

# RENEWABLE ENERGY AND ENERGY EFFICIENCY IN AGRICULTURE AND RURAL AREAS IN SERBIA<sup>1</sup>

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## Abstract

*The author analyses strategic and legal regulatory rules of Serbia in the field of renewable energy (RE) and energy efficiency, state in the field of RES and energy efficiency in agriculture and rural areas, and possibility to apply the small and mobile renewable energy generators in different aspects of agricultural production and rural development in Serbia. The goal of this manuscript is to point out to possibilities that the users of energy production devices from renewable sources (primarily agricultural manufacturers, rural population, etc.) can achieve economic interest by using these devices; produce more healthy and quality product (especially in organic production); provide energy in those areas without the built electric grid; increase energy efficiency and achieve a positive effect to the environment in a longer period of time.*

**Key words:** *renewable energy, energy efficiency, agriculture, rural areas.*

## Introduction

The Republic of Serbia has been on its way to sustainable development since the year 2002 by implementing the Johannesburg Declaration on Sustainable Development (UN, 2002) in its strategic documents and always taking into consideration the Rio Declaration on Environment and Development (UNEP, 1992), the Agenda 21 (UNEP, 1992a) and three Rio conventions (UNDP/UNEP, 2012).

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In the national report of the Republic of Serbia for the World Conference on Sustainable Development “Rio+20” (UNDP/UNEP, 2012), there underlines the commitment of Serbia to sustainable development and the green economy principles, more efficient use of resources, along with the process of social inclusion and employment decrease.

In terms of climatic changes and limited land and water resources, the development of agriculture and rural areas on the sustainability principles, green economy and RE use, which requires the minimum engagement of limited land and water resources, and doesn't violate their ecological status, becomes an important issue for the future of the world food production. One of the ways to reduce the use of fossil fuels is their partial substitution by energy from renewable sources, which is very up-to-date in the field of agriculture and rural development.

The concept of RE and “green economy” in sectors such as agriculture, fishery and forestry is integrated in the Common Agricultural Policy of EU (CAP), in which the support to “green economy” implies the targeted assistance to rural development measures, which promote the ecologically sustainable agricultural practice, such as agro-ecological schemes and the improvement of compliance with the environmental protection laws. The reformed Common Agricultural Policy for the program period 2014-2020 for 28 EU member countries put emphasis on: „improvement of agricultural competitiveness by the promotion of innovations; environmental protection; sustainable management of natural resources; climate changes“. Achievement of the rural development objectives is realized through six priorities of the Union, while the support in using renewable sources is available through the fourth and fifth priority of EU for rural development (Regulation of EU, No. 1305/2013):

- ✓ “Renewal, preservation and improvement of eco-system connected to agriculture and forestry” and
- ✓ “Promotion of efficiency in using resources and encouraging moves towards the economy with low level of carbon, resistant to climate changes in the agricultural, food and forestry sector”.

### **National regulations in the field of renewable energy (RE) and energy efficiency**

The most important national regulations in the field of RE and energy efficiency are the Law on Energetics (Official Gazette of RS, No.

145/2014) and the Law on Efficient Use of Energy (Official Gazette of RS, No. 25/2013).

Among other things, the *Law on Energetics* (Official Gazette of RS, No. 145/2014) accentuate that long-term objective of Serbia in the field of energy policy and specify the economic and financial conditions for energy production from renewable sources, which are defined as the non-fossil energy sources (watercourses, biomass, wind, sun, biogas, landfill gas, gas from the sewage treatment power plants and geothermal energy sources). The third energy package of EU in Serbia has been applied since 1st January 2015 in the field of RE, electric power and gas sectors. In this way, Serbia has become the first country in the region which had applied all these regulations.

The environment for investing into the energy sector was improved by adopting the Law on Energetics. In order to reach a binding share of energy from renewable sources in gross final consumption of energy, in accordance with the ratified international agreements, all privileged producers of electricity from RE are entitled to direct incentive measures (“feed in” tariff) by the conclusion of a contract on electricity purchase with a guaranteed (public) supplier.

