

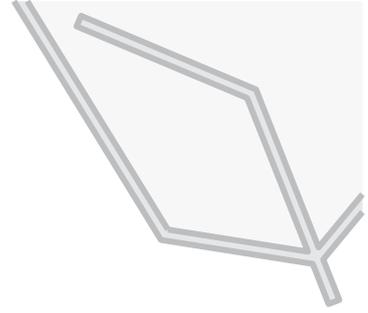
THEMATIC REPORT 09

# China Agricultural Waste Treatment Industry

Edited by China-Italy Chamber of Commerce



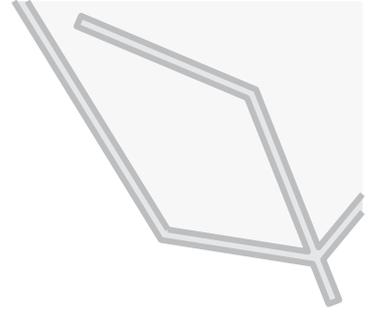
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# 1. Explanation, Policies, Laws and Regulations regarding the Agricultural Water Treatment Industry

## 1.1. Explanation of Agricultural Waste

Agricultural solid waste refers to organic substances discarded during the entire agricultural production process. The process includes plantation, forestry, animal husbandry, fishery, and other industries. The agricultural waste mentioned in this report mainly refers to crop straw, livestock, and poultry manure. Returning to land use and composition are among the main treatment options.

## 1.2. Policies and Laws and Regulations of Agricultural Waste

The Party Central Committee and the State Council have attached great importance to the utilization of agricultural waste resources. The Fifth Plenary Session of the Eighteenth Central Committee, *No. 1 Central Document 2016, Opinions on Accelerating the Construction of Ecological Civilization by CPC Central Committee and the State Council* and *Opinion on Accelerating the Transformation of Agriculture Development Mode by the General Office of the State Council*, made clear arrangements for this.

Focusing on five types of waste, including livestock and poultry manure, diseased and dead livestock and poultry, crop stalks, waste agricultural membranes, and waste pesticide packaging materials, the documents aimed at eliminating livestock and poultry waste by 2020. It set the comprehensive utilization rate of straw at least at 85%. As it is planned to recycle waste pesticide packaging, the documents specified that the recycling and comprehensive utilization rate of agricultural film in the season will have to be above 80%.

The policies stated two clear directions, one is the utilization of agricultural waste resources market and the other one is resource utilization of livestock wastes.

No.	Time	Institution	Policy name	Main Content
1	March 2007	The Ministry of Agriculture	<i>National Rural Biogas Project Construction Plan (2006 ~ 2010)</i>	Continuous promotion of the socialization, marketization, and standardization of the construction of base-level rural biogas service system to ensure the sustainable and healthy development of rural biogas services.
2	November 2016	The Standing Committee of the National People's Congress	<i>Law of the People's Republic of China on Energy Conservation (revised in July 2016)</i>	Vigorous development of biogas in rural areas, promotion of the use of renewable energy and other renewable energy technologies; use of non-arable land to grow energy plants, and vigorous development energy forests such as charcoal forests.
3	June 2017	The Standing Committee of the National People's	<i>Law of the People's Republic of China on Water Pollution Control</i>	Support of the construction of comprehensive utilization or harmless treatment facilities for livestock and

		Congress		poultry manure and wastewater in livestock and poultry farms and breeding communities.
4	July 2017	The Ministry of Agriculture	<i>Action Plan for the Utilization of Livestock and Poultry Manure (2017-2020)</i>	By 2020, the comprehensive utilization rate of livestock manure in China will have to reach more than 75%, and the supporting rate of manure treatment facilities and equipment in large-scale farms will have to reach more than 95%.
5	August 2017	National Development and Reform commission, Ministry of Agriculture	<i>National Promotion Project Work Program for the Utilization of Livestock and Poultry Manure Resources (2018-2020)"</i>	From 2018 to 2020, more than 200 large livestock farming counties will be selected for the construction of facilities for the treatment of livestock and poultry manure and the utilization of resources. After the project is completed, the comprehensive utilization rate of livestock and poultry manure in the project counties will reach more than 90%, and the supporting rate of manure treatment facilities and equipment in large-scale farms will reach 100%.
6	December 2017	National Development and Reform commission, Energy Bureau	<i>Notice on Issuing Guiding Opinions on Promoting the Development of Biomass Energy Heating</i>	By 2020, the installed capacity of biomass cogeneration will have to exceed 12 million kW, and the annual utilization of biomass gas (biogas, biomass gasification, etc.) will have to be about 10 billion m <sup>3</sup> . By 2035, the combined installed capacity of biomass cogeneration will have to exceed 25 million kW, and the annual utilization of biomass gas will have to be about 25 billion m <sup>3</sup> .
7	November 2017	General office of the National People's Congress standing committee	<i>Renewable Energy Law of the People's Republic of China (revised in November 2017)</i>	The country has listed the development and utilization of renewable energy as a priority energy development. It encourages and supports renewable energy to be connected to the grid for power generation.
8	October 2018	The standing committee of the National People's Congress	<i>Law of the People's Republic of China on the Promotion of Circular Economy</i>	It encouraged and supported agricultural producers and related enterprises to adopt advanced or applicable technologies to utilize crop straw, animal manure, by-products of agricultural products, waste agricultural films, etc., and to develop and use biomass energy such as biogas.

