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ANALYSIS OF THE STRUCTURE OF SOLID BIOFUELS ON INTERNAL MARKET OF UKRAINE

Abstract: The volumes and structure of consumption of solid biofuels on internal market of Ukraine are analyzed. The share of export-import of wood briquettes and pellets to the markets of EU, CIS and Asian countries is calculated. Volynska, Zhytomyrska, Zakarpatska, Ivano-Frankivska, Lvivska, Rivnenska, Ternopilska, Hmelnytska and Chernivetska oblasts are proven to have the highest capacity of bioenergy market development. Fluectuation of prices for solid biofuel on internal market are analyzed across producers' positions and the reasons of this situation are found. The range of activities to stimulate available capacity of domestic enterprises both on internal and foreign markets of bioenergy resources is outlined.

Key words: bioenergy resources, briquettes, internal market, pellets, solid biofuels.

JEL classification: Q42, Q49

Introduction

Bioenergy market in Ukraine has a strong development capacity; there are good preconditions and the market is actively forming with the rules and actors in relevant segments. Ukrainian biofuels market grows 20-30% each year. Absolute majority of produced biomass is used domestically. Markets' expansion through improvement of existing actors' efficiency, emergence of new actors on the market, geographic expansion of markets within Ukraine and their further segmentation has substantial potential for the development of small and medium business. It its turn, development of small and medium entrepreneurship will boost economy growth, create new jobs and increase tax revenues to state budget.

Analysis of the EU bioenergy market attractiveness for Ukrainian producers shows that solid biofuels market remains to be the most perspective market for domestic producers in all respects. Lack of high technology for production of solid biofuels, raw materials surplus in Ukraine and ease of transportation are the major criteria necessary for Ukrainian companies in order to increase their share on the solid biofuels market of EU Member States. Therefore, the research of solid biofuels market in Ukraine gains more and more importance as the major market share, which is the most attractive and competitive among other types of bioresources in the EU for Ukrainian producers.

The purpose of the article. The paper aims to research modern tendencies and define priority directions of bioenergy market development in order to promote the products at foreign markets.

Research results

Solution of the problem of misbalance both at domestic and foreign bioenergy markets through its elimination and reorientation of traditional way to provide consumer and industrial sectors with energy. It is also necessary to achieve the level of saving of energy from bioresources that makes it possible to overcome the problem of continental energy transfer and reduce the CO_2 emissions into the atmosphere.

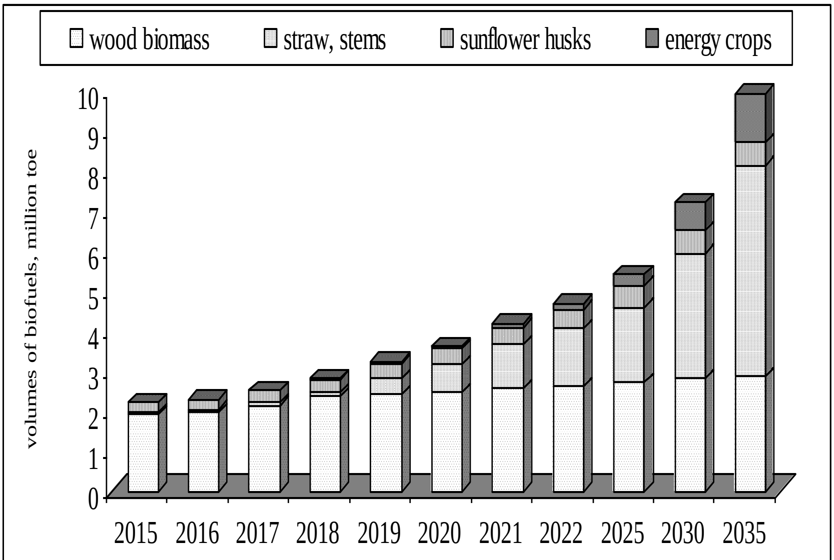
The 2030 Energy Strategy of Ukraine (Cabinet of Ministers of Ukraine 2006, Available from: http://search.ligazakon.ua) provides that instead of the tasks of energy maintenance of quantitative development the economy of Ukraine has been following for decades, the country should shift to energy maintenance of sustainable economy development pursued by the developed countries nowadays, i.e. the use of alternative energy sources and development of bioenergy market.