The status of the privileged electricity producer from RE is precondition for signing a contract with the public supplier on electricity sale by the incentive prices, where a RE power plant owner is not obliged to gain this status (in that case, he cannot count on the incentive measures). In order to have a right to the incentive measures, the privileged producer is obliged to sell all produced electricity exclusively to the guaranteed supplier. Status of electricity producers from the renewable resources has not been still regulated by the law, in regard that the adequate bylaws have not been adopted. Among other things, it is necessary to establish officially the system of origin guarantee, while the adoption of Regulation on origin Guarantee was planned for the fourth quarter 2016 (KEI, 2016).

The production of electrical and thermal energy for *own needs* by using RE is considered as a measure of the efficient energy use in sense of the *Law on Efficient Energy Use* (Official Gazette of RS, no. 25/2013). Support to producers which produce the renewable energy for their own needs doesn't currently exist, although it is anticipated by the Law on Efficient Energy Use.

In accordance with this law and the Decision to open the Budget fund for the improvement of energy efficiency of the Republic of Serbia (Official Gazette of RS, No. 92/13), in 2014 has started to operate the Budget Fund for the Improvement of Energy Efficiency, which should stimulate, through financing or co-financing the appropriate projects, programs and activities, also the use of RE for the production of electrical and thermal energy for their own needs, as well as other activities which aim to more efficient energy use.

During the years 2014 and 2016, through public calls, the funds were allocated only for the energy efficiency improvement projects in the local authority units.

Domestic regulations in the field of RE are adjusted to the Directive 2009/28/ EC of the European Parliament and Council on the promotion of renewable energy use and amendment and repeal of directives 2001/77/EC and 2003/30/EC. The directive was partly carried over into the national legislature by adopting the Law on Energetics and appropriate regulations (KEI, 2016).

It is important to adjust with the Directive 2006/32/EC of European Parliament and Council in the field of energy efficiency since 5th April 2016 on final consumption efficiency and energy services (Directive 2006/32/EC were replaced with the Directive 2012/27/EU on energy efficiency). The Directive 2006/32/EC is still relevant for Serbia (until the end of 2017) in regard to its obligation towards the Energy Community and it was substantially transposed into the applicable Law on Efficient Energy Use, while the complete adjustment will be realised by adopting all by-laws. The Law on Efficient Energy Use was partly adjusted to the Directive 2012/27/EU on energy efficiency (KEI, 2016).

### **Analysis of state in the field of RE and energy efficiency in Serbia**

According to data of the Statistical Office of the Republic of Serbia (SORS), an extremely low share of renewable sources in **energy production** in the Republic of Serbia is noticeable (Table 1). According to the same resource, the dominant share within the renewable energy production in the year 2014 had wood fuels and hydro-electric energy (Table 2).

**Table 1. Primary production of energy in Serbia, 2014**

	<b>TJ (terajoule)</b>	<b>%</b>
– Coal	239.185	60
– Hydro-electricity	41.821	10
– Solar electric power	22	0
– Crude oil and natural gas liquid	50.592	13
– Firewood <sup>/1</sup>	46.532	12
– Natural gas	20.639	5
– Geothermal energy	235	0
– Biogas	215	0
<b>TOTAL</b>	<b>399.241</b>	<b>100</b>

<sup>/1</sup> Final consumption of firewood for households was taken over from the Ministry of Mining and Energy.

**Source:** *Statistical Yearbook of the Republic of Serbia, 2016, SORS.*

**Table 2. Renewable energy production in Serbia, 2014**

	<b>TJ (terajoule)</b>	<b>%</b>
– Hydroelectricity	39.611	44
– Solar electricity	22	0
– Wood fuels <sup>/1</sup>	50.048	56
– Geothermal energy	235	0
– Biogas	215	0
<b>TOTAL</b>	<b>90.131</b>	<b>100</b>

<sup>/1</sup> Final consumption of firewood for households was taken over from the Ministry of Mining and Energy.

