

**ASPECTS REGARDING THE ROLE OF AGRICULTURE IN THE PROVISION OF  
RENEWABLE ENERGY RESOURCES**

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*Abstract: Finding solutions in order to accommodate the needs of renewable resources and to stop the pollution and degradation of the natural environment has become one of the characteristics of the contemporary world. The concept of sustainable development is the concept which brings about this concern and encloses responsibly in addition to care for the welfare of future generations, also the concern for the efficient use of renewable resources. A special category within the framework of the energy resources is the energy crops. Energy crops are crops that have a high density and are used in the combustion plant for the production of heat. Taking into consideration that in Romania there are areas of land that are uncultivated and exposed to degradation, their use for energy crops represents a successful deployment of the sustainable development strategy of Romania. In the countries of the European Community, obtaining the biofuels from energy crops is a frequent practice, one can notice a trend where the entire quantity of biofuels obtained in the EU are to be obtained from energy crops. This article, through the use of methods as well as the study and analysis of strategic documents in the field, the comparison and interpretation of statistical information is intended to reflect the way in which the Romanian agriculture can provide renewable energy resources.*

*Keywords: biogas, biofuels, biomass, energetical plants, sustainable development*

**Introduction**

The agricultural sector of the economy in the world has a major contribution to the welfare of society providing the foundation of existence and of sustainable development. Due to its potential, agriculture provides raw materials to ensure the needs of food for humanity, as well as resources for the production of green energy, energy which has no negative impact on the environment. The renewable resource with the largest potential is biomass. The concept which balances the ratio of economic growth, natural capital, and other aspects of the social nature, is the concept of sustainable development. This concept, which was initiated in The Report of the Commission Brundtland, in 1987, is defined as being the model of development that *"aims to meet the needs of the present without compromising the ability of future generations to meet their own needs"*<sup>1</sup>. Together with the enhancement of the crisis of conventional resources, the population growth and also the deterioration of natural environment, the concept of sustainable development has been consolidated, so that, starting from the year 1997, sustainable development has become a priority policy of the European Union.

**Agriculture, source of raw materials for renewable energy**

In a sustainable economy, economic growth is achieved by integrating the principles and practices of sustainable development in all sectors of the economy. Therefore, sustainable agriculture, developed as a reaction to the performance-intensive agriculture, but unsustainable, aims to optimize the productivity of resources, while at the same time, the conservation of natural resources, *"generates a series of services of the ecosystem, such as the management of non-*

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<sup>1</sup>Raportul Comisiei Mondiale pentru Mediu și Dezvoltare "Viitorul nostru comun", 1987

*cultivated areas, conservation of Biotopes, the supply of fresh water of good quality as well as the ability to store carbon and other nutrients in the soil<sup>2</sup>*. In order to protect the natural capital and also as a method to combat environmental pollution, with gases with greenhouse effect, exploiting the potential of renewable energies is essential for a sustainable development. The main feature of renewable resources consists in *their capacity of continuous regeneration, under conditions of normal life of the ecosystem in which they are found<sup>3</sup>*. In the Strategy for Sustainable Development of Europe, it is expected that by the year 2020, the renewable resources to contribute with 20% to the production of energy of the EU. In the illustration below, it should be observed, the expected contribution of each type of renewable resource to energy consumption of the countries of the EC.

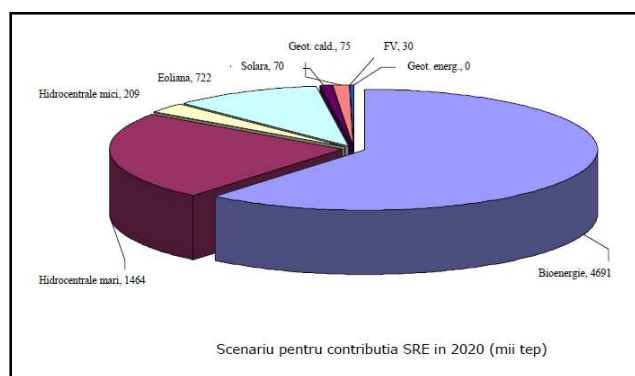


Figure.1 Contribution of renewable resources to the energy consumption of Europe  
 Source: Action Plan for biomass

The most substantial contribution to the production of energy from renewable sources is that of biomass.

*Biomasses defined in The UE Regulation nr.1782/2003, art. 88 “as the degradable part from waste and residues from vegetal agricultural products, forestry and related industries, as well as industrial and municipal waste and debris”<sup>4</sup>*. One of the oldest uses of the biomass is the generation of thermal energy, obtained by combustion, and through industrial processing, and specific procedures, like pyrolysis, combustion or fermentation, the biomass harvest, is converted to liquid or solid fuels, also called bio-fuels. The countries with the highest production of biomass are: France, Germany, and Sweden. In Romania, production of energy based on biomass<sup>5</sup> has a share of 0,62 % of the total production of energy, due to the high cost, the function of the processing plant to biomass. The largest quantity of biomass is produced in agriculture, as can be observed in table no.1

