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AGROBIOMAS AS THE ENERGY POTENTIAL OF UKRAINE

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Nowadays energy safety is one of the most important parts of the national economy since only reliable use of fuel energy sources enables relevant operating of all economical (and on basis thereof — public) institutions. Without any doubt it can be stated that energy sector is a basis for almost every activity in modern world and plays a crucial role in economical progress of a country, moreover it provides foundation for sustainable development of a society as a whole.

Nonetheless considering the energy safety of a country (society) to be completely reliable in every socio-political situation is a great mistake. In the

context of globalization (first of all under conditions of competitive development of polycentric world) positions of states being the energy donators are characterized by increased instability, unpredictability, and political selfishness.

Consequently, the countries which were and are the energy recipients must build their own systems of energy safety which become effective enough to balance dysfunctional influences (challenges, threats, dangers) which are created by international environment [1].

The task of reducing of energy dendence can be partially solved by developing the effective energy safety programmes and the alternative energy sector in Ukraine. According to Energy Strategy for 2030, the alternative energy share should reach 20 %. The main directions of alternative energy in Ukraine are wind power, solar power, bioenergy and hydroelectic power [1].

High and unstable oil and gas prices, the necessity in more economical consumption of fuel reserve, the necessity to protect the environment and solving the problems of climate change cause the need to find alternative energy sources, in particular, to expand the energetic use of biomass. Its main components are straw and other agricultural waste (stems, pots, husk, etc.), as well as wood waste, liquid fuels from biomass, different types of biogas and energy crops [2].

It is projected that by 2023 the EU land available for cultivating energy crops will grow to 20.5 million ha, and by 2030 – to 26.2 million ha.

Energy crops are very important for the bioenergy sector of the European Union. European Biomass Association (AEBIOM) estimates the current potential of energy crops in the EU as 44-47 Mtoe/y. One of the EU 2020 targets is to reach 138 Mtoe of biomass in the gross final energy consumption that corresponds to 14% of GFC. The available potential of energy crops allows covering about 1/3 of the target [3].

In Ukraine, only 2.5% of the energy consumed from its total volume comes from biomass, while in Western Europe – about 12%, and in a number of Scandinavian countries – from 17% to 40% [4].

Currently, the world has accumulated enough extensive experience in the use

of vegetable waste agricultural production, primarily straw, for energy purposes. When burning 1 ton of straw, about 3 MW of thermal energy is exuded, which means replacing 333 cubic meters of gas. The recognized leader in this sector of bioenergy is Denmark, where from 6 million t of straw annually produced nearly 1.5 million t are burned down for energy production (~ 17 PJ / year) [5].

In the UK (Ely) there is one of the most powerful straw power plants in the world – 38 MW. The straw of grain crops, the volume of about 200 thousand t/year, is the main fuel of this TPP. Straw-fired power plants are also implemented in Spain [6].

In Poland, there are about 100 small-capacity straw boilers (~ 100 kW) and more than 40 not large and medium-sized boilers in the district heating system (0.5-7 MW) [7-8].

In Sweden, the straw market as a fuel is in the process of development. Currently, the country has a relatively small number of straw boilers and boilers in the district heating system [9].

Ukraine has some experience in energy and biofuels production from straw. About 100 boilers and heat generators for straw bales are in operation in rural areas of the country. About 45 of them are the boilers manufactured by UTEM (Ukraine), 10 units are the boilers of Faust and Passat Energy (Denmark) make, the others are heat generators of Brig (Ukraine) make. Total installed capacity of the equipment is estimated as 70 MWth. The sector of solid biofuel production from straw is also developing: in 2012, 21,700 t of pellets and 2,000 t of briquettes were produced in the country. The first part of Vin-Pelleta, a new factory, started its operation in Vinnytsa oblast (Ukraine) in autumn 2012. Its productivity is 75,000 t/yr of straw pellets. In 2014 the factory reached its design productivity of 150,000 t/yr. Smart Energy, the owner of Vin-Pelleta, is planning to build 20 factories for the production of straw pellets in all Ukraine’s regions. Total productivity of the factories is supposed to be 2.5-3 Mt [17]. In addition, KSG Agro (a Ukrainian agricultural holding) started the operation of a factory for straw pellets production in Dnipropetrovska oblast (Ukraine) in 2014. The agricultural holding is going to

use its own feedstock for the pellets production. Further plans include construction of another two factories, in Dnipropetrovska oblast.