**Source:** *Statistical Yearbook of the Republic of Serbia, 2016, SORS.*

On the other hand, in the Study on the Achievements and Perspectives towards the green economy and sustainable growth in Serbia (UNDP/UNEP, 2012) was stated that the energy potential of renewable sources in Serbia was very significant. Technically usable potential of RE, without large hydro-power plants, amounts over 4.3 million tons of equivalent oil per year (Ibid).

In accordance with the Republic of Serbia Strategy of Energetics Development data until 2025, with projections until 2030 (Official Gazette of RS, No. 101/2015), the total technically available potential of RE in Serbia evaluates on 5.65 million of toe per year. Of this potential, there already uses 1.054 million toe of biomass (mostly as firewood) and 909 thousands toe of hydro energy.

According to the Decision on establishing the Energy Balance of RS for the year 2016 (Official Gazette of RS, no. 113/2015) in the structure of

planned total domestic production of primary energy for 2016, the renewable energy participates with 17%. There is planned the increase of primary energy production from wind, sun and biogas, but also the reduction of primary energy from hydro-power plants (Ibid).

Since the year 2009, when the legal framework with incentives (“feed-in” tariffs) was established for the first time in Serbia, many new facilities for electricity production from the renewable sources were built, while solar energy records the most dynamic developmental trend regarding a number of projects. Ministry of Mining and Energy of the Republic of Serbia keeps the Register of Privileged Electricity Producers<sup>3</sup>.

The installed power of power plants to renewable sources (November 2016) was given in Table 3, as well as the objective to produce energy from renewable sources for 2020.

**Table 3.** *Installed power of plants to renewable sources 2016 and the goal by the end of 2020*

Technologies	Installed power (MW) November 2016	National goal (MW) 2020
Mini hydroelectric power plants	40.9	188
Wind	0.5	500
Sun	8.7	10
Biomass	0	100
Biogas	5/5	30
Geothermal energy	0	1
Waste	0	3
Landfill gas	0	10

**Source:** <http://zelenirazvoj.org/aktivnosti/mapa-projekata-obnovljivih-izvora-energije/>, accessed on November 15, 2016.

Since Serbia is a member of the Energy Community, aiming to integrate its energy sector into the EU energy system, there was predicted by the national strategic documents more efficient energy use and increasing the share of RE in gross *final consumption of energy*. In accordance with the Directive 2009/28/EC on the promotion of the renewable energy use and the decision of the Energy Community Ministerial Council (D/2012/04/MC – EnC),

<sup>3</sup> Ministry of Mining and Energy of the Republic of Serbia, Sector for Energy Efficiency and RE, RE Department, Register of privileged electricity producers, 23<sup>rd</sup> November 2016, available at: <http://www.mre.gov.rs/doc/registar23.11.16.html> (date of access 27th November 2016)

National Action Plan for Using RE of the Republic of Serbia was determined a very ambitious binding objective for Serbia in the field of RE, which was amounted 27% of RE share in its gross final consumption of energy in 2020, where increasing energy efficiency (Official Gazette of RS, No. 53/13) is of the utmost relevance.

According to data from the Report on Practicing of the National Plan for Using Renewable Energy of the Republic of Serbia (Official Gazette of RS, No. 8/2015), the share of RE in gross final consumption of energy in 2013 was amounted 19.1% (in the production of electricity 37.8%), which still hasn't achieved a basic share of 21.2% in 2009<sup>4</sup>. The reason for this is not the reduction of RE consumption in Serbia, which surely records real growth, but the fact that due to the other macro-energy disturbances, the gross final energy consumption in Serbia drastically changes, which directly reflects on a proportionally expressed amount of RE share in the gross final consumption of energy. The significant impact to energy consumption has the Ironworks Smederevo, l.l.c., i.e. import and consumption of coke and electricity which use in this company, so when this Ironworks works, the consumption of gross final energy in Serbia increases for several percentages, which furthermore reflects on the RE percentage reduction (Ibid).

