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## **CROP PRODUCTION AS A STRATEGIC RESOURCE OF UKRAINIAN ENERGY**

*The article analyzes the possibility of Ukraine for the production of various kinds of biomass of basic and crop by-products for the production of biofuels. Strategic energetic resources of the state and their possible implementation are considered.*

**Keywords:** *biofuels, biomass, energy resources, crop production, energy storage*

**Introduction.** The main source of energy available to human is the energy of burning fossil fuels, oil, coal, natural gas and others. This path has its inherent disadvantages: limited and uneven allocation of energy reserves in the world and the rapid accumulation of carbon dioxide in the atmosphere of the planet.

Different countries have not the same level of personal energy supply. In particular, Germany - 59%, Italy - 16% France - 56%, Ukraine 54% [4]. Lack of domestic energy carriers are forced to compensate for the import of oil, gas, coal, etc., or develop an alternative sources of energy for their own territory.

Currently biofuels occupies a dominant role among the other alternative and renewable sources of energy, forming about 46% of the market, can provide production of heat, electricity and various types of solid (wood, straw), gaseous (biogas, hydrogen), liquid (ethanol, methanol, biodiesel) fuels.

**Analysis of recent publications.** The issue of energy sustainability and implementation alternative fuels devoted to scientific work V.I. Gavrishina, V.A. Dubrovin, H. Lins, G.M. Kaletnik, A.M. Schpuchak and other scientists.

However, further study needs to expediency and priority of the use of certain types of biomass plants.

**The purpose of the article.** Explore the available resources and potential of biomass available for energy production, which is owned agro-industry of Ukraine, in particular crop.

**Results of research.** People make their nature (unfortunately, mostly destructive), create arable lands for growing crops, destroying forests, polluting the water and atmosphere. The amount of photosynthesis agrophytocenoses (arable land cultivated plants of grassy and tree plantation) is less than 8% of the total biological productivity of the globe. Therefore, even today, people can deliberately create and use only a small fraction of energy in the energy balance of the planet.

While maintaining the rate of increase energy capacities time is approaching not only a strict regime of economy, but also by the traditional constraints of energy production and the transition to cleaner production through the widespread use of alternative renewable energy sources.

As an alternative to this process may be reasonable limitation of burning fossil fuels and energy technologies and improvement of production and processing. Another way is to use renewable energy sources that are transformed of solar energy: the power of the waves, wind, direct conversion of light energy into electrical energy, bio-energy plants that use natural way to accumulate energy through photosynthesis. The advantage of this method of producing energy is the fact that it does not give a result to increase the carbon dioxide contents in the atmosphere and quite ecological [6].

Burned traditional fuels increases the concentration of carbon dioxide in the atmosphere. Bioenergy crops are more eco source of energy. Among the renewable energy sources become increasingly developing biological energy or biofuels: biodiesel, bioethanol, biogas [2].

Currently, bioenergy can develop most rapidly. It is expected that the energy use of all types of biomass can provide an annual replacement of 9.2 million tons of standard fossil fuels in 2030, including through the use of the energy balance of

crops, including: straw - 2.9 million tons of fuel, wood and wood waste - 1.6 million tons of fuel, peat - 0.6 million tons of fuel [1].

The legislative framework of biofuels was begun in Ukraine after the sign of the Law "On Alternative Liquid and Gaseous Fuels" in 14.01.2000. The priority of this task is emphasized by the President of Ukraine "On measures for further development of fuel from biological raw material" in 26.09.2003.

The program of biodiesel production provides to ensure by the fuel agrarian sector and aimed to solving the following main tasks [7]:

1) creation of raw materials for the production of diesel fuel, including: development of energy-saving technologies of oilseed rape; rape cultivation area expansion, increase its productivity, creating areas of concentrated cultivation of rape in order to approximate sources of raw materials to the places of biodiesel production;

2) creation a technical basis for growing, storage and processing of oilseed rape, including: rationale selection of machines and equipment for manufacturing machine complexes for growing and storage of rape, oil production (to reduce the cost of production of raw materials).

