STOWARZYSZENIE EKONOMISTÓW ROLNICTWA I AGROBIZNESU
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Mirosława Szewczyk[*], Agnieszka Tłuczak[**]

[*]The Opole University of Technology, [**]Opole University, Poland

BIOETHANOL PRODUCTION – OPPORTUNITIES AND THREATS FOR AGRICULTURE IN OPOLSKIE PROVINCE

PRODUKCJA BIOETANOLU – SZANSE I ZAGROŻENIA DLA ROLNICTWA W WOJEWÓDZTWIE OPOLSKIM

Key words: bioethanol, corn, agriculture, Opolskie Province
Słowa kluczowe: bioetanol, kukurydza, rolnictwo, województwo opolskie

Abstract. Biofuels of renewable origin, like bioethanol, biodiesel, and biomass are the subject of increasing attention around the world. Biofuels may have significant benefits both environmental and social. The EU has declared its intention for 10 per cent of all energy for the transport sector to come from renewable fuels by 2020. The Opole Region's economy boasts of a stable industrial base and an agricultural sector. The paper describes current situation of biofuel production in Opolskie Voivodship. The Ethanol Plant in Goświnowice (Opolskie Voivodship) started production in 2009. The plant processes around 350 thous. tonnes of corn into 140 mln litres of ethanol (annually). The plant creates employment in rural areas (in the services, transport, storage). For the years to come, it is very likely that the negative impacts of biofuel production will increase. The expansion of agriculture and intensive mono-cropping is closely linked to biodiversity loss.

Introduction

Cars emitting carbon dioxide constitute for the fastest growing problem for the environment and the greenhouse effect. Ethanol-blended fuels cut exhaust emissions and therefore contribute less to the greenhouse effect. Ethanol can also function as an energy carrier, regardless of whether calculations are based on the currently available engines or on the hybrid motors and fuel cells of tomorrow. Ethanol has gradually been introduced into the current distribution system for petrol and diesel.

Ethanol is an alcohol with many different applications. It is used within industry, where it's known as denatured alcohol, because of its solvent-like properties. Industrially produced ethanol is used in water-based paint, pharmaceuticals, perfumes, cleaning products, varnishes and inks, amongst other things. Ethanol is also growing in its use as a vehicle fuel, where it is often mixed with petrol.

Biofuels of biological and renewable origin, like bioethanol, biodiesel, and biomass for energy are the subject of increasing attention around the world. Bioethanol and biodiesel are still relatively minor sources of energy use and are produced in just a few countries. Global production of ethanol has increased greatly since the middle of the 1970s. In 1975 industrial ethanol was the most common form of ethanol, followed by drinking ethanol, with only a small amount of ethanol produced for fuel. By 2010, ethanol fuel had become the most common of the three.

Today's ethanol market

The bioethanol produced around the world today comes primarily from sugarcane, corn and wheat, and is referred to as first generation ethanol. In the long term, sugar cane will be the predominant raw material in the tropical countries, and the temperate climate zones will increasingly be shifting to manufacture of ethanol from raw materials rich in cellulose. In Europe the majority of ethanol is produced from wheat and barley, with sugar beets and corn. A certain amount of ethanol is also produced from surplus wine. The EU has declared its intention for 10 per cent of all energy for the transport sector to come from renewable fuels by 2020.

In 2002, world production of ethanol was 33 539 mln litres [World Ethanol... 2010]. The production increased by 11,7% (on average) per year after 2002 (Tab. 1, Fig. 1) [Jajuga 1999, Strahl i in. 2004]. In 2009, world production of ethanol was 87 260 mln litres. In 2002, production of ethanol in Europe was 3 891 mln litres. The production increased by 8,7% (on average) per year after 2002

Table 1. Ethanol - world production

Specification	World production of ethanol in years [mln l]							
	2002	2003	2004	2005	2006	2007	2008	2009
Africa	514	540	583	608	629	652	684	794
Asia	5822	6157	5895	6036	7109	7898	8291	8030
Europe	3891	3895	3836	4202	4746	5233	5851	7166
N & C America	10 136	12 622	14 911	16 845	20 573	27 181	38 041	42 921
Oceania	182	164	149	149	172	203	224	242
South America	12 994	15 188	15 155	16 382	18 597	23 387	27 994	28 107
World	33 539	38 566	40 529	44 222	51 826	64 554	81 085	87 260

Source: World Ethanol... 2010.