Table no.1 Agriculture source for bioenergy

Domain	Resource	Fuel category	Fuel quality		Conversion technology
			Water content	Ash content	
	Agricultural	Dry ligno-cellulose	30-50	2,2-17	combustion gasification

<sup>2</sup>The European Parliament The Council of the European Union

<sup>3</sup>F.Bran, 1997, Politici ecologice, Editura ASE, p.19

<sup>4</sup>Wijkman A.,Rockstrom J., 2013, Fermentation of Nature, Compania Publishing House, Bucharest

<sup>5</sup>Romanian Association of Biomass and Biogas

Agriculture	residues				n liq uefying
	Z oo technical residues	Wet cellulose	7 4-92	27, 1-35,4	dig estion
		Dry ligno- cellulose	7 5	17, 5-28	co mbustion gasificatio n liq uefying
	E nergy crops	Oils eeds	- 02	<0, 02	ext raction
		Cro ps for ethanol	- 02	<0, 02	fer mentation

Source: Agricultural Engineering Review

The biomass contributes to a decrease in the pollution by 70% more than the fossil fuels. However, processing of biomass includes a series of related activities which generate, depending on the type of energy produced, different amounts of carbon dioxide. Thus for:

- 1 MWh of thermal energy is released into the atmosphere 86 kg of CO<sub>2</sub>;
- 1 MWh of electric energy, based on biomass, determines 201 emissions of CO<sub>2</sub>;
- 1 MWh bioethanol is formed 78 kg of CO<sub>2</sub>;

Romania has a large potential for biomass, evaluated at 518439TJ/year, generated by the different categories of sources like:

- residues from forest exploitation and fire wood (1175 thousand tep);
- wood waste, sawdust and other wood chips (487 thousand tep);
- agricultural waste arising from the grain and corn stalks;
- vegetable waste of grape vine (4799 thousand tep)
- biogas (1588 mii tep)
- household waste (545 thousand TEP)

*Biofuels* are obtained by the processing of the biomass crop. Solid fuel in the form of briquettes or pellet is obtained by pressing and pelleting the biomass. The most used biofuel is biodiesel, which is obtained through the chemical reaction between the lipid contents, of vegetable origin, and is used in a mixture with diesel fuel or in the original status. The production of biodiesel owns 80% of the production of biofuels in Europe and has the advantage compared with biodiesel from oil, that is biodegradable and does not pollute the environment. Crops intended for the production of biodiesel, are cultures of rape, sunflower, palm. Bioethanol, also called ethyl alcohol obtained naturally, is the result of the fermentation of saccharides products. The crops used to obtain bioethanol are: wheat, maize crops and crops from beet. The countries with the highest production of biofuels are: USA- producing bio-ethanol from maize, Brazil - bioethanol based on cane sugar, the People's Republic of China- with Bioethanol on the basis of sorghum.

*Biogasis* obtained by anaerobic fermentation, at temperatures of 20-45 °C, of the biomass. As a result of the fermentation process we obtain a gas like product consisting of methane and

carbon dioxide, and a residual mixture, used for the fertilization of the soil. The uses of Biogas are multiple: it can be used in obtaining thermal energy, electric energy and in cogeneration with another resource, as biofuel, as bio methane through treatment and conditioning, and as bio fertilizer in agriculture. Because biogas contains 50% methane, has a pollutant character and contributes to the formation of the greenhouse effect.

In accordance with the laws of Romania, the promotion of the production of energy from renewable resources comprises several forms of incentives. So through the rewards system, energy production based on biomass benefits of the three green certificates for 1MWh energy delivered to a network, and for the production of biogas from waste shall be granted two green certificates. Also energy plant growers benefit from support schemes financed through European funds and government funds. Modifications of the laws on granting these forms of support and the bureaucracy necessary to obtain these forms of support are factors that discourage many potential investors in this field.

### **Culture of energy plants in Romania**

In Europe, particular in the East European countries, there are large areas of agricultural land, uncultivated, which could be cultivated with energy plants, Romania currently holds a surface of 800000 ha that are unused, in the various stages of the degradation.

Energy crops are used for the generation of thermal energy, have a high density, include species with high production efficiency. Energy crops come from:

- wooden plants as the willow, poplar and Paulownia tree
- annual grassy plants as cereals, cole, soybeans, cameline
- perennial grassy plants: the pampas grass, elephant grass

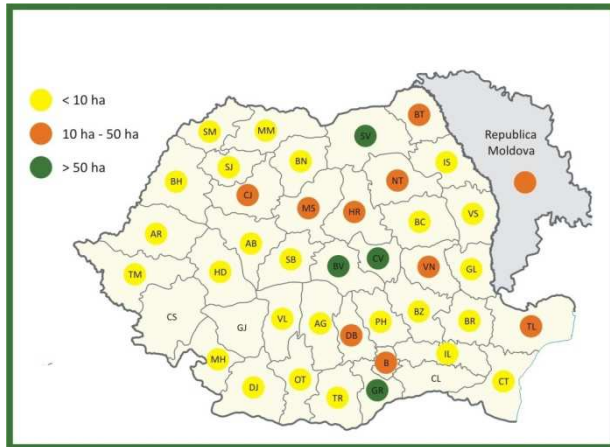
In addition to the fact that they give utility to uncultivated lands energy crops, they have multiple advantages such as: the opportunity for planting on marshy lands and sandy soils, increased resistance to the variation in the climatic conditions.

