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BUILDING STAKEHOLDER RELATIONSHIPS IN BIOMASS ENERGY INDUSTRY IN RURAL CHINA

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ABSTRACT

China continues to be the world's second largest energy consumer after the United States. Facing problems of increase in energy demand and environmental pollution, the government has made more efforts to develop the biomass energy industry. With 802 million tons of crop straw, 14.2 billion m^3 of livestock mature, 153 million tons/year of waste, and 3.65 million tons/year of oil seeds, China has rich resource potential condition for developing biomass energy industry. Until 2011, 8.3 billion m^3 of biogas was generated in large-scaled biogas projects and 5.8 billion m^3 in households. The production of biodiesel, biomass briquettes fuel, bioethanol, and biomass electric power generation has reached 1.45 million tons/year, 6.1 million tons/year, 2.45 million tons/year, and 4.2 million MWh/a, respectively. In recent years, the biomass energy industry has developed increasingly fast. However, the biomass industrial basis is weak because of insufficient follow-up services, imperfect policy system and incentive mechanisms, low efficiency of energy conversion, unclear responsibility in the level of management, and insufficient feedback. One of the fundamental causes of these problems is considered to lie in weak relationship among stakeholders. This paper overviews biomass energy industry in China and discuss future directions of stakeholder relationships to solve the above mentioned problems.

Keywords: Biomass energy industry, Development, Stakeholder relationship, Rural China.

1. INTRODUCTION

With voice of reducing using fossil fuel, decreasing green-gas and enhancing energy security, as well as supporting agricultural production and boosting rural economic growth, biomass energy has attracted significant attention from public. Hence, developing biomass energy industry becomes a significant task for the government in China. In some extent, with the support of government, and the endeavors of local people and the enterprise, the biomass energy industry has some achievements; however, there are still problems that hinder the development. The basic and significant problem is how to build sound stakeholder relationships. In fact, key stakeholder

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satisfaction is critical for companies to be successful in a hypercompetitive environment (D' Aveni 1994). Numerous experiences have been done to investigate what determine the success or failure of organizations. This has been accomplished by examining both the characteristic of the organization as well as the specific stakeholder groups and the interaction between them (Jensen& Meckling 1976; Morgan&Hunt 1994). An assumption that has been made in much of the empirical and conceptual work is that the organization development and stakeholder relationships are desirable goals for both the stakeholders and the organization (Dwyer et al. 1987). However, for biomass energy industry in China, the problems that are related to stakeholders, such as lack of follow-up services, unclear responsibility in the level of management, and insufficient feedback, still block biomass energy industry development. This paper overviews biomass energy industry in China and discuss future directions of stakeholder relationships to solve the above mentioned problems.

2. STATUS OF BIOMASS ENERGY INDUSTRY IN RURAL CHINA

2.1. Biogas Industry

Biogas is a flammable mixture comprising primarily CH_4 produced by bacterial anaerobic fermentation of biomass and waste, such as livestock, straw, and waste water (Reddy et al. 2000). The process of producing biogas is a beneficial circle.