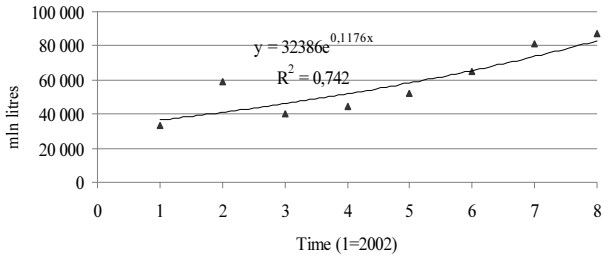

Figure1. Evolution of the ethanol production in the world (2002-2009).
Source: own calculations based on World Ethanol ...2010.

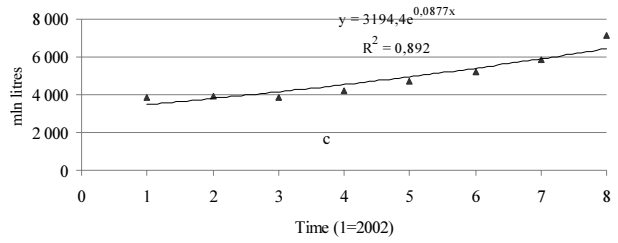

Figure 2. Evolution of the ethanol production in Europe (2002-2009).
Source: see fig. 1.

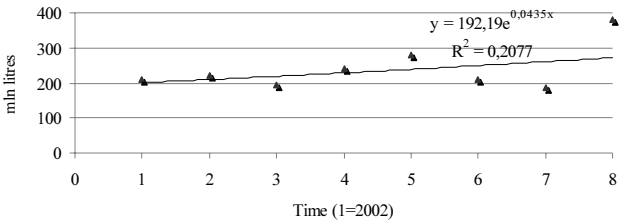

Figure 3. Evolution of the ethanol production in Poland (2002-2009).
Source: see fig. 1.

(Tab. 1, Fig. 2). In 2009, production of ethanol was 7 166 mln litres. Brazil and the United States are the largest producers of ethanol for about 90 percent of world production (Tab. 2). The primary feedstock for ethanol is sugarcane in Brazil and corn in the United States.

The European ethanol production amounted to 7166 mln litres in 2009. France is the leading producer in Europe (1850 mln l). Germany was the second largest European producer in 2009 with 1 100 mln l, Spain was the third with 590 mln l. Ethanol production in Poland amounted to 380 mln l in 2009.

In 2002, production of ethanol in Poland was 210 mln l. The production increased by 4,3% (on average) per year after 2002 (Tab. 2, Fig. 3). In 2009, production of ethanol was 380 mln l.

In 2005, domestic consumption of bioethanol for blending with gasoline in Poland was 53 thous. t. The consumption increased by 4,2% (on average) per year after 2005 (Fig. 4). In 2008, consumption of bioethanol for blending with gasoline in Poland was 198 th. t [Energia ze źródeł... 2008].

Many plant species can provide suitable biofuel yields. Ethanol is currently made from two basic feedstocks: starch-based feedstocks, such as corn, grain, wheat, barley and grain sorghum; and sugar-based feedstocks, such as sugarcane, sugar beets, fruits, citrus molasses and cane (sweet) sorghum [Bioenergy and Agriculture...2006].

Table 2. Ethanol – world production by chosen country

Specification	World production of ethanol in years [mln l]							
	2002	2003	2004	2005	2006	2007	2008	2009
Austria	9	8	7	7	12	25	88	180
Brazil	12 565	14 729	14 663	15 899	17 830	22 551	27 146	27 165
Denmark	19	18	18	21	20	16	13	8
France	844	816	830	910	850	1150	1545	1850
Germany	275	280	230	335	742	689	815	1100
Hungary	43	47	54	58	86	100	175	202
Italy	200	149	150	161	180	160	111	115
Poland	210	220	195	241	279	208	186	380
Russia	728	745	745	716	606	609	535	465
Spain	258	292	334	379	478	573	510	590
Sweden	97	100	105	110	115	164	138	220
Switzerland	11	10	12	11	10	8	11	0
Turkey	14	15	20	45	50	45	45	55
U.K	330	310	285	290	330	377	350	390
U.S.A	9416	11 885	14 158	16 044	19 689	26 008	36 399	41 100
Ukraine	274	286	250	320	332	370	370	360

Source: see tab. 1.