Table 1 Major policies for the utilization of agricultural waste in China.

Data source: GEP Research

## 2. General Overview of the Agricultural Market

### 2.1. Agricultural Waste Market

According to GEP Research data, in 2018 China held a huge agricultural waste output of about 4.8 billion tons, and the utilization rate of resources is about 60%. China's agricultural waste resource processing capacity was about 2.9 billion tons, while the amount that was not recycled was about 1.9 billion tons. The market size of the processing industry was about RMB 470 billion, with a decrease of about 3% year-on-year (mainly due to the impact of livestock and poultry inventory at the end of the year and the decline in grain output). Out of the RMB 470 billion, fertilizer treatment market accounted for about RMB 230 billion (about 700 million tons), the energy treatment market for about RMB 80 billion (140 million tons of processing capacity), the fodder and others market size for about RMB 70 billion (160 million tons of processing capacity). About RMB 90 billion worth of waste (1.9 billion tons of processing capacity) were returned to field.

With a further increase of utilization ratio of the agricultural waste resources, together with the cycle recovery of the breeding industry, it is estimated that China's agricultural waste production will reach about 3.34 billion tons in 2025, and the market size of the processing industry will reach about RMB 550 billion. The average annual compound growth rate of the agricultural waste resources processing market is estimated to grow at approximately 2.3% from 2018 to 2025.

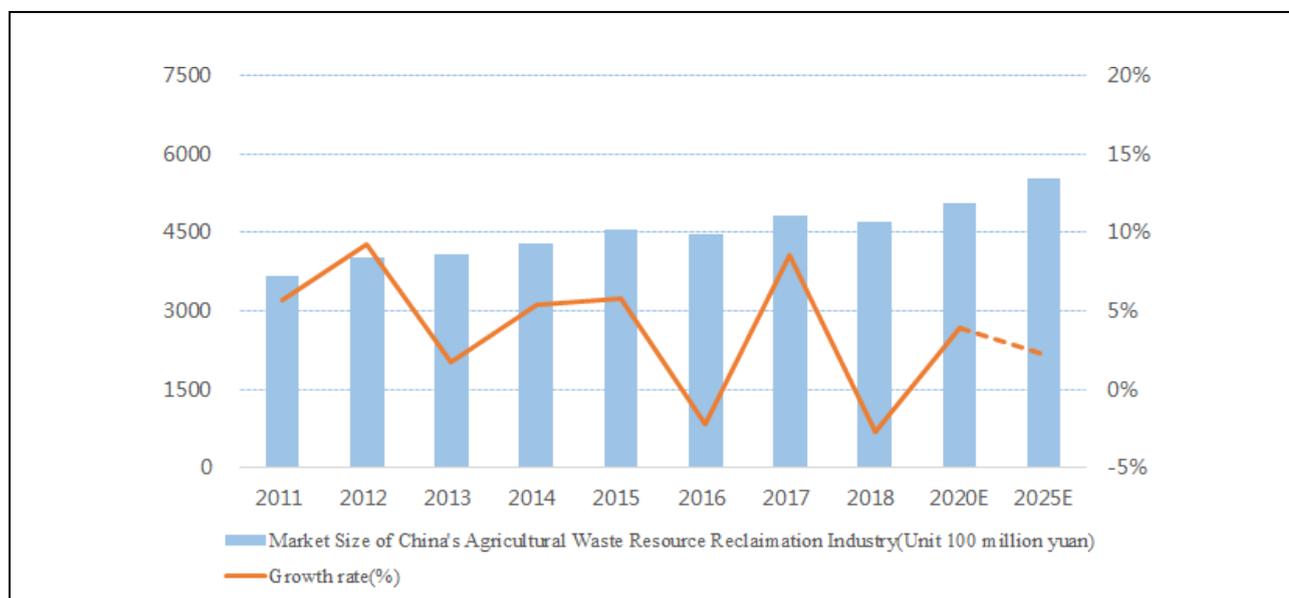


Figure 1 Market Size and Forecast of China's Agricultural Waste Resource Reclamation Industry in 2011-2025.  
Data source: GEP Research.

