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AGRICULTURAL DEVELOPMENT OF NIŠ DEPENDENT UPON SECURE ENERGY SUPPLY

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Summary

In order to achieve energy stability and sustainable development, it is necessary to secure the energy supply and improve efficiency of energy production and consumption at all levels. The increase of energy production from renewable sources will help deliver secure supply and can be one of the most attractive areas for foreign investment in the territory of Niš. Biomass, which is considered to be the greatest potential renewable source of energy in the city of Nis, has insufficiently been utilised. The authors of the paper highlight the importance of using biomass and consider the issues which arise from substituting conventional energies, such as securing the safety of energy supply, enhanced agricultural development and environment protection.

Key words: *agriculture, supply security, energy, renewable sources of energy (RSE).*

JEL: *K32, Q2*

Introduction

The trend towards replacing conventional sources of energy with renewable ones has improved the position and importance of agriculture in the overall economic development of Serbia. Agricultural production is important for two reasons it contributes to the overall economy delivering a positive social outcome through its contribution to total employment and it is a fundamental pre-requisite for the development of renewable energy. The current development of agriculture in almost all the parts of Serbia is characterized by two facts: the first is that agriculture is declining in gross domestic product as it is being replaced by other economic activities; the second is a consequence of this trend and of the modernization of the production process. Together they result in an absolute and relative reduction of employment and the agriculturally active population. For the improvement of agricultural production,

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the most important is to keep levels of population and agricultural areas as the two main resources.[3]

The fulfilment of all the conditions for agricultural development in the Republic of Serbia and especially in the city of Nis (developed biodiversity with adequate climatic conditions, adequate operating assets, educated and skilled personnel, favourable conditions for scientific method application in practice, etc.) will generate a renewed approach to agricultural production delivering a greater food supply to meet the population's needs and will support the development of biomass as the basic renewable source of energy.

In the city of Nis, biomass is used sporadically and in a traditional way as energy for heating, cooking or water heating. However, by raising agricultural production to a significant level coupled with new investments, biomass can be used in large co-generation plants for electricity and heating energy production and it can serve as a raw material for bio-fuel production. This will result in increased employment rates, social product growth, reduced consumption of fuel from conventional sources of energy and reduced pollution and preservation of the environment.

Nis agricultural production

The city of Nis with about 258,000 citizens is the third largest city in Serbia.[4] Once an industrial and economic centre of the region, it today shares the fate of most cities with similar structure of economy and population in Serbia, namely uncompetitive exports, outdated technology and low productivity.[5] These factors have also affected the development of agriculture.

Table 1. Structure of agricultural land in the city of Nis (in %)

Year	Fields and gardens	Orchards	Vineyards	Meadows	Grasslands
1996	58.97	5.29	11.01	5.49	19.22
1999	58.44	5.25	10.99	5.46	19.86
2000	57.87	5.25	10.88	5.80	20.20
2004	58.65	5.34	10.51	5.05	20.45
2008	56.16	5.07	8.90	5.12	24.74
2009	56.60	4.91	8.79	5.13	24.57

Source: Odsek za statistiku (2006, 2010), Statistički godišnjak grada Niša, Poljoprivreda, šumarstvo i vodoprivreda, Niš.

3 Rajić, Z., Davidov, R., Dimitrijević, B., Mišić, I. (2006): *Upravljanje resursima u kontekstu razvoja poljoprivrede.* Ekonomika poljoprivrede, IEP Beograd, 53(4), pp. 1023-1024.

4 Republički zavod za statistiku (2011*), Popis stanovništva, domaćinstava i stanova u Republici Srbiji,* Ukupno popisana lica, ukupan broj stanovnika prema Popisima 2011 i 2002 i ukupan broj domaćinstava i stanova, Beograd.

5 Gligorijević, Ž., Petrović, J. (2008): *Održivi razvoj turizma na teritoriji grada Niša,* Ekonomika, Društvo ekonomista „Ekonomika", 58 (5-6), Niš, pp. 58.