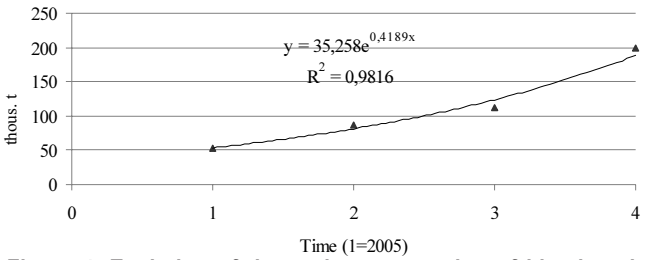

Figure 4. Evolution of domestic consumption of bioethanol for blending with gasoline (Poland, 2005-2008).
Source: own calculations based on Energia ze źródeł... 2008.

The low price of corn, in particular, created an economic climate that facilitated research and development into industries such as corn-based ethanol. Corn dominates the US. biofuel feedstock industry as well as the industrial livestock feed industry because, traditionally, no other feedstock could compete against low corn prices. With a global oversupply of most agricultural commodities, diverting some agricultural resources to the production of bioenergy offers an attractive way of helping farmers. Thus far, the preferred path for using bioenergy in the transportation sector has been to convert traditional crops, like sugarcane and maize, into ethanol to be either blended with gasoline or used directly in internal combustion engines. For example, the diversion of part of the maize crop to ethanol production in the United States helps maintain the maize price, reducing the need for price compensation and export subsidies. The potential economic and social benefits of modern biomass energy arise from the fact that agriculture could face enormous demand for feedstock. This feedstock will need to be produced, harvested, transported, converted into biofuels, and distributed. Medium-term projections for the EU cereals market appear moderately positive thanks to the expansion of domestic consumption (growth in bioethanol and biomass demand).

The market for biofuels and agricultural products are strongly entangled. Because of crop substitutability, world biofuels markets will also be related to crop markets that are not used as an input for biofuel production. All crops tend to compete for the same inputs, land, fertilizers and water. Farmers should find the best return on investment.

A great advantage of biofuels is that their production is much more labor-intensive than fossil fuels and that they create employment in rural areas. In view of the weight and bulk of most biomass feedstock, it is necessary to install collection and conversion plants in the rural areas where the crop is grown. Consequently, economic activities will increase there first and semi-

skilled industrial jobs such as truck driving, machinery operation and maintenance work will also be created. The overall cost-effectiveness of biofuels seems to be low in almost all cases. Costs are relatively high per unit of fossil energy displaced or per unit of CO_2 emissions reduced.

Agricultural practices and deforestation are the main causes of soil erosion and land degradation. Large-scale deforestation has occurred as a result of the expansion of soy in Brazil and palm oil plantations in Malaysia and Indonesia, for example. The expansion and intensification of agriculture due to the use of irrigation, agrochemicals and heavy machinery can lead to further soil erosion and land degradation. The expansion of agriculture and intensive mono-cropping is closely linked to biodiversity loss.

Bioethanol production in opolskie voivodship

In September 2004 was established Bioagra as a special purpose entity that was launched specifically in order to build the Goświnowice Ethanol Plant. Bioagra is both the organizer of this investment project and its direct investor. Bioagra main shareholders are: Polskie Młyny and the Swedish Company, Sekab [BIOAGRA, SEKAB]. Polskie Młyny is one of the biggest Polish businesses that running activities concerning purchasing, storing, and processing grains. The Company owns several detached and mill-adjacent elevator sets, which constitutes approximately 35% of the total grain storage capacity in Poland. The Sekab Group is one of Europe's leading ethanol producers. Sekab BioFuels & Chemicals produces, imports, develops, sells and distributes bioethanol fuel and chemical products. Sekab E-Technology is currently developing the cellulose-based ethanol technology. Due to its shareholders' business competence, Bioagra has some special conditions to organise proper raw material supply structures and to sell products being manufactured at Goświnowice Ethanol Plant.

The Ethanol Plant in Goświnowice started production in 2009. The plant located in Goświnowice processes around 350 th. tonnes of corn into 140 mln l of ethanol and 100 th. t of DDGS (Dried Distillers Grains with Solubles) per year [Bioagra rozpoczyna walkę..., Zakład produkcji etanolu...]. Due to its specifics, Bioagra is active above all on the following three markets today: corn as material used for production purposes, dehydrated ethanol designed for fuel purposes, and DDGS, which is an excellent feed material. DDGS is a by-product obtained in the manufacturing process of ethanol . The total content of the remaining nutrients in DDGS (mainly protein, fat, cellulose) is 2 to 3 times higher than that in corn grain.