The following are the major preconditions of bioenergy market forming: rapid growth of prices for natural gas (bringing them closer to market prices) in Ukraine in 2014; great demand for wood biomass in EU Member States (the largest biomass importer in the world – 5.5 million tons of pellets annually); development of woodworking and agriculture that generate large quantities of raw materials for production of biomass and biogas for energy needs; the share of renewable energy will amount to 12.4% in the heat and cooling sector according to 2020 National Actions Plan, while the use of biomass for production of heat and cooling will amount to 5.0 million tons of oil equivalent (toe) in 2020, including the 4.85 million toe from solid biomass. It amounts to 85% of the overall volumes of renewable energy sources used for production of heat.

Taking into account these preconditions and 9.4 million ha forests area of Ukraine, the country has perspectives for development of bioenergy market and for bringing domestic enterprises to foreign markets.

The 2016 Energy Balance of Ukraine (State Statistical Service of Ukraine 2016, Available from: www.ukrstat.gov.ua/metaopus/2018/2_03_08_03_2018.htm) provides that production of biofuels and wastes in the country amounted to 3348 thous. toe, while their primary energy supply was 2832 thous. toe (3.1% of total primary energy supply). The gap was formed primarily by exports of biofuels (553 thous. toe in 2016). The growth of bioenergy sector in Ukraine in 2010-2016 is estimated at 45%/year in average by production of biofuels and wastes and 35%/year by total supply of primary energy from them.

Solid biofuel in the form of firewood, wood chips, pellets and briquettes from biomass and packed straw takes the largest segment on biofuels market (Figure 1).



	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030	2035
wood biomass	1,9	1,95	2,12	2,35	2,4	2,45	2,55	2,6	2,7	2,8	2,85
straw, stems	0,05	0,07	0,08	0,1	0,4	0,7	1,1	1,45	1,89	3,12	5,26
sunflower husks	0,25	0,26	0,3	0,34	0,38	0,4	0,43	0,49	0,54	0,58	0,59
energy crops	0	0	0	0,01	0,04	0,05	0,1	0,13	0,27	0,7	1,2
overall, million toe	2,2	2,28	2,5	2,8	3,22	3,6	4,18	4,67	5,4	7,2	9,9

Figure 1. **Assessment of the overall volumes and structure of solid biofuels consumption in Ukraine (90% of all biofuels and wastes)**[1]

Source:Zhelezna 2018, Available from: http://biomass.kiev.ua/images/news/pdf/zheliezna-secbiomass-briquettes-infoday-forbio-cherkasy-16052018.pdf

According to experts (UNDP Project, GEF 2016, Available from: www.

[1] Assessment is based on key parameters of 2035 Energy Strategy of Ukraine, STC prognosis «Biomass» on the structure of solid biofuels consumption and prognosis of thermal energy production from renewable energies across various sectors by 2050.

http://uabio.org/img/files/docs/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf), total production of pellets in Ukraine in 2015 amounted to almost 1.32 million tons at 494 enterprises, including pellets from wood – 390 thous. tons, from husks – almost 724 thous. tons, from straw – 146 thous. tons, from peat – 8.4 thous. tons, from other types of raw materials – 51.8 thous. tons.

Fuel briquettes in Ukraine are produced in smaller volumes than the pellets. Mostly wood, husks, straw and reed are used as raw materials.

Production of briquettes from wood in 2015 was 170 thous. tons, from crops – 95 thous. tones (UNDP Project, GEF 2016, Available from: http://bioenergy.in.ua/media/filer_public/b4/bd/b4bda440-5ab8-4c64-943a-a094da7a757f/dorozhnia_karta_z_rozvitku_rinku_tverdogo_biopaliva_ukrayini.pdf).

