Problems in the Biogas Construction in Weihui City and Development Strategies

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Abstract Taking the demonstration biogas construction city in Henan Province - Weihui City as the survey and research city, we give an overview of the industrial and agricultural base and current situation of biogas development in Weihui City, and analyze the main problems in biogas construction, such as simple development mode of biogas adopted by rural households, laggard construction of large and medium-sized biogas projects, unsound service system for biogas development and failure to comprehensively use biogas resources. According to the practical work experience, we sum up the following.

Key words Biogas, Weihui City, Problems, Development strategies

Biogas technology can take advantage of a variety of anaerobic heterotrophic microorganisms under anaerobic conditions to convert agricultural production and domestic waste into methane and other combustible gases, transform complex organic matter into simple amino acid, humic acid, crude protein, crude fat and vitamins[1-2]. Vigorously developing biogas can effectively alleviate the situation of rural energy shortage, improve the ecological environment, and also provide biogas slurry, biogas residue and other organic fertilizers[3]. As the resource recycling chain linking breeding and farming, biogas construction is welcomed by the all levels of government and people, becoming a growth point for the local economic development and grasp for new rural construction. The biogas agriculture mode with methane as a link is a sustainable road for the development of recycling economy and ecological agriculture[4-5].

Peng Wang[6], Shang Gaowei[7] and Tian Shuyin[8] reported the problems in rural biogas construction in Shuangfeng County, Hunan Province, Zhouqu County, Gansu Province, Luonan County, Shaanxi Province, such as flawed thinking and understanding, unsound institutions, poor follow-up services, shortage of funds for construction, lack of raw materials for fermentation, and inefficient comprehensive utilization. Lei Zhenyu[9] summarized and reported the experience in the development of rural biogas construction in Panji District, Huainan City, Anhui Province. Liu Dejiang[10] put forth the future development recommendations based on the problems in rural biogas construction in the Xinjiang Autonomous Region.

Further development of biogas is the need of socio-economic development in rural areas[11], and an effective way to promote the new rural construction and build ecological civilization homeland[12]. For the regional biogas construction, there are differences in level of awareness, promotion efforts, development model, and specific development measures. In recent years, Henan Province has made great progress in biogas construction, but its successful experience and development is rarely reported in detail.

Taking the demonstration biogas construction city in Henan Province - Weihui City as the survey and research city, we give an overview of the industrial and agricultural base and current situation of biogas development in Weihui City, and analyze the main problems in biogas construction. Based on the existing measures and work experience, we put forth the countermeasures for the development of biogas, to provide a reference for the continued development of biogas in other regions.

1 Overview of Weihui City and development status of biogas

1.1 Overview of industry and agriculture in Weihui City

Weihui City, located in the northern part of Henan Province, east of the Taihang Mountains, north shore of the Yellow River, is a county-level city in Henan, People's Republic of China. It belongs to Xinxiang. The city has an area of 882 km? and a population of 480000. The terrain is mainly plain, mountain and hill. It has a warm temperate continental monsoon climate, with sufficient sunlight, rain and heat in the same quarter, suitable for the growth of a variety of crops and livestock.

The industrial base in Weihui City is good. The added value of four pillar industries (building materials, machinery, chemicals, textiles and deep processing of farm and sideline products) accounts for more than 83% of the industrial added value. There are 1 industrial park, 3 industrial areas and 91 industrial enterprises. As the country's wheat grain production base, the biggest egg production and fruit, vegetable base in the Central Plain, Weihui City has been vigorously developing efficient agriculture and farming. There are 21 bases having passed the certification of pollu-

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tion-free agricultural product origin by the Ministry of Agriculture, 4 products having passed the certification of green food and pollution-free agricultural product, 13 pollution-free enterprises. It was honored as "Strong Animal Husbandry County" and one of "Ten Pollution-free Animal Product Demonstration Bases". Good industrial and agricultural conditions provide a material basis for the development of biogas in Weihui City.