The city of Niš represents the socio-economically most developed area of southeast Serbia. According to its location and topography, soil and hydrographical characteristics, the city has significant potentials and conditions for the development of agricultural production. The largest uninhabited part of the territory consists of very fertile agricultural land. However, taking into the account the materials that include the term "biomass"[6] (in the context of renewable energy sources) there is a need to adapt the sown species i.e. planted areas.

Data from the table below indicates that the structure of agricultural land in the city of Nis is dominated by fields and gardens. In the observed period, the area covered with fields and gardens was reduced by 2.37%, vineyards by 2.22%, orchards by 0.38%, meadows by 0.36%, while the area covered with grassland expanded by 5.35%. This trend adversely impacts on the potential use of renewable sources of energy and the development of the energy sector in the city.

Although fields are traditionally planted with maize and wheat as the main crops, the production level is not constant (Table 2). The values presented in the table show large annual fluctuations. Thus, total wheat production ranges from 8,000 to 20,000 tonnes, and maize production ranges from 10,000 to 31,000 tonnes. Yields of wheat and corn are below the average yield obtained in Serbia as the result of factors such as field fragmentation, insufficient soil irrigation, growing corn and other vegetables on the same land, outdated machinery, ageing agricultural workforce, poor agricultural policy, etc.[7]

Table 2. Wheat and corn yield in the city of Nis

Year	Total cereal production (in t)	The average yield of wheat on family farms (in kg)	The total production of corn (in t)	The average yield for corn on family farms (in kg)
1996	8,581	2,086	9,737	1,371
1999	16,401	3,089	23,208	3,672
2000	10,395	2,061	9,548	1,471
2004	19,464	3,743	27,459	4,400
2008	15,870	3,777	26,271	4,122
2009	12,238	2,933	26,935	4,295

Source: Odsek za statistiku, (2006, 2010), Statistički godišnjak grada Niša, Poljoprivreda, šumarstvo i vodoprivreda, Niš.

In the past, viticulture represented a significant share of agriculture with about 5,000 acres of vineyards and 3,500 of installed capacities in the four wineries. The wineries closed between 2001 and 2003 as the result of the termination of grape purchase and the occurrence of phytoplasma in vines, consequently the vineyard area in Nis was decreased.

Viticulture and fruit production are faced with numerous problems. The highest recorded number of vines was noted in 1971 and since then it started decreasing, so that in 2009 it

6 Infra, 3.

7 Đekić, S. (2001): *Agrarni menadžment,* Europrint, Niš, pp. 46.

totalled only 20,446. However, grape production was not significantly reduced until 2002, because the yield per vine was 1kg. One exception is low yield achieved in 1999 (Table 3).

Table 3. Viticulture and fruit production in Nis

Year	Vineyards		Apples		Plums	
	Number of fertile vines (1000 pieces)	The yield (in t)	Number of productive trees	The yield (in t)	Number of productive trees	The yield (in t)
1996	26,727	22,554	219,770	4,024	648,477	9,104
1999	25,599	4,730	198,490	2,429	611,950	4,324
2000	25,416	22,049	190,890	2,754	600,758	5,944
2004	24,031	19,442	175,920	2,363	522,915	5,825
2008	20,406	14,325	167,330	1,905	468,820	4,200
2009	20,446	15,794	159,740	2,525	441,010	4,930

Source: Odsek za statistiku (2006, 2010), Statistički godišnjak grada Niša, Poljoprivreda, šumarstvo i vodoprivreda, Niš.

Fruit production is outdated, uncompetitive and not cost effective. Factors that negatively affect the quantity and quality of fruit are:

1) Small and fragmented planted areas,
2) Old planted areas,
3) Limited production of seedlings in the city,
4) The quantity of fruit production depends on climatic conditions,
5) Lack of investment,
6) Inadequate policies in the area of subventions,
7) Lack of modern facilities for processing and packaging.

Nis has very favorable conditions for the development and further improvement of fruit production. Exploitation of given conditions implies creation of a favorable environment for the rapid recovery of agriculture and the economy.[8]

The city of Nis has potential for far greater agricultural production. A significant part of the area is not used for growing crops. The observed part of the area also has good potential for the expansion of crop production. In addition, agricultural production can be expanded to arable land by applying modern technology. Nis is behind other areas and other countries in its use of modern technology in agriculture.