***As to data on energy efficiency and RE production and consumption for own consumption***, there are no systematized and relevant data. Some of the reasons are:

- Small production of electrical and thermal energy from renewable sources, for which no energy permit for facility construction is required;
- No license for conducting the energy activities is required. It issues only for conducting wholesale electricity supply activities (production of electricity in the facilities of total approved power of 1 MW and more) and under conditions determined by the Law on Energetics;
- Energy produced in this way is not delivered in the electro-energy system,
- Neither incentives, nor the register of incentive users.

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<sup>4</sup> Most of the current RE use refers to the traditional way of biomass use and large hydro-power plants.

## **State and possibilities for energy efficiency and using RE in agriculture and rural areas in Serbia**

According to data of the Statistical Office of Republic of Serbia (total energy balance, 2015), within the final energy consumption in the year 2015, agriculture had participated with 1.9%, while oil and petroleum products had been consumed the most within.

Renewable energy in domestic agriculture is insufficiently researched and utilised and there is also no systematized and relevant data on the current production and consumption of renewable energy for own consumption on agricultural holdings.

Some data are given by Statistical Office of Republic of Serbia (Census of Agriculture in 2012 in the Republic of Serbia), like following:

- ✓ Utilized agricultural area (UAA) under crops for energy production (crops meant for the production of biofuels: grain, legumes, soy, oilseed rape, potato, fodder, meadows and pastures hay, etc.) amounts 3,087 ha (or 0.09% of UAA);
- ✓ Only 22 agricultural holdings (of totally 631,552) are engaged in the production and sale of energy from renewable sources, as the second profitable, non-agricultural activity<sup>5</sup>.

Opportunities of the RE use in agricultural production in the Republic of Serbia are determined by following factors (Ministry of Agriculture and Environment of the Republic of Serbia, 2016):

- ✓ Geographic location of land,
- ✓ Climatic, soil and hydrological characteristics (natural resources),
- ✓ Technical-technological developmental level of society,
- ✓ Educational level and ecological awareness of people,
- ✓ Financial possibilities of a state,
- ✓ Economic possibilities of agricultural holdings,
- ✓ Administrative-legal regulations in the field of natural resources use,
- ✓ Long-term world and European strategies of rural development and fight against the negative effects of climate changes.

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<sup>5</sup> In accordance to Census of Agriculture methodology (2012), the production of renewable energy implies the production and sale of energy obtained by using wind energy, burning of straw, producing biogas etc. , and if a holding uses the energy obtained in such way exclusively for own needs, this activity doesn't register.



***Solar energy, wind energy and hydro-energy of watercourses*** are at this moment the most appropriate and the most effective forms of RE for the application in agrarian practice taking into account (Ministry of Agriculture and Environment of the Republic of Serbia, 2016; Despotović et al, 2016):

- Wealth of natural resources,
- Requirements of modern agricultural production<sup>6</sup> and
- Characteristics of agricultural production, which are given below.

The most important characteristics of domestic agriculture are following (Census of Agriculture in 2012 in the Republic of Serbia):

- ✓ Dominant share in the total number of agricultural holdings have family agricultural holdings, which make 99.5% of total number of agricultural holdings and dispose with 82.2% of UAA.
- ✓ Small plots. The average size of UAA per holding amounts 5.4 ha, and 77.4% of agricultural holdings have UAA ≤5 ha. Also, the average number of separate lots of UAA per holding is six, and the average separate lot covers 0.98 ha. Observing by regions, the average size of separate lots of UAA per holding is the least in the region of Šumadija and Zapadna Srbija (0.77 ha) and in the region of Južne i Istočne Srbije (0.51 ha).
- ✓ Agricultural holdings irrigate only 2.9% of UAA.
- ✓ According to a type of agricultural production, there dominate mixed holdings for plant and livestock production (share of 31.4%).
- ✓ Prevalently extensive and relatively expensive production (significant percentage of farmers work in traditional way, without any agro-technical measures).