Currently a large share of pellets and briquettes is exported from Ukraine to European countries because of the low demand on internal market. Therefore, export of wood pallets in 2015 amounted to over 150 thous. tons (38.5% of overall production volumes), export of husks pellets (including re-export) – almost 822 thous. tons (UNDP Project, GEF 2016, Available from: www. http://uabio.org/img/files/docs/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf). Regarding the geography of fuel briquettes and pellets export, its EU share accounted for 98.57%, and already in 2015 only 75.58 % (Table 1). The fall in exports of wood fuel briquettes and pellets to the EU was in the first place stipulated by the growth of their exports to Asia, which amounted to 24.05% of overall production in 2015. Exports to CIS countries haven’t reached even 1% in the whole period under research (Popadynets, Maksymiv 2016, p. 94).

Poland and Germany were the leaders among European exporting countries.They had accounted for over 70% of overall EU exports until 2012. However, the Czech exports increased substantially in 2013 and Romanian and Italian – in 2014. In 2015, Romania became the leader, accounting for over 33% of exports.

Table 1: **Export-import shares of wood fuel briquettes and pellets**

Aggregate shares of exports of wood fuel briquettes and pellets								
	2008	2009	2010	2011	2012	2013	2014	2015
CIS countries	0.97	0.27	0.66	0.16	0.32	0.39	0.46	0.34
EU countries,	98.57	99.66	99.19	99.80	99.50	99.34	89.60	75.58
including:								
Austria	1.70	0.63	0.50	0.94	1.54	1.86	5.63	4.35
Italy	1.58	6.80	8.72	3.27	5.95	17.18	12.75	8.46
Germany	13.23	20.74	20.66	17.50	10.91	20.32	15.71	13.20
Poland	59.17	40.70	40.59	57.62	63.17	33.84	16.34	17.15
Romania	0.91	0.21	0.06	-	0.01	0.07	21.45	33.77
Slovak Republic	0.43	1.06	2.13	3.41	1.99	2.91	11.08	6.31
Hungary	1.78	3.80	2.30	1.45	1.73	2.61	3.47	4.47
Czech Republic	1.31	6.92	10.25	9.76	7.38	12.15	4.50	4.68
Asia	0.46	0.04	0.11	-	0.09	0.03	9.93	24.05
Aggregate shares of imports of wood fuel briquettes and pellets								
CIS countries	19.5	6.1						9.0
EU countries,	80.5	83.6	88.9	93.8	86.6	79.3	82.1	45.1
including:								
Germany	79.44	75.53	74.55	91.35	95.63	89.49	90.76	77.49
Poland	20.56	21.87	11.43	8.10	0.10	3.98	3.15	4.53
Asia	-	-	-	-	0.11	19.01	-	41.25

Source: State Statistical Service of Ukraine 2018, Available from: http://www.ukrstat.gov.ua/

The largest importers of wood fuel briquettes and pellets were Poland and Germany as well. The CIS countries lost their share in exports and Asian countries increased it only in 2015 up to 41.2%.

Despite the range of problems, this bioenergy segment keeps developing. Creation of favourable conditions at domestic market will contribute to reorientation of solid biofuels exports at sales in Ukraine.

Solid biofuels production in Ukraine is characterized by regional inequalities and relative dispersion as well as large number of small enterprises working with traders. Location of production as close as possible to raw materials basis is also typical. For example, producers of wood and peat pellets are mostly situated in the West of Ukraine and in small numbers – in industrial regions of the Centre and the East (up to 70% of production of wood pellets is provided by seven oblasts – Zakarpatska, Volynska, Chernihivska, Kyivska, Zhytomyrska, Lvivska, Sumska). Producers of husks pellets tend towards the central and eastern regions. In these regions there is the raw materials basis of secondary waste from sunflower processing due to great concentration of oil-extract plants (for example, only four oblasts – Dnipropetrovska, Zaporizka, Odeska and Mykolayivska provide production up to 413 thous. tons, i.e. more than the half of all husk pellets in Ukraine).

Producers of straw pellets are situated in agrarian regions and are characterized by small number and greater concentration of production. The largest producers of straw pellets in Ukraine are Smart Holding «Vinpeleta», LLC «Bioenerdzhi», LLC «Avers-tex», Creatyv Ahro, Berdyanski Zhnyvarky (up to 50% of total production of straw pellets) (UNDP Project, GEF 2016, Available from: www. http://uabio.org/img/files/docs/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf).