8 Vukoje, V., Milić, D. (2009): *Ekonomski efekti u proizvodnji važnijih vrsti voćaka,* Ekonomika poljoprivrede, Institut za ekonomiku poljoprivrede, 56(3), Beograd, pp.377-387.

Agricultural production and security of energy supply

The availability of a secure energy supply is of strategic importance. Substitution of conventional fuels (coal, gas, oil and oil products) by synthetic raw materials often relies on the provision of other raw materials for the production of substitutes, which are also difficult to obtain. Thus, states often become dependent upon the countries rich in mineral wealth, especially in energy resources such as oil.[9]

Table 4. Dependence of the Republic of Serbia[10] on imported primary energy sources (in %)

Element	2008.	2009.	2010.
Oil and derivatives	85.80	83.77	78.19
Gas	88.54	85.77	83.56
Coal	11.36	8.44	9.58

Source: Republički zavod za statistiku (2008, 2009, 2010), Ukupni energetski bilans Republike Srbije, Beograd.

Reducing dependence can be achieved by reducing consumption and increasing production itself. The basic requirement to reduce consumption is to raise the level of energy efficiency. Potentials of energy savings by raising energy efficiency vary with respect to the observed sectors.

Table 5. The possibility of energy saving by sector

Sector	The potential savings (in %)
Transport	10
Habitation	10-35
The public sector	35-40
The service sector	10-30
Industry	5-25

Source: WBIF, Executive Summary, Financial Support Facilities Available for Energy Efficiency and Renewable Energy in the Western Balkans, November 30, 2011. Available at: http://www.energy-community.org/portal/page/portal/ENC_HOME/DOCUMENTS?library.category=165

The greatest energy savings can be achieved in the housing sector and public sector. The new Law on planning and building[11] has systematically solved the problem of energy efficiency in housing, but only for newly constructed buildings i.e. reconstructed buildings. Namely, the Regulations on Energy Efficiency in Buildings[12] have established energy performance

9 Mrdaković, C., Mihajlović, D. (2008): *Upravljanje energetskim resursima Srbije i spoljnotrgovinska razmena sa Rusijom*, Međunarodni problemi, Institut za međunarodnu politiku i privredu, 60 (4), Beograd, pp. 542.

10 According to the census from 2011 year, 5.24% of the total population of Serbia lives on the territory of Nis.

11 Sl. glasnik RS, br. 72/2009, 81/2009 - ispr., 64/2010 - odluka US i 24/2011.

12 Sl. glasnik RS, br. 61/2011.

of residential buildings which are aimed at increasing energy efficiency i.e. decreasing energy consumption. However there are no equivalent solutions for the public sector or for other sectors. This is considered to be the key to achieving major cost savings (Table 5).

Reducing dependence of the State upon imported energy is possible by increasing its own production, which, when it comes to Serbia, can be done in two ways. The first involves new investments in the production of fossil fuels (coal and oil), which is of very limited nature due to restricted and insufficient resources. Another option is based on investment into projects aimed at obtaining renewable sources of energy. The most effective investment in terms of ensuring security of supply and environmental protection is to invest in agricultural production in order to obtain biomass. In accordance with the Decision on Establishing the Energy Development Strategy of the Republic of Serbia[13], increasing production using renewable sources of energy refers primarily to biomass, hydro potentials of small water flow (with facilities up to 10 MW), geothermal energy, wind energy and solar radiation. The Decision states that the circumstances in Serbia require so-called decentralized production of heat (through combustion of biomass and "collection" of solar radiation) and electricity (by building mini hydroelectric power plants with the power of 10 MW and wind generators of up to 1 MW) to meet the needs of local consumers (villages, cities) and to supply surplus electricity to networks across Serbia. The energy potential of these renewable energy sources is very important and is over 3 M t.en.[14]a year (with the potential of small hydroelectric power plants of about 0.4 M t.en). About 80% of the total potential is in the utilization of biomass, about 1.0 M t.en of which is comprised of wood biomass (wood cutting and timber residue in its primary and/or industrial processing), and more than 1.5 M t.en. of agricultural biomass (agricultural and farming residues including slurry) - with 50% greater potential than the one of wood biomass.

