RENEWABLE ENERGY AND GREEN ECONOMY AS A SUPPORT TO RURAL AREAS[1]

Svetlana Roljević, Predrag Vuković[2]

Abstract

Green economic development is based on the definition of national resources and identifies the most appropriate sectors of the state economy on its path to achieve sustainable development. As a realistic and promising way to achieve green economic growth in rural areas this paper highlights the use of renewable energy and agricultural biomass. The potential for farming and manufacturing, as the major source of agricultural biomass for the period 2001-2010 is analyzed, covering the Metropolitan area of the Belgrade-Novi Sad, which for this survey includes 11 municipalities. It was found that the most realistic source of agricultural biomass according to the current seeding structure, lays in the production of cereals, industrial crops and fruit. Appropriate use of these resources could attract new investments in rural areas, labor employment, less dependency on the national energy networks and revenue diversification on farms.

Keywords: *Sustainable development, green economy, renewable energy, rural development*

Introduction

Energy stability is the key to economic, social and environmental dimensions of social sustainable development (Dincer, 1999). Sustainable development requires a energy supply from renewable, cost effective and

[1] The paper represents part of a research project 46006: "Sustainable agriculture and rural development in order to realize the strategic goals of the Republic of Serbia as part of the Danube region" and 179028 "Rural labor markets and rural economy of Serbia - the diversification of income and reducing rural poverty" funded by the Ministry of Education and Science of the Republic of Serbia.

[2]Svetlana Roljević, Research Associate, Institute of agricultural economics, Volgina 15, 11060 Belgrade, e mail: svetlana_r@iep.bg.ac.rs, Predrag Vuković, MSc, Research Associate, Institute of agricultural economics, e mail: predrag_v@iep.bg.ac.rs, tel. 011/ 29 72 842

with no or minimal social impact resources. As the previous development of primarily economically powerful countries is based on the exhaustion of not renewable fossil fuels, thus no viable with reserves steadily decreasing, it is clear that further growth on such grounds is not realistic. On the other hand, nature provides green sources of energy sustainable over a long period and thus completely acceptable from the sustainable development viewpoint (Dincer and Rosen, 2004). The term renewable energy means energy sources that are found in nature and reproduced in whole or in part, particularly energy streams, wind energy, solar energy, geothermal energy, biomass and others. Dincer and Rosen (2005) point out that renewable energy resources and the development of supporting technologies can be a key component of sustainable development for three reasons:

1. Using green energy causes less impact on the environment than other energy sources, and a variety of green energy sources provides a wide range of its use;
2. If green energy sources are used rationally and in sustainable way it can provide reliable energy supply in almost unlimited period;
3. Favors a system of decentralization and local solutions that are somewhat independent of the national network enabling the realization of economic benefits, especially in rural areas.

In addition, the current global economic crisis and available increasingly scarce financial resources make a renewable energy more important because of the ability and aspirations investment from a number of different funds, which are seen as an opportunity, especially in developing countries. Because of all this renewable energy is the focus of a green economy that is seen as the realization of the sustainable social development fine direction concept (UNEP, 2011).

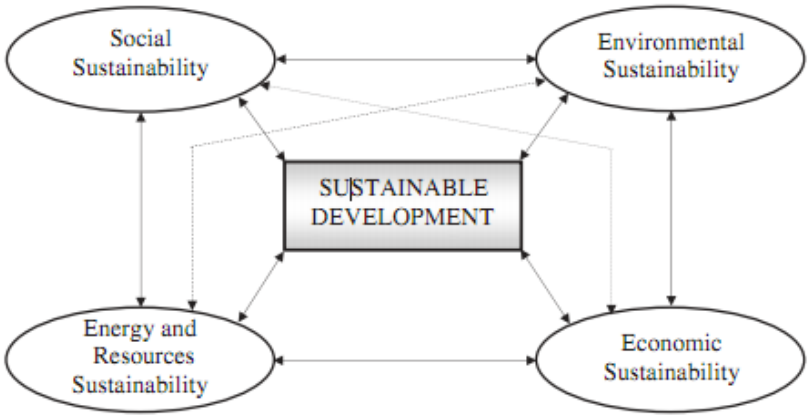
The concept of the green economy is not new, but in the last decade, it is more and more mentioned because of global interest growth in environmental protection. In addition, the last definition given by UNEP (2011) in its report "Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication" promote the role of this concept as a mean of achieving social equity and poverty reduction, especially in rural areas, where diversification and farm income through the use of renewable energy is considered as a chance. In rural areas, most of the natural resources are placed representing therefore a real basis for the production and use of renewable energy in exactly these areas. Regarding