If to consider and analyze the development of bioenergy market across regions in more details, the lion's share of the capacity of wood biomass accounts for nine Western Ukrainian oblasts – Volynska, Zhytomyrska, Zakarpatska, Ivano-Frankivska, Lvivska, Rivnenska, Ternopilska, Hmelnytska, Chernivetska, and amounts to 50.79 PJ, or 57% of overall forests.

Access to the wood biomass for actors on the market, in particular the companies producing and packing the biomass, is the major factor for the use of wood biomass for bioenergy needs. Existing model and system of access to wood biomass has the range of critical flows for bioenergy market, including: lack of transparency on the market for packing companies, lack of transparency on the market of technical wood (wood wastes in the first palace), dependence of bioenergy raw materials market on strategic approach to forest resources management.

As of 2017, at least 94 pellets and briquettes plants are located at the territory of these oblasts, with total production capacity over 204 thous. tons per annum (or 80.4 thous toe), working mostly on wood biomass. Most plants are located in Zhytomyrska (28) and Rivnenska (18) oblasts. Up to 10 producers are registered in other oblasts. Zhytomyrska (91 thous. tons / year), Volynska (32 thous. tons / year) and Zakarpatska (27 thous. tons / year) oblasts are the leaders by the volumes of production. Overall, over 50% of companies by region are flexible in terms of sales markets by the volumes and capacity of production and follow the current market conditions (unlike the purely export-oriented companies and companies oriented solely on domestic market) (Lviv Business Support Center based on PPV Knowledge Networks 2017, Available from: www.ppv.net.ua/uploads/.../Western_Ukrainian_Bioenergy_Market_Study_2017.pdf).

At least 5 companies growing energy crops and producing wood chips operate in the region. Total area of plantations covers over 2.400 ha, providing harvest at the level of 49 thous. tons / year (11.54 thous. toe). Salix-Energy Company is the greatest player in the segment. The Company grows energy willow at 1.700 ha and covers 68% of the market.

Overall, 286 companies involved in supply of biomass to consumers and at least 183 energy service companies and utility companies that use the biomass operate in these oblasts. Their total capacity exceeds 633 MWt. Volynska (159 MWt), Rivnenska (109 MWt), Zhytomyrska (98 MWt) oblasts are the leaders by installed power capacity.

Prices for solid biofuels substantially differ across different producers (Figure 2) and across the regions of the country. We can also observe the prices fluctuations during a year. In particular, they grow during the heating season due to the change of supply and demand balance. Conditions of supply and transportation distance significantly influence the final price. Moreover, biomass with the quality guaranteeing certificate costs more and is usually exported. For example, an EN Plus A1 certified wood pellet costs 100 EUR/tons more, and an agro pellet – 20 EUR/tons more than the non-certified one.

Pellets and briquettes are considered to be the «improved» solid biofuel due to their higher calorific capacity, less humidity and in general higher energy density (GJ/cbm) compared to unconsolidated types of biomass and biofuels.

Other countries' interest in biofuels and export development is the decisive factor of market establishment. Domestic market also tends to increase consumption; however, the process will largely depend on the companies' readiness for re-equipment.