To achieve better utilization of agricultural biomass it is necessary to establish incentives to promote the introduction of modern technologies for biomass and waste combustion, to invest in new facilities and to purchase equipment for the use of renewable sources of energy. It is also important to raise public awareness of the possibility of using renewable energy sources and about the benefits provided by the International Fund for Implementation of Specific Projects. This includes greater involvement of local authorities by showing the positive impact of these activities on employment and development of the local infrastructure.

The city of Nis has already established a Council on Energy Efficiency[15] which aims to manage energy in a more rational way, to reduce the share of fossil fuels in favour of renewable sources of energy, to decrease emissions of green house gases in order to preserve the environment, and, as its basic task, to promote the use of renewable sources of energy, with agricultural biomass representing the greatest overall potential.

13 Sl. glasnik RS, br. 44/2005.

14 Millions tones of oil equivalent.

15 Rešenje o obrazovanju Saveta grada Niša za energetsku efikasnost (Sl. list grada Niša, br. 22/2011).

Biomass as the engine of agricultural production development

Increased agricultural activity in the Nis area would create the conditions which would allow biomass to become a major source of energy. There is no exact economic data about the current feasibility of biomass use but by applying established principles we can conclude that greater available amounts would create favourable conditions for investment in great power plants which would be able to meet most energy needs on the whole territory of the city and beyond.

Table 6. Biomass as a renewable source of energy

Includes:	**Does not include:**
plants and parts of plant	fossil fuels and secondary and by-products produced thereof
energy sources derived from plants or parts of plants, whose entire components and intermediate products were generated from biomass	peat
waste and by-products of plant or animal origin from the agricultural, forestry or fishing industry	mixed municipal waste from private households and similar waste from other origins including biomass fractions derived from mixed municipal waste
Bio-waste	waste wood with the exception of industrial residual wood
gas produced from biomass through gasification or pyrolysis and its secondary and by-products	paper, cardboard
alcohols produced from biomass, whose components, intermediate, secondary and by-products were generated from biomass.	sewage sludge within the meaning of the Sewage Sludge Ordinance (Klärschlammverordnung)
	harbour mud and other water body sludge and sediments
	textiles
	landfill gas
	sewage treatment gas

Source: Ordinance on the Generation of Electricity from Biomass (Biomass Ordinance – Biomasse V), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany, December, 2011, available at: http://www.bmu.de/english/renewable_energy/downloads/doc/5433.php

The potential of biomass in the city of Nis is large. The basis for this statement is derived from the definition of biomass itself. Biomass is a biodegradable fraction of products, waste and residues in agriculture (including vegetable and animal substances), forestry and associated industries, as well as a biodegradable fraction of industrial and city waste.[16] The Energy Law

16 Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

of the Republic of Serbia defines biomass as[17]: ''a biodegradable part of products, waste and residues of biological origin in agriculture (including vegetable and animal substances), forestry and associated industries, as well as a biodegradable part of industrial and communal waste", the contents of which were expanded on the basis of the Decision on adoption of the biomass action plan from 2010 to 2012[18] which states: ''Biomass is a biodegradable matter originating in agriculture, forestry and associated industries and households, which includes: plants and plant parts, plant residues and by-products in agriculture (straw, corn, branches, seeds and nuts), residues of animal origin in agriculture (manure), the remains of plants in forestry (logging residue), biodegradable residues in food and timber industry which do not contain hazardous substances and separated biodegradable fraction of communal waste". Finally, biomass is defined in overseas publications as a renewable source of energy which is comprised of matter composed of plants and plant parts, residues and by-products of plant and animal origin in agriculture, forestry, and commercial production of fish, biological waste, as well as gas and alcohol produced by chemical processes from biomass (Table 6).

