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Possibility of production and use of BIODIESEL in Serbia

POSSIBILITY OF PRODUCTION AND USE OF BIODIESEL IN SERBIA

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1 Problem and report objective

The Republic of Serbia in 2006 ratified the Treaty on establishing the European Energy Community, thereby, inter alia, accepting the obligation to, within one year from the effective date of the contract, submit to the European Commission plan for the implementation of Directive 2003/30/EC of the European Parliament and the Council on promoting use of biofuels or other fuels produced from renewable energy sources in the transport sector [1]. The directive defines biofuels and imposes obligations on States to put on market an amount of biofuel (2% of the total amount of fuels used in transport sector to the end of 2005, ie 5.75% by the end of 2010).

Regardless of the international obligations of the Republic of Serbia, the need for increased using renewable resources is in accordance with the practices of developed countries and their aiming at reducing emissions and encouraging sustainable development. Except direct effects (reduction of consumption of imported energy and endangering the environment), increased production and use of biodiesel in the transport sector would engage domestic investment capital, encourage domestic production and development of small and medium-sized companies. At the same time this would help local industry to participate in offerings of foreign companies to invest in the production of energy from renewable sources in order to acquire the so-called Green certificate.

The turning point in the state attitude towards renewable energy sources (RES) is adoption of the Programme for the implementation of the Energy Development Strategy of the Republic of Serbia for period 2007 to 2012 (2007). According to the document, activities that need to be undertaken for the production of energy from RES in Serbia are the following:

- creating necessary legislation;
- adoption and implementation of financial policies and activities to encourage the use of RES;
- adoption and implementation of non-financial measures and activities to encourage the use of RES;
- creation of professionals for planning, designing, construction and exploitation of the facilities for the use of RES-biomass;
- realization of investment projects in the field of the use of RES;
- monitoring and controling the implementation of development strategies in the field of RES.

There were no concrete results and progress in this field, according to the above guidelines, by the beginning of 2010. In January 2010 in Srbia biodiesel was not produced nor used.

• **The aim** of this report is to show the existing conditions, opportunities and barriers for the production and use of biodiesel in Serbia, and to propose a number of legal, financial and non-financial measures, which should take roots in the legal and economic system of Serbia to enable the production and use of biodiesel as a renewable fuel in Serbia. We will show three important aspects of manufacturing and application of bio-diesel which determine current and future conditions, and suggest a number of measures to enable the use of biodiesel in Serbia.

• **The market aspect**. -Is there a need for biodiesel production in Serbia, i.e. is there the possibility of placing the produced amounts of biodiesel on the market;

• **Raw material aspect**. - What is the raw material potential of agriculture in Serbia for the production of raw materials for processing into biodiesel. Raw materials such as waste edible oil from households and restaurants, as well as waste oil and grease from the manufacturing industry will not be considered in this paper;

• **Economic and legal aspect**. - Can the production of biodiesel be economically viable in the existing market and financial and legal environment in Serbia and what should be done to enable economically justified and sustainable production and use of biodiesel.

2 Production and use of biodiesel in Serbia

Biodiesel was defined by European standard EN 14214 in 2003 [2]. In Serbia it was defined in 2006 by SRPS (ISO) standard EN 14214 "Fuels for motor vehicles. Methylestras of fatty acids (MEFA) for diesel engines, Requirements and test methods ", (which is identical to European standard EN 14214) [3]. In addition, in May 2006 "Regulation on technical and other requirements for liquid fuels" was adopted which specified technical and other requirements that fuels must fulfil [4]. Given the very bad experience with "biodiesel" in Vojvodina, in the 1990s we emphasized the need for strict compliance with all provisions of these regulations.

Since 2005 it has been considered that in biodiesel, produced according to EN 14214 in the 1990s, all the problems of using biodiesel according to previous generation of standards have been surpassed. Therefore, the biodiesel according to EN 14214 is a reliable, quality fuel for diesel engines, produced from renewable raw materials, which may be used, without limitation, pure or mixed with mineral diesel in all modern diesel engines in accordance with recommendations of the manufacturer, and whose products of combustion do not affect the increase in greenhouse gases in the atmosphere.

In Serbia in 2006 about 1.4 million tons of diesel fuel was spent. Data on biodiesel production in Serbia in 2006 cannot be reached, and there is no information on biodiesel consumption. It is estimated that the consumption of biodiesel made less than 1% of diesel consumption in Serbia in 2007. Gas station "Vjestica" in Novi Sad in November 2007 was selling at its pumps biodiesel (B100) for cars at the price of 72.6 din/ (0.91 €/l). In Germany biodiesel was sold at the pumps at the time for 1.025 €/l and diesel for 1.144€/l. In 2008 there was not any production, and no use of biodiesel in Serbia [5].

"Victoriaoil" company in 2007 built a factory in Sid with the capacity of 100.000 t of biodiesel per year. That year it produced 27,000 tons of biodiesel. Since there was a significant increase in the price of raw materials for biodiesel and a slight rise in the price of mineral diesel in 2008 and 2009 the production of biodiesel was stopped, but the production of edible oil products was not. In addition, there were no expected state incentives.

3 Projection of the consumption of biodiesel in Serbia

Tab. 1 shows the production of biodiesel needed in Serbia, under the assumption of the adoption of the Regulation on biofuel content in fuels for motor vehicles and Directive 2003/30/ EC of the European Parliament and the Council. Under the expected Decree of the Serbian Government manufacturers and fuel distributors would be required to mix biofuel in all fossil fuels starting from 2007, and the following volume percentages: 2007: 2% 2008: 3%, 2009: 4%, 2010. and later 5% [6]. Up to January 2010. This Regulation was not made.

