

LIQUID BIOFUEL MARKET AS A BASIS FOR SUSTAINABLE DEVELOPMENT IN UKRAINE

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Abstract

The article considers and generalizes the methodical approaches to understanding the essence of the concepts of “biofuels”, “bio ethanol”, “biodiesel”. The present state of formation and development of liquid biofuel market in the world and in Ukraine is analyzed. It is pointed out that at present in Ukraine production of biological fuels is almost stopped, however, the decision of the problems of biofuel production will depend on the coordination of joint actions of the state and participants in market relations. The necessity of development of liquid biofuel market in Ukraine is substantiated and measures are proposed to promote the development of liquid biofuel production for achievement of the international obligations of Ukraine concerning motor biofuel and ensuring sustainable development in Ukraine. Analysis of indicators of requirements for the sustainability of biofuels and biodiversity in the EU and their implementation in Ukraine.

Keywords: *biodiesel, bioenergy, bioethanol, biofuels, liquid biofuel market, sustainable development.*

JEL classification: *R11; Q16; Q42; P28*

1 Introduction

The energy sector of Ukraine is an economic basis of state sovereignty, an element of good governance, a sound basis for the sustainable development of a competitive economy and an integral part of the European energy space.

A modern energy development strategy in most European countries involves the widespread use of energy from renewable and non-polluting sources of energy (RES), including biomass and liquid biofuels in particular. Liquid biofuels continued to represent the vast majority of the renewable energy contribution to the transport sector. In 2016, they the majority of transport energy use.

Dependence on imported petroleum products makes Ukraine vulnerable to fuel supply. This is especially true for agrarians: it is impossible to conduct a stable business and perform a complex of agricultural works without a stable supply of fuel and lubricants to the industry. Alternative sources of energy would play a significant role in the achievement of energy and gasoline independence.

Nowadays as a replacement, on the first place are considered biofuels. In Directive 2009/28/EC, “bioliquids” means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass [5].

Ukraine has huge potential in biomass production, especially for first generation biofuels extraction. Main promising feedstock sources are agricultural commodities, primarily grain and corn for bioethanol, rapeseed, sunflower and soybean for biodiesel.

The research market for liquid biofuels consists of several basic segments of products: bioethanol and biodiesel.

Ethanol is the oldest, by far the largest and the fastest growing biofuel in the world, a realistic alternative to much of the fossil oil. In terms of volume, ethanol is the largest biofuel in the world and accounts for about 90 percent of global consumption [12]. Ethanol is most often produced from sugar and starchy crops such as sugar cane, sugar beet and wheat. But in Ukraine the most more popular crops for production bioethanol are corn, sugar beet (molasses) and wheat.

After ethanol, the second most important liquid biofuel is biodiesel made out of fats and vegetable oils such as rapeseed, sunflower, and soy [9]. Many factors would influence the liquid biofuel production cost, including materials price, conversion efficiency and production scale.

In Ukraine the liquid biofuel (bioethanol and biodiesel) production is slowly developing for lack of real government assistance. In the recent years Ukraine was working on fulfilment of European standards in the sector of biofuels. Producers will be able to count on certain profitability only after legislative authorization of the standards of the obligatory biofuel additives in traditional petrol.

The novelty of this paper is that it provides a comprehensive analysis of the use and production of liquid biofuels in transport sector over the past five years and analyses this topic in more detail. This paper also includes a discussion on the prospects of using liquid biofuels in transport sector in the future.

2 Data and Methods

The method used for this paper is to some extent a review and synthesis of the existing literature.

The economic impact of bioenergy is presented by conducting a meta-analysis contrasting and combining results from various studies, biomass supply scenarios and global models linked to land, water and energy use, and climate change in terms of food- energy-, environmental security. The combinations of following terms were used to search relevant studies: food-, energy- and environmental security, food demand, yield trends, renewable energy, biomass, biofuels, by-products for livestock feeding from biofuel production, land-use change, biofuels and the environment, sustainability requirements, climate change mitigation.

