



Situation and perspectives of waste biomass application as energy source in Serbia

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ABSTRACT

The Autonomous Province of Vojvodina is an autonomous province in the Republic of Serbia. It is located in the northern part of the country, in the Pannonia plain. Vojvodina is an energy-deficient province. The average yearly quantity of the cellulose wastes in Vojvodina amounts to about 9 millions tons barely in the agriculture, and the same potential on the level of Serbia is estimated to almost 13 million tons. Only minor part of straw is utilized, and almost two-thirds are incinerated on fields owing to the problems during plowing under. The large sector in Serbia utilizes only about 15% of straw, while the individual one utilizes about 50% of straw and 20% of cornstalks. Environment pollutions, abandonment of the utilization of at least of one-third of the yield and extermination of the natural resources, primarily of humus, represent very adverse results of such procedures. Main problems with respect to the profitable usage of straw and other post-harvest residues are high expenses of their collection (collecting, balling or some other manner of compression), transportation from production- to the usage cites, as well as their handling and storing. The agricultural production in Serbia should be based on the system of farms. For the efficient farming, it is obvious to organize life of producer and of his family immediately close to the production capacities. For the agriculture development, it is obvious to create a system of premiums, efficient crediting and the elaborated tax system that could create a basis for the certitude of work, confidence and constant growth of production, together with the mentioned and other measures. As the result of the activities oriented to substitution of the classical energents with energy obtained from biomass, farm that is in a higher degree energetically independent should be created. In such case, farms should apply the basic principles of the cleaner manufacturing, as an integral part of the concept of the sustainable development.

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1. Introduction

The Autonomous Province of Vojvodina is an autonomous province in the Republic of Serbia, with about 27% of its total

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population according to the 2002 Census. It is located in the northern part of the country, in the Pannonia plain. Vojvodina is an energy-deficient province.

Because the energy, irrespective in which form, represent basis for human activities, the increased needs and consumption of energy is always present. On the other hand, actual structure of the primary energy resources cannot assure such a tendency on the global level. The limited reserves of fossil fuels, especially of the crude oil, whose reserves are estimated to last for a period of 30–40 years, instigate the humanity to turn itself to search for supplements of oil and of its derivatives. With the global energy crisis, global ecological problems are intimately related. That fact is that the existing period of the depletion of the existing oil reserves would be decreased to less than 10 years, if the whole mankind of the Earth would increase its energy consumption to the level that exist in countries of the developed World. Natural energy reserves on the Earth are considered to be practically inexhaustible, but the existing technological basis uses these resources in an extremely irrational manner. The application of these abundances of energy is stipulated with the directions of development of technology and economy. This is especially evident that in Serbia, as well in the World, the always accessible, and today drastically ignored, huge quantities of energy could be obtained by the conversion of organics. Only the plant that grow on the Earth contains more than 18,000 billion of tons of the dry substance, whose energetic equivalent amounts to 30×10^{21} J. Yearly production of the plant biomass owing to the photosynthesis amounts to 173 billion of tons of the dry substance. The European Union prescribed that by the end of the year 2010, participation of biomass in the commercial energy has to be increased from the programmed 6% to 12%. Applying this program, some countries in Europe yet use some 20% of their commercial energy obtained from the biomass (Austria, Sweden, Finland), and in the underdeveloped countries this figure reaches up to 5% [1].

The increase of energy consumption rate in Serbia is relatively high (6–7% yearly) and with the reserves of the primary energy it is about six times poorer than the World's average. The use of biomass in Serbia is significant not only with respect of the momentary solution of the energy deficiency problem, but, even more, with respect to unavoidable depletion of the fossil fuels and the ever increasing problem of the global warming owing to the CO₂ emission. The additional weight for considerations of the renewable energy sources generally, and especially in the case of Serbia, makes the process of adaptation and of preparing of Serbia for the inclusion into the European Union.

The general concept of the biomass is very wide and it includes the biomass of plant and of animal origin. However, according to the estimations, of the total quantity of biomass produced in the World, less than 4% is utilized. Approximately 1.2% of that quantity is used for food and feed, some 1% for pulp and paper production and only about 1% for the energetic purposes, that is, for fuel. Unfortunately, the energetic application of biomass is mainly limited on wood as a fuel for direct combustion, what in the majority of cases is not ecologically justifiable and what cannot be considered as a basis for further increase of application of biomass [2].

2. Waste biomass

Waste biomass, that is considered as a potential energy source, can be divided on biomass originated in the forestry and the biomass generated in the agriculture. The waste biomass, generated in the agriculture, can further be divided according to the agriculture branches on biomasses from field crops cultivation, or from orchards and vineyards, and that from the livestock cultivation. In spite to the fact that this very last waste represents

waste directly originated by the animals, owing to the fact that it contains organic substances that basically are of the plant origin, it is considered to be the biomass. The field crops cultivation biomass is the largest potentially available biomass and it is contained in the residues obtained during the primary harvesting of the field products [2].

The primary advantage of the waste biomass as an energy source represents not its huge potential, because it is only to the limited degree usable, but in its renewable nature. Its renewable characteristic is a reason for its preference with respect to the classical, fossil fuels that must be, in the relevant period, be considered as non-renewable, and, as such, could not represent the basis of the sustainable development, which includes the rational energy consumption as well.

The average yearly obtained of the (lygno) cellulosic wastes in Vojvodina make some 9 million tons only in the agriculture, and the same potential for Serbia is estimated to be just something less than 13 million of tons. Only small part of straws is utilized, and about two-thirds are combusted on the allotments, due to the problems connected with their plowing under. The accustomed combustion of the post-harvest residues means not only wastes of the organic substances and of considerable energetic value contained in it, but also the destruction of humus and annihilation of microorganisms from the surface layer of soils. Besides to that, the combustion of the post-harvest residues lifers not only carbon into the atmosphere, but also the other significant biogenic elements, such as nitrogen and phosphorus. As the combustion residue remains only ash, containing only mineral substances, which, by the greater part, are less acceptable to the plants. Very inconvenient is also the fact that, during the combustion of the post-harvest residues, the best combustion properties have the most valuable parts of plants, i.e. the leaves, having more convenient chemical composition, and the stalks incinerate harder. The combustion of the post-harvest residues need the significant quantities of oxygen and at the same time, contaminates the environment with smoke and ash, and annihilates, besides to the harmful, also the useful animals. Combined with the intensive exploitation of the agricultural soils and minimal utilization of organic fertilizers, all these factors permanently degrade the agricultural soil. Besides, the other unacceptable consequences appear as well. In spite to the abundance of the harmful consequences, the incineration of the post-harvest residues on parcels where they were originated represents often-found appearance. Under the conditions of the inadequately developed livestock cultivation in the agriculture of our country, the agricultural wastes find not their application on the field crops cultivation, so that they represent the worthless ballast. The crucial significance for this phenomenon has also the fact that, for the successful ploughing under of the post-harvest residues, such as corn stalks or the sunflower stems, the appropriate mechanization is needed, whose utilization necessitates definite spending of human work and funding. In order of the avoiding of such spending and problems, the simplest, and at the same time ecologically, on the long term economically the most inconvenient solutions, in the form of incineration on parcels, is applied. To this harmful practice contributes also the fact that, together with combustion of the post-harvest residues, some benefits owing to the annihilation of weeds and pests are achieved, what contributes to the easier primary cultivation of soils.

Because of that, the significance investigation of the possibilities of the energetic uses of the post-harvest residues is more than the simple technological progress, as it represents the alternative way that the undeveloped countries have to choose. In order of enabling the chose of the right orientation of such one development, it is unavoidable a priori to create the technical and

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