Ukraine has favorable conditions for growing crops (rape seed, soybean, corn, sunflower, etc.) as a feedstock for biofuel production, providing requirement for a rape 10% agricultural lands and productivity of 25 kg / ha per year the country could grow to 8.5 million tons of rapeseed, recycling which provides access to over 3 million tons of biofuel annually. This will satisfy the current country needs in diesel fuel by 60% [3].

The main components of the energy potential are waste production of crops and energy crops. The most economic potential of agricultural residues are from sunflower and corn.

For Ukraine the most perspective is the growing of bioenergy crops: sugar beet, sugar sorghum, millet, miscanthus that provide receiving one hectare of fuel which is equivalent to 0.72 to 4.1 t / ha of oil.

Bioenergy plants traditionally meet certain requirements: high performance with photosynthesis and the ability to accumulate a significant amount of solar energy in the synthesized organic substances [6].

The sugar beet growing is perspective as can synthesize during the growing period up to 28 t / ha dry substance, especially sugars. The perspectives are other crops with intensive photosynthesis: maize, sorghum sugar. Valuable are plants that synthesize not only hydrocarbon compounds and vegetable fats and which hardly inferior in energy value of hydrocarbons from petroleum.

According to the Institute of Renewable Energy Academy of Sciences of Ukraine the annual total potential energy available for biomass production in agricultural of Ukraine is about 49.2 million tons of fuel.

Crop productions for biomass production are classified by types (Table 1).

*Table 1*

**Types of biomass in the structure of crop production**

Straw of crops	Type of biomass	Straw of rape
Wastes from the production of corn (stems, leaves, of corn starts)		Residues of sunflower production (stalks, sunflower, husk)
Raw material for biodiesel fuel (rape, soybean, sunflower)		Raw material for bioethanol (grain, molasses, potatoes, etc.)
Raw materials for biogas (silage, etc.)		Woody biomass

One of the main indicators of the suitability of a particular type of plants is an indicator of the total energy output per unit area per crop year of vegetation, the form of such biofuel and its energy value.

The most economically valuable are such plants that synthesize raw approximate to hydrocarbon compounds oil. Among agricultural plants grown in Ukraine, this plants of vegetable oils are: rape, sunflower, soybean, mustard, castor, etc. These oils after appropriate modifications can be used as a diesel engine, with a calorific value 35-37,6 MJ / kg. Out of such raw materials from one hectare of crops actually is 0.8-1.5 t / ha which is equivalent to 0,72-1,4 t / ha of diesel fuel oil [6].

Productive are plants that form the carbohydrate energy commodities: sugar, starch. Such materials can be transformed by fermentation and distillation to the ethanol. Fuel from bioethanol may have wide practical application as a supplement to traditional oxygen fuel from petroleum products and as a traditional fuel. Nevertheless bioethanol not deprived some drawbacks. Energy value of the fuel is only 65% to traditional gasoline.

The value of output per unit of cultivated area of the biofuels depends on the size and quality of the crop. For example, after direct recycling of sugar beet into bioethanol from biomass yield (60 t / ha of potatoes and 25 tons / ha of leaves) can be obtained 6,36 t / ha bioethanol which is equivalent to 4.1 tons of gasoline [5].

Besides liquid biofuels, which is the most energy concentrated and universal deserve attention to the plants of solid and gaseous fuels. For Ukraine perspective types of bioenergy plants are switchgrass and miscanthus.

For high biogas production output of finished energy products can be obtained from the cultivation of sugar beets, feeds, recycling organic, plants by-products.

The only way in the production of solid biofuels, which, in fact, employed today, is a segment of the production of pellets from straw. By experts estimate this raw material has enormous potential in Ukraine. The straw's pellets using is very small now because of equipment and technology lack for the correct straw collecting from the fields. Based on the example of Denmark, which is a world leader in the use of straw for energy purposes (the country burned annually to 14% of the produced straw), the calculation of fuel straw shows that at least five million tons of raw materials remains only after collecting cereal crops can be used in Ukraine for the production of fuel pellets.