The efficiency of alternative biofuel policies in achieving energy, environmental and agricultural policy goals is assessed using economic cost-benefit analysis for sustainable development.

3 Results and Discussion

According to a new market research report “Bioethanol Market by Feedstock (starch-based, sugar-based, cellulose-based), End-Use Industry (transportation, pharmaceuticals, cosmetics, alcoholic beverages), Blend (E5, E10, E15 to E70, E75 to E85), and Region – Global Forecast to 2022”, published by MarketsandMarkets™, the market is estimated at USD 53.19 Billion in 2017 and is projected to reach USD 68.95 Billion by 2022, at a CAGR of 5.3% from 2017 to 2022 [2].

Global bioethanol market segmented by: raw material (grains, sugarcane, industrial beets, others) type (corn-based ethanol, wet milling, dry milling, sugarcane-based ethanol (cellulosic ethanol others), Blend: (E10, E20 & E25, E70 & E75, E85), generation (first generation, second generation, third generation), application (transportation, power generation, medical).

Due to unique geographical position and the energy dependence, Ukraine plays essential role in European energy market. On one hand, Ukraine is an energy-dependent country with insufficient volume of its own conventional energy sources (oil and gas). On the other hand, Ukraine is important for the global energy markets, being a major transit centre for exports of Russian oil and natural gas to both eastern and western Europe.

In 2013 Cabinet of Ministers signed new Energy Strategy until 2030. Strategy proposes objects for biomass utilization in electricity generation that should reach 2.4 % from the total renewable electricity and only 0.1 % from the total

electricity produced in Ukraine. Meanwhile it does not cover the usage of biomass in heat supply. The sector of liquid biofuels

Table 1 Biodiesel and bioethanol development in the Energy Strategy until 2030

	2010	2015	2020	2025	2030
Bioethanol consumption, million tons	< 0,11	0,3	0,6	0,8	1,1
Biodiesel consumption, million tons	0	0	< 0,1	0,3	0,8
Total consumption of biofuels	< 0,1	0,3	0,6	1,1	1,9
Share of biofuels in motor fuels consumption (%)	< 0,1	2,5	4,5	7,2	10,9

Source: Energy Strategy of Ukraine until 2030, 2013.

is the only sector of bioenergy, development of which is described in the document. One third of 33.7 billion m³ (in 2015) of consumed natural gas is necessary to be replaced by biofuels. In the baseline scenario the shift to the usage of gasoline containing 10% bioethanol until 2020 and 15% – by 2030 is planned. According to the ES, the expansion of biodiesel as motor fuel happens after 2020. Further up to 2030, will be made a transition to use of biofuels with 7 % of biodiesel [11].

Information of biodiesel and bioethanol development in the Energy Strategy until 2030 is shown in the table 1.

Table 2 Energy balance of liquid biofuels in Ukraine for the period from 2011 to 2016

	2011	2012	2013	2014	2015	2016
Production liquid biofuels, kt	9,73	60	66	26	16	6
Import				38	46	58
Export					-9	-6
Domestic supply			66	64	53	58
Final consumption	9,73	60	66	64	53	58

Source: Energy balance (productive) of Ukraine 2011 – 2016 [8].

In Ukraine, the main producers of bioethanol are enterprises based on the State Enterprise Ukrspyrnt, the priority of which is the introduction of energy saving technologies, the use of alternative fuels, renewable energy sources and raw materials in all technological processes. SE Ukrspyrnt produces 1320 tons of

bioethanol per month. The total production capacity is over 36 million decaliters a year (360 million liters per year) [14].

Information of Energy balance of liquid biofuels in Ukraine for the period from 2011 to 2016 is shown in the table 2.

The main reason for reducing the production of liquid biofuels and technical alcohol is the lack of incentive policies of the state in relation to the use of alternative fuels, the imperfection of regulatory and tax policy and the state tax policy, the failure to implement decisions already taken, the insufficient level of informing market players about existing opportunities in this area while alcohol production capacity is only 25 %.