1.2 Development status of biogas in Weihui City Since 2003, the leaders at all levels in Weihui City have attached great importance to and support the construction of rural biogas, in order to increase farmers' income, develop circular economy, and protect the ecological environment. It strengthens publicity, demonstration, technology drive, and funds for comprehensive advance and development; adheres to the scientific concept of development and the development idea of service protection. The rural energy and environmental protection work has made remarkable achievements, and it has maintained the honor of demonstration municipal biogas construction city for many years.

In recent years, Weihui City has successfully built more than 40 000 household methane tanks, making the rural biogas gradually develop into an emerging industry of the rural economy. Many kinds of biogas development mode have gradually taken shape, such as "large and medium-sized biogas project mode" (farm, farming community building) and "quaternity mode" (greenhouse, digesters, livestock breeding, toilet).

2 Main problems in biogas construction

2.1 Simple development mode of biogas adopted by rural households The construction of methane tank in rural areas is simple, only used for cooking. The invested funds are not enough, and the understanding is limited. The kitchen, shelter, and toilet are not transformed well and completely. The farmers' residence is very far from the farm land; the inconvenience of water, electricity and roads makes the construction of "quaternity mode" constrained.

Some farmers are relocated due to town planning, and the new area is densely populated, with small courtyard, making some farmers fail to build methane tank; some farmers do not develop breeding, and the supply of raw materials for methane tank is inadequate. These factors limit the general promotion of biogas.

2.2 Unsound service system for biogas development The construction and maintenance technique of methane tank require a lot of attention, so the problems often occur in the process of use, to some extent, affecting the enthusiasm of farmers. On the one hand, the majority of farmers lack knowledge and experience concerning the maintenance and management of methane tank, so there is an urgent need to train more biogas construction technicians.

On the other hand, due to the lack of biogas construction grant funds, low wages and poor treatment, the biogas service personnel with high quality are instable, and the service level of biogas construction is not high, having an impact on the biogas building and development.

2.3 Laggard construction of large and medium-sized biogas projects At present, the biogas construction in Weihui City is mainly focused on household methane tank, using rural straw, manure and other agricultural wastes to develop biogas to meet the farmers' demand for energy. The construction of large and medium-sized agricultural biogas projects is regarded as an important strategic initiative for resource-based utilization of agricultural waste, which has begun to receive widespread attention.

Expanding the sources of raw materials for biogas (urban solid waste, industrial waste, high concentration organic wastewater), and building large and medium-sized biogas projects to achieve economies of scale and industrialization is the development direction of biogas[13]. However, the overall technology level of large and medium-sized biogas projects is low, the funding input is inadequate and the supporting policies are imperfect, thus the construction is relatively backward.

2.4 Failure to comprehensively use biogas resources Achieving the comprehensive utilization of biogas resources is the important content and basis of biogas development. At present, the comprehensive utilization of biogas in Weihui City still remains at a relatively low level, and the application area is very narrow.

In addition to the use of energy, the majority of farmers only regard the biogas residue and biogas slurry as organic fertilizer for simple application. Using biogas residue to produce edible fungi, biogas slurry soaking, and pest control have not yet been widely applied. The production of household biogas slurry and biogas residue is low and dispersed. It is difficult to collect biogas slurry and biogas residue as green pollution-free fertilizer for large-scale pollution-free agricultural production, and high – quality resources are difficult to play a greater role.

3 Measures for the further development of biogas

3.1 Strengthening the organization and leadership to promote biogas construction Government at all levels should take biogas construction as a project enriching people, and establish the leading work group of biogas construction with the leader in all levels of government as head. Each township should establish corresponding organization, make clear the division of labor and responsibilities, and sign the target management responsibility paper of biogas construction.

The relevant departments should strengthen the coordination and cooperation of biogas construction work in rural areas, break the boundaries of industry, and connect the rural biogas construction with other development projects in rural areas, to form top-down management system. For the difficulties and problems occurring in biogas construction, it is necessary to solve them, to ensure the rapid and healthy development of the construction of biogas.