### 2.2. Management Situation of Agricultural Waste

In 2018, China produced about 4.8 billion tons of agricultural waste (about 900 million tons of straw waste and about 3.9 billion tons of livestock waste). The collected and processed volume was 2.9 billion tons. Among them, in terms of resource utilization processing, individuals collected 1.3 billion tons, most of



which were returned to field, while enterprises collected 1.6 billion tons, mainly used for fertilizer treatment or returning to field.

### **2.3. Agricultural Waste Resource Reclamation Projects**

In order to build beautiful and liveable villages, in accordance with the overall requirements of the implementation of the rural revitalization strategy, it is essential to deepen the utilization of agricultural production waste resources, to accelerate the supplement of rural habitat shortcomings, and to promote a virtuous cycle of rural ecological protection and economic development. By 2020, the comprehensive utilization rate of crop straw will remain above 95%, the comprehensive utilization rate of livestock and poultry manure will reach 75%, the amount of fertilizers and pesticides will be reduced, and the utilization rate of main crop fertilizers will reach 40%.

According to GEP Research, the average investment cost of agricultural waste reclamation projects is about RMB 400,000 per ton. Among them, the average investment cost of biogas resource reclamation projects is about RMB 250,000 per ton (the on-grid electricity price of end products is about RMB 0.65 per kilowatt hour, the fat is about RMB 3,000 per ton, and the biogas residue is about RMB 300 per ton). The average cost of organic fertilizer reclamation project investment is about RMB 60,000 per ton.

### 3. Analysis of Supply and Competition in China's Agricultural Waste Treatment Industry

#### 3.1. Overview of the Competition Pattern

According to GEP Research data, the companies that work on comprehensive utilization of agricultural waste are mainly based on composting and biogas production.

There are more than 3,000 companies producing biogas from agricultural waste. Every year the total number increases. Most of the projects in rural areas are on small-scale. There are about 20 companies that cooperate with large and medium-sized farming and animal husbandry companies, and the partners have a greater impact on corporate profits.

There is a large number of agricultural waste-based organic fertilizer companies, but only about 2,800 companies with microbial fertilizer registration licenses from the Ministry of Agriculture and Rural Affairs (Pesticide Management Division). The sales scope of the company is mainly in the province and in the surrounding provinces and cities. There are about 20 large-scale enterprises nationwide.

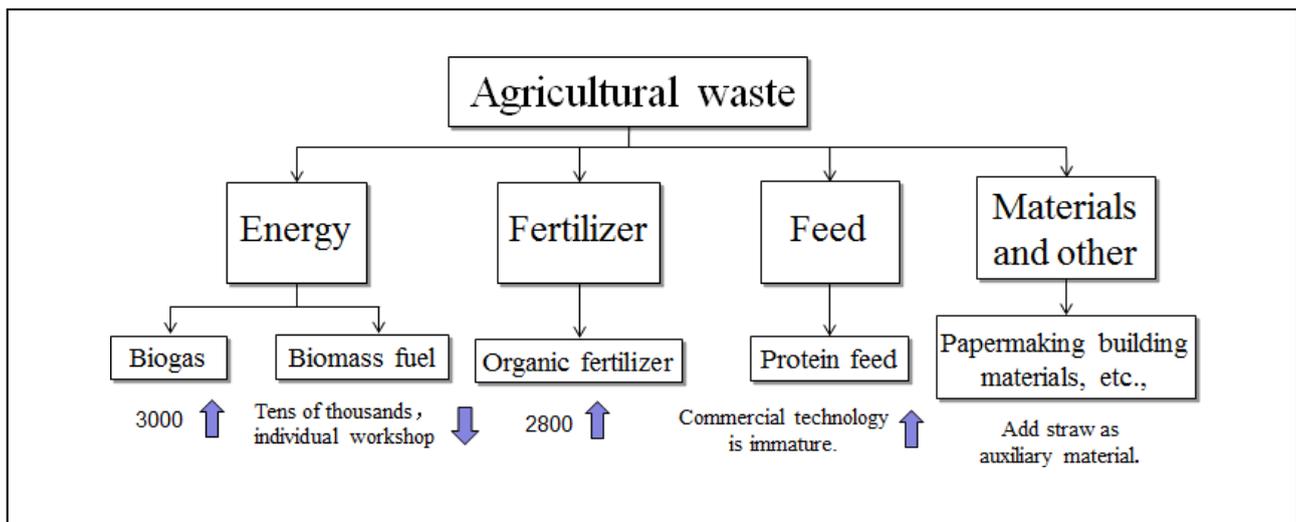
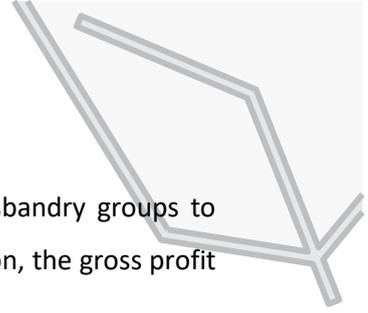


Figure 2 Resource reclamation of agricultural waste and enterprise scale.  
Data Source: GEP Research.