Full utilization of these volumes for the production of pellets could contribute to economy on a national scale to three billion cubic meters of natural gas [8].

It is appropriate to mention that the current technology in the field of biofuels allows to dispose and recycle of valuable pellets and briquettes not only straw, but also any other biomass: corn cobs and stalks, sunflower stalks, and more.

Today the "straw" trend is slowly gaining speed in Ukraine. The company "Smart Energy", which belongs to the group of "Smart Holding", has launched in autumn 2012 a powerful new plant for production of fuel pellets "Vin Pellets" in the village Turbiv Lypovetsky region of Vinnytsia oblast. The first stage of the plant production capacity of 75 thousand tons / year is commissioned. To its final capacity - 150 tons of pellets per year plant expects to come out in 2013. The raw material for the production of pellets is straw crops that will be procured in five districts.

Further holding company expects to continue construction of plants for the production of fuel pellets in different regions of the country and bring their numbers up to ten companies a total capacity of 1.5 million tons per year, taking into account the potential reserves of straw in the country corresponds to about 15% of its use.

**Conclusion.** Economic feasibility of growing crop production as a feedstock for biofuel production in the country is not in doubt. Using biomass energy of plant origin in order to cover the needs of agriculture in the production of heat, electricity and various types of solid, gaseous, liquid fuels, must be consistent and reasonable, taking into account international experience achieved in combination with keeping the balance between food, feed and energy using products grown.

### **Bibliography**

1. Енергетична стратегія України до 2030 року від 15.03.2006 № 145-р // Електронний ресурс: <http://zakon4.rada.gov.ua/laws/show/145-2006-%D1%80>
2. Енергоефективність та відновлювальні джерела енергії (за ред. А. К. Шидловського), К.: видавництво «Українські енциклопедичні знання», 2007. – 559 с.
3. Енергоефективність як ресурс інноваційного розвитку: Національна доповідь про стан та перспективи реалізації державної політики енергоефективності у 2008 році / С. Ф. Єрмілов, В. М. Геєць та ін. – К.: НАЕР, 2009. – 93с.
4. Інноваційні пріоритети паливно-енергетичного комплексу України, НАНУ, видавництво «Українські енциклопедичні знання» - К.: 2005, - 491с.

5. Калетник Г. М. Розвиток ринку біопалива в Україна: Монографія. – К.: Аграрна наука. – 2008. – 464 с.

6. Рослинництво як основа виробництва біопалива / О.О. Іващенко, О.О. Іващенко / Електронний ресурс:

[http://archive.nbu.gov.ua/portal/Chem\\_Biol/znpicb/2011\\_12/02-24.PDF](http://archive.nbu.gov.ua/portal/Chem_Biol/znpicb/2011_12/02-24.PDF).

7. Програма розвитку виробництва дизельного біопалива від 22.12.2006 № 1774 //Електронний ресурс: <http://zakon4.rada.gov.ua/laws/show/1774-2006-%D0%BF>

8. Навіщо Україні біопаливо з соломи і насіння / В. Андрієнко / Електронний ресурс: <http://news.finance.ua/ua/~2/2013/06/05/303122>

### **Анотація**

**Марчук У.О., Чудак Л.А.**

***Продукція рослинництва як стратегічний ресурс української енергетики***

*У статті проаналізовано можливості України щодо виробництва різних видів біомаси основної та побічної продукції рослинництва для виробництва біопалива. Розглянуто стратегічні енергетичні ресурси держави та можливості їх реалізації.*

**Ключові слова:** біопаливо, біомаса, енергетичні ресурси, рослинництво, енергетичні носії

### **Аннотация**

**Марчук У.А., Чудак Л.А.**

***Продукция растениеводства как стратегический ресурс украинской энергетики***

*В статье проведен анализ возможностей Украины относительно производства различных видов биомассы основной и побочной продукции растениеводства для производства биотоплива. Рассмотрены стратегические энергетические ресурсы страны и возможности их реализации.*

*Ключевые слова: биотопливо, биомасса, энергетические ресурсы, растениеводство, энергетические носители*