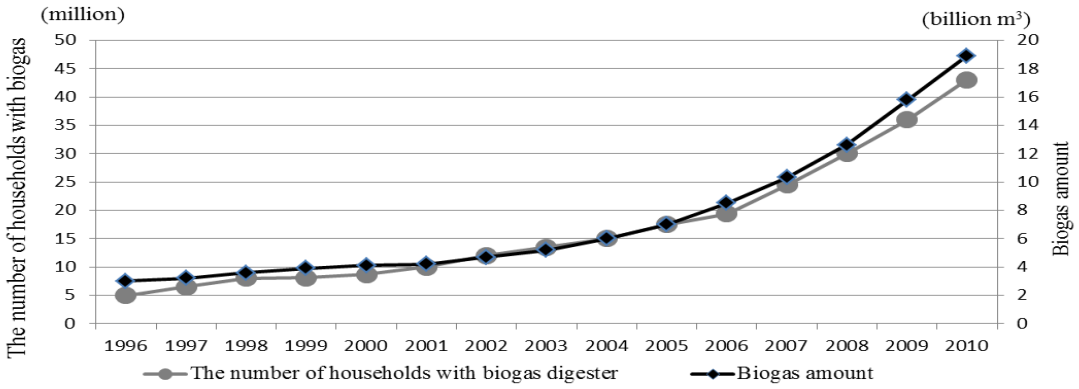

Figure 1: Household biogas

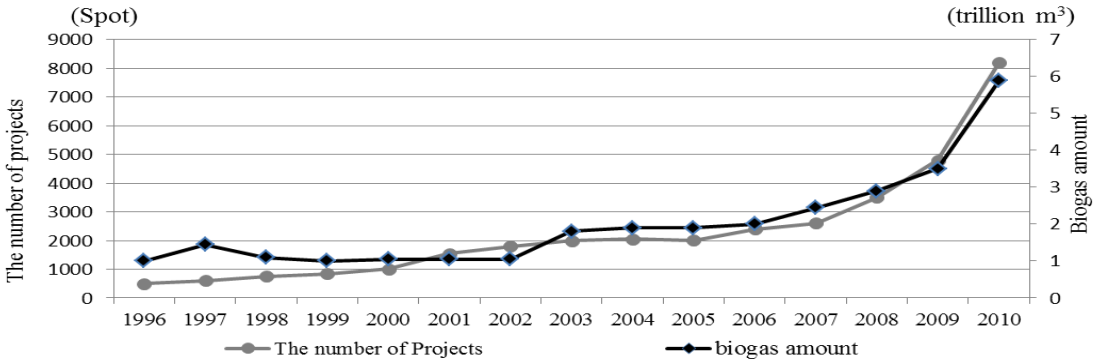

Figure 2: Large and Middle-Scale Biogas

With the technologies and recycling eco-agricultural models, at the end of 2010, China had developed 43 million household biogas digesters. There are 8,200 poultry and farm biogas projects (National Development and Reform Commission of China 2010), producing 6.019 trillion m^3 of biogas totally, which were 1.98 million tons of coal equivalent and reduced CO_2 by 1.27million tons (Figures 1 and 2). Household biogas and poultry farm biogas projects have been extended widely in rural area. In addition, sewage treatment of biogas project has entered the initial commercial demonstration and promotion stages. Biogas industry is in the phase of massive popularity and growth showing economic and social effectiveness.

2.2. Bioethanol Industry

Bioethanol is ethanol derived from fermentation, distillation, and denaturalization of biomass, such as starchiness, sugariness and cellulose (Zhang et al. 2010), etc. The technology of "semi-arid" bioethanol production has been successfully developed, and it is used widely in producing bioethanol. Since 2000, the government has approved five enterprises to produce bioethanol with food and cassava. At the end of 2010, the production capability of bioethanol reached 2.10 million tons (Yan 2012). China has been the third largest bioethanol-production country in the world following the USA and Brazil. Ten provinces are developing bioethanol demonstration projects (Table 1).

Table 1: Regions with active bioethanol production in China

Province	Popularized regions and beginning time	Source
Heilongjiang	October 1st 2004, whole province	HeilongjiangHua-run Alcohol Co.Ltd
Jilin	November 18th 2003, Whole province	Jilin Fuel Ethanol Co.Ltd.
Liaoning	October 1st 2004, Whole province	Jilin Fuel Ethanol Co.Ltd
He'nan	December 1st 2004, Whole province	Henan Tianguan Enterprise Group Co.Ltd
Anhui	June 1st 2005, Whole province	Anhui BBCA Biochemical Co.
Hubei	December 1st 2005, popularized in nine cities of Wuhan	Henan Tianguan Enterprise Group Co.Ltd
Hebei	December 1st 2005, popularized in six cities of Handan	Henan Tianguan Enterprise Group Co.Ltd supplied four cities Anhui BBCA Biochemical Co. supplied two cities
Shandong	January 8 th 2006, popularized in seven cities	Anhui BBCA Biochemical Co.
Jiangsu	December 1 st 2005, popularized in five cities	Anhui BBCA Biochemical Co.
Guanggxi	April 15th 2008, Whole province	Guangxi COFCO Bioenergy Co.Ltd.

