ELSEVIER

Energy Policy 36 (2008) 485–489

ENERGY POLICY

www.elsevier.com/locate/enpol

Communication

Biofuel chain development in Germany: Organisation, opportunities, and challenges

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Received 9 May 2007; accepted 2 August 2007
Available online 27 September 2007

Abstract

Increasing production activities have been observed in many EU member states since the EU Commission sent a clear signal establishing and supporting the bioenergy industry. This article discusses current sector developments and therewith evolving biofuel value chain activities and management requirements by means of two German biofuel processing firms. Usually, the processing company can be regarded as the initiator of the regional value chains. In order to safeguard the high initial investments and secure efficient supply, the processing company relies on contract farming or profit participation rights rather than spot market interactions. In addition to discussing that point, this paper also explores opportunities and threats for the suppliers of raw materials as well as for the processors.

Keywords: Bioenergy; Structural change; Value chains

1. Introduction

The EU Strategy for Biofuels (2006), the Biomass Action Plan (2005), and the adoption of the Biofuels Directive (2003/30/EC) by the EU Commission all sent a clear signal that the EU wishes to establish and support the bioenergy industry (Commission of the European Communities, 2003). Furthermore, biofuels have been required to account for at least 2% of the total transportation fuels used in EU member states since 2005. That minimum level increases to 5.75% in 2010. In Germany, the additional introduction of a biofuel quota—which began on 1 January 2007—required that mineral oil companies ensure that 4.4% of diesel sales are made of biodiesel. In addition, they must ensure that 1.2% (from 2008, 2%; from 2009, 2.8%; and from 2010, 3.6%) of the sales of motor fuel are made of biofuel (Bundestag Resolution, 26 October 2006).

Further motivating factors regarding the attractiveness of biofuel production are the price history of crude oil and natural gas in recent years, as well as international efforts to reduce greenhouse gas emissions. For example, the EU is committed to reducing its CO_2 emissions, but emissions from transport are still growing. For example, road transport in particular generates 85% of the transport sector's emissions. Moreover, technological advances and innovations in biofuel production, the past price developments of agricultural commodities and substitutes, as well as free agricultural capacities (obligatory set-asides) are other drivers. In addition, the perceivable aim of the Common Agricultural Policy (CAP) consists of reducing food production in favour of enlarging non-food production.

As a result, the total production of biofuels in the EU is increasing rapidly, and new biomass energy value chains are being formed. The evolving biofuel supply chains are complex in structure and are most often set up by processing firms. Because they have a vital interest in the efficiency of these supply chains, processing firms are developing mechanisms for managing them effectively and are seeking solutions for cooperation problems between partners.

This article provides an overview of the sector's current developments in Europe, with particular attention paid to

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0301-4215/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2007.08.010

Germany. We then focus on characteristics of the evolving value chains. In this context, we address questions such as who is the initiator of the biomass-based energy value chain, who coordinates the process of bringing biomass into final energy products, and how to organise it. We conclude the discussion about developments in the evolving value chains in the biofuel sector with opportunities and threats, as well as future prospects for the involved enterprises.

2. German production capacities of biodiesel, bioethanol, and biomass-to-liquid

In 2005, the EU's production of liquid biofuels (bioethanol, biodiesel) amounted to a total of more than 3.4 million t; this represented an increase of more than 40% from the previous year (FNR, 2007). As Table 1 shows, German biofuel production has increased since 2003, especially for biodiesel.

The increased production of biofuels in recent years in Germany will obviously continue; i.e., in 2007 biodiesel capacity increased by an additional 1.9 million t (see Table 2). In general, biodiesel has a dual production structure. On the one hand are smaller oil mills owned by single farmers or biofuel-producing associations; on the other hand are larger commercial mills, with production capacities over 100,000 t/a. Recently, a move towards larger production facilities has been observed. Comparing the production and the sales of biodiesel in Germany over the last few years shows a balanced relationship. Furthermore, the biodiesel supply and plant capacities in Germany are developed enough such that the biofuel quota for diesel will be fulfilled within the next 7 years.

In order to meet the 2015 deadline for 7% compulsory blending of biodiesel in Germany, production of 2.4 million t/a biodiesel is required (FNR, 2007). Assuming that the raw material consumption for biodiesel would be derived exclusively from German rapeseed, the demand for this crop will increase from 4.7 (2005) to 5.9 million t/a (2015). Therefore, by 2015 the share of total agricultural area dedicated to biodiesel production will rise from 11.8% in 2005 to more than 15% by 2015 (FNR, 2007). Table 2 gives an overview of what are currently the larger biodiesel production facilities, locations, and capacities.

Table 1
Biofuel production in the EU 25 and Germany (in t)

	2002	2003	2004	2005
Biodiesel				
EU 25	1,134,000	1,504,000	1,933,400	2,740,000
Germany	450,000	715,000	1,035,000	1,669,000
Bioethanol				
EU 25	388,200	424,750	491,040	720,000
Germany	0	0	20,000	280,000
Total				
EU 25	1,522,200	1,928,750	2,424,440	3,460,000
Germany	450,000	715,000	1,055,000	1,949,000

Source: European Biodiesel Board (EBB) (2006), EurObserver, (2005), FNR (2007).

Bioethanol production in Germany is, with 330,000 t/a (2005), at a starting point (FNR, 2007). Indeed, in 2006 there was a production capacity of around 640,000 t. As Table 2 shows, the production capacity for bioethanol will increase to approximately 430,000 t in 2007. Unlike biodiesel production, bioethanol production is only profitable in large plants due to economies of scale. For example, the German "Südzucker Group" has already planned capital expenditures of about €500 million in bioethanol production and already plans to triple production capacity within the next few years.

The need for large production plants and their accompanying high costs necessitate securing investments. For example, to safeguard their high investment costs, the processor Crop Energies (Südzucker Group), which is located in Zeitz, is using long-term grain supply contracts with agricultural enterprises in Germany. Actually, Crop Energies offers contracts to local farmers via local co-operatives or wholesalers. These contracts contain a price premium for protein-poor bioethanol-wheat, which is a particular breed for energy production. As a result, for the first time, wheat with a protein content of less than 12% receives a price premium (dlz agrarmagazin, 2006). The specific amount is not yet defined, but it seems to be an interesting prospect for farmers.

In 2007, Crop Energies will produce an additional 100,000 t/a bioethanol from sugar beets. About 600,000 t of sugar beets are required to supply the bioethanol plant every year. Decisions regarding investment in the new bioethanol production plant depend on the fact that at least 80% of the required sugar beets are produced under binding 5-year contracts. To supply bioethanol beets, farmers must subscribe to delivering right E.[1] The total amount of investment is divided among a high number of farmers to share risk. The amount of subscription of delivering right E consists of fixed and variable components. The variable rate is coupled with the prices for bioethanol. On the one hand, the farmers gain additional capital in rising markets, and on the other hand, they will be discharged in falling markets. The fixed rate constitutes the personal capital contribution of the farmer. In 2006, farmers all over southern Germany signed up for production contracts. Due to the great demand for bioethanol beets by the farmers, every farmer is allowed to sign up for a maximum of 14.4% in unabridged contracts for sugar beets. As the examples show, contracting between processors of biofuels and suppliers of raw materials are usual instruments to secure investment costs.

Besides the developments within the range of the first-generation biofuels (e.g., biodiesel, bioethanol, ETE, and

[1]The delivering of right E is a joint project of about 25,000 sugar beet farmers and contains a delivery agreement over a fixed delivery volume and delivery period (SZVG, 2006).