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THEMATIC REPORT 01

China Village Sewage Treatment Industry

Edited by China-Italy Chamber of Commerce

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1. Definition of China Village Sewage Treatment Industry

China village sewage treatment industry is mainly specialized in treating sewage discharged from villages and towns as per specific conditions, thus to enable the treated sewage to meet discharge or reuse standards. In this definition, villages and towns include incorporated towns, townships and villages.

The village and town sewage mainly includes domestic sewage, livestock and poultry breeding sewage and sewage from township enterprises, among which the concentration and harmfulness of domestic sewage are relatively low with high biodegradability. Its COD concentration usually greatly reduces after passing through simple septic tanks or oxidation ponds, and it is then treated by environmental self-cleaning, artificial wetland or integrated processing equipment. The livestock and poultry breeding sewage has high concentration and serious pollution. For this reason, high attention should be paid to the concentrated livestock and poultry breeding areas in towns and villages. For township enterprises, especially individual workshops, it is difficult to bear sewage treatment costs. Therefore, this kind of enterprises has a relatively high closedown ratio. At present, the sewage treatment in villages and towns is mainly directed to domestic sewage and livestock and poultry breeding sewage.

The treatment modes of village and town sewage mainly divide into centralized treatment and decentralized treatment. The centralized treatment mode treats village and town sewage through building sewage treatment plants (stations), which is suitable for the areas with dense population. Each township sewage treatment plant usually has a treatment capacity of 500- 5000m^3/d. The decentralized treatment mode mainly applies to small-scale integrated sewage treatment device and constructed wetland technologies. It is suitable to rural areas with relatively dispersed population. Its treatment capacity per treatment device usually does not exceed 500m^3/d.

Treatment Mode	Specific Device	Main Techniques	Treatment Scale (m^3/d)	Scope of Application
Centralized treatment	Sewage treatment plant (station)	A2/O, A/O, MBR, oxidation ditch, etc.	500-5000	Town and township level
Decentralized treatment	Small-scale integrated sewage treatment device	A/O、SBR、FMBR、CASS	<500	Village level
	Other processes	Constructed wetlands, stable ponds, land treatment, septic tanks, and biogas digester purification, etc.	-	Township and village level

Table 1 Definition of Treatment Modes for China Village Sewage.
Data source: GEP Research.

2. Analysis of the Development Environment for China Village Sewage Treatment Industry

2.1. Relevant Policies Concerning China Village Sewage Treatment Industry

In recent years, China has strengthened its efforts to improve rural ecological environment, and released a series of national-level policies in an intensive manner.