#### 3.2. Industry Gross Profit Margin

Large biogas projects need more policy support. First, although there is a large demand, few projects are being issued. Second, the channels of the power companies that use biogas sometimes cannot flow smoothly, resulting in inefficient and irrational use of resources. Third, the effect of straw biogas is relatively good, and pipeline biogas is very popular, but the costs of straw collection, baling, air-drying, transportation, and storage are relatively high. In addition, it is very difficult for the enterprises to bear the costs of the management and maintenance personnel, and of the equipment maintenance, as they are relatively high compared to the profits.

According to GEP Research data, the average gross profit margin of the agricultural waste biogas industry is



around 10%. Some companies have cooperated with large agricultural and animal husbandry groups to ensure stable supply. If biogas products can be connected to the grid for power generation, the gross profit margin will be greater than 15%.

The gross profit margin of agricultural waste-based organic fertilizers varies widely. The gross profit margin of ordinary organic fertilizers is between 5-20%, while the gross profit margin of microbial fertilizers is between 20-40%.

## **4. Problems and Trends of Fertilization and Biogas Utilization of Agricultural Wastes**

### **4.1. Problems and Trends of Fertilization of Agricultural Wastes**

Several problems need to be tackled. First, there is only one unified content standard of organic fertilizer, while there is no corresponding technical requirement for organic fertilizer produced by different raw materials and processes. Established operating procedures and technical standards are lacking, most of them rely on feeling and experience. For example, in the process of making organic fertilizer from agricultural waste, it is difficult to determine the effectiveness of organic fertilizer and unstable feed nutrient content. The problem of heavy metal pollution of organic fertilizer using livestock manure as raw materials also needs to be solved. In general, terminal products are sold at low prices, so that it is difficult to sell high-priced products. Raw materials characteristics change according to the different regions. The separation of planting and breeding areas has also led to regional misalignment of raw materials and products. The storage and the transportation systems are not sound, while the sources of raw materials are unstable. Consequently, they all increase the uncertainty of project operation.

In *The Strategic Plan for Rural Rejuvenation (2018-2022)*, the utilization of agricultural waste resources is said to be further promoted. More than 60% of China's arable land is of poor quality, and the demand for organic fertilizer has increased year by year. Because of new policies and the comprehensive application status of various resource treatment technologies, fertilizer treatment is still the main guarantee for resource reclamation.

### **4.2. Problems and Trends of Biogas Utilization of Agricultural Wastes**

Several factors have affected the smooth operation of the projects. Among them, there are difficulties in the sales of terminal products from biogas projects of agricultural waste, the low proportion of on-grid power generation, the forced torch burning due to inadequate utilization of biogas, the reduction in rural population leading to reduced biogas use, and the immature temperature process technology leading to unstable gas production.

The National Development and Reform Commission has issued *the Notice on Guidance for Promoting the Development of Biomass Energy Heating* in order to further promote installed capacity of biomass cogeneration and to encourage the utilization of biogas from agricultural waste. China's natural gas dependence is about 40%, and the biogas fermentation technology of agricultural waste is relatively mature. Biogas treatment is still the main treatment method besides fertilizer treatment.

China's agricultural waste production is enormous, and most of it is discarded as not recyclable, causing environmental pollution. Biogas dry fermentation technology has many advantages, as it has higher waste treatment efficiency, low operating cost, large organic load, small water demand, and less biogas production. It can effectively solve the problems of agricultural waste disposal and energy utilization.

The research status of anaerobic fermentation process and biogas production from dry fermentation of agricultural waste were reviewed. The application prospect and development trend of dry fermentation are in progress to be developed.



The high-level training program Sicab – Sino Italian Capacity Building for Environmental Protection is supported by IMELS – ITALIAN MINISTRY FOR THE ENVIRONMENT, LAND AND SEA.



Sicab is included within the SINO-ITALIAN COOPERATION PROGRAM FOR ENVIRONMENTAL PROTECTION (SICP). SICP was launched by IMELS – the Italian Ministry for the Environment, Land and Sea and MEE – the Chinese Ministry of Ecology and Environment.

Sicab consortium includes five partners: Politecnico di Milano (Lead Partner), Euro-Mediterranean Center on Climate Change, Italy China Foundation, Fondazione Politecnico di Milano, Sapienza University of Rome.



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