Tab. A projection of the consumption of biodiesel in Serbia in accordance with the Regulation on biofuel content in fuels for motor vehicles or Directive 2003 / 30/EC of the European Union [5]

Indicator	Year				
	2007.	2008. **	2009.	2010.	2011.
Consumption of diesel in Serbia (in thous. t)	1.455*	1.542	1.634	1.732	1.835
Part of the diesel fuel that will be replaced by biodiesel (in thous. t)	30,4 (2%)	48,3 (3%)	68,2 (4%)	90,4 (5%)	95,9 (5%)
Directive 2003/30/EC (in thous. t)	57,5 (3,5%)	74,0 (4,25%)	92,3 (5,0%)	112,5 (5,75%)	119,3 (5,75%)

* according to the Secretariat of Energy and Mineral Resources

** In the projection of the consumption of diesel fuel for the period 2008-2011 the annual growth rate of the consumption of diesel fuel was used 6% compared to the previous year

Possible biodiesel consumers in Serbia [5]:

- **Business entities** - small, medium and large companies, shipping companies, car transport companies, urban transport companies, taxi carriers. They are primarily interested in price, the amount of fuel consumption and the quality of biodiesel. In the first stage of the introduction of biodiesel, agricultural vehicles and machinery are potentially the largest consumers of biodiesel. The other potential market for biodiesel is in the public city transport sector. It is estimated that in the public transportation companies in major towns in Serbia an estimated 60.000 tons of diesel fuel is spent in the annual basis.

- **Population** - their focus is price, quality and availability of biodiesel. They would be considered as major consumers only after the adoption of the Regulation on compulsory mixing of biodiesel in mineral diesel.

- **Users directly related to the environment protection** - in their focus are environmental benefits of bio-diesel and the price (national parks, spas, resorts). There are no accurate assessments of their needs for diesel, i.e. biodiesel fuel.

- **The demand for fuel of the state bodies' fleet** - There are no data on cars, buses and trucks that are in the fleet of the republic and municipal authorities (military, local government, the Republican Ministries), and neither on their consumption.

- As a separate consumer there is the **Petroleum Industry of Serbia (NIS).** According to the draft of the Regulation on biofuel content in fuels for motor vehicles NIS, as a distributor and fuel producer, has an obligation to mix a certain percentage of biofuels in mineral diesel.

4 Abilities to produce raw materials for biodiesel in the agriculture of Serbia

In the European Union is one hectare of oilseed rape provides a sufficient amount of grain for the production of 1.090 liters of biodiesel fuel [7]. However, in Vojvodina, rapeseed, as well as sunflower and soybean, earn significantly lower returns than the European average, Figure 1. With the average yield of 1.69 t/ha, and seed oil content of 36%, 1 ha of oilseed rape in Serbia provides 608 kg of oil, or about 690 l of biodiesel. The average grain yield of sunflower in Serbia is 1.79 t/ha, so with the oil content of 40% the yield of biodiesel from sunflower is 716 kg/ha or 816 l/ha. The average soybean yield in

Serbia is 2.25 t/ha, so with the grain oil content of 18% the biodiesel yield of 405 kg/ha or 460 l/ha is derived [5].

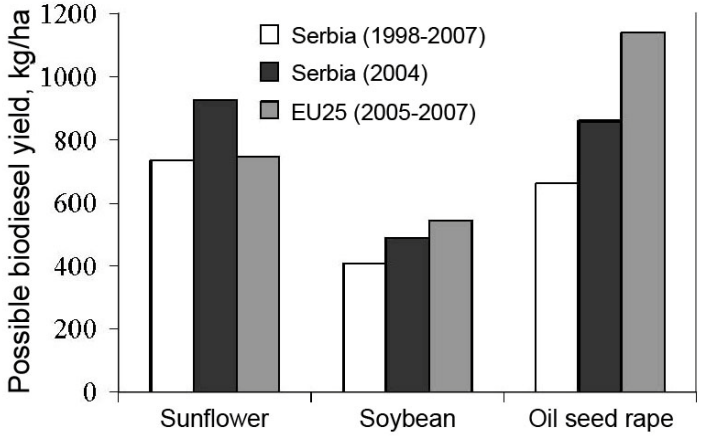

Figure 1. Possible biodiesel yield per 1 ha of oil plants in Serbia and the EU, depending on the actual oil crops yield [5]

In Vojvodina about 93% oil crops is produce, and in central Serbia, the remaining 7%. For the production of raw materials for edible oils, margarine and solid vegetable fat in Serbia 272.000 ha of arable land is necessary. For the production of seeds for the next planting of oil crops and animal husbandry 54.000 ha are needed. This means that for the purposes of food production in Serbia 326.000 acres should be engaged. In Vojvodina for the cultivation of oil crops 20% of arable land can be engaged, which is 316.000 ha. This shows that with the current structure of sowing, and the present relations of agricultural crops in Vojvodina there is no arable land available for production of oil crops intended for processing in biodiesel. The most important reserve for the provision of large quantities of raw material for biodiesel is the increase in yield oil crops in Vojvodina. They are well below the European average and biological seeds potential. The olein type of sunflower production should be particularly encouraged.

Potential areas in Serbia for the cultivation of oil crops intended for processing into biodiesel is estimated at approximately 350,000 hectares (668.800^{1}-(271.722^{2} + 54.000^{3}).
[1]- Potential area for cultivation of oil crops, 20% of arable surface,
[2]- for crude oil for food,
[3]- for seeds and livestock. It could provide 212.800 to 250.600 tons of biodiesel, tab. 2.