2.3. Biomass Power Industry

Biomass power is obtained by converting gas though burning agricultural residues, forest and waste directly, including direct combustion power generation, gasification power generation, waste power generation, and biogas power generation (Zhao et al. 2012). Types of biomass power generation are described in Table 2 (Yan et al. 2012). At the end of 2007, more than 30 waste incineration power generation projects have been constructed, and more than 40 small straw gasification systems were

implemented. The total installed capacity reached $3.0*10^6$ kW, producing $6.42*10^9$ kWh/a (Dan 2009). In 2010, the installed capacity of biomass power electricity was $5.50*10^6$ kW (Zhao 2011).

Table 2: The current situation of biomass power generation development in China

Type	Specification	Installed capacity ($*10^4$ kW)	Generated electricity ($*10^8$kWh)
Biogas power generation	Gas consumption rate 0.6-0.8 m^3/kWh	1.92	0.40
Direct-burning power generation	Stalk consumption rate 1.00-1.60 kg/kWh	45.8	23
Gasification power generation	Gasification efficiency 78% system power generation efficiency 28%	174	2.63
Waste power generation	Waste harmless disposal rate 52.2%	80	30
Mixed-burning power generation	Mixed fuel ratio less or equal to 20%	16.4	8.6
Total		318.12	64.23

3. OBJECTIVE

The ultimate goal of this paper is to propose sound stakeholder relationships based on the situation of biomass energy industry in China. Three stakeholder relationship models for biogas, biomass fuel and biomass power generation, are proposed to smoothen the communication channel and to clarify responsibility of each stakeholders. The aim is to solve the problems such as lack of follow-up service, waste of biomass resources, and unclear responsibility of management level.

4. BUILDING STAKEHOLDER RELATIONSHIP MODELS

One of the reasons that cause the problems is the insufficiency communication between stakeholders. Hence, building up suitable stakeholder relationship to guarantee smooth communication is significant to solve problems in biomass energy industry.

4.1. Intensive producing and dispersing consumption

This model is used for biogas energy production (Figure 3). It is mainly used in the areas that are rich in crop straw, livestock or domestic waste, such as in the Northern China and Southeast China. In the intensive producing and dispersing consumption model, there are several stakeholders with different responsibilities. In addition, this model also clarifies the process of communication among stakeholders.

The logic of the intensive producing and dispersing consumption model is as follows. The local NDRC (National Development Reform Committee) makes plans and gives information to the biomass energy factory and township government directly. Currently, because of government's subsidy, every department that is related to biomass energy intends to take charge of biomass energy industry, such as forestry department, agriculture department, and energy department. This situation puts the biomass energy factory into a confusing position because the factory receives different information from different departments. The process represented with (1) in the figure could solve the problem of unclear responsibility of management level as well as simplifying the management procedure. The local NDRC also makes standards to control and monitor quality of the

facilities. The process represented with (2) is expected to contribute to guaranteeing quality of facilities to enhance energy conversion efficiency. In order to improve follow-up services, the special equipment manufacture and the stove suppliers should make contract with the biomass energy factory and the users, respectively, represented with (3), to ensure long-term cooperation. In rural area, the main reason that the farmers combust the biomass directly instead of selling it to biomass energy factory is high transportation cost from village to the factory. Setting up collection sectors represented with (4) in every village could reduce farmers' transportation costs. In order to reduce biomass resource waste, it is significant to encourage the farmers to sell their crop straw.