Keeping in mind the above, author consider that ***solar and wind energy and hydro-energy of watercourses*** in agricultural production and in rural areas in Serbia can be efficiently used by the development, supply and promotion of ***small*** and ***mobile*** (portable, movable) ***power generators of less power*** (installed power less than 10 kW).

Some of these power generators are (Ministry of Agriculture and Environment of the Republic of Serbia, 2016; Despotović et al, 2016):

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<sup>6</sup> High level of business flexibility; mobility and transport, i.e. change of location; economic, social and ecological sustainability of business, food safety; rational use of land, water and energy within the energy efficiency, etc.

- ✓ **Mobile solar electronic generator.** This is a device which is reliable, tested and verified in the field by the Institute Mihajlo Pupin, Belgrade and Institute of Agricultural Economics, Belgrade. It provides, besides other things, the use of single-phase vacuum pumps for irrigation (power up to 2.5 KW), as well as more powerful three-phase pumps (up to 4KW). The device recharges by energy onsite, based on solar panels in the device or by night from the power grid at a reduced rate. It belongs to the group of extremely economic and noiseless devices, which satisfy high economic and ecological criteria for application in agriculture. This technical solution has great potential in the application of environmental and clean energy technologies in crop and livestock production. One of the most effective applications is in crops irrigation (on fields, orchards, etc.). One of more significant optimisations in Mobile Solar Generator is dual axis drive and tracking of sun trajectory.
- ✓ **Small wind turbines.** Although Serbia doesn't belong to those countries which have many windy days, this natural resource can be very significant as an additional energy source. In the morning or at sunset, due to the local difference in temperature (between plough land/garden and forest, plough land/garden and river, in gorges around the canals and river), there occurs the adequate airflow which affects the microclimate conditions in the specific location. These favourable conditions for using airflow can be used for starting the wind-generators of less power, mobile or stationary, which can serve, for example, for pumping water out of the pool (Renney well, canal, pond, river, lake). This device also works in low wind flow, but cumulatively, within 24 hours, it can provide sufficient energy for starting the water pump of less power.
- ✓ **Small hydro turbines** power of 1kW-10kW. Building small hydroelectric power plants requires a stable watercourse that do not dry up during the season. In the mountain regions, Serbia has the potential for use of these types of renewable energy that can be of great use in the supply of mountain farms.
- ✓ **Solar concentrator for utilization of solar thermal energy.** These are devices which collect thermal energy emitted from the sun and distribute hot water for additional heating of greenhouses/glasshouses.

The objective to support the production of RE for own consumption in agricultural holding or/and household in rural areas is to affirm and encourage the use of all mentioned devices in agriculture of Serbia, so users of these devices:

- ✓ Have ***economic interest*** to purchase and use them,
- ✓ Achieve positive results related to ***energy efficiency***,
- ✓ To be more reliable in ***energy supply***,
- ✓ Assure ***permanent protection of land, water and air***, i.e. the environment in long period of time.