the draft Rural Development Strategy Plan 2009-2013.rural areas in the Republic of Serbia comprises approximately 70% of the territory inhabited by 43% of the population and it is of great importance to the creation of favorable conditions for the greening of the rural economy through the available resources. The rural areas of Serbia represents a significant potential of agricultural biomass (solid, liquid and gas) which currently manages an inappropriate way, and it would be the correct policy, simultaneously, to support the use of renewable energy sources and encourage the development of rural areas.

The concept of green economy basis

Politics of renewable energy sources in the past few decades has evolved differently depending on the objectives of national interest in different countries and regions. Interest in the use of renewable energies with the increased awareness of the need for environmental protection appeared in first debate on the relative advantages of nuclear power over fossil fuels beginning in the 1960s. Even then it was pointed to the unsustainability of social development on reserves of fossil fuels and the need for finding alternative directions to meet energy needs. During the mid-1970s and 1980s, interest in renewable energy has increased as a result of the energy crisis caused by decreasing oil supplies and rising prices of other fossil fuels. Since the 1990s, interest continues to grow due to the expansion of concerns about the state of the environment on a global and local level, particularly after the publication of the report" Our Common Future" (World Commission on Environment and Development, 1987.) and the definition of the concept of sustainable development. Then the approval of a number of environmental agreements came such as the United Nations Framework Convention on Climate Change (1992), the Kyoto Protocol (1997) and many others who have supported the principles of sustainability. The focus of sustainable development pays an attention on three points: economy, society and environment, and the essence of a balanced relationship between economic growth, social progress and environmental protection. However, Dincer and Rosen (2005) offer a model by which sustainable development includes four pillars: environmental sustainability, economic, social and sustainability of energy resources (Figure 1). Through this approach the concept of sustainability, green growth strategy can be considered as an appropriate framework of policies.

Graf 1. *Factors affecting sustainable development and their inter-dependences*



Source: *Dincer I., Rosen M (2005;184)*

Justification placing sustainable development at the four pillars rose prior to the summit in Rio de Janeiro in the 2012 because they were increasingly able to hear the loud criticism that sustainability goals placed up in 1992. are not even half realized and there is a need to be approached in a more sophisticated and specific manner and alternative strategies for the development of society must be applied.

The concept of green economy to achieve sustainable development goals largely depends on changes in the economic sphere and is seen as a very realistic and promising direction for future development of the company. According to UNEP (2011) definition of a green economy as "the economy which results lead to improvements in human well-being and social equity, while significantly reducing environmental risks." The idea is based on transition to a green economy, growth in income and employment thus encouraging public and private investment in "clean production" - the new promoters of social development, with the aim of reducing emissions of greenhouse gases and pollution of the area, increasing energy efficiency and preserving biodiversity. Green economy represents a new impetus to the growth and generator of new jobs, as well as the necessary strategy for current poverty reducing, especially in rural areas. The basic assumptions and objectives of this concept can be defined in a few points:

1. Awareness of resource and energy efficiency, diversification of energy sources;
2. Sustainable production and consumption;
3. Sustainable use of natural resources;
4. Reduction of environmental pollution;
5. Conservation of biodiversity;
6. Fighting of climate change and desertification;
7. Create greater opportunities for sustainable development, including rising incomes, reduce poverty and improve the quality of life;
8. Clean energy, green jobs, economic competitiveness, and investments in renewable energy can benefit the entire population.