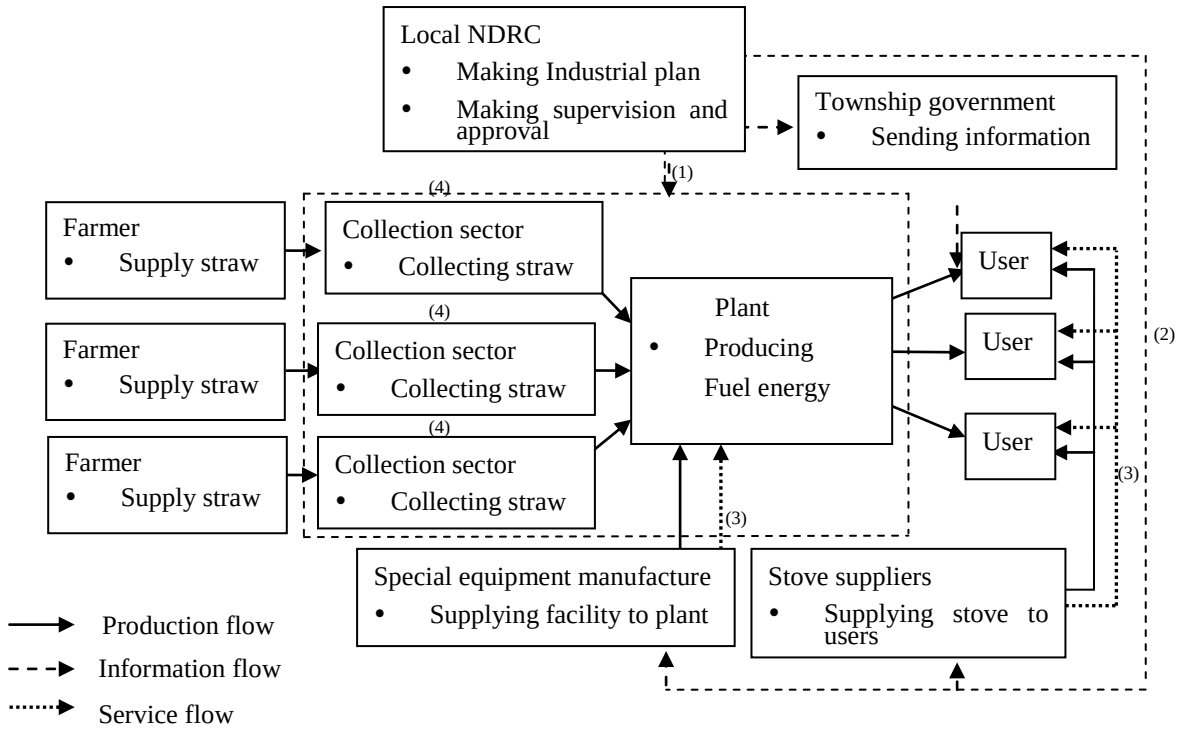

Figure 3: Stakeholder relationship of intensive producing and dispersing consumption

4.2. Stakeholder relationship for producing and supplying biomass fuel

This model is mainly used for biomass fuel industry (Figure 4). In China, Yangtze River Area is the main production area for winter rapeseed, accounting for 83.5% of the country's total output, and is the world's largest rapeseed production area. However, the factory still faces problems of lack of raw materials. In order to keep long-term cooperation with farmers and biomass fuel factory, stakeholder relationship for producing and supplying is built. It is obvious that the factory could not develop well without the coordination with farmers, bioethanol industry, and other stakeholders.

The process of stakeholder relationship for producing and supplying biomass fuel is as follows: the Ministry of Agricultural Office (MAO) and the National Development Reform Committee (NDRC) exchange information on concrete plans of developing biomass fuel industry. The MOA send information to the Energy Office and Township government. The third-party represented with (1) in the figure is set up to collect crop straw, transport and store biomass. In addition, the third-party

also monitors the quality of the biomass resource and guarantees the fair price of the biomass. In order to improve the quality of biomass fuel to enhance the utilizing efficiency, feedback system represented with (2) is also established. The petroleum company gives feedback on quality of biomass fuel to the energy office. New plans and requirement are sent to the biomass fuel factory and township government based on the feedback and requirement. Therefore, the biomass fuel factory would improve the process of producing fuel, and the township government could instruct farmers to plant the high qualify biomass energy plant.