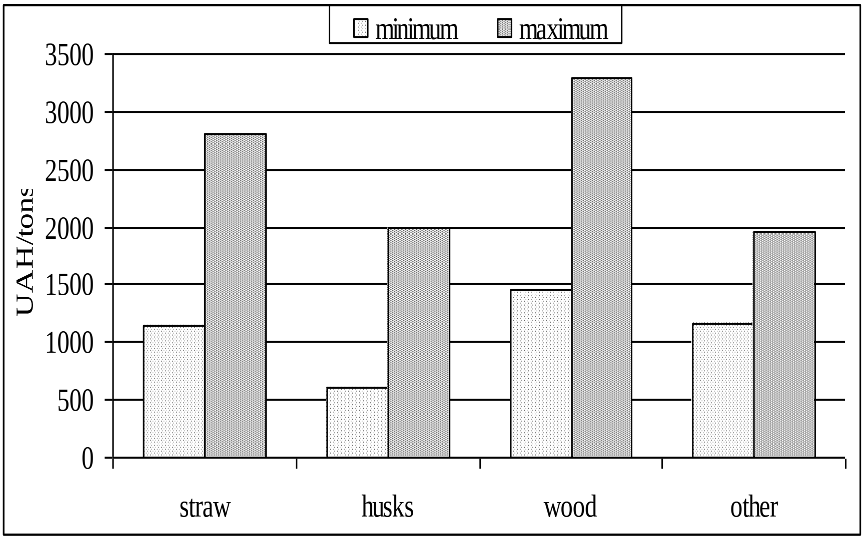


Figure 2. **Pellets price fluctuations at domestic market by producers' positions, 2016 (minimum-maximum)**

Source: UNDP Project, GEF 2016, Available from: www. http://uabio.org/img/files/docs/kompleksnii_analiz_ukrayinskogo_rinku_pelet_z_biomasi.pdf.

It is not worth expecting the dramatic growth of demand in consumer market for such products, however substantial growth of exchange rate and gas price can influence the attitude of population to alternative energy sources.

Current volumes of Ukrainian market of fuel briquettes from biomass for the needs of population (individual heating) can be estimated to be

~500 thous. tons/year with the perspective growth up to over 3 mln. tons/year by 2035 (Figure 3).

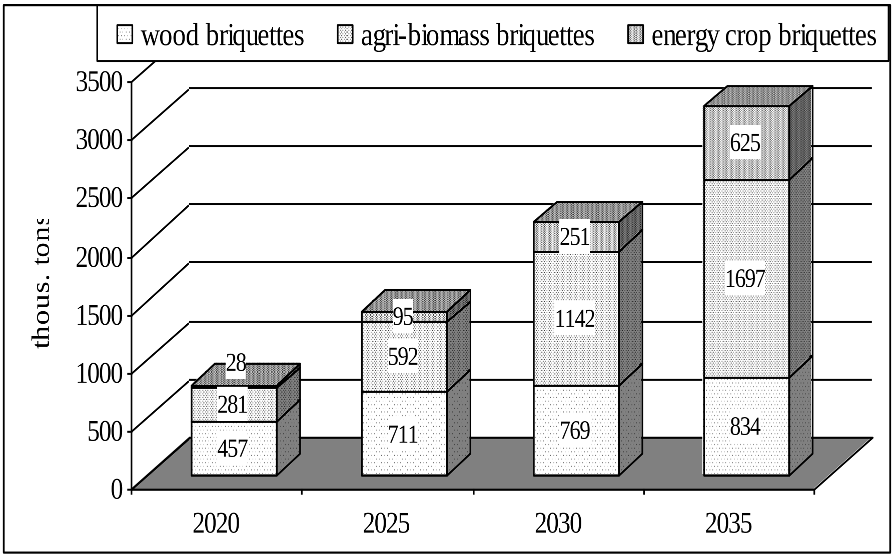


Figure 3. **Assessment of the volumes of Ukrainian market of fuel briquettes from biomass for domestic needs (individual heating)**[2]

Source: Zhelezna 2018, Available from: http://biomass.kiev.ua/images/news/pdf/zheliezna-secbiomass-briquettes-infoday-forbio-cherkasy-16052018.pdf.

Conclusions. Nowadays biofuels production is the perspective development direction of domestic companies to enter foreign bioenergy markets. Dynamics of solid biofuels production from various materials grows each year. Therefore, the export of products to the EU Member States, CIS and Asia also develops. In order to receive and keep competitive positions at domestic and foreign markets, it is necessary: to use available raw materials capacity (wood wastes, husks, straw, peat, etc); to increase the number of companies participating in the bioenergy market in the regions with secondary raw materials available for processing through state stimulation of the branch (concessional lending, abolition of technology import duties, etc); to attract foreign investors that can provide additional

[2] Assessment is based on key parameters of 2035 Energy Strategy of Ukraine, STC prognosis «Biomass» on the structure of solid biofuels consumption and prognosis of thermal energy production from renewable energies across various sectors by 2050.

impetus for the development of Ukrainian market of biofuels through transfer of management know-how and transfer of technological decisions; to expand infrastructural basis in the sphere of production and consumption of biofuels. etc.

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