Based on the above it can be said that energy touches on almost all aspects of social development, and energy efficiency and conservation of natural resources is defined as the green economy and renewable energy sources pillar and green agriculture as a measure of its implementation (UNEP, 2011). Renewable energy can be an answer toward the challenges of the environment protection by reducing greenhouse gas emissions, and other socio-economic benefits in the form of equal population with energy supply can be achieved simultaneously creating jobs through investments in this area, which is in line with the principles of green economic development . Increased investment in renewable energy can be the backbone of economic development and energy security, especially in developing countries and their rural areas where the population is significantly dependent on traditional energy obtained using different types of biomass. Globally, the proportion of biomass in the total consumption of renewable energy dominates (Renevables 2012 Global Status Report, 2012) and this paper will discuss the potential of biomass as a natural energy resource.

The potential production and use of agricultural biomass in Republic of Serbia

According to Fischer and Schrattenholzer (2001) renewable energy sources can be determined theoretically, technically or economically. *The theoretical potential* is primarily determined by natural conditions and describes the amount of biomaterials that can be created during the year. *Technical potential* depends on the available technology and is therefore changeable as the technology matures. Economic potential is the most

variable as economic conditions fluctuate, sometimes dramatically over time.

Technically feasible renewable energy potential OIE in Serbia is significant and estimated at over 4.3 million tones of oil equivalent (toe) per year - of which about 63% of the total potential OIE is biomass utilization (2.6 million toe per year), 14% is the share of energy from small hydropower plants, share of 5% is wind power, 14% is the share of solar energy and a 4% share of geothermal energy (Regulation amending and modifying the Regulation on the Identification of the Energy Development Strategy of the Republic of Serbia until 2015. For the period 2007-2012). The share of renewable sources in total primary energy consumption in 1990 was 4.7% and in 2010. 8.2%, representing an increase of 64% at an average rate of 2.5% (National Report for the "Rio +20" with a focus on the Green Economy, 2012).

According to the EU directive 2003/30/EC dated 08.05.2003. under Article 2: "Biomass is defined as the biodegradable part of products, waste and residues from agriculture, forestry waste and related industries as well as the biodegradable components of industrial and municipal waste." It can be used for heat, electricity and fuel for transportation. The main characteristics of the biomass as an energy renew ability, calorific value and CO2 neutrality, but the main problem is the small value of the energy per unit mass and the biomass is processed to obtain a form suitable for transport and storage - biofuels (pellets, biodiesel, bioethanol, biogas). Biomass for energy can be used directly and indirectly.

- ✓ Direct use, often named as *the traditional use* of biomass, which is primarily related to the combustion process. The energy thus obtained is usually used for cooking, space heating and industrial processes. The direct use of biomass is the most prevalent in developing countries;
- ✓ indirect use or *modern commercialized ways of using biomass* are related to advanced processes of biomass converting into useful energy. This includes the creation or production of heat and electricity and is current in developed countries like the U.S. and the European Union.

According to Brkic et al. (2004, 2005), Serbian agriculture produces 12.6 million tons of biomass with the use of energy of 30 to 50% of this amount, which would mean 3 to 5 Mt of biomass, or 1, 0 to 1.6 Mtoe of

oil equivalent. In central Serbia, the largest potential renewable energy resources represent a solid biomass, while in Vojvodina it is represented by crop production remains. However, the same authors point out that over the past decade, the amount of biomass generated in farming, fruit growing and viticulture at Republic of Serbia was reduced by 19%, and the level of 32.3% is noticed in Vojvodina (Brkic and Janic, 2011). Although many difficulties affected the decrease in the volume of agricultural production, biomass in Serbia remains one of the most realistic sources of energy for the substitution of conventional fuels.

Lack of investment, modest cross-border cooperation in the field of renewable energy, and many other factors make the use of modern technology and the commercialization of green energy consumption imposible. Thus, agricultural biomass in Serbia is used primarily in industry primary in sunflower oil factories where in a specially constructed plant sunflower shell burns, usually in combination with dust silo and fossil fuel.

Among the other significant industrial users soybean plants "Sojaprotein" from Bečej, Is also important, burning soybean stubble in specially constructed boiler plant. In some cooperatives and farms bales of soybean and wheat or corn cobs to produce thermal energy for heating and drying facilities are used. When it comes to the use of biomass drying is commonly used for the grain crops, mostly corn seed, and for herbs. The most frequent users are individual households with smaller combustion chamber using different biomass in different ways for space heating. Diverse solutions for using thermal energy from biomass are represented: from individual furnaces for local space heating to smaller boilers for central heating of entire buildings.

