

Promoting the energy structure optimization around Chinese Beijing-Tianjin area by developing biomass energy

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Abstract. In recent years, remarkable achievements in the utilization of biomass energy have been made in China. However, there are still some problems, such as irrational industry layout, immature existing market survival mechanism and lack of core competitiveness. On the basis of investigation and research, some recommendations and strategies are proposed for the development of biomass energy around Chinese Beijing-Tianjin area: scientific planning and precise laying out of biomass industry; rationalizing the relationship between government and enterprises and promoting the establishment of a market-oriented survival mechanism; combining ‘supply side’ with ‘demand side’ to optimize product structure; extending industrial chain to promote industry upgrading and sustainable development; and comprehensive co-ordinating various types of biomass resources and extending product chain to achieve better economic benefits.

1. Introduction

Biomass energy is the solar energy stored in biomass in the form of chemical energy. Namely, biomass works as the carrier in this case. Biomass energy is an important type of renewable energy, and recognized as the fourth largest energy after coal, oil and natural gas, accounting for 14% of the total energy in the world. Since Chinese 12th Five-Year plan, Hebei province, the most important and closed province around Beijing-Tianjin area, firmly grasping the country's strategic opportunities to promote the development and utilization of biomass energy and other renewable energy, and has achieved much success [1-4].

Compared with fossil energy, biomass energy has many advantages, such as renewability, low pollution, wide distribution, abundance and widely application. Hebei province is a large agricultural province in the area around Beijing and Tianjin, including the annual output of crop straw about 60 million tons, ‘Forest three remains’ (post harvest residue, bucking residue and processing residues) of 5.7 million tons, edible fungi residue of 1.3 million tons and breeding livestock manure about 20 million tons. After years of development, a relatively large scale of scientific and technological team for biomass research is formed. Some remarkable achievements have been made in the biogas technology, liquid fuel technology, biomass power generation and biomass briquetting molding fuel technology. Preliminary research results on biogas, natural gas, synthetic oil and hydrogen from biomass have been made [5-8]. By the end of 2015, the total biomass energy utilization amount is about 1.3 million tons of standard coal in Hebei Province, including installed power capacity of 0.458 million kilowatts, straw briquetting molding fuel capacity of about 0.53 million tons and bio liquid fuel 0.3 million tons.



2. Main problems of biomass energy industry

There are still many gaps compared with the developed countries and domestic developed area in Beijing-Tianjin area in biomass utilization. i Lack of long-term planning, the industrial layout is unreasonable. Large amount of agricultural waste and domestic garbage has not found good use, causing environmental pollution and waste of resources. ii The market mechanism of survival for biomass energy plants remains to be established. Whether it is large scale farming biogas, straw briquetting fuel or biomass power generation, the production cost is higher compared with fossil fuel producers. It is difficult for these enterprises to survive without financial subsidy from the government. iii The present biomass energy producers develop off balance in the product kinds and technologies. The product structure is not reasonable. iv Most Product technologies are outmoded. The product chain is short and lack of core competitiveness. v The production scale of biomass enterprises are mostly small, resulting in low economic efficiency. vi The biomass resources in this area are very scattered. Transportation cost is higher and the facilities are not so perfect.

3. Suggestions on the development of biomass energy

3.1 *Adjusting measures and scientific planning to local conditions*

Considering the natural resource differences in different places, scientific planning and development as well as utilization of biomass energy should be made to avoid repeated and excessive construction. According to the circumstances of biomass resources, diversified way of using biomass in major grain producing areas and forestry developed areas is necessary. Besides, we should speed up to build biomass energy demonstration area of different characteristics to promote various types of biomass energy marketing and large-scale utilization. The development of biogas projects with large-scale farming manure and agricultural wastes as raw materials in suburbs is very important, which is not only the effective path of biomass energy production, but also the need of environment protection. Other important resources of biogas engineering are industrial and domestic waste water, waste fungi residue etc. Large-scale pilot biogas project of should be launched as soon as possible, while actively promoting appropriate biogas power generation projects. We should promptly implement bench project of biomass charcoal project and properly distribute biomass briquetting fuel project in urban and mountain areas.