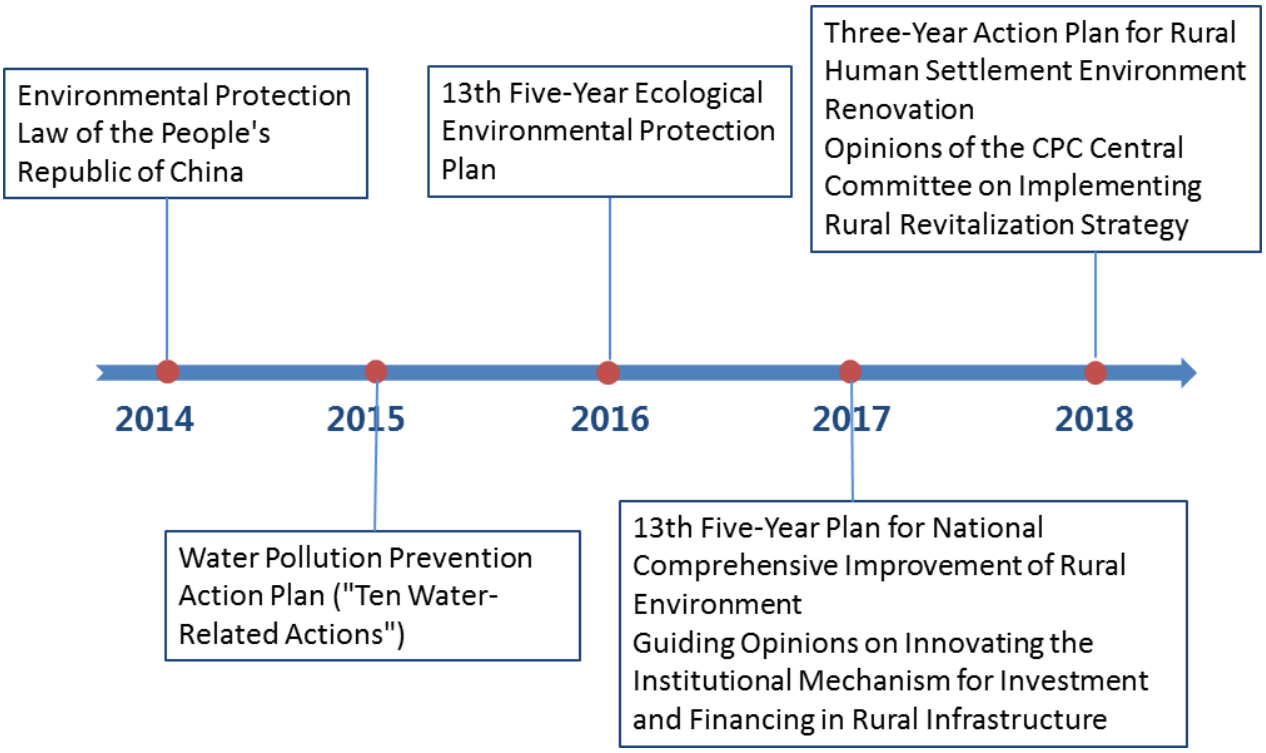

Figure 1 National Policies Concerning China Village Sewage Treatment Industry.
Data source: GEP Research.

2.2. Local Policies

2.2.1. Planning Level

All local provinces and cities have steadily carried out village sewage treatment work, with their sewage treatment plant coverage rate and sewage treatment rate increasing year by year. Meanwhile, some provinces and cities have put their policy emphasis on the promotion of sewage treatment facilities, with relatively less attention to the later operations, which would leave certain hidden dangers to the future operation.

2.2.2. Funding Policies

The General Office of the CPC Central Committee and the General Office of the State Council of the People's Republic of China have put forward to "encourage capable regions to explore to establish the peasant household payment system for sewage treatment, and improve reasonable sharing mechanism between financial subsidies and peasant households' payment" in the Three-Year Action Plan for Rural Human Settlement Environment Renovation issued by them. However, through the observation of the

actual situation, most of the central and local financial funds have been used to support treatment facilities construction, while the pricing mechanism for rural sewage treatment has not yet been formed, and the projects relating to rural environmental governance did not obtain operational income based on a return mechanism mostly relying on government payment.

2.2.3. Discharge Standards

At present, most rural projects in China still implement the *Discharge Standards for Pollutants in Urban Sewage Treatment Plants* (GB18918-2002). In terms of the controlling index values, all provinces and cities have divided the index values into multiple levels, which are differentiated according to the scale of receiving water and treatment facilities.

Minimum treatment standard (at a scale less than 500m^3/d)						
Province/City	COD	Suspended Matter	Ammonia Nitrogen	Total Nitrogen	Total Phosphorus	Animal and Vegetable Oil
	(CODcr)	(SS)	(NH3-N)	(in N)	(in P)	
Beijing	100	30	25	-	-	-
Tianjin	60	20	8 (15)	-	2	5
Zhejiang	100	30	25	-	3	5
Guangdong	60	30	8 (15)	-	2	5
Shandong	120	50	-	-	-	-
Jiangsu	100	30	25 (30)	-	-	5
Ningxia	120	50	25 (30)	-	-	10
Hainan	120	60	25	-	-	30
Shanxi	80	50	15 (20)	-	-	5
Hebei	150	50	25	-	-	15
Fujian	120	50	25 (30)	30	4	8
Chongqing	100	50	25	-	4	10
Sichuan	100	40	25	-	4	10
Shaanxi	150	30	-	-	3	10
Refer to "Discharge Standards for Pollutants in Urban Sewage Treatment Plants" (GB18918-2002) (at a treatment scale greater than 500m^3/d)						