Potential production of agricultural biomass in the Metropolitan area of Belgrade-Novi Sad

Metropolitan area of Belgrade-Novi Sad includes for this research the administrative area of the City of Belgrade (17 municipalities) and Novi Sad (2 municipalities) and the municipalities of the shaft Belgrade - Novi Sad, which gravitate to the Danube: Beočin, Irig Sremski Karlovci Inđija, Ruma, Pećinci, Stara Pazova, Pancevo and Smederevo. The goal is to analyze farming and fruit production and determine the production potential of biomass as an energy source.

According to the Statistical Office of the Republic of Serbia data from 2011. the Metropolitan area Belgrade-Novi Sad has 744,600 ha of agricultural land, which makes 72.5% of the area. Arable land makes up 95% of total agricultural land. The structure of agricultural land in this area is dominated by arable land with 84%, followed by orchards with 4.7%, pastures with 3.9%, meadows 3.6% and vineyards from 1.4%.

Analysis of data of the Statistical Office of the Republic of Serbia for the period 2001-2010. in the Metropolitan area of Belgrade-Novi Sad has underlined that the main potential for utilization of agricultural biomass for energy purposes primarily is in the cultivation of cereals, industrial crops and fruit, and in the efficient use of these production in the rest of the production of thermal energy and liquid biofuels (ethanol and biodiesel).

Cereals cover 63% of the arable area observed at an average rate of depletion of -0.7% in the last ten years. The most common crop structures are corn, wheat, barley and oats. Rye, and particularly triticale are in this area intensively cultivated since 2006., however, due to the given interval 2001-2010. the production of these two crops has not been analyzed in this paper.

Table 1. *Areas under most abundant grain in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in hektares*

Crop	Average value (ha)	Variation interval		Rate of change %	Structure %
		Min	Max		
Corn	189.191	181.660	202.481	0,84	64.57
Wheat	82.919	67.315	99.434	-4,00	28.22
barley	14.721	12.291	18.174	-2,96	5.01
Oats	3.576	2.868	4.208	-4,17	1.22

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

The crop structure is dominated with the corn covering 64.57% of the total area under cereals, with a slight increase at the rate of 0.84%. Wheat is the second most abundant crop in the structure, which is grown on approximately 82,919 ha.

Paradoxically, the increase in area covered with wheat globally, is not followed by one in Serbia and thus analyzed in the field, and it is constantly declining at an average rate of -4%. The smallest surface of bread wheat was sown in 2010. covering only 67,315 ha. Barley production is also getting smaller and the cultivation of this crop performs

an average of 14,721 ha. The structure of sowing accounted for 5%, and the surface is reduced by average rate of nearly 3%. Oats is the least represented in the crop structure, with only 1.22%, grown to an average of 3576 ha, while reducing size by an average of -4.17%. Because of the many problems in agriculture and the inability of an intensive and effective reduction of production area directly reflected in the total production of some crops, which is strongly expressed in wheat (Table 2).

Table 2. *The most common species of grain production in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in tons*

Crop	Average value (t)	Variation interval		Rate of change %	Structure %
		Min	Max		
Corn	981.683	687.284	1.191.449	2,13	71,75
Wheat	317.395	218.433	439.156	-6,00	23,41
barley	48.733	34.006	66.934	-4,31	3,58
Oats	7.374	4.229	9.440	-4,50	0,54

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

Only the corn has a positive average rate of total production movement of 2.13%. At the same time, corn and grapes makes actual production of wheat (71.75%), with an average of 981,683 tons. The high impact of weather variation to interval and lowest and highest scale maize production is very broad and ranges from 687-1200 tons, and the same goes for other crops.