3.2 *Promoting the establishment of market survival and development mechanism*

Because the development of biomass energy possesses the public welfare characteristics, the government fiscal support is necessary from environmental, ecological, national energy security and other considerations. Firstly, the government should classify biological natural gas as natural gas field (rather than into the category of biogas), and eliminate barriers entering into the natural gas pipeline, as well as provide policy support for the development of biogas. Secondly, biological natural gas and biogas enterprises should be able to enjoy policies, which are even more preferential than traditional fossil natural gas. The government should formulate the preferential policies of tax revenue, the subsidy for the construction of the pipe network and the amount of subsidies for the end users, based on the environmental costs of biogas and biological natural gas, and environmental benefits obtained by substitution for coal-fired. The final target is that the enterprises have profit; users get benefit, realizing healthy and sustainable development for the industry. At the same time, the fertilizer from biogas plant should be included in the scope of the organic fertilizer, so as to improve the subsidy mechanism of biogas fertilizer, and make the biogas and biological natural gas production more valuable. However, the government must not undertake the whole things. Proper financial subsidies is necessary in order to give support in the early stages of development, aiming at leading the industry, and helping companies find endogenous motivation, thereby cultivating market-oriented mechanism for them. At the beginning, with the help of subsidies and preferential policies, the project construction is advanced, and then gradually transition to the market regulation. Therefore, a continued regulating preferential way through policy guidance is set up, promoting the establishment of a market-oriented system of survival for the enterprises.

3.3 Exerting force jointly at both ends of “Supply side” and “demand side”

Biomass energy product design should comply with the laws of the market and consider the coordinated development of Chinese Beijing-Tianjin area and new urbanization trend. It would have to consider the advantages of local resources and the needs of users, i.e., ‘producing gas product (biogas, natural gas) where such product is appropriate and needed, producing liquid product (liquid fuel) where such product is appropriate and needed, producing solid product (biomass briquette) where such product is appropriate and needed’, hereby the product structure is optimized. It is necessary to vigorously support the use of large-scale livestock waste, agricultural waste and urban sewage in the combined production of biogas and organic fertilizer projects. The environment is improved while developing biomass energy. It should be actively to explore the market potential, devise biogas distributed cogeneration project, to improve local consumptive ability, comprehensive utilization and energy utilization efficiency, thus reducing transportation costs and improving economic efficiency. It is imperative that promote the application of biomass briquetting, biomass gasification in the field of heating and cooking for urban and rural residents, and further promote the garbage power generation and cogeneration projects as soon as possible.

3.4 Extend the industrial chain, promoting industrial upgrading and sustainable development

Further increase research investment is necessary to optimize and improve the comprehensive utilization of biomass industry chain. Considering that the higher cost of biogas separation and power generation in biogas project from large-scale livestock waste, green circular economy industrial chain is ideal path to reduce cost and increase economic benefit by increasing industry ‘nodes’ and extending product chain. Figure 1 gives the circular economy industrial chain for biogas project from large-scale livestock waste. Solid line with arrow stands for material stream between two units, while the dotted line stands for energy stream. By extending the industrial chain, the economic benefits of large-scale breeding industry can be improved, and the industrial structure might be optimized.

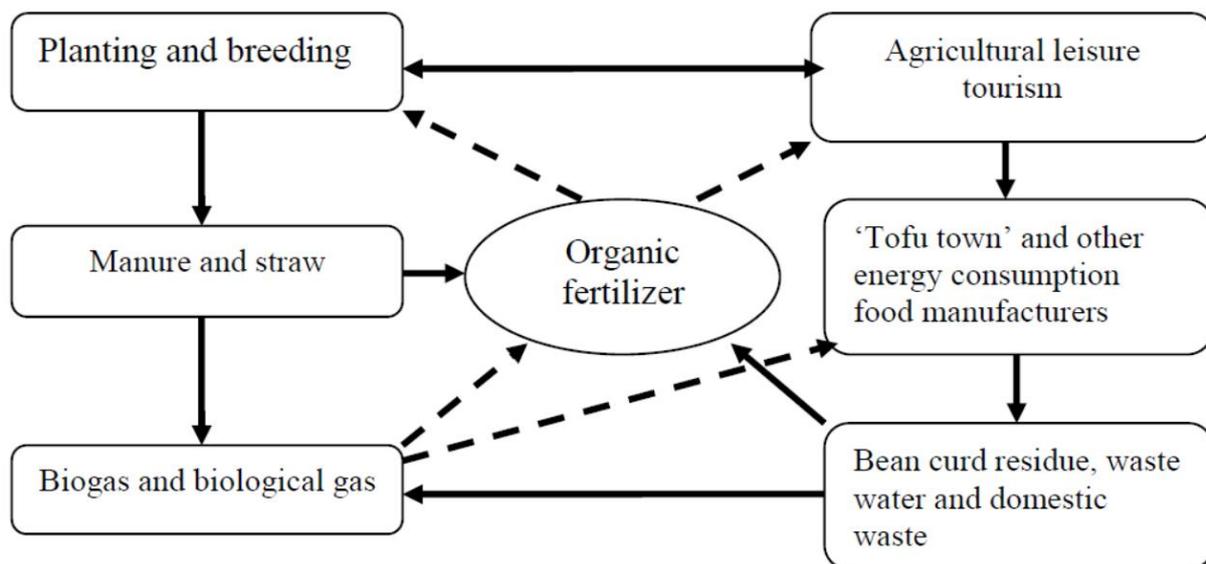


Figure 1. Circular economy industrial chain for biogas project from large-scale livestock waste