The use of analysed ***RE generators*** can be especially useful and justified in next segments:

- Irrigation in plant production (production of vegetables, fruits, flowers, organic crops), or in starting water pumps (less power) and drop irrigation system and/or periodical irrigation on small surfaces (apply depends on the necessary amount of water, crops which irrigate, areas which irrigate, etc.),
- In agricultural production in mountain areas (production of raspberry, potato, etc.), where there is no energy infrastructure, but with developed network of river courses (using hydro energy of water courses),
- In livestock production (for lighting or the ventilation systems in stables, for starting devices/systems for milking or manuring, for work of lacto freezers; for starting the device for supply of livestock with drinking water),
- For heating greenhouses/glasshouses, fishponds,
- Drying cereals, fruits, vegetables, medicinal and aromatic herbs (driers powered by solar energy, so called solar driers), etc.,
- In organic production,
- In areas of high natural value and/or in the vicinity of protected areas and/or under developed energy infrastructure, where tourism (agro-eco) and/or organic production and/or pasture cattle breeding could develop,
- For lighting farms; supplying drinking water in household; households heating, etc.

Target group of users, these analysed devices for RE production are meant for, are:

- ✓ Family agricultural holdings of small and medium size – the most numerous in Serbian agriculture. In accordance to data of Census of Agriculture in 2012, of total number of agricultural holdings in

- Serbia which dispose with agricultural land (621,445), 92% of them uses agricultural land of 10 ha and less<sup>7</sup>;
- ✓ Younger farmers (not over 44 years of age)<sup>8</sup>, which are engaged in agriculture actively and have a registered agricultural holding. According to Census of Agriculture in the Republic of Serbia in 2012, the share of agricultural holdings of younger farmers in total number of agricultural holdings is 15.9%, UAA of these holdings is 27.2% of total UAA, average UAA per agricultural holding of younger farmers is 9.3 ha, and an average economic size of these holdings (standard output) is 10,160 euros, and almost 10 times more in regard to an average economic size of agricultural holding in Serbia;
  - ✓ Agricultural holdings which realize and/or plan investments in physical assets for agricultural production and processing and marketing of agricultural products (through the use of their own funds/bank credits or subsidies from the agrarian budget). For example, the potential users of analysed generators can be agricultural holdings as users of incentives (grants) of Ministry of Agriculture and Environmental Protection of the Republic of Serbia for purchasing new mechanization and equipment for irrigation: irrigation pumps, generators for starting the pumps (diesel, gasoline and electric powered); the drop irrigation system; the systems of irrigation by sprinkler (Official Gazette of RS, no. 38/16);
  - ✓ Households, legal entities, entrepreneurs, associations in the fields outside of agriculture, for example in traffic and tourism, in remote mountain centres, with no available electro-distribution network (for campers, etc.).

There should be pointed out that ***barriers for using RE power generators in agriculture and rural development for own consumption*** can be:

- ✓ Financial restrictions and low purchasing power of agricultural holdings. The average economic size of agricultural holding in Serbia (data for 2012) amounts 5,918 euros, while in EU-28 is even 30,542 euros (data for 2013) (Cvijanović et al, 2014),

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<sup>7</sup> Physical size of a farm are usually characterized by a size of utilised agricultural area (UAA) and according to this criterion, farms with less than 2 ha or less than 5 ha UAA are defined as small farms (European Commission, Brief AGRI.L.2 – N°2 – July 2011).

<sup>8</sup> According to EU regulations on support to rural development (Regulation EU No 1305/2013, L 347), young farmer is a person who is not older than 40 years at the time of the request, and who has the adequate professional qualifications and skills, and he takes the office manager of an agricultural holding for the first time.

- ✓ Low level of organisation and association of farmers. The producers are disunited, since cooperatives and associations of farmers are not sufficiently developed (Popović, Paraušić, 2016),
- ✓ Difficulty in accepting innovations (new technologies) by farmers, due to a low educational level, low IT knowledge, conservative attitudes of rural population, etc.,
- ✓ Failure in recognizing the benefits (interests) in using RE,
- ✓ Unsatisfying marketing promotion of RE and energy efficiency.
- ✓ Insufficient training and awareness of farmers.