Table 3. *Average yields most common species of grain in in Metropolitan area of Belgrade-Novi Sad in period 2001-2010.,in kg/ha*

Crop	Average value (t/ha)	Variation interval		Rate of change %
		Min	Max	
Corn	12.831	9.048	15.699	1,71
Wheat	5.480	3.578	7.349	-4,61
barley	3.292	2.151	4.512	-1,29
Oats	19.843	1.088	2.093	-2,51

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

Average yields of wheat in the observed area exhibit a tendency to decrease, most significantly expressed. Slightly lower average rate of -2.51% and -1.29% have oat and barley respectively. Slight increase in average yields in the period 2001-2010. was presented only in maize (Table 3).

Industrial crops are covering 12.2% of arable land in Metropolitan area, which are in the analyzed period increased at an average rate of 2.6%. Areas under industrial crops are most common in Pancevo, Novi Sad, Belgrade, Ruma and Pecinci. Given the increasing demand for oilseeds in order to feed, and biofuel production in the future is expected to be a significant growth area under these crops. The most significant growth area in the analyzed period is recorded in canola and soybeans, which can be a good basis for other than use of biomass and create conditions for proper cultivation of these crops for the production of liquid biofuels.

Area under rapeseed show growth at an average rate of 16.72% (Table 4). The largest increase was in 2007 when the rapeseed planted area 1.3 times more compared to 2006. In 2009. the oilseed rape was grown on 2657 hectares representing the record. Positive growth surface at an average rate of 6.08% recorded in soybean and so that it covers almost 40% of industrial plants and has grown to an average of 19,867 ha. Although no positive average change is noticed in the reporting period, sunflower, however, is significantly represented in the crop structure and a third of the area is under industrial crops. Sugar beet crop structure is represented with 21.84% of its surface and show a positive rate of change of 2.21% and the average of growth is placed on 11,051 hectares.

Table 4. *Areas under most abundant industrial crops in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in hektares*

Crop	Average value (ha)	Variation interval		Rate of change %	Structure %
		Min	Max		
Sugar beet	11.051	7.364	14.958	2,21	21,84
Sunflower	18.366	13.931	22.403	-1,52	36,64
Soybean	19.867	14.226	24.190	6,08	39,20
Rapeseed	1.188	162	2.657	16,72	2,32

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

Movement in the area is positively correlated to the production of crops listed. Thus, a positive average rate in the total production of all crops except sunflower, whose production is reduced, are noticed The total production of industrial crops has the largest share of sugar beet (83.57%) with an average output of 486,515 tons, while the share of oil one is at the minimum representing only 0.5%. In all crops variability in volume production is achieved as evidenced by the wide variation interval, referred to minima and maxima (Table 5).

Table 5. The most common species *industrial crops in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in tons*

Crop	Average value (t)	Variation interval		Rate of change %	Structure %
		Min	Max		
Sugar beet	486.515	328.037	672.916	4,56	83,57
Sunflower	39.510	29.618	51.456	-0,08	7,25
Soybean	49.697	33.930	72.396	8,79	8,68
Rapeseed	2.918	277	7.633	18,34	0,50

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

By observing the values of grain yields per unit area of individual crops it can be seen that growing of soybean and rapeseed made the biggest move in the adaptation of technology which resulted in an increase in earnings in the period observed (Table 6). Sunflower and sugar beet had no significant shifts in the average yields for the period and it can be explained by insufficient investment in raw materials, inadequate agricultural technology and application of high impact of weather conditions

Table 6. *Average yields most common species industrial crops in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in t/ha*

Crop	Average value (t/ha)	Variation interval		Rate of change %
		Min	Max	
Sugar beet	31.841	19314.39	36539.83	1, 02
Sunflower	1.978	1764.23	2259.63	1,19
Soybean	2.231	1694.34	2741.5	9,62
Rapeseed	1.279	571.65	2510.22	7,81

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

The use of agricultural biomass for energy producing in Metropolitan area of Belgrade - Novi Sad has significant capacity in farming and in fruit production. According to the RSO data from 2011. the fruit orchards accounted for 5% of arable farmland. Observing by the number of trees growing apples, plums, peaches, pears and apricots, in Belgrade, Novi Sad, Smederevo and Pancevo are dominated.