3.5 Co-ordination of various types of biomass resources and use the best advantage.

Firstly, it should give full play to the advantages of regional resources, focusing on large-scale development and comprehensive utilization of resources of renewable energy rich area. For example, the scale and degree of concentration should be increased for large-scale aquaculture waste and agricultural waste comprehensive utilization enterprises. Secondly, the diversified utilization of various resources according to local conditions is very important for the wider range of renewable energy resources distributed areas. Thirdly, we should accelerate the development of energy plants by

making full use of the coastal beach and hillside wasteland, guaranteeing the supply of raw materials. Fourthly, the strategy of giving priority to the waste should be taken to achieve the optimal environmental protection and energy conservation. Besides, it should be further to improve the integrated operation mode for agricultural and forestry waste ‘acquisition-crush-collection-storage-molding-consumption’ and promote rural garbage classification, collection, transportation and processing system. ‘Internet + big data’ is important tool to process biomass resources in the area, in order to achieve to achieve comprehensive arrangement and make the best use of resources. Figure 2 gives a typical straw storage mode of large scale biomass briquetting enterprise.

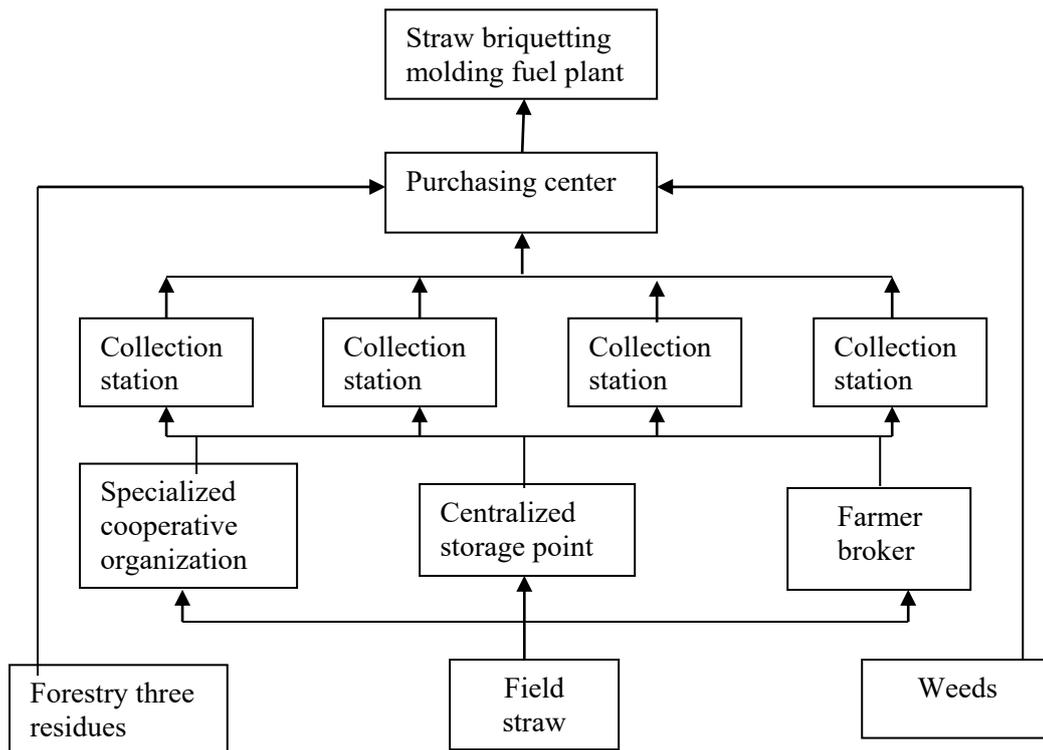


Figure 2. Straw storage mode of large scale biomass briquetting enterprise.

4. Concluding remarks

The burning of fossil fuels is one of the important causes leading to haze. The use of renewable energy to reduce the use of fossil fuels is not only the main path to improve the quality of the atmospheric environment, but also an inevitable requirement for sustainable development of social economy and Chinese national energy security. As a big agricultural province, Hebei province is rich in biomass resources. Thus, vigorously developing biomass energy in the province particularly suits its own situation. The development and utilization of biomass energy will contribute to further optimize the energy structure in Hebei province, and thus continuously improving the quality of atmospheric environment of Chinese Beijing-Tianjin area.

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