Level 1 A	50	10	5 (8)	15	0.5	1
Level 1 B	60	20	8 (15)	20	1	3

Table 2 Rural Domestic Sewage Treatment and Discharge Requirements in Some Provinces and Cities in China.
Data source: GEP Research and the Discharge Standards for Water Pollutants from Rural Domestic Sewage Treatment Facilities, and the pH range is 6-9.

Generally speaking, the pollutants discharge standards are more loose and the total nitrogen and total phosphorus standards are more flexible for the treatment facilities with a processing capacity of less than 500m^3/day. The rural domestic sewage treatment facilities with a capacity of 500m^3 per day or above have been managed according to the *Discharge Standards for Pollutants from Urban Sewage Treatment Plants* (GB18918-2002). Each local standard could increase control indicators according to actual conditions.

3. Demand Analysis of China Village Sewage Treatment Industry

3.1. Market Scale and Growth Rate of China Village Sewage Treatment Industry

The sewage treatment in the rural area of China started relatively late, with the construction level of sewage treatment facilities lagging behind the speed of economic development. According to the data collected by GEP Research, in 2018, the discharge volume of sewage from the villages and towns in China exceeded 10 billion tons, while the sewage treatment rate was only about 22%.

The village sewage treatment status is uneven in different regions: the village sewage treatment rate of the eastern region reached 34.1%, that of the central region reached 13%, while that of the western region was only 12.4%; and from the view of provinces and cities, the ratio of villages and towns that completed sewage treatment exceeded 30% in Zhejiang, Shanghai, Jiangsu, Beijing, Fujian, and Guangdong.

In 2018, the market scale of China village sewage treatment industry was about RMB 48 billion, experiencing a year-on-year increase of 31%. By 2020, the market scale is expected to exceed RMB 70 billion at an annual compound growth rate of about 22% from 2018 to 2020; and by 2025, it is expected to exceed RMB 110 billion.

However, in the actual operation process, due to the lack of fund supports for the latest operation of village sewage treatment PPP projects, especially the excessive financial pressures faced by local governments at village and town levels, many projects became such projects that look impressive but cannot achieve practical effects, and some enterprises become cautious about these projects. Therefore, the growth rate of the industry slowed down in the latest period of the 13th Five-Year Plan. If the financial problems could be solved, the industry will continue to develop in a stable manner (with low short-term expectations).