According to the given data reduction is noticeable for the number of pear and plum trees, while the number of peach and apricot trees grow (Table 7). According to the calculated average rate of change of 0.67% it can be said that the number of apple trees in the last ten years has stagnated.

Table 7. *Number of fruit trees, the most abundant species in Metropolitan area of Belgrade-Novi Sad in period 2001-2010.*

Fruits	The average number of trees	Variation interval		Rate of change %	Structure %
		Min	Max		
Apples	4.106.748	3.495.598	4.451.343	0,67	38,78
Pears	844.782	576.723	966.486	-5,58	7,98
Apricots	596.680	507.445	692.051	3,15	5,64
Plums	2.620.143	2.277.929	2.756.739	-1,66	24,75
Peaches	2.421.003	2.014.076	2.972.412	2,97	22,86

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

From the aspect of biomass energy efficiency this situation is quite favorable. Specifically Radojevic et al. (2005) point out that the remains of residual peaches and apricots have the highest heating value of 19.4 and 19.3 MJ / kg. In this sense, the use of these residues can be obtained by a solid amount of renewable energy to replace fossil on heating facilities in the farm (houses, barns, greenhouses).

Table 8. *Production of most common species of fruit in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in tons*

Fruits	Average value (t)	Variation interval		Rate of change %	Structure %
		Min	Max		
Apples	46.233	19.749	59.496	5,7	31,06
Pears	8.629	5.743	11.097	-1,21	6,00
Apricots	12.625	5.825	26.604	17,16	8,50
Plums	39.951	18.736	51.492	2,87	27,11
Peaches	39.594	26.366	52.301	7,02	27,34

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

In the structure of total volume of production the most represented species are fruit apple with 31.06% share, followed by peach and plum with 27.34% and 27.11% respectively. The share of the actual production of apricot and pear in total fruit production is low (Table 8). Observed through changes in the average rate achieved, most apricot production increases as a result of the number of its trees increase. According to the data of Table 8 a wide interval of variation in the volume of production of all kinds of fruits is visible.

Table 9. *The yield per tree most common species of fruit in Metropolitan area of Belgrade-Novi Sad in period 2001-2010., in kilograms*

Fruits	The average value (kg/tree)	Variation interval		Rate of changes %
		Min	Max	
Apples	16,63	6,42	22,86	4,28
Pears	12,67	5,57	17,02	1,13
Apricots	13,26	6,95	21,55	1,11
Plums	14,55	6,12	19,3	0,27
Peaches	14,59	9,64	18,5	3,56

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

The yield per tree of all these fruits have quite wide interval of variation as a result of weather events high impact in the production (Table 9). However, it is important that in this period there was no reduction of yield per tree proven by the calculated average rate of change. In all these species it is positive. The lowest increase in yield per tree in the analyzed period was recorded in the plum, and the largest in apple and peach. In addition, the average yield per tree in this area are higher regarding on average on the national level. Based on the average value of the acreage under different crops and their average yields in Table 10 gives an overall budget and the amount of biomass that could be used for energy purposes.

Table 10. *Potential production of agricultural biomass in the Metropolitan area*[3]

Crop	Surface 10^3ha	Yield t/ha	Total biomass, t	Biomass for energy purposes (30% of the total), t
Corn	189,2	12,9	2.427.510	728.253
Wheat	83	5,5	454.396	136.318,8
Barley	14,7	3,3	48.462	14.538,6
Oats	3,6	19,8	70.959	21.287,7
Sunflower	18,4	2	36.328	10.898,4
Soybean	20	2,2	44.324	1.3297,2
Rapeseed	1,2	1,3	1.520	456
The total crop production			3.083.499	925.049,7
Fruit	25.351	3,4*	86.193,4**	86.193,4
In total			**3.169.692**	**1.011.243,1**

Source: *Statistical Office of the Republic of Serbia and authors' calculations*

* Pruning residues yield per hectare, source: Brkic and Janic (2011)

** Total pruning residues mass during the year

[3] Residues in sugar beet (root head, tail root and leaf rosettes) have poor energy performance not used for energy purposes, as is the case with the remains of other crops mentioned bodies in Table 10. In technological terms the most significant is the root of sugar beet and it's used for bioethanol production

According to these data, the Metropolitan area has the potential to produce an average of 3,169,692 tons per year of agricultural biomass. If one takes into consideration that due to the maintenance of soil fertility for energy producing purposes the percentage 25-30% of the available agricultural biomass is reached, then annual yield in this area can count on the 857.068 - 1.011.243 tons of biomass used as an energy source, and that amount would change 0.26 million tons of oil equivalent. However, it might be counted on the change in the existing planting structure, for which certainly potential exists given the land resources in order to obtain sufficient material for serious production of liquid biofuels.