This is only the theoretical potential of biodiesel production in Serbia, while the real potential is significantly lower. In fact, looking at regional distribution of oil crops production in Serbia, it can be concluded that over 90% of oil crops is produced in Vojvodina. Participation of oil crops in the yield structure of Vojvodina in the period 2001-

2005 is close to 20%, which is on the verge of biological maximum. On the other hand, the share of oil crops in the yield structure of Central Serbia is about 1%.

This means that in Vojvodina a substantial increase in area under oil crops cannot be expected, i.e., that the largest part (90%) of potential areas for cultivation of raw material for biodiesel is in Central Serbia. It is difficult to assess which of the potential area for the production of raw material for biodiesel will be used in future in Central Serbia, but it is certain that it will not be a big part. The biggest obstacles to significant production of raw materials for biodiesel in Central Serbia are the fragmentation of agricultural holdings and large distance between them. This is not only the logistical problems of organizing production and collection of oil plants in central Serbia, but it would also cause large costs, particularly due to the need of investment in new collection centers (silos), and high costs of transport. In addition, in Central Serbia farmers do not know production of oil crops and have no specific machinery for oil crops.

Tab.2. Potential biodiesel production on the surface of 350.000 ha depending on the sowing structure of oil plants [5]

Variations	Structure of planting	Possible biodiesel production (t/a)	Possible substitution of fossil diesel with biodiesel	
			Total economy (%)	In agriculture (%)
I	100% Rapeseed	212.800	13,49	46,67
II	70% Rapeseed 30% Sunflower	224.140	14,21	49,16
III	50% Rapeseed 50% Sunflower	231.700	14,69	50,81
IV	70% Rapeseed 30% Sunflower	239.260	15,16	52,47
V	100% Sunflower	250.600	15,88	54,96

Theoretically, local biodiesel would be possible to substitute 13 to 16% of domestic diesel fuel consumption (calculated on energy basis). In reality these figures are considerably lower due to the inability to organize cost-effective production of dispersed and mutually remote farms in central Serbia.

5 Processing facilities in the oil industry in Vojvodina / Serbia and oil production in the “mini - oil mills"

Having in mind the oil mill installed capacity, 390.000 tons of crude sunflower oil and 51,000 tons of soybean oil could be produced in Serbia per year. In relation to domestic edible oil needs (around 160.000 tonnes), it can be concluded that the oil mill production capacity in Serbia is too large and can be used in part to supply plants for the production of biodiesel with raw materials [5].

Over 90% of processing capacity in the oil industry is located in Vojvodina, or its surroundings. Most of the area that could be used for the production of oil crops for biodiesel is located in Central Serbia. It is necessary to consider the possibility of establishing so-called "mini – oil plants" which should act on the area that large industrial plants are not able to cover. In these plants, with much simpler technology and relatively low investments a good quality of raw material for biodiesel production can be produced. Establishing the network of mini-oil mills in central Serbia, and organizing the production of oil crops in their environment, mini oil factories would contribute to a better utilization of land capacity for the production of raw material for biodiesel in Central Serbia [5].

6 Prospects and dilemmas about the future of the production of raw materials for biodiesel in Serbia

The relative importance that biodiesel can have in substitution of mineral diesel fuel depends on many factors [5]:

- **The yield of oil crops**. It can be expected that the trend of increasing oil crops yield in unit area will continue, due to the application of more complete and renewed agro technology and renewed machine park. Higher yields of oil crops are the basis for increased production of biodiesel. If the yield of oil crops in Serbia achieves the same level as in the EU, the available surfaces in Serbia could achieve up to 35% higher production of biodiesel than those defined in tab. 1.

- **Crop rotation**. Here it is assumed that the oil crops will be grown on 20% of arable surface. In practice, farmers, motivated by the relatively high purchasing prices of oil crops, often opt for the cultivation of oil crops in the same area each 4th year, i.e. at 25% of its arable land. Assuming that oil crops will be grown in 25% of arable land in Serbia, every year it would be possible to produce raw materials for the production of 350.000 to 385.000 tons of biodiesel. With this amount of biodiesel 21-23% of domestic need for diesel fuel can be substituted.

- **Consumption of edible oils and other food-based oils.** Consumption of edible oils in Serbia is considerably lower compared to other countries in the region. With the growth of the standard it is realistic to expect that the demand for these product will also grow. Assuming that own needs for edible oil will be met by domestic production, it can be expected that the surfaces that can be used to produce raw materials for biodiesel will be gradually reduced.

- **Consumption of diesel fuel**. The need for diesel fuel will grow due to the development of transport and overall economic activity. Thus the relative proportion of biodiesel in motor fuel consumption will decline because land for the production of biodiesel is limited.

- **Joining the EU**. It is still unclear how the EU accession will affect the size and the structure of the area under oil crops in Serbia. In the EU an average of 10% of arable areas is not intended to cultivate food plants, but only plants for technical purposes. In Serbia, it would mean an area of over 300.000 ha where sunflower and rapeseed for biodiesel could be cultivated. But in this case, to meet the requirements regarding crop rotation, surface under oil crops intended for processing into edible oil would have to be cut. There is another doubt. In Serbia, soya is grown on the surfaces of over 120.000 ha. The question is whether Serbia after EU accession will be able to keep producing soybeans and how much.

- **Unused arable land**. In Serbia there are about 250.000 ha of fallow and unused land. With appropriate economic incentives, some of these areas could be used for the cultivation of oil crops. However, given the state of local agriculture, as well as the modest resources from the agricultural budget of Serbia allocated for this purpose, is not realistic to expect a significant start of production in these areas at the moment.