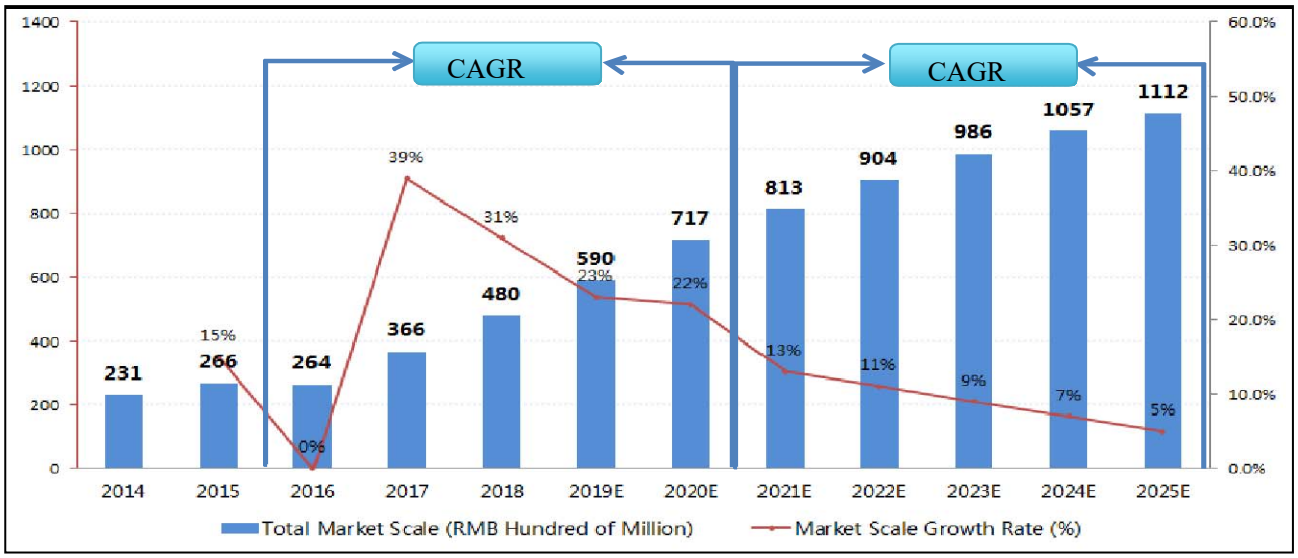

Figure 2 Market Scale and Forecast of China Village Sewage Treatment Industry from 2014 to 2025.
Data source: Ministry of Housing and Urban-Rural Development, GEP Research.

3.2. Development Status of Segment Markets in China Village Sewage Treatment Industry

3.2.1. Construction/Operation Market Analysis

At present, the development of China village sewage treatment industry is mainly driven by the construction market, the scale of which accounts for nearly 90% of the industrial scale. In 2018, the scale of sewage treatment construction in villages and towns of China was about RMB 42.6 billion, having a year-on-year increase of 33%. It is estimated that by 2020, the scale of sewage treatment construction in villages and towns would reach RMB 64.4 billion, with an annual compound growth rate of about 23%.

China village sewage treatment industry has faced the problem of "emphasizing construction while not paying enough attention to operation" all the time. In 2018, the actual operation rate of sewage treatment facilities in villages and towns in China is less than 30%, many of which were in idle state. In 2018, the operating market scale of China village sewage treatment industry was about RMB 5.4 billion, having a year-on-year increase of about 17%; it is estimated that by 2020, the operation scale of China village sewage facilities would reach RMB 7.3 billion, with an annual compound growth rate of about 15%.

3.2.2. Regional Market Demand Analysis

In 2018, the village sewage treatment industry witnessed a strong demand in the south region and weak demand in the north region; the village sewage treatment demands were mainly concentrated in coastal areas such as Zhejiang, Jiangsu, and Guangdong Provinces. In terms of sewage treatment rate, according to the data released by the Ministry of Housing and Urban-Rural Development, the sewage treatment rate of the incorporated towns in China is 47%, the township sewage treatment rate is 25%, while the rural sewage treatment rate is less than 10%. Among these cities, the sewage treatment capacity of villages and towns in coastal or near-coastal economically developed areas is significantly higher than that of other areas, and the village sewage treatment rate is generally positively correlated with the local economic development degree.

3.2.3. Development Status of Sewage Treatment Plants /Small-Scale Integrated Treatment Plant

At present, according to the data released by the Ministry of Housing and Urban-Rural Development, the sewage treatment capacity of villages and towns in China is about 35 million tons per day. Among them, 5,879 sewage treatment plants have a total treatment capacity of 18.42 million tons/day; and 23,219 small-scale integrated sewage treatment plants (excluding villages) have a total treatment capacity of 14.75 million tons/day. In the future, as the main emphasis of China village sewage treatment transfers from townships to rural areas, the proportion of small-scale integrated sewage treatment plants will increase accordingly.