A formal commitment to meeting the 10% RES-T target in Ukraine by 2020 has been established through the adoption of the National Renewable Energy Action Plan (NREAP) (CMU Ordinance no.902, October 2014). This sets out an ambition to meet the target primarily through the supply of biofuels. However, at present Ukraine lacks the legislative and regulatory framework necessary to facilitate the sustainable production and supply of biofuels in the country. Enabling this will be crucial to meeting the aforementioned target. Thus, preparing and adopting relevant legislative acts will be essential in order to establish the conditions for the introduction of biofuels & bioliquids, and their subsequent contribution towards the renewable energy targets established in the Renewable Energy Directive.

The principal legislative measures in Ukraine related to biofuels are:

- Law of Ukraine “On Alternative Energy Sources”(No. 555-IV dated 20 February 2003). This law defines legislative, economic, environmental and institutional framework for the use of RES and encourage their extended use in the fuel and energy sector.
- Law of Ukraine “On Alternative Types of Fuel” (No. 1391-XIV dated 4 January 2000). This law defines biofuels for the purposes of production and consumption in Ukraine. In June 2014 an amendment to Article 2 of this law was adopted which formally sets out the biofuel ambitions within the Ukraine by establishing targets for bioethanol use in transport. These are:
 - in 2013 – recommended content of 5 % (by volume);
 - from 2014-2015 – mandatory content of 5 %;
 - from 2016 onwards – mandatory content of 7 %.

While these targets have been established, they have not been enforced to date. Moreover, several other measures related to biofuels that are set out in Directive

2009/28/EC (RED) have not yet been transposed, in particular the sustainability criteria for biofuels and bioliquids [6].

In relation to Ukraine below in Table 3 specifies the amount of biofuels needed to achieve the target for 2020 as predicted in Ukraine by the NREP. In 2020, it will take about 630 million liters of ethanol and 90 million liters of biodiesel. The expected installed and planned capacity of ethanol production is about 120 kT (150 million liters), sufficient to meet about a quarter of the target group of ethanol by 2020. The domestic production in 2012 amounted to 50-70 kT (60-90 million liters). Please note that NREAP has an ambition to meet all of this internal supply demand, so there is currently a significant gap in production capacity. There is currently no commercial production of biodiesel in Ukraine.

Table 3 Biofuel consumption forecast until 2020 for Ukraine

	ktoe	M.litres	Notes
Biodiesel	70	89	100% domestic supply
Ethanol	320	630	100% domestic supply
Total	390	719	

Source: NREAP

Sustainable development of bioenergy is an integrated part of the general sustainable development of society. The European Commission pays big attention to the issues focusing on sustainable production of biomass and bioenergy. Some of the sustainability requirements are binding for the EU countries (production of biofuels and bioliquids). General trend is toughening of the sustainability requirements [1].

Now the sustainability requirements for biofuels and bioliquids in the EU are determined by Directive 2009/28/EC on the promotion of the use of energy from renewable sources and Directive 2009/30/EC⁹ regarding the quality of transport fuels [6].

Directive 2009/28/EC sets a mandatory 10 % minimum target to be achieved by all Member States for the share of RES in transport sector by 2020. At that the proportion of biofuels from food crops that can be counted towards the 2020 renewable energy targets is limited to 7 % of the final energy consumption on transport, and the contribution made by biofuels produced from wastes, residues, non-food cellulosic material and lingo-cellulosic material shall be considered to be twice that made by other biofuels. It is also noted that biofuel production should be sustainable. Biofuels used for compliance with the targets laid down

in this Directive, and those that benefit from national support schemes, should therefore be required to fulfil sustainability criteria.

The greenhouse gas emission saving from the use of biofuels and bioliquids shall be at least 35 % until 31.12.2017 and at least 50 % from 01.01.2018 for biofuels and bioliquids produced in installations in which production started before 05.10.2015.