3.2 Strengthening the exemplary role of demonstration villages and households In the beginning of biogas construction, the cadres and the masses know little about and have doubts at the new pool type, new technology, with serious wait-and-see atti-

tude. On the one hand, the relevant government departments should organize the cadres to visit and study, to increase perceptual knowledge and understand the benefits of the development of biogas construction; on the other hand, the relevant government departments should play the exemplary role of demonstration villages and households, use various forms and means to strengthen propaganda and create atmosphere for the construction of biogas, such as opening TV column, demonstration, mobile broadcasting, writing fixed slogans.

3.3 Raising funds from many sources and increasing investment in biogas construction Rural biogas construction is rural infrastructure construction, which entails sufficient financial support. On the one hand, the relevant government departments should raise funds from many channels and do everything possible to increase the funding; gradually establish the diversified investment mechanism with government investment as guidance, farmers' input as main body and participation of social capital as complement.

On the other hand, it is necessary to take full advantage of the investment of the government departments at all levels for the rural biogas project, pay attention to project reporting, and actively apply for the national, provincial and municipal funding. Government at all levels should establish the special funds to provide subsidies for construction of methane tank, so as to mobilize farmers' enthusiasm for developing biogas and building eco-home.

3.4 Selecting appropriate biogas mode according to the actual situation and local conditions Targeted selection of the appropriate mode of biogas is an important prerequisite for the development of biogas. All regions should take actions that suit local circumstances to choose appropriate eco-development mode, such as the "trinity mode" of "farming – biogas – breeding" or "pig – biogas – fruits" with biogas as a link, combining agricultural production and ecological protection; the "quaternity mode" of "methane tank-solar vegetable greenhouse-solar pigsty-toilet".

According to the actual needs, there is a need to focus on the targeted construction of large and medium-sized, small-scale biogas projects and biogas eco-homes. In the units and factories where there are many people, the public toilets can be transformed into big – and – middle – sized biogas project, which can not only solve the energy use problem in the cafeteria, but also reduce the amount of water for flushing toilets. Biogas slurry and biogas residue can be used for growing flowers and grass to beautify the courtyard.

3.5 Implementing the biogas association system to improve service system Perfect service system is the key to healthy and sustainable development of rural biogas. The biogas construction in various regions should attach great importance to the service system construction and actively explore the mode of service. There is a need to organize and guide the grass-roots organizations, enterprises, energy departments, associations and biogas users to participate in building the rural biogas service system with clear division of labor and efficient operation; establish biogas association to provide tracking service for the biogas users, guide the construction of methane tank, and provide maintenance and training services, so as to create lasting benefits and solve the worries of biogas users; step by step implement the new market-oriented mode with biogas association as a platform, explore new ways of rural biogas social service[14].

Biogas is an important area of renewable energy development. Currently the state has included biogas into "four energy projects" that need to be vigorously developed and "six small rural projects"[15-16]. Each region should explore the model suitable for the biogas development in the region[17-18], gradually shift to the industrial production and industrial application, build large and medium-sized biogas projects, and develop "industrial biogas"[19-20]; pay attention to the policy drive, market guidance, technological innovation and management, give full play to the role of various market players, establish and improve biogas service system, achieve the sustained and healthy development of the biogas.

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owned by rural collectives, and which are owned by farmer individuals. Plant genetic resources on farmers' (communities') land are not natural resources, but fruits of farmers' hard work from generation to generation and have been added with labor of farmers, so they should be collective or individual resources owned by farmers or communities.

In conclusion, the ownership of farmers and communities over plant genetic resources on their land should be admitted by the state. In the *Outline of National Strategies on Agricultural Intellectual Property Rights* (2010 – 2020) issued by the Ministry of Agriculture, it is planned to formulate *Regulation on Registration Management of Ownership of Agricultural Biological Genetic Resources*, gradually establish management system of ownership of agricultural biological genetic resources, promote connection of the system with patent law and plant variety protection system, and set up and perfect the disclosure and benefit sharing system[11]. To formulate the *Regulation*, we must firstly solve the problem of ownership of genetic resources. In the *Regulation*, it should recognize rights of farmers and communities over plant genetic resources on their land, promote multiple subjects of the ownership for plant genetic resources, to make full preparation for China's accession to the *International Treaty on Plant Genetic Resources for Food and Agriculture*.

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