Straw is a waste product of cereal crops production. The ratio between the grain part and straw is about 1:1 (except for corn, for which the ratio is 1:1.3) therefore the annual amount of straw is close to the production volume of cereal crops in Ukraine. During harvesting the grain part of a crop is detached from the stalk, and the way of collecting straw depends on the technology applied. Some part of the straw is left in the field as stubble remains to be plough back into the soil later on.

The following technologies for collecting straw of spiked grains are applied in Ukraine:

- “Streaming” technology. Straw is shredded by a combine harvester, collected in replaceable trailers and transported to a storage place. If the trailer is not available, the straw is scattered over the field.

- Stacking technology. Harvester-stacker makes stacks of 150-300 kg and they are discharged onto the field on the stubble remains. The stacks are collected from the field by rope sweeps or by push sweeps. If stacks are formed (shaped) as blocks, they are taken out of the field by stack-movers.

- Swathing technology. Straw is swathed by a combine swathe. There are different ways for collecting swaths, one of which is baling.

- “Spreading” technology. During cereal crops harvesting, straw is shredded and spread (scattered) over the field.

The swathing technology of straw collection provides for further baling. It is important for the case of transporting straw at middle or relatively long distance and the use as a fuel. Baled straw can be stored under a shed or indoors that protects it from moistening and contaminating. Baling considerably reduces the volume of straw and allows mechanizing some operations during straw handling and transportation.

For the wider introduction of straw energy equipment in Ukraine, it is necessary to switch from streaming technology of the straw harvesting to swathing

technology with its further baling.

The collected cereal straw is utilized in different ways: as litter and fodder for cattle, as organic fertilizer, for growing mushrooms in hothouses, and also for energy purposes (direct combustion in boilers, production of pellets/briquettes). The unutilized remains, which altogether make up quite big volume all over the country, are often burnt on the field that is legally prohibited in Ukraine and harmful for the environment and soil [9].

Just after harvesting, the moisture of cereal straw is 15-20% (heating value Q = 12-15 MJ/kg). If straw is left on the field for some (rather long) period of time 11 its moisture drops to 14-17% (Q = 14-15 MJ/kg); content of chlorine and potassium decreases due to washing-out that improves the quality of straw as fuel. For combustion in boilers, straw moisture content must be below 20%, for pellets production it should be below 12-14%.

The fuel characteristics of biomass of agricultural origin are specific and differ from wood biomass (that is are worse), which requires a more thorough approach to the choice of energy equipment and the organization of the process of combustion. For example, straw contains chlorine and alkali metals, which means that in the process of its combustion, some chemical compounds such as sodium chloride and potassium chloride are formed. These compounds cause corrosion of steel elements of energy equipment, especially at high temperatures. Another feature of straw as a fuel is the relatively low melting point of ash (900 – 1000°C), which can lead to the slugging of elements of energy equipment. Fortunately, today in the world there already exist some constructive and other technological solutions that minimize these negative impacts and allow to use straw as a fuel successfully [7].

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ЕКОНОМІЧНА ДОЦІЛЬНІСТЬ ТА ПРОДУКТИВНІСТЬ ТЮТЮНУ ЗАЛЕЖНО ВІД СИСТЕМИ ЖИВЛЕННЯ В ГРУНТОВО-КЛІМАТИЧНИХ УМОВАХ ЛІСОСТЕПУ ЗАХІДНОГО

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Вступ. Впродовж останніх восьми років спостерігається тенденція до розширення площ під тютюном в Україні, зростає науковий та практичний інтерес до вирощування культури. Наукова спільнота сьогодні вивчає різні питання агротехніки вирощування тютюну в різних ґрунтово-кліматичних умовах України.

Науковцями Тернопільської державної сільськогосподарської дослідної станції ІКСГП НААН встановлено ефективність застосування інсектицидів Фастак і Конфідор максі при вирощуванні тютюну [1]. Удосконалена екологічно безпечна ресурсоощадна технологія вирощування тютюну, на думку Пащенко В. та Гаврилюк О., може включати застосування проти злакових бур’янів гербіциди Фюзілад Форте та Тарга Супер [2]. В умовах Хмельниччини вивчався вплив системи удобрення та кількості проведених ломок на урожайність листків на насіннєву продуктивність різних сортів тютюну [3, 4]. Значна увага приділяється створенню нових сортів тютюну. Глюдзик-Шемота М.Ю. у своїй науковій статті здійснив аналіз та узагальнив результати досліджень науковців різних селекційних установ, що дозволило