Bioagra's demand for corn reaches as much as 15% of the total domestic production volume of this grain. The raw material must be produced, stored and then it must be shipped to Goświnowice. Therefore, while launching its manufacturing activities, the Company affects the local market.

Bioagra has become an important business entity on the Polish grain market. The company's significant role results from a high demand for corn. In organising its raw material supplies, the Company has at its disposal its own elevator at Goświnowice, and makes use of the storage potential of the Polskie Młyny Company. Bioagra is able to guarantee permanent and confident purchases of this raw material and also – through a long-term cooperation perspective based on agricultural procurement contracts and the possibility of introducing price formulas – development and transferring of farms into ones focusing on growing energy plants.

DDGS, as an animal-feeding material, meets all requirements that are imposed on feed materials. Animal feeding experiments run by some highly renowned Polish research and development institutions, in particular on poultry, milk and meat cattle, and pigs confirm that DDGS is an excellent feed material in feeding various species and usable groups of animals.

Goświnowice Ethanol Plant affects the local labour market. Social and economic benefits result from commissioning production include job opportunities (in the farming sector, services, transport, and storage).

For the years to come, it is very likely that the negative impacts of biofuel production will increase. Production of biomass for biofuels can have widely differing impacts on water quality (through the use of fertilizers and pesticides), water use and soil erosion. In many cases, production of biomass has the very high environmental impacts in terms of biodiversity loss. Biodiversity loss has impacts in terms of biosecurity threats (invasive plants and animals, diseases, etc).

Conclusions

The growing world energy demand, the insecurity of long-term supply and the consequences of fossil fuel use for climate change are driving governments to look for alternatives. Biofuels may have significant benefits both environmental and social. The right choice of biomass crops and production methods can lead to favorable carbon and energy balances and a net reduction in greenhouse gas emissions. With a global oversupply of most agricultural commodities, diverting some agricultural resources to the production of bioenergy offers an attractive way of helping farmers. Countries can increase their access to energy and create much needed employment in rural areas. Bioenergy production systems also need to be adapted to local conditions to avoid generating environmental problems [Biokomponenty i biopaliwa..., Uchwała Rady Ministrów 2007]. As a guiding principle, bioenergy crop systems can potentially provide benefits if implemented on land that is currently under annual row crops or is undergoing uncontrolled degradation. In either case, providing social benefits will require engaging local communities and understanding the current uses of the land, such as food production, livestock grazing, and fuelwood gathering.

For the years to come, it is very likely that the negative impacts of biofuel production will increase. Bioenergy uses resources (land, water, and labor) that compete with food and feed production. This would lead to higher food prices. A key question is how to ensure that production of bioethanol will be sustainable. One answer currently being explored intensively is to certify the conformity of bioethanol with minimum environmental and social standards on a life-cycle basis.

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Streszczenie

Biopaliwa ze źródeł odnawialnych, takie jak bioetanol, biodiesel i biomasa, są przedmiotem coraz większego zainteresowania na całym świecie. UE zadeklarowała, że do 2020 r. 10 procent całej energii w sektorze transportu pochodzić będzie z paliw odnawialnych. W artykule omówiono aktualny stan produkcji biopaliw w województwie opolskim. Zakład produkcji bioetanolu w Goświnowicach (województwo opolskie) rozpoczął produkcję w 2009 roku. Zakład przetwarza rocznie około 350 tys. ton kukurydzy na 140 mln litrów etanolu. Powstanie zakładu wiązała się m.in. z powstaniem nowych miejsc pracy na obszarach wiejskich (w usługach, transporcie, magazynowaniu). W najbliższych latach jest bardzo prawdopodobne, że ujawnią się również negatywne skutki produkcji biopaliw. Rozwój rolnictwa opartego na intensywnych uprawach monokulturowych jest bowiem związany z utratą bioróżnorodności.

Corresponding address:

dr Mirosława Szewczyk
The Opole University of Technology
Faculty of Management and Production Engineering
str.. Waryńskiego 4, 45-047 Opole
tel. 77 454 35 33, e-mail: m.szewczyk@po.opole.pl
dr Agnieszka Tłuczak
Uniwersytet Opolski
Faculty of Economy
str. Ozimska 46a, 45-058 Opole
tel. (77) 401 68 63, e-mail: atluczak@uni.opole.pl