There is currently no support to agricultural holdings and/or households in rural areas, which produce RE for own needs, although certain laws and programs predict it:

- ✓ ***Law on efficient energy use*** (Official Gazette of RS, no. 25/2013). In compliance with the new law and the Decision on opening the Budget fund for the improvement of energy efficiency of the Republic of Serbia (Official Gazette of RS, no. 92/13), the Budget Fund for the Improvement of Energy Efficiency has started to work in 2014. It should encourage *inter alia* also the use of RE for the production of electrical and thermal energy for ***own needs***, as well as the other activities which aims to use energy more efficiently, through financing or co-financing of the appropriate projects, programs and activities.
- ✓ ***Law on incentives in agriculture and rural development*** (Official Gazette of RS, no. 10/13). The support to investments in RE belongs to the group of incentives for the rural development measures, for the programs of sustainable rural development, which implement in order to improve and protect the environment,
- ✓ ***IPARD program for Serbia for the period 2014-2020*** (Official Gazette of RS, no. 30/2016). Investments in energy production from renewable sources will be supported through the rural development measures, which refer to investments in physical assets of agricultural holdings and the investments which refer to processing and marketing of agricultural products and fishery products, as well as through measures by which encourage the diversification of agricultural holdings and business development, whereby there will be supported only investments in RE power plants for ***own needs*** (sale of electricity to the network is allowed only within the limits of own consumption).

The application of renewable energy sources is closely associated with meteorological conditions and therefore very important to carry out measurement and acquisition of certain meteorological (weather) size, like atmospheric pressure, temperature of air, humidity, quantity of rainfall, solar insolation, wind speed (Despotović et al, 2016).

## Conclusions and Recommendations

For all governments, the commitment to sustainable development and energy efficiency, the green economy development and greater use of RE means redefining of legal framework and the system of subsidies, the construction of market infrastructure and market mechanisms, “greening” of public procurements, redirecting public investments into the green economy and strengthening the public-private partnership and cooperation with science-research institutions and civil society organisations.

Serbia's activities and obligations concerning the application of European directives in the field of energy efficiency and RE come from the obligations according to the contract on the Energy Community establishment (Official Gazette of RS, no. 62/06), and they are in accordance to the national legislation adjustment to EU legislation in the field of the *efficient and sustainable use of natural resources (including more efficient use of RE), energy efficiency and the development followed by low emission of gas with the greenhouse effect.*

Preconditions for investments in production and greater use of renewable energy for own needs in the sector of agriculture and rural development of Serbia (development of so called “green” agriculture and sustainable agricultural and rural development) in future period will depend substantially on the following assumptions:

- ✓ **Financial support to users** by the state, i.e. Ministry of Agriculture and Environmental Protection and the Ministry of Mining and Energy (subsidies or reliefs to agricultural holdings for purchasing power generators from renewable sources, as well as incentives directed to producers of these devices). Substitution of fossil fuels and electricity from the power grid, electricity from RE (solar and wind energy) requires *subsidies* in order to be accepted by farmers. Besides, it will be also important to motivate the business sector to invest in eco-innovations and use resources and energy rationally,
- ✓ **Providing favourable credit lines**, in order to encourage investments in facilities and devices which use RE,

- ✓ **Informing and education of users (agricultural producers, population of rural areas, etc.)**, especially in remote areas, so agricultural extension and associations of farmers will play an important role in dissemination of knowledge in future,
- ✓ Development and strengthening of **public-private partnership**. The concept of energy cooperatives implies active inclusion and association of local communities and physical persons, aiming to joint venture in energy facilities based on renewable energy, hasn't yet begun to live in Serbia. This form of investments, especially popular in Germany and Denmark, would affect positively on the local areas economy, as well as to wider acceptance of RE technologies<sup>9</sup>.
- ✓ **Increased activities of the local authority units** (towns, municipalities), through programming an annual budgetary support to agriculture and rural development (through the Program of measures for implementation of agricultural and rural development policy) in terms of subsidizing the procurement of equipment and devices for RE production,
- ✓ Possibilities of inclusion into the regional and pan-European flows of rural development and the environmental protection.

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