The advantages of using agricultural biomass as a fuel in development of rural areas

According to the OECD classification, rural areas in Serbia covers 85% of the territory with 55% of the population, while the national classification of rural areas cover 70% of the territory inhabited by 43% of the total population (Network for Rural Development Action Plan 2011-2015). Approximately 50% of the total rural population is employed in agriculture, which is a clear statistical indicator of low diversified activities of the rural sector, and therefore the income of the rural population (National Rural Development Programme 2011-2013.). Therefore, the diversification of economic activities in rural areas is crucial to mitigate "rural poverty", and exhaustion of natural resources and their sustainable use. Within agriculture it is possible to introduce new forms of production, such as the production and use of biomass for energy purposes. Available renewable agricultural resources will be not just simply transformed into food, but could be included in green agriculture and rural development.

Use of agricultural biomass in the Metropolitan area of Belgrade-Novi Sad represents the real possibility given the structure of plant production and availability of agricultural land. Calculated use of available crop residues would create conditions for the development of rural areas through self-employment, additional involvement of local labor for the production of energy from biomass, attracting investment and infrastructure development. In this way, the working population would be retained in rural areas and in sparsely populated and industrially underdeveloped areas. Production of renewable energy from biomass would require the association of farms in clusters in order to supply

sufficient quantities of raw materials and provide ongoing energy production, which has wider benefits in terms of greater access to innovative methods of production, the creation of new employment opportunities and better living conditions.

One of the first steps that must be done is to support farmers in the direction of a rational and appropriate use of agricultural biomass. If the increasing number of households are qualified to produce renewable energy from its own resources it would reduce the use of conventional energy sources on farms, increase reliability of energy supply, energy development, establish sustainable development and improve standards of living in rural areas, while the production of sufficient quantities of food will not been compromised. Intensive cultivation of energy crops will improve the overall profitability of the farming business, thereby increasing the profitability of agricultural production on the farm. In this way, it would significantly influence the development of the state, because the diversification of energy supply reduce dependence on imported fossil fuels and increase energy security.

In addition to all the advantages that its use should have to an economic and social point of view, its environmental aspects and appropriate use of agricultural biomass, primarily through reduced emissions of greenhouse gases released during the burning of crop residues in the fields, which is analyzed in a common area of practice, are very important.

Conclusion

Green economy is a new growth momentum that promotes economic development based on the recognition of national capacity and most appropriate sectors of the economy of a country on the path to achieve sustainable development. The focus of the green economy is on the ecosystem conservation, energy efficiency, establishment of social equality and poverty reduction. As the two most important areas for further resource development companies globally recognized green agriculture and renewable energy. In this sense, a great opportunity for development may have very rural areas, because most of the potential of renewable energy sources is actually located there. In the development of the rural economy in Serbia, as great potential, this paper highlights the production of renewable energy from agricultural biomass.

Analysis of the data of the Statistical Office regarding the Metropolitan area of Belgrade-Novi Sad leads toward conclusion that the main potentials for the use of agricultural biomass for energy purposes are primarily in the cultivation of cereals, industrial crops and fruit, and in the efficient use of the rests estimated to production of 3,169,692 tons of biomass. Bearing in mind the importance of the remains in maintaining and improving soil fertility, at least 25-30% of the total biomass potential or 857.068 - 1.011.243 tons, could replace 0.26 million tons of equivalent for energy purposes. With the current seeding structure use of biomass for heat and ethanol production is promising, while a change in planting structure by increasing the area under oilseeds create a solid base of raw materials for biodiesel production, The European Union toward we strive is a world leader in that segment. Through the use of agricultural biomass as an alternative energy source it would contribute to the self-employment, job creation and labor expansion, diversification of activities and sources of income holdings, and hence can greatly affect the development of the rural economy and poverty reduction, which is one of the goals of the green economy concept.