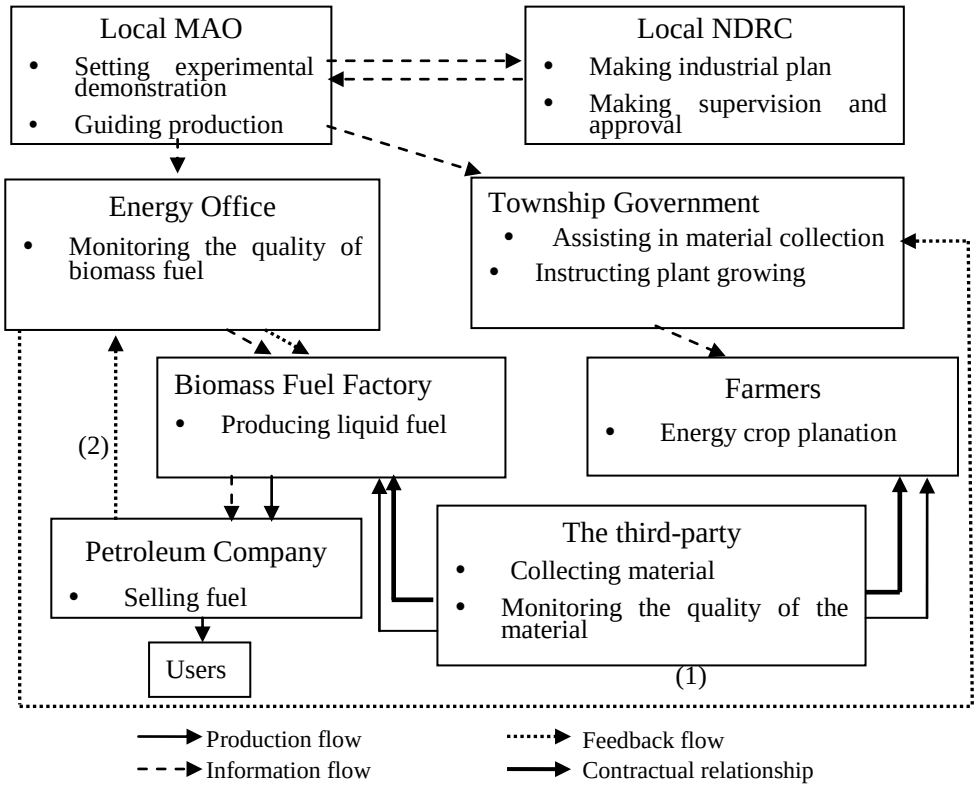

Figure 4: Stakeholder relationship for producing and supplying biomass fuel

4.3. Stakeholder relationship for producing and supplying electricity

Straw resources in China are available throughout eight regions. In the eight regions, the middle and lower reaches of Yangtze River Area produces the most straw. In North China and Northeast China, the straw resources are also rich. Therefore, it is advisable for these areas to develop biomass power plant.

The stakeholder relationship below is proposed for better cooperation among stakeholders (Figure 7). The process flow of the model is as follows: the National Development Reform Committee (NDRC) and the Ministry Agriculture Office (MAO) exchange information on power generation plans. According to the information, the Energy Office delivers information to the Township Government, as well as monitoring usage of crop straws. The Township Government encourages farmers to sell crop straws to the power plant. After generating electricity, the power plant sells the electricity to the Electric Grid Company before distribution. The Electric Grid Company sets the

electricity price based on regulation from the NDRC. The Electric Grid Company summarizes the electricity consumption and reports to MAO. Based on this information, the MAO makes a plan of the quantity of biomass needed in the next year, which is significant for biomass power plant program. In the model, the Crop Straw Pricing Consultation Board (CSPCB) plays an important role of making contracts with farmers, power plants and government, which makes pricing mechanism transparent to guarantee farmers' benefit. Because farmers are weak and vulnerable group, it is necessary for the local government to establish price consultation board consisting of farmers, power plant and local government to protect farmers' benefit.