From these definitions and the data on biodiversity in the territory of the city, we can conclude that possible increase in production would not have adverse effects on the production of traditionally grown crops, indeed it would be just the opposite. Therefore, it is necessary to extend the existing agricultural production and make it more effective, resulting in larger quantities of matter that can be considered as biomass.

Table 7. Biomass of targeted agricultural crops and equivalent oil value (t/year)

No	Culture	Area (in ha)	Yield (t/ha)	The total biomass (in t)	The equivalent value oil (t/year)
1	Wheat	4,167	2.94	12,250.98	4,083.65
2	Rye	38	2.07	94.39	31.46
3	Barley	568	2.77	1,575.06	525.02
4	Oats	355	2.12	752.25	250.75
5	Corn	6,265	4.30	32,327.40	10,775.78
6	Branches from the orchard	1,905		2,000.25	800.10
7	Grape-vine	3,408		3,237.60	1,295.04
	In total			52,237.93	17,761.80

Source: Authors' calculations based on the data from Odsek za statistiku (2010), Statistički godišnjak grada Niša, Poljoprivreda, šumarstvo i vodoprivreda, Niš.

17 Član 2. stav 1. tačka 3. Zakona o energetici (Sl. glasnik RS, br. 57/2011 i 80/2011 - ispr).

18 Sl. glasnik RS, br. 56/2010.

Apart from the expansion of the existing production, it is also possible to increase agricultural production through ‘’special purpose plantations’’[19]. This involves planting special types of fast growing trees (willow, various types of cane) which are used specifically for the production of biomass matters. This approach is technologically possible and has been achieved in many developed countries, particularly Great Britain[20].

Furthermore, it is considered that the concept of special purpose plantations could include targeted crops which would provide greater benefit than the plantations cultivating types of longer vegetative development. First, the available field would not be exclusively used for the production of biomass, but would also be used for agricultural products which can be offered on the market. Second, by increasing the production of targeted crops, conditions for the upgrade of other industries, especially manufacturing, would be created. Third, employment among agricultural workers would be more regular because of the requirement to grow crops with a shorter vegetation period. Fourth, by growing targeted plants, biodiversity would be much higher.

Table 7 shows current production of targeted agricultural crops in the city of Nis and the equivalent oil value. Based on the energy value of biomass of certain crops, total equivalent oil value is 17,761 tonnes per year. If the production of all crops was increased up to the volume of production which was realised during the nineties in the last century, overall biomass and the equivalent oil value would be about 1.5 times higher.

Table 8. Estimation of total biogas production in the city of Nis

Types of livestock	The number of heads of cattle[1]	Excrement[2] (kg/day)	The total dry matter (kg/day)	Organic matter (kg/ day)	The amount of biogas (Nm^3)
Cattle	3,330	122,328	15,492.6	12,565.8	4,028.07
Pigs	934	20,548	2,521.8	2,521.8	756.54
Poultry	290	7,540	2,291.0	1,682.0	580.00
In total	4,554	150,416	20,305.4	16,769.6	5,364.62

Source: Calculations based on the data from Odsek za statistiku (2010). Statistički godišnjak grada Niša.Poljoprivreda, šumarstvo i vodoprivreda, Niš.

The situation is similar with the production of biogas. Table 8 shows estimates of energy potential of biogas, first of all by taking into consideration the state of cattle, pigs and poultry which was achieved in 2007. Total heat equivalent obtained from the manure is equal to about 120,704 MJ / day. The stated potential would not greatly affect the energy balance, but it would contribute significantly to reducing environmental hazards.

19 Nacionalna strategija za uključivanje Republike Srbije u mehanizam čistog razvoja Kjoto protokola za sektore upravljanja otpadom, poljoprivrede i šumarstva, (Sl. glasnik RS, br. 8/2010), pp. 31.