Biofuels produced in new installations (that is production started after 05.10.2015) must achieve GHG emission savings of at least 60% in comparison with fossil fuels. It should be noted that the requirements are new, they were included in Directive 2009/28/EC by Directive (EU) 2015/1513 of the European Parliament and of the Council in September 2015 and they are more strict than the original ones of 2009 [7]. The greenhouse gas emission saving from the use of biofuels and bioliquids shall be at least 35 %. With effect from 01.01.2017 the GHG emission saving shall be at least 50 %, and from 01.01.2018 it shall be at least 60 % for biofuels and bioliquids produced in installations in which production started on or after 01.01.2017.

At present, the use of voluntary schemes recognized by the European Commission is the most common way of demonstrating compliance with sustainability criteria. For a voluntary scheme to be recognized by the Commission, it must fulfil criteria such as (any changes in the schemes must be notified to the Commission so that to be assessed and the Commission be able to establish whether the schemes still adequately cover the sustainability criteria): (feedstock producers comply with the sustainability criteria; information on the sustainability characteristics can be traced to the origin of the feedstock; all information is well documented; companies are audited before they start to participate in the scheme and retroactive audits take place regularly; the auditors are external and independent; the auditors have both the generic and specific auditing skills needed with regards to the scheme's criteria [4].

The main standards that determine the requirements for sustainability criteria are: European standard CEN 16214-1:2012: Sustainability criteria for the production of biofuels and bioliquids for energy applications – principles, criteria, indicators and verifiers 19 was adopted in 2012 [13].

Published in 2015, the ISO 13065 standard on Sustainability Criteria for Bioenergy provides a framework for evaluation of environmental, social and economic sustainability of different bioenergy products and supply chains, including biofuels. It specifies a set of principles, criteria and indicators that should be used in sustainability assessments. The standard deals only with direct impacts, defined as those that are “under the direct control of the economic operator and caused by the process being assessed” [10].

4 Conclusion

From a sustainability perspective, biofuels offer advantages as well as risks. On the upside, biofuels can contribute to increased energy security, help reduce GHG emissions, improve air quality in cities and, in the process, spur growth in rural areas. On the downside, expansion of biofuels, especially under intensive production systems, could have negative impacts on biodiversity (e.g. replacement of natural forest with biofuel crops, spread of monocultures), water availability under scarcity, water quality, soil degradation, negative carbon and energy balances, potential conflict with food production and food security, as well as worsening GHG emission levels because of indirect land-use change.

Balancing the economic benefits with environmental and social impacts is a delicate act. Even when biofuels meet some environmental and social sustainability criteria, they need to first pass the economic sustainability (or viability) test. This means ensuring efficiency of production (through high yields and intensive management) and long run profitability, access to productive resources (e.g. land, labour, technology), and reliable output markets. The challenge is achieving all this while ensuring economic viability and minimizing potential negative social or environmental impacts.

Economic sustainability (viability) requires long-term profitability, minimal competition with food production and competitiveness with fossil fuels. The economics of biofuels have been in part driven by active policy support measures (subsidies and mandates) which makes it difficult to assess the long run economic viability of biofuels systems current or future. However, the protection of the domestic biofuel industry (sugarcane ethanol in Brazil from the 1970's, US corn-ethanol and EU rapeseed – biodiesel), have managed to develop the economies of scale and cut long run costs through the introduction of technological improvements (diversification and market opportunities for by-products; efficient internal energy consumption etc) [12].

It should be noted that, in general, Ukraine's current legislation provides a proper basis for the sustainable development of the market for alternative fuels in Ukraine. In particular, this applies to tax benefits granted by the state to participants in this market. However, the use of economic incentives and the definition of a stable strategy for the development of the market for liquid biofuels will increase the production of ethanol, biodiesel or other types of liquid or gaseous biofuels from raw materials of agriculture and forestry. This will replace the use of fossil fuels for both stationary (for example, biodiesel for power plants) and for mobile use (motor fuels).

Most importantly, Ukraine has built legislative base which aims to support the industry development and offer large scale of benefits. But due to high excise duty, low oil prices and no penalties for not achieving established indicators, the biofuel industry still stays non operating.

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