4. Analysis of Supply and Competition in China Village Sewage Treatment Industry

4.1. Supply and Concentration Degree of China Village Sewage Treatment Industry

China village sewage competition market is mainly composed of three types of participants. The first type is large-scale water service companies (less than 100 companies). They mainly undertake large-scale village sewage treatment PPP projects, and generally have their own decentralized integrated sewage treatment equipment. Engineering companies are other competitors in the market. They usually choose a local engineering company from the project location to carry out construction work, with little impact on the village sewage treatment industry. Finally, there are equipment suppliers, which are very numerous (thousands of suppliers). They mainly use decentralized integrated sewage treatment equipment.

The main enterprises in China village sewage treatment industry are traditional large-scale water service companies, with relatively low industry concentration degree. According to the data collected by GEP Research, the market share of CR5 is about 15%, and that of CR10 is about 20%.

4.2. Analysis on Village Sewage Treatment Projects

China village sewage treatment projects have relatively small individual scale, which are generally carry out in a packaged manner, including the packaging of sewage projects in multiple villages and towns within the region, the integrated packaging of plants and networks, and the packaging of village sewage projects with other environmental comprehensive management projects. The packaged village sewage treatment PPP project has an aggregate sewage treatment scale of tens of thousands of tons, generally amounting to about RMB 100 million, which puts higher requirements on the qualification of the winning bidder.

This industry shows obvious regional characteristics, and all the major companies have endeavoured to strengthen their national layout. Major companies in the industry have strengthened their national market layout, and the majority of the companies mainly carry out business around their location. In addition, the construction projects show a more obvious regional characteristics, as more than 70% of the construction units are local engineering companies.

5. Price and Profitability of China Village Sewage Treatment Industry

According to the statistical data of GEP Research, the operating prices charged by enterprises for village sewage treatment are within the range of RMB 1-1.5. In terms of the charging mechanism, enterprises do not directly collect sewage treatment fee from residents, instead, the government is responsible to pay such fee.

At present, the government pays about 70% of enterprise sewage treatment fee. The sewage treatment fee levied by the government on the incorporated towns is about RMB 0.66/ton, and the collection of sewage treatment fee in rural areas faces more difficulties. In the short run, the sewage treatment fees in villages and towns would still mainly depend on government subsidies.

As China village sewage treatment industry mainly focuses on engineering work (accounting for nearly 90%), there are certain deviations in the confirmation of PPP project income, which would lead to certain gap between gross profit margin and the actual situation.

In 2018, according to the data collected by GEP Research, the gross profit margin of China village sewage treatment industry was within the range of 10-15%, which was lower than the gross profit margin of urban sewage treatment business (i.e., 20%-30%). The gross profit margin of sewage treatment equipment was generally above 50%, but the sales cost was also relatively high.

6. Technology and Cost of China Village Sewage Treatment Industry

6.1. Village Sewage Treatment Technologies

Since the village sewage treatment modes vary greatly in different regions of China, sewage treatment needs to adapt to local features in light of actual conditions. In terms of treatment technologies, village sewage treatment technologies mainly include decentralized mode and centralized mode; in terms of the technical unit composition of participants, village sewage treatment technologies could be divided into natural biological purification, ecological purification, artificial synthesis and other purification systems.

Each kind of village sewage treatment technologies has their own advantages and disadvantages. At present, the mainstream technologies in Chinese market include activated sludge technology, biological contact oxidation technology, and constructed wetland technology among others.

6.2. Effluent Discharging Standards and Construction and Operation Costs of Village Sewage Treatment

With respect to the construction cost, according to the data collected by GEP Research, the construction cost of centralized treatment units ($1m^3/d$) is within the range of about RMB 2500-4500. With the expansion of sewage treatment scale, the unit construction cost would be gradually reduced. In terms of treatment process, MBR method shows a relatively high effluent discharging quality (which could reach level 1A), with a unit construction cost between RMB 3000-5500. In terms of operating cost, the price for treating per ton of domestic sewage is between RMB 0.5-1.5.

The unit cost for decentralized treatment is generally lower than that of centralized mode, with a unit construction cost generally between RMB 2000-3000, and a unit operating cost between RMB 0.2-0.5.

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