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Focus on bioenergy industry development and energy security in China

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ABSTRACT

This paper focuses on the relationship between bioenergy industry and energy security. The situation of fuel ethanol, biodiesel, biogas and biomass power industry of China in recent years has been introduced comprehensively. With a quick look at the existing bioenergy industrial development policies, combined with China's energy security situation, we drew the following conclusions: (1) the bioenergy industry is an effective way to achieve China's energy security; (2) as for energy substitution from cost aspect, China has already had the ability to make bioenergy substitute for fossil fuels; (3) from technical aspect, however, China's bioenergy technologies are not mature, this means that in a very long period of time, biomass and fossil energy will jointly develop in a *mutually beneficial* way.

Contents

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1. Introduction

1.1. Background

In recent years, China has made significant achievements in using of bioenergy. The production capacity of fuel ethanol had reached 2.1 million tons in 2012, while it is estimated that production capacity in 2013 would reach 2.3 million tons [15]; China′s production capacity of biodiesel had achieved more than 2.6 million tons in 2012, and will be 3.1 million tons in 2013 [18]; the production capacity of biogas in China in 2012 was over 17 billion cubic meters, which makes China the first place in terms of development potential [17]; up to 2012, China′s total installed capacity of Straw direct-fired power generation was 5819 MW, accounting for 60% of all biomass power generations [18]. It should be believed that bioenergy industry has preliminary formed in China [6].

International Energy Agency (IEA) data shows that in 2010 China has surpassed the U.S. as the world′s largest energy consumer, and has become the world′s largest CO_2 emitter. Estimated by National Bureau of statistics of China, the energy consumption of 2012 reached a total of 3.62 billion ton of coal equivalent (Mtce), with 3.9% more than that of 2011. Among them, the coal consumption was with an increase of 2.5%; crude oil consumption was with an increase of 6.1%; natural gas consumption was with an increase of 10.2%. Meanwhile, in 2012 China′s emissions of GHG accounted for 30% of the world′s total. So the development of bioenergy industry needs to be improved right now.

1.2. Issues

China′s bioenergy industry is in the initial stage of development, without either the scientific market mechanisms to guide or a sound policy framework to support. At the same time, China faces the dual task of energy security and food security [20]. On the one hand, feedstocks for ethanol and biodiesel production make the national food security theoretically more serious [11]. On the other hand, with economic development, China′s energy consumption keeps growing. Oil consumption of China relies heavily on imports. High prices of international oil make China′s energy security faces realistically serious challenges [29]. Uncertainties that bioenergy industry can affect China′s energy security negatively still exist. It is hoped that the question will be resolved in our paper.

2. Current situation of China′s development of bioenergy industry

2.1. Fuel ethanol industry

China′s development of fuel ethanol industry has gone through three major phases: the initial pilot phase (from mid 1990s to 2000), steadily developing phase (2000–2005) and non-food fuel ethanol developing phase (from 2005 to the present). Initially, China′s fuel ethanol production was used to digest the stale corn, wheat and other grains, so fuel ethanol products led agriculture a way to a huge market [32].

China′s current fuel ethanol market structure was formed in 2004. In 2005, China produced nearly 1 million tons of fuel ethanol, ranked after Brazil and the United states. Table 1 shows China′s fuel ethanol consumptions in regional energy market.

With the gradual depletion of stale rice and the obvious increase of corn prices, the development of bio-ethanol might threaten the national food security [2]. In December 2006, the National Development and Reform Commission (NDRC) issued an urgent notice on fuel ethanol project management required using non-food crops as raw materials to realize diversification and encourage the development of non-food crops as raw materials in the progress of fuel ethanol. In June 2007, the State Council of the People′s Republic of China held a conference on renewable energy which made final decisions that the bio-ethanol projects making use of corn and other edible grain must be officially stopped, the future development should adhere to the principle of “No occupation of cultivated land, No waste of consuming food, and No damage of the ecological environment”. Since then, the beginning of the exploration and development of China′s non-food fuel ethanol has been on the go [10].

After years of development, China′s fuel ethanol already has a certain amount of production capacity. From 2002 to 2012, China′s fuel ethanol production grew rapidly [4]. However, with the adjustments of national policies, the capacity slowed down after 2006. Table 2 shows the changes in China′s fuel ethanol production.

Currently, the main raw material for domestic fuel ethanol is corn, accounting for 80%. Table 3 shows the costs of three of them used to produce fuel ethanol.

2.2. Biodiesel industry

Although for biodiesel, China started to research and develop relatively late, some achievements have reached the international advanced level with a rapid pace of development. The achievements involved the distribution, selection, cultivation, processing technology

Table 1
Area analysis of China's fuel ethanol production and supply.
Source: China Agricultural Development Report 2010.

Suppliers province	Manufacturer	Raw material	Buyers province
Heilongjiang	China Resources Alcohol Co., Ltd.	Corn	Heilongjiang
Jilin	Fuel Ethanol Co., Ltd.	Corn	Liaoning
Anhui	BBCA Biochemical Co., Ltd.	Corn	Anhui, Shandong, Jiangsu, Hebei
Henan	Tian Guan Fuel Ethanol Co., Ltd.	Wheat	Henan, Hubei, Hebei
Guangxi	COFCO Biomass Energy Co., Ltd.	Cassava	Guangxi