20 Royal Commission on Environmental Pollution (2004), *Biomass as a Renewable Source*, Biomass Fuels, London, 2004.

Manure can also be used as fodder, for production of earthworms, humus and biogas as well as protein feed by using microorganisms. None of these possibilities have been used sufficiently, so the problem with slurry still exists and it puts livestock production in danger and makes it more expensive.[21]

It is therefore not surprising that farming in Nis is significantly declining (Table 9). In the period from 1960 to 1975, the number of cattle was increased, with the index of 120.8 for the year 1975 when compared to the year 1969. In the period from 1975 to 2007 the number of cattle was reduced, with the index of 34.2 for the year 2007.

Breeding pigs and producing corn both have an important role in supplying the population with meat and meat products. When it comes to pig production it should be noted that changing breed and the transition from fat to meat are important factors. Development of the observed production depends on the development of the slaughter industry. This is dependent upon revitalization of the existing plant, construction of new plants and a growth in the volume of production, i.e. that the decrease of the number of bred pigs is stopped. The index in 2007 was only 24.8.

Table 9. Number of cattle, pigs, sheep and poultry

Year	Cattle		Pigs		Sheep		Poultry	
	Total	Index	Total	Index	Total	Index	Total	Index
1961	10,681	100.0	13,767	100.0	28,880	100.0	102,857	100.0
1965	11,379	106.5	17,576	127.7	23,703	82.1	126,701	123.2
1971	11,184	104.7	20,285	147.3	13,574	47.0	165,496	160.9
1975	12,899	120.8	22,386	163.0	15,900	55.1	242,756	236.0
1991	8,994	85.0	25,357	185.0	10,333	35.6	157,786	154.0
2001	7,636	71.5	17,981	130.6	14,376	49.8	171,339	166.6
2004	6,951	65.1	15,112	109.7	4,310	14.9	109,062	106.0
2007	3,653	34.2	3,416	24.8	4,451	15.4	93,088	90.5

Source: Odsek za statistiku (2010). Statistički godišnjak grada Niša.Poljoprivreda, šumarstvo i vodoprivreda, Niš.

Sheep farming on the territory of Nis is also in an unfavourable position. The number of sheep in 1961 was 28,880, this decreased to 15,900 in 1975 and by 2007 it was only 4,451. The number of female breeding stock and the number of animals per 100 ha of arable land changed alongside with the fluctuation of the overall number of sheep.

Although the highest level of modern technology in livestock production in Nis was achieved in the poultry production, the period from 2000 to 2007 was characterized by a significant decrease in production compared to the previous period. The development of this production was influenced by changes in modern technology and industrial production of poultry and eggs, however an important element which would improve the sustainability

21 Brkić, M. (1993): *Proizvodnja i korišćenje biogasa i biođubriva iz stajnjaka,* Institut za poljoprivrednu tehniku, Poljoprivredni fakultet, Novi Sad, pp. 5-11.

of production was left out thus reducing the overall rate of return. In poultry production the cycle is not long, and with the help of incubators much more meat can be produced than with conventional breeding.[22] If we add income from biomass production, economic sustainability would be viewed in a different way.

Sustainability of agricultural production

The link between agricultural production and energy independence is of a permanent character. The greater agricultural production, the greater the amount of available biomass there is, which in turn improves the conditions for increased energy production and reduced energy dependency. However, for project realisation it is necessary to fulfil two conditions.

First, it is necessary to create a favourable investment atmosphere for investing into facilities for renewable energy. This primarily involves the adoption of new regulations in accordance with the EU whose solutions would help abolish general and specific legal and administrative barriers to exploiting new energy facilities. Regulations which relate to the facility construction in which production of energy would be carried out are considered as general because they are covered by general regulations, common for building other types of facilities. To include energy plant into the existing energy infrastructure in the country, an investor is obliged to fulfil several conditions and to obtain certain approvals and permits apart from procuring necessary equipment and facilities. We consider the complicated and often imprecise procedures for obtaining necessary approvals and permits from the relevant public services (at national or local community level) as particular barriers.[23]

Legal and administrative barriers of special character could be useful to support pure development techniques which ensures agricultural development based on biomass use providing this guarantees the sustainability of development and also meets the second condition, i.e. realization of interdependence of agriculture production and energy stability.