In Romania starting with 2011, the year, when the energy plants have become eligible in the unique payment per surface scheme, the area owned by these crops has expanded, so that 500 farmers have energy crops which occupy an area of 5000 hectares.

*Wooden species* of energy crops, used in the production of alternative fuel are willow and poplar. These crops have a growing period in rotation of maximum 3 years, maintenance costs are small, requiring minimal maintenance work at two years after their establishment.

*Energy willow* ( *salix viminalis* ), have a rapid growth of 3-3.5 cm/day, and has a high calorific value which reach up to 19000 kl/kg. In Romania, where the moisture content of the soil is 30%, we can reach an average production of 30 tonnes/hectare. The benefits of the cultivation of this species lies in the exploitation of frequently floodable land, the possibility of using them for the clarification wastewater, thanks to the evotranspiration capacity of 15-20l/m<sup>2</sup>, the willow crops harvesting shall be carried out during the winter months, as a result of high content of salicylic acid, the willow does not require closed storage conditions. The disadvantage of this crop is determined by the amount of the expenses with the setting up of the plantation, the reason for which, in Romania, the culture is part of the aid scheme. As can be noticed in figure 1., the largest plantations of energy *Salix* are in the counties: Suceava, Brasov, Covasna, Giurgiu.

*Figure.2* Total of plantations realised by KWG- Energy Willow

Source : KWG<sup>6</sup>



In comparison to the bio ethanol obtained from maize, soy-based bio fuel is the better, because it has high power efficiency and pollutes the environment to a lesser extent than the other cultures. Concerning the conditions of cultivation, soya beans grown in the month of April, requires irrigation during dry periods, and in the first stages of vegetation needs protection against pests. In the year 2017, in Romania, the area of land cultivated with soybeans, has been of 920000 hectares, obtaining a production of 430000 tonnes, with an average of 2400kg/ha. Romania has so situated on the second place of the soy top producer countries in Europe, the largest production of soya beans have been obtained in Romanian Plain, the centre of Transylvania, Banat and Botosani.

*Jerusalem artichoke*( *Helianthus tuberosus* ), is a plant used in food industry, pharmaceutical industry, as a fodder plant and as raw material for bio fuels. The Jerusalem artichoke is planted in March, presents resistance to pests, in dry periods needs irrigation, it grows well in meadow-like fields and for optimal productions needs hoeing 3 times per year. Setting-up and maintenance of culture of Jerusalem artichokes is advantageous. Because the tubers are predisposed to dryness, this plant presents difficulties at storage; the optimal solution for the storage of the tubers is in the ground for the winter period. The culture of Jerusalem artichokes has a yield of 120 tonnes per hectare. The underground tubers of such plants are used for the obtaining of bio fuel, and strains, are used to obtain pellet. In Romania the Jerusalem artichoke is cultivated in Buzau and Calarasi counties.

*Cameline* (*Camelina sativa* ) sometimes called the False Flax is the plant that can be cultivated on lands that are less fertile, it presents resistance to dry and cold temperatures, has a short vegetation period and can be cultivated in rotation with other cultures in order to increase the degree of fertilization of the land. Due to the fact that this plant has a high energy potential it is used as raw material for obtaining kerosene. Expenses for establishing one hectare of cameline culture are inferior to those of establishing cultures of wheat or rape. The production of seeds obtained from a surface of one hectare is of 2000kg cameline seeds, that after being processed, produce an average quantity of 650kg of bio kerosene. In Romania the surfaces of land cultivated with cameline are situated in Iasi, Calarasi, Sibiu, Satu Mare and Timis counties.

### Conclusions

The policies and programs relating to the use of biofuels in Europe have been determined by the depletion of fossil fuels, but especially by the large amount of gases with greenhouse effect, the fuels used in the field of energy and transport. The energy obtained from biomass as a renewable source of energy is not completely environmentally friendly, because of the related activities, with processing of biomass, but compared to the fossil fuels, is a highly superior resource. The ascendant trend of demand for biofuels on the market determined in many countries deforestation, the transformation of agricultural land, and the pastures, in land for energy crops, to the detriment of the crops intended for the food industry, having as effects: the increase in the prices of food products and the loss of biodiversity in the natural environment. Romania has the soil and climatic conditions that are hospitable for cultivation of energy plants, but the biggest impediments in the use of energy plants as raw materials for energy, are determined by the thick and inconsistent law, large expenditure with the means that are necessary for the establishment of production units from biomass, and the dividing of agricultural land, which does not make it possible to ensure a continuous flow of raw materials. Although establishing the cultivation of energy plants is supported by a number of different forms of subventions and bonuses, storage insufficiency and lack of production units in the country make the most of the harvest of energy plants to be exported to the detriment of satisfying the energy market in Romania.

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