7 The competitiveness of biodiesel in the domestic market for liquid fuels

The widespread use of biodiesel can be counted on only if its cost is competitive to fossil diesel, which means that its price is lower than the cost of diesel fuel for at least 5-8%. This difference in cost is explained by less energy value of biodiesel in relation to mineral diesel (about 5-8%), and therefore there is a proportional increase in fuel consumption.

Figure 2 shows the pricing of Eurodiesel and biodiesel fuel based on sunflower grain in 2006 and 2008.

The analysis of retail fuel prices of Eurodiesel indicates the importance of national measures on tax and excise policy for the creation of the sales price. In the structure of retail prices of Eurodiesel fuel in 2008 the factory cost accounts for less than 60%, while the rest is discount (5 d/l) to be paid to fuel distributors, excise taxes (16.27 d/l) and the VAT value of 18% (14.19 d/l). In Serbia production and use of biodiesel has not yet been legally regulated, and manufacturers do not yet know whether the biodiesel will be charged wit excise tax and value added tax, and to what extent. Judging from the experience of developed countries, as well as the fact that the current Law on the special tax on oil derivatives in Serbia does not include biodiesel, it is realistic to assume that biodiesel will not be charged with excise tax, but that the VAT (VAT) will be paid to the value of biodiesel to at the usual fuel rate of 18%. In the case of biodiesel sold at the same price as fossil fuel, and taking into account the above assumptions and the current price of Eurodiesel fuel of 92 d/l (1.1 €/l in October 2009) it can be concluded that at the established price of biodiesel based on sunflower at 73 d/l (0.86 €/l), the production of biodiesel would be on the border of profitability with a profit of 0.31 d/l of biodiesel. Profit is defined as the difference between acceptable market price of biodiesel (which is equal to the retail price of Eurodiesel fuel), and the sum of the cost of biodiesel, discounts and VAT, Fig. 2.

At an average price of fossil diesel fuel and raw material for biodiesel in 2008 and assuming its full burden of excise, production of biodiesel cannot be economically viable. Namely, if the price of biodiesel would be added to the full excise taxes of 7 d/l the price of biodiesel would be 1.32 €/l, i.e. € 0.22 higher than the Eurodiesel fuel cost.

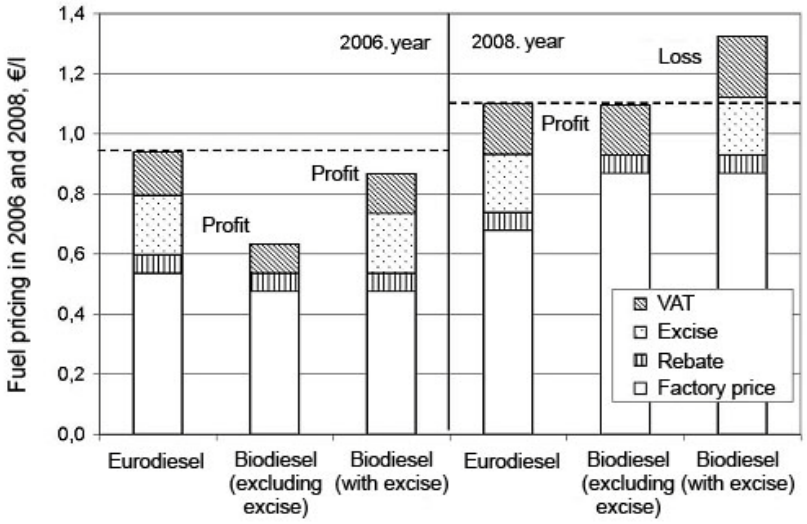

Fig.2. Pricing of Eurodiesel fuel and biodiesel, depending on the application of excise

(Note: Biodiesel based on sunflower seeds, plant capacity of 100,000 tonnes of biodiesel per year, calculated on the basis of market prices in 2006 and 2008 and the methods described in [8])

The competitiveness of biodiesel is determined primarily by two factors: the retail Eurodiesel fuel price and cost of biodiesel, which in turn largely depend on the price of the input raw material, i.e. oil crops. Fig. 3 shows the formation of the price of biodiesel depending on the cost price of oil crops. The analysis was done for the variable values of purchase price of oil crops and assuming the fixed size of other input parameters (selling price of oil meal, the prices of energy, other material and wages as in 2008). It can be noticed that the cost of biodiesel based on sunflower and rapeseed oil is greater than the cost of Eurodiesel fuel, even assuming a relatively modest purchase price of these oil crops seeds. At a lower soybean price of 300 €/t biodiesel can be price-competitive to fossil diesel, even assuming the full excise duty and VAT[1]. However, in all other cases biodiesel achieves higher sales price. In these circumstances it is evident that future production of biodiesel can be competitive only under the assumption of full or partial exemption from excise taxes. While the cost of biodiesel is relatively resistant to changes in the purchase price of sunflower it is very sensitive to changes in the purchase price of soybeans.

Investments in the machinery capacity of 100,000 tons of annual production of biodiesel range € 15-20 million [8]. Even though the construction of such facilities would be helped with € 10 million non-refundable funds, this would have only modest impact on the reduction of the cost of biodiesel, of about 0.01 €/l [5]. State incentive to the biodiesel factory building means new impetus to the market introduction of biodiesel, but has a relatively small influence on the cost. State incentives make sense only as a support to developing new technologies and building a pilot plant (the actual case of second-generation biodiesel).