The application of the pure development mechanism protects agricultural land from negligence and abuse of exploitation and at the same time it guarantees the sustainability of agricultural production and application of all environmental protection standards. Pure development mechanism is based on the use of two concepts: "carbon neutrality" and "renewable biomass".[24]The concept of "carbon neutrality" means that the CO2 emissions generated in the process of biomass combustion do not exceed naturally-generated levels, ie .the amount of CO2 released in the process of biomass combustion is equal to the amount

22 Đekić, S. (2001): *Agrarni menadžment*, Europrint, Niš, pp. 66.

23 Dimitrijević, Ž., Ivanović, Đ. M. (2011): *Revoking of legal and administrative barriers for using renewable energy sources in order to increase competitiveness of companies in Serbia,* Proceedings - 16th International Conference of the Series Man and Working Environment Safety of Technical Systems in Living and Working Environment - [STS-11], Univerzitet u Nišu, Fakultet zaštite na radu, Niš, pp. 490

24 Nacionalna strategija za uključivanje Republike Srbije u mehanizam čistog razvoja Kjoto protokola za sektore upravljanja otpadom, poljoprivrede i šumarstva (Sl. glasnik RS, br. 8/2010), pp. 28.

of CO2 used by plants in their growth and development process. Thus, the CO2 released in the biomass combustion process is a part of the natural cycle and biomass is considered to be carbon neutral (because it does not release additional CO2). In this respect, biomass as an energy source is similar to renewable energy sources such as water, wind or solar energy.

The concept of "renewable biomass" relates to the standards of land treatment which generates biomass matter. It is necessary to ensure that after the collection of matter on the treated land the level of carbon is not increased, i.e. the conditions for the emergence of new material are created.

Conclusion

Reducing dependence of the country upon imported energy is also possible by raising its own production, which can be done in two ways when it comes to Serbia. The first involves new investments in the production of fossil fuels (coal and oil), which is of a very limited nature due to insufficient resources. An alternative is investment into projects for obtaining renewable sources of energy. The most promising investment in terms of ensuring security of supply and environmental protection is to invest in agricultural production in order to obtain biomass.

The city of Nis is rich in resources for the development of agricultural production and obtaining agricultural biomass. Increased agricultural activity in the city would provide conditions for biomass to represent a major source of energy. However, for the realisation of the project in such an established interdependence, it is necessary to fulfil two correlative conditions.

First, it is necessary to create a favourable investment atmosphere for investing into facilities for renewable energy, and then ensure the sustainability of agricultural production based on the principle of biomass through a pure development mechanism – by applying the concept of "carbon neutrality" and "renewable biomass". The application of the pure development mechanism protects agricultural land from negligence and exploitation and at the same time it guarantees the sustainability of agricultural production and application of all environmental protection standards.

Increasing agricultural production in the Nis area would increase biomass matter and create the conditions for the production of larger quantities of energy. The production of larger amounts of energy would mean less energy dependence of the city of Nis, and it would also lay the foundation for the application of that pattern to other parts of Serbia.

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SIGURNOST SNABDEVANJA ENERGENTIMA U FUNKCIJI RAZVOJA POLJOPRIVREDE GRADA NIŠA

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Rezime

Za ostvarivanje energetske stabilnosti jedne države i njen održivi i ravnomerni razvoj neophodno je obezbediti sigurnost snabdevanja energentima i unaprediti energetsku efikasnost proizvodnje i potrošnje na svim nivoima. Povećanje proizvodnje energije iz obnovljivih izvora u cilju obezbeđenja sigurnosti snabdevanja može biti jedna od najatraktivnijih oblasti za strana ulaganja na teritoriji grada Niša. Biomasa, kao najveći potencijalni obnovljivi izvor energije u gradu Nišu, nedovoljno je iskorišćen. Autori u radu ukazuju na značaj korišćenja biomase, koji se prvenstveno ogleda u obezbeđivanju sigurnosti snabdevanja energentima, ubrzanom razvoju poljoprivrede i zaštiti životne sredine supstitucijom konvencionalnih energenata.

Ključne reči: *poljoprivreda, sigurnost snabdevanja, energija, OIE.*

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