References

1. Brkić Miladin, Janić Todor (2011): *Procena vrsta i količina biomasa Vojvodine*, Ekonomika poljoprivrede, SB-1, Institut za ekonomiku poljoprivtrede, Knjiga 1, str. 54-59;
2. Brkić Miladin, Janić Todor (2005): *Poljoprivreda kao proizvođač i potrošač energije*, Savremena poljoprivredna tehnika, Nacionalno naučno društvo za poljoprivrednu tehniku, Vol. 31, No.4, str. 155-264;
3. Brkić Miladin, Furman Timofej (2004): *Obnovljivi izvori energije u poljoprivredi*, Traktori i pogonske mašine, Naučno društvo za pogonske mašine, traktore i održavanje, VoI.9.No.3. str.12-18;
4. Dincer Ibrahim (1999): *Environmental impacts of energy*, Energy Policy 27, 845–854;
5. Dincer Ibrahim, Rosen A. Marc (2004): *Exergy as a driver for achieving sustainability*, International Journal of Green Energy 1 (1), pp. 1–19;

6. Dincer Ibrahim, Rosen A. Marc (2005): *Thermodynamic aspects of renewables and sustainable development*, Renewable and Sustainable Energy Reviews No 9, pp. 169–189;
7. *DIRECTIVE 2003/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport*, Official Journal of the European Union, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF;
8. Gunther Fischer, Leo Schrattenholzer (2001): *Global bioenergy potentials through 2050*, Biomass and Bioenergy No 20, pp. 151–159;
9. Midilli A., Dincer I., Aya M. (2006): *Green energy strategies for sustainable development*, Energy Policy No 34, pp. 3623–3633;
10. Ministarstvo životne sredine, rudarstva i prostornog planiranja (2012): *„Studija o dostignućima i perspektivama na putu ka zelenoj ekonomiji i održivom rastu u Srbiji“,* Nacionalni izveštaj za Svetsku konferenciju o održivom razvoju „Rio+20”, Rio de Žaneiro, 20–22. jun 2012. godine http://www.ekoplan.gov.rs/src/upload-centar/dokumenti/projekti-i-aktivnosti/rio/studija_o_zelenoj_ekonomiji_i_odrzivom_rastu.pdf;
11. Network for Rural Development Action Plan 2011-2015) http://www.ruralinfoserbia.rs/dokumenta/akcioni%20plan%202011%20-%202015%20mreza%20za%20ruralni%20razvoj%20srbije.pdf;
12. *National Rural Development Programme 2011-2013.* ("Official Gazette" of the Republic of Serbia, No. 15/11);
13. Radojević Rade i saradnici, (2005): *Biljni ostaci rezidbe voćnjaka kao biomasa i obnovljivi izvor energije*, PTEP, Nacionalno društvo za procesnu tehniku i energetiku u poljoprivredi, Vol. 9; No. 3-4; str. 85-87, Novi Sad;
14. *Regulation amending and modifying the Regulation on the Identification of the Energy Development Strategy of the Republic of Serbia until 2015. For the period 2007-2012.* The "Official Gazette" of the Republic of Serbia, No. 27/10
15. Renewable Energy Policy Network for the 21st Century (2011): *Renewables 2011 Global Status Report*, Paris: REN21 Secretariat; http://www.ren21.net/REN21Activities/Publications/GlobalStatusReport/tabid/5434/Default.aspx;

16. Svetlana Roljević, Vladana Hamović (2010): *The significance of agriculture in strenghtening the energetic potential in Serbia*, Economic themes, Faculty of Economics Niš, No. 2/2010, pp. 217-230;
17. Statistical Office of the Republic of Serbia, internal database for the period 2001-2010.;
18. UNEP (2011): *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*, http://www.unep.org/greeneconomy/GreenEconomyReport/tabid/29846/language/en-US/Default.aspx;