[1] A low cost of biodiesel on soybean basis is primarily a result of the high price of soybean meal in Serbia (35-38 $/kg without VAT), which are often higher than the price of soybeans. It is important to note that, according to the current quality standard of biodiesel fuel, soybean and sunflower oil cannot be used as the only raw material but only in the appropriate blend with oils of lower ion number, such as palm oil and rapeseed.

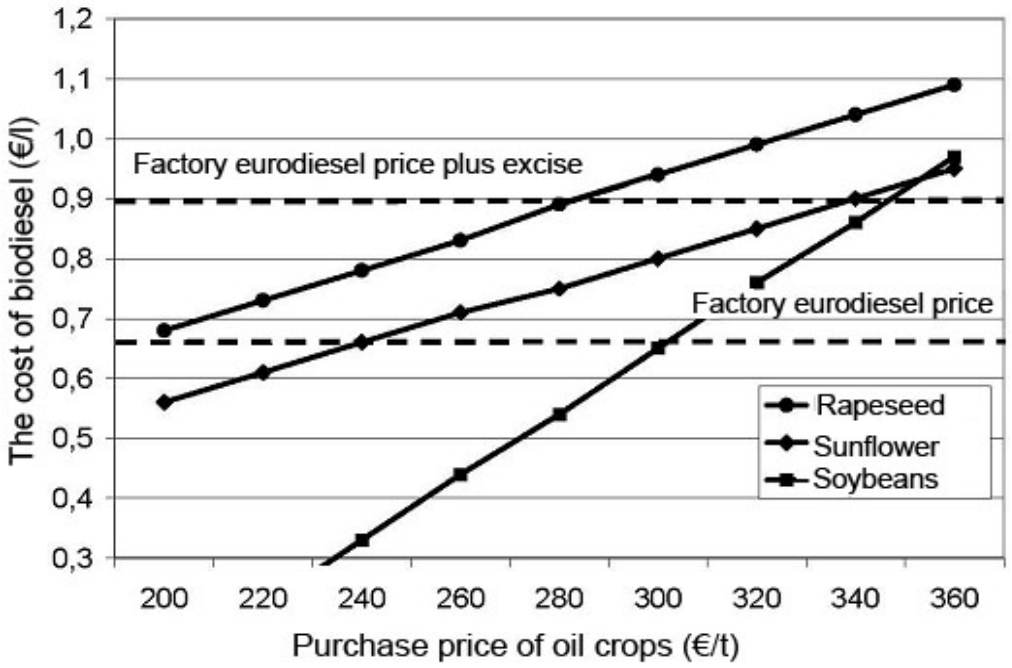

Fig.3. Formation of biodiesel cost depending on the price of oil crops

Full exemption of biodiesel from excise duty would ensure the competitiveness of biodiesel on domestic market. This measure is essential to encourage greater production, and therefore a wider use of biodiesel. At the same time, the adoption of this measure will mean a reduction in the planned collection of excise tax on mineral fuels. In order to achieve the planned substitution of 29.100 t of mineral diesel with biodiesel 2007 and to release biodiesel from excise tax on fuel, which is 16.27 d/l, Republican budget deficit would have smaller revenue from excise of around 6.7 million €. This amount represents about 0.65% of excise tax revenue generated in 2007, or about 0.1% of total budget income of Serbia in 2007. Assuming the adoption and implementation of the Regulation on compulsory mixing of biodiesel in mineral diesel, and assuming full biodiesel exemption from excise duty in the period 2007-2010, the amount of unpaid excise taxes on fuel would amount to about € 52 million cumulative [5].

8 The legal framework of the production of biodiesel and identifying the barrier for a greater production and use of diesel would in Serbia

The legal framework for the production and use of biodiesel is not sufficiently developed, there are many ambiguities and uncertainties, missing several laws, decrees, regulations, standards, which should be mutually consistent. At the end of 2006 several

important documents were prepared, but in January 2007 all of them were "diluted", and the use of renewable energy sources was practically postponed for later. Until January 2010 that "later" did not come to the agenda.

By the end of 2007 Directive 2003/30/EC of the European Parliament and the Council on promoting the use of biofuels or other fuels produced from renewable energy sources in the transport sector [9] should have been adopted, which is the international obligation of Serbia. This would ensure a safe market to producers of biodiesel in Serbia. Although Proposal of Decree on biofuel content in fuels for motor vehicles was already prepared in 2007, until January 2010 this decree was not adopted by the Serbian government.

It is often pointed out that the Energy Law (passed in 2004) made legal preconditions for taking measures to create conditions to stimulate the use of renewable energy sources. However, Energy Law, as well as other laws, does not recognize categories of biofuels that are used as fuel in transport, and does not create any necessary framework for their use, and for the implementation of Directive 2003/30/EC.

The Serbian government in January 2007 adopted the program for implementing the Energy Strategy of Serbia in the field of RES for the period 2007-2012, in which the proposal provides, among other things: "From 2010 public transport of passengers and goods can be done by carriers whose consumption of liquid and at least 15%." This and similar provisions should have ensurer that spending and creating biodiesel market. The above specific provision was not adopted, but "diluted" - reworded so that the approved version reads: "Among other things a possibility to stimulate use of biofuels in road transport should be considered by performing, from 2010, public passenger and goods transport by carriers whose consumption of liquid and gaseous biofuels in total consumption of petroleum products in the past year was over a specified percent."