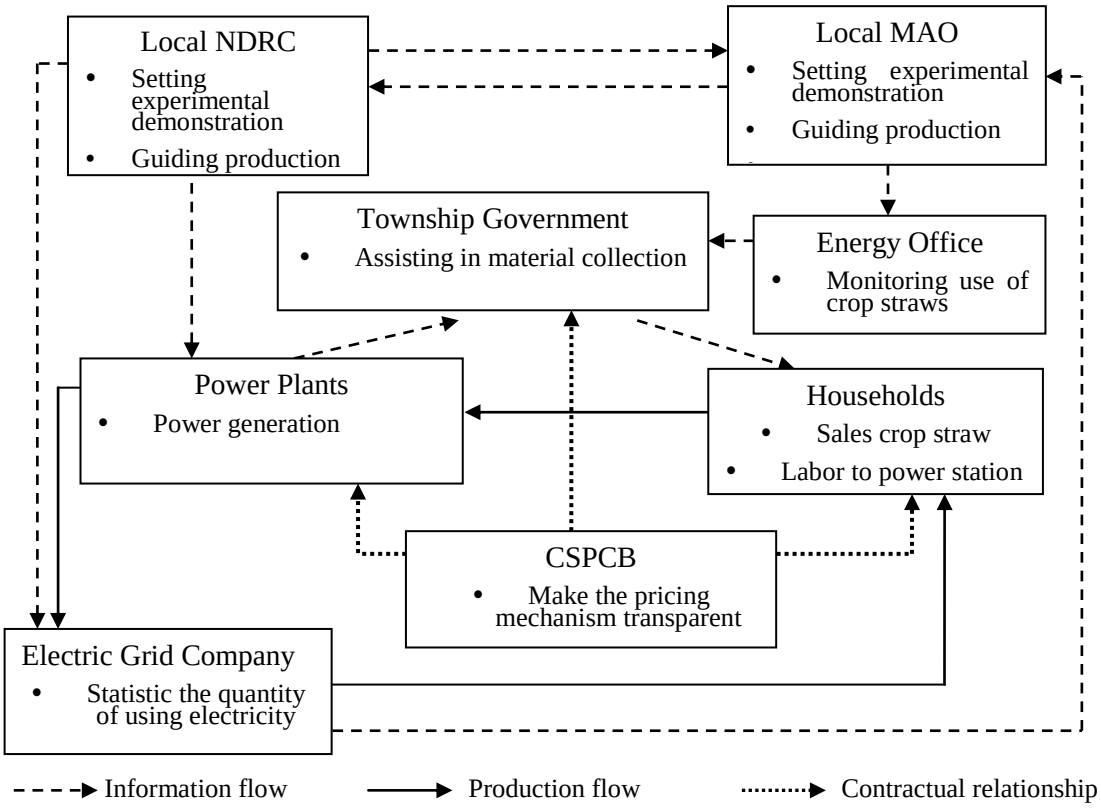

Figure 5: Stakeholder relationship for producing and supplying biomass power

5. CONCLUSIONS

Biomass energy industry is a developing and promising industry. In this paper, the situation of biomass energy industry is introduced. For biomass energy industry in China, there are many problems that hinder biomass energy development. The problems that are related to stakeholders such as lack of follow-up services, waste of biomass resources, and unclear responsibility of management level, are as important as technology because human are the promoters of the industry. Hence, solutions are proposed from stakeholders' perspectives.

The sustainable development of the biomass energy industry requires consideration of institutional and social factors as much as it needs the design of environmentally-friendly technologies and processes and the resolutions of scientific uncertainties. With a focus on the situation of biomass energy industry, this paper stresses on the value of stakeholder cooperation. Stakeholder

relationships are proposed to smoothen communication among stakeholders and clarify responsibility of each stakeholder, which could better guide the biomass energy industry.

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