) in MSW management, which is a microcosm of the practice of MSW management in China. "Tremendous change" can be used to represent the development of MSW management sector in China in the past 30 years, which means:

99.4% of urban and county town areas have effective transportation and treatment of MSW, which is an important guarantee for the development of urban living environment;

About **300 million tons** of MSW are effectively collected, treated, and disposed annually (301.43 million tons of harmless MSW treatment in 2023), with construction and demolition waste, bulky waste, and landscaping waste counted separately;

As of 2023, the capacity of harmless MSW treatment reaches **1.32 million tons per day**, of which incineration accounting for 59%, sanitary landfill accounting for 35%, and other treatment technologies (mainly anaerobic digestion treatment of food waste) accounting for 6%; MSW treatment and disposal facilities are being constructed and updated continuously, with **1,871** existing sanitary landfills, 619 incineration plants, and 225 other treatment facilities;

According to incomplete statistics, China's fixed asset investment in the field of urban amenities and environmental sanitation from 2001 to 2020 totaled **CNY 831.51 billion**, of which **CNY 405.12 billion** was invested in the field of MSW treatment; the development of waste management sector has created more than ten million green jobs, and also formed a vibrant and representative green industry;

Development Of MSW Management

99.4%

of urban and county town areas have effective transportation and treatment of MSW

As of 2023, the capacity of harmless MSW treatment reaches

1.32

million tons per day

About **300** million tons

of MSW are effectively collected, treated, and disposed annually

***301.43** million tons of harmless MSW treatment in 2023*

*China's fixed asset investment in the field of urban amenities and environmental sanitation **from 2001 to 2020** totaled*

831.51 biliion CNY

more than **10** million green jobs

01//

Environmental-friendly

Summarized from an environmental-friendly perspective, it means strict environmental discharge standards, open and transparent data disclosure and continuous communication with the public, specially key pollutants data of all waste treatment projects are **automatically monitored and disclosed** in real time; in addition to avoiding the leakage of waste in the environment, secondary pollutant emissions from the treatment process are also strictly controlled, representing responsible environmental management process and environmentally friendly waste treatment facilities;

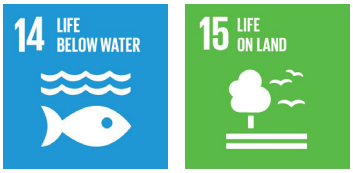
02//

Tackling Climate Change

Summarized from the perspective of tackling climate change, transformation from landfill to waste incineration effectively avoids mixed waste from entering landfills, therefore avoids disorganized emissions of methane from landfills, and effectively reduces the carbon emission intensity of the waste treatment process; taking the monitoring results of the Integrated Waste Management NAMA project (https://iwm-nama.caues.cn/) as an example, five representative cities achieved a cumulative emission reduction of more than **6.88 million tons** of carbon dioxide equivalent in 2019-2022 through the transformation and upgrading of waste management, and the carbon emission intensity per ton of waste was reduced from 0.76 tons to 0.53 tons;

03//

Plastic Pollution Control And Marine Litter Reduction



Summarized from the perspective of plastic pollution control and marine litter reduction, a market-oriented sanitation and cleaning system has been established, especially for the water environment management, a river/lake chief system has been set up, which established a clear division of responsibilities for water environment management; most coastal cities have carried out special service for marine sanitation with regular marine litter cleanup, covering a service area of **200 meters** from the low tide line to the land and **100 meters** extension to sea surface, realizing effective cleaning of floating marine litter in addition to avoiding land-based waste sources from entering the water body;

04//

Transforming And Upgrading To Higher Level Waste Management

From the perspective of transforming and upgrading to higher level waste management, under the requirements of high-quality development and refined management, recyclables, construction waste, landscaping waste will be further incorporated into the urban waste management system, which gives greater connotation and extension to the MSW management, and the optimization and improvement of **resource utilization and high-value utilization** will become the key focus of future development; encouraging reduction at source, guiding the use of recycled materials, and continuously practicing the concept of responsible production and consumption and "making the best use of everything";

05//

Awareness Raising And Cultural Development

From the perspective of awareness raising and cultural development, as an important part of the construction of ecological civilization, with the in-depth development of waste classification, the MSW management has entered a new stage from technological development to **cultural leadership**; waste management connects the public, city and the nature, and it is the best scene for practicing "Harmonious Coexistence of Human and Nature" in the urban context, and also the practical action of "Beautiful China" and "Sustainable Development" in cities.

Looking to the future, in the field of MSW management, cities in China will continue to explore the sustainable development paths of waste wise reduction and smart management, and continue to practice zero waste cities and realize the beautiful vision of Beautiful China. We also hope that China's experience can provide reference for other regions, hence promote effective waste management and environmental improvement in joint efforts.

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China Waste Wise Cities Good Practices

中国智慧减废城市优秀案例

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IMPLEMENTING THE NEW URBAN AGENDA

11 SUSTAINABLE CITIES AND COMMUNITIES