It is planned that by end of 2007 the Serbian government should adopt the following provision: "The minimum content of biofuels in all diesel fuel (D2, Eco-diesel, Euro-Diesel) that are distributed in the territory of the Republic of Serbia: in the calendar 2007 year. min 2% v/v, in calendar 2008 year. min 3% v/v, in the calendar 2009 year. min 4% v/v, in the calendar 2010 year. later min 5% v/v. For the prescribed minimum biofuel content in fuel is not calculated and paid excise taxes on petroleum products. Obligation of mixing bio fuel with fuel is held by both distributors and importers .... For a repeated offense distributors shall be punished by subtracting the license for the sales of fuel." Neither the said provision was adopted.

The program of implementing the Strategy of energy in Serbia in the field of RES for 2007-2012 provides for the amendments to the Law on energy and the introduction of biofuels used as energy in transport, with defining necessary sub regulations.

These far-reaching decisions in the spirit of the Treaty on establishing the European energy Union that Serbia signed in 2006, as well as the Kyoto Protocol ratified by Serbia in September 2007 should have created a biofuel market in Serbia and opened to investors in the plants for the production and sale of biodiesel, new jobs were to be opened and agricultural production diverted. Unfortunately, until January 2010 only a small number of measures and activities envisaged in the Programme in the field of biofuels were realized.

Of legal acts adopted by the Government of the Republic of Serbia, the program of the Energy Strategy of Serbia in the field of RES for the period 2007-2012 first mentioned biodiesel as transport fuel from renewable sources, and sets as a goal the gradual introduction of biodiesel in the use mixed with diesel with fossil origin. The program proposed to investigate the possibility of introducing and implementing a series of measures and activities to use biodiesel, but without clearly defined terms of adoption and early implementation and figures on quantities.

9 Recommendations for the introduction of biodiesel in the wider use

On the whole, population and economy of Serbia are not familiar with biodiesel, experience in its use is negligible, the advantages of its use are not recognized, and there are no major initiatives, outside of academic circles and potential investors in the plants for the production of biodiesel, for the spread of awareness about the positive effects of its manufacture and application. Economic viability is certainly playing a key role in the overall problem.

In order that the entire system of investment in biofuels (biodiesel) should be accepted in the economy, and thereby lead to the greater use of biodiesel in the Vojvodina / Serbia it is necessary to:

- Lobby for the coordination of activities of the Ministry of Agriculture, Ministry of Environment and Spatial Planning, Ministry of Mining and Energy, Ministry of Finance and the Ministry of Science, with the aim of making the necessary legal and technical regulations concerning the production, distribution, sale and use of biodiesel in Serbia. The ultimate goal is to establish a legal and financial system in Serbia that makes biodiesel cheaper than fossil diesel fuel at retail, making the entire enterprise cost-effective. There is no coordination of activities in these ministries in the area of using renewable energy sources.

- Benefits offered by biodiesel can be seen at levels, not only in terms of agricultural, transportation and energy sectors, but as a matter of public importance, where complex instruments for the control and management of the system must be applied.
- The effects expressed through the reduction of environmental pollution, the ability to trade with CO_2 certificates, employment of local population and job creation must be seen and evaluated, and thereby the contribution to the economic and financial development of the country.
- Identify key actors who are prepared to accept the use of biodiesel as soon as possible after the start of the production.
- Select distribution channels that correspond to the projected biodiesel plant capacity.
- Promote all the benefits of biodiesel, to the economy as well as population (public marketing, round tables, through chambers of commerce and associations, fairs, schools) to increase awareness of the existence of biodiesel and its availability on the market in Serbia, and ecological benefits and the favorable economic effects of its application.
- To start selling, we recommend placing a mixture of biodiesel and mineral diesel, providing adequate income to farmers and competitive prices to final fuel consumers.
- Ensure that the production of raw material for biodiesel should be financially interesting for agriculture, and for users pure biodiesel should be 0.15 and 0.20 €c/l cheaper than eurodiesel.
- The first stage of promotion and sale of biodiesel, in addition to direct use in own fleet of state bodies, should focus activities on freight forwarders, transport companies and public transport companies.
- These subjects are best reached by direct contact and promotion through Chamber of Commerce of Serbia, Vojvodina Chamber of Commerce, Regional Economic Chamber of Commerce, the Secretariat of Energy and Mineral Resources, Regional Centers for energy efficiency in Novi Sad, Belgrade, Nis and Kragujevac.
- For consumers who may be especially interested in the ecological aspects of biodiesel (national parks, agriculture, spas, the authorities of major cities in Serbia - Belgrade, Novi Sad, Nis) - to focus attention on the promotion of environmental benefits of the use of biodiesel.
- Direct selling of pure biodiesel to population is unlikely. First of all there needs to exist a wide network of biodiesel pump. It is possible to use some of the already existing networks (Lukoil-Beopetrol, NIS Jugopetrol, OMW and individual pumps privately

owned). However, we suggest placement through a mixture of mineral diesel and 5% biodiesel.

- Training - training specialists for the production of biodiesel (biofuels) and promotion of its use, particularly with understanding the economic effects of biodiesel use and trade of CO_2 certificates obtained from the production and placement of biodiesel.
- Vojvodina should look at what the effects of the announced measures of the Government of Serbia will be in the field of using renewable energy on the producers of raw material for biodiesel and others in the chain of production, distribution and use of biodiesel, as well as other renewable energy sources in Vojvodina. It's been 3 years from the announcement of these measures, and in Vojvodina nothing has been done to analyse their effects on the economy and finances of Vojvodina.
- The Executive Council of Vojvodina should establish an expert advisory institution in the field production and use of renewable energy sources, and biodiesel among them. Such an organization should also exist for the territory of Central Serbia. The Program of implementing the energy strategy adopted in January 2007 provides that by 2012 in the field of renewable energy 24.000 new jobs will be opened in Serbia. Given the level of development and significant agricultural production it is estimated that at least 60% of that number will be implemented in Vojvodina. This means that in Vojvodina there will be 14.000 new jobs in the field of the use of renewable sources of energy. So Vojvodina must have at least 2% of that number, so 300 people capable of competently reasoning and quality information dissemination that will lead to the recruitment of new 13.700 employees. The Executive Council of AP Vojvodina must make efforts to "create" the 300 experts for the use of renewable energy sources in Vojvodina.

  The concrete measures to be taken are shown in tab. 3.

Tab. 3. Measures to be taken to achieve a safe and supportive environment for investment and use of biodiesel in Serbia

1	**Changes and amendments to existing Laws**	**News, changes, goals**
1.1.	Law on energy	Objectives: 1) Establishing the National Fund for financial incentives to the national program of energy efficiency and production of energy from RES. The funds for the state fund will be provided from the funds for the consumed energy, from the sales of oil and petroleum products, coal, motor vehicle registration, tax, charities, international donations, funds etc.; 2) Defining the procedures and requirements for obtaining approval for construction of facilities intended for the use of RES. Changes: The introduction of the notion of biofuels that are used as energy in traffic with the definition of the necessary supporting by-laws and regulations in this area.
1.2.	Law on the Guarantee Fund	Objective: In Article 9, after paragraph 1, a new paragraph 2a. is added which reads: "2a. The Fund is obliged to provide for each budget year at least 10% of their capital for the issuance of guarantees and super guarantees for loans that banks and other financial organizations in the Republic of Serbia approve to commercial entities for the implementation of projects for the use of RES".
1.3.	Law on Excise	Objective: In Article 9 paragraph 4) is added which reads "4) in a mixture of biofuels with petroleum derivatives in paragraphs 1), 2) and 3) of this Article excise rates will be applied specified in the paragraphs reduced in proportion to the percentage with which biofuel in the mix participates."
1.4.	Law on transport and road traffic	Objective: In Article 10, after paragraph 1, paragraph 2 is added which reads: "From 2010 the public transport of passengers and goods can be performed by carriers whose consumption of liquid and gaseous biofuels in total consumption of petroleum products in the previous year was at least 15%."
2.	**Adoption of the missing and by-law regulations**	**News, changes, goals**

2.1.	Law on the production, processing, sales and energy use of biomass	Objective: This law is necessary to pass in order to most rationally regulate the area of production, processing, sales and energy use of biomass and create conditions for the production of energy from the biomass which is our largest energy potential among the RES.
2.2.	Regulation on biofuel content in fuels for motor vehicles	Objective: This regulation prescribes the minimum content of biofuels in fuels for motor vehicles, the obligations of distributors in connection with biofuel content in fuels, reporting and monitoring content of biofuels in fuels for motor vehicles, as well as monitoring implementation of this Regulation.
2.3.	Regulation on the prohibition of the use of biogenic waste grease for animal feed or discharge in sewers or waterways.	Objective: A legislation must be passed that would prohibit the misuse of disposal and use of waste biogenic fat for animal food or discharge in the sewers or waterways.
3.	**Financial incentives**	
3.1.	Establishing subsidies for research and development of technologies and specific products and education in the field of RES	Objective: State fund for encouraging energy production from RES will, for each dinar that a business entity should invest in research and development of technologies and specific products in the field of RES, subsidize with 0.5 dinars, and the company income tax will be provide by the law with a tax credit of 20% of the amount invested in the projects (research, development and education) in the field of RES.
3.2.	The establishment of subsidies for biofuels used in motor vehicles	Objective: 1) The State Fund RES will subsidize with € 2.5 per cent the price of each liter of liquid and gaseous biofuels that are through the distribution network delivered to motor vehicles. 2) The State Fund and the competent body of local self-government, i.e. the city of Belgrade, will subsidize, according to the "fifty-fifty" principle, with € 6.0 cent the cost of each liter of 100% biodiesel or any percentage of the amount of biodiesel mixture of diesel fuel of fossil origin which is through registered sales network sold in the territory of the local government.
3.3.	Establishment of a system of incentive mechanisms for targeted production of oil	Measures: subsidizing oil crops production for use as energy, guaranteeing the safe purchase of crops during the period of several years in the future, guaranteed prices oil

	crops for use as fuel	crops for several years in advance, installing an additional premium for oleic sunflower type.
4	**Adoption and enforcement of non-financial measures and activities to encourage use of RES**	
4.1.	Forming of an inter resource body for the coordination of activities to a greater use of RES and the implementation of the NOIE Programme	Given the necessity of activities among various sectors to greater efficiency in the implementation of the Programme of the NOIE and ensuring active participation of all relevant Ministries in the implementation of the Program in the NOIE sector.
4.2.	Defining administrative procedures for obtaining necessary permits for construction and the use of plants using RES	In order to create favorable investment climate these procedures should be transparent and publicly available to the investors, local government and other institutions.
4.3.	Training experts for managing projects in the field of RES	Objective: 1) Sustain study groups at universities and research and development projects in the Ministry of Science and Environmental Protection in the area of energy efficiency and RES, as part of the national program, to create experts in the field of RES. 2) In Vojvodina at least RES 140 specialists with a university degree should be trained. It will be only 1% of 14.000 workers in new jobs in the field of use of RES in Vojvodina in 2012, which is specified by the Program for the implementation of the Energy Development Strategy in Serbia from 2007.

10. Conclusions

In Serbia in 2010 there is no recorded production, or even use of biodiesel. There are no incentives for using biodiesel. Its production and use are not competitive with the price of mineral diesel in the market.

There are several reasons for not using biofuels, and even biodiesel, as energy in 2009 in Serbia, or for using them in negligible quantities:

- absence of appropriate legal and technical regulations that would meet an ambient supportive for the use of biofuels and investment in the facilities for biofuel production.

- insincere and incomplete attitude towards European integration, i.e. the tasks to be done before it may occur,
- majority of the population, not even a great number of professional staff in municipalities and ministries, do not have enough responsible attitude towards environmental protection and they feel helpless, without initiative and icentive,
- in Vojvodina / Serbia there is a negligible number of experts of all professions and qualifications that are able to introduce the use of various forms of renewable energy sources.

Serbia has significant land potential for the production of raw materials for processing into biodiesel, which is estimated at about 10% of the total arable land. This area can provide enough raw materials to produce 210 to 250 thousand tons of biodiesel per year, enough to replace about 13-16% of fossil diesel in Serbia. Currently, oil seed rape occurs as the sole raw material for biodiesel production. Unprofitable production, inexperience and inadequate scientific farming are the main obstacles to the increased production of oilseed rape. The most important reserve for the provision of large quantities of raw material for biodiesel is increasing the yield oil crops, particularly oilseed rape. They are considerably below the European average. For a number of reasons, the sunflower is imposed as a more favourable raw material for biodiesel production in Serbia. Because of the high iodine number of oil obtained from domestic hybrids, sunflower cannot be used as the sole raw material. A particularly emphasis should be placed on the importance of introducing oleinic sunflower with a low ionic number into production.

The economic status of biodiesel producers is determined primarily by two factors: the price of fossil diesel, which is largely determined by the tax and the excise state policy, and purchasing cost of oil crops. A particular challenge is the unregulated market of oil crops characterized by high fluctuations in price and sown areas under oil crops.

Activities to be undertaken in order to create safe environment for investment in biodiesel production and its use can be classified into the following groups:

1. creating a supportive regulatory framework for manufacturing and greater use of biodiesel;
2. adoption and implementation of financial policies and activities to encourage the use of biodiesel;
3. adoption and implementation of nonfinancial measures and activities to encourage the use of biodiesel.

A key condition for wider use of biodiesel in Serbia will be the introduction of economic measures that will allow biodiesel to be competitive with mineral diesel, and the most important among them is full or partial exemption of biodiesel from excise. In addition to price, consumers find important the availability of biodiesel and quality assurance. Adoption of Regulation on biofuel content in fuel for motor vehicles, which will determine the minimum content of biofuels in all diesel fuels which are distributed on the territory of Serbia, which was expected by the end of 2007 but was not implemented even in January 2010, would certainly contribute to increased production of biodiesel, and therefore affect its greater presence in the market. Besides there is lack of incentive and accompanying measures, legislative and financial, that would form economic environment needed for modern management of biodiesel and all other renewable energy sources.

Placement of biodiesel through a mixture of diesel and biodiesel is a real opportunity to promote the use of biodiesel, providing adequate income to farmers and competitive prices to the final fuel consumers. We recommend mixing 5% biodiesel in all amounts of mineral diesel fuel. The mixing should be done by distributors and importers.

Production and use of biodiesel in Serbia should be encouraged in the usual ways tested in developed countries:

a) Measures to support the production of oil crops include:

- incentives for intended production of oil crops,
- additional special premium for the oleic type of sunflower
- secure purchase during a period of several years in the future,
- guaranteed price for several years in advance,
- ban of unintended consumption of waste biogenic fat for animal feed,
- production and use of oil crops in the production process that give the best ratio

between prices and oil content.

b) For the purpose of easier and more efficient investment in the biodiesel industry, there is need to:

- promote the production and use of biodiesel (regulations, certificates, creating the market),
- introduce export incentives for biodiesel and biodiesel production subsidy,

- encourage investment by creating an attractive competitive economic environment for biodiesel,
- control the quality of biodiesel produced, to be in compliance with applicable standards not only at the factory immediately after production, but also at the pumps when selling it to customers,
- encourage investment in small plants for the production of oil to be used as raw material for biodiesel production, but biodiesel production should be done primarily in larger plants due to the ability for facilitated security and quality control.
- allow partial or full exemption of biodiesel from excise duty.

c) Incentive for producers

- given that in the cost of biodiesel the costs of raw materials (seed oil crops) account for about 55%, subsidies would have the greatest effect if it would be directed toward producers of oil crops, which will be used as raw material for biodiesel.

d) Liabilities for fuel distributors

- envisaged and implement the obligation of distributors to mix biodiesel in mineral diesel in a certain percentage (5%)
- oblige distributors to sell a specific quantity of biodiesel fuel on the fuel market (determined by a certain percent of the total quantity of fuels sold)
- obligations of distributors to cooperate with other dealers and sell a certain amount of biodiesel on the fuel market (this scenario also includes the trade system with the so-called portable fuel certificate from renewable sources).

e) Quality control

In Serbia there are regulations that require certain quality of biodiesel (standard SRPS (ISO) EN 14214, which provides characteristics of methyl esters of fatty acids that can be used for diesel engines, and the Regulation on technical or other requirements for liquid fuel (with bio origin)), but there are no regulations on procedures of control and quality assurance, so they should be developed and introduced into practice. Particular attention should be paid to quality control of biodiesel in retail shops, through the Ministry and market inspection. This very important segment of the production and use of biodiesel must include strict punitive measures, and they have to be implemented in practice.

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