

Potential of Use of the Republic of Serbia Renewable Energy Sources

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Abstract—Renewable energy sources are energy sources that can be completely or partially renewable. Their use is lately more and more prominent because of the increasing pollution of the planet Earth. Support for the sustainable development of renewable energy sources has become one of the main goals of the European Union, and thus of the Republic of Serbia. The Republic of Serbia has a significant energy potential that it will strive to use in the future. Therefore, in this paper we will present the potential of renewable energy sources of the Republic of Serbia, as well as the possible potential of their use in electricity production.

Keywords-Renewable energy sources; The Republic of Serbia; Energy potentials; European Union Directive

I. INTRODUCTION

Renewable energy sources are one of the most efficient solutions for clean energy and sustainable development. Throughout the world today, the strategic positioning of states, nations and companies for access to the remaining natural resources, especially mineral energy sources such as oil and gas, but also the technological competition in energy efficiency and commercial use of renewable energy sources, is still in progress [1].

Renewable energy sources are the priority of energy union. In the countries of the European Union, and thus the Republic of Serbia, renewable energy sources are one of the most current issues as possible producers of electricity.

Directive 2001/77/EC [2] on promotion of electricity produced from renewable energy sources and Directive 2003/30/EC [3] on promotion of the use of biofuels and other renewable fuels in transport are among the first directives on renewable resources.

Directive 2009/28/EC on renewable energy has set a mandatory target of 20% of the total share of renewable energy sources in electricity consumption by 2020 [4].

In 2018, the revised Directive on Renewable Sources (Directive (EU) 2018/2001) entered into force, as part of the

“Clean Energy for All Europeans” package. The aim of this directive is that the total share of renewable energy sources in electricity consumption will be 32% by 2030 [5].

The Republic of Serbia in 2007 ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change. The Kyoto Protocol aimed to reduce the emission of harmful gases that cause the “greenhouse” effect, thus reducing the rate of warming of the atmosphere. By ratifying this protocol, the Republic of Serbia has given a clear signal to its commitment to renewable energy sources [6], and gained the status of a net seller of emission credits and the right to finance projects to improve energy efficiency in the country. This led to the increase of competitiveness of its economy on the world market.

II. NATIONAL STRATEGY OF THE REPUBLIC OF SERBIA ON ELECTRICITY PRODUCTION FROM RENEWABLE ENERGY SOURCES

Ministry of Energy, Development and Environmental Protection of the Republic of Serbia in 2013 adopted the National Action Plan for the use of renewable energy sources. [7] This Action Plan is the result of the international obligation of the Republic of Serbia from 2006: “Law on the Ratification of the Treaty establishing the Energy Community between European Union and The Republic of Albania, the Republic of Bulgaria, Bosnia and Hercegovina, the Republic of Croatia, The Former Yugoslav Republic of Macedonia, the Republic of Montenegro, Romania, the Republic of Serbia and United Nations Interim Mission in Kosovo in accordance with the resolution 1244 of the United Nations Security Council” (“Official Gazette of the Republic of Serbia” No. 62/06 [8]). Action Plan defines fundamental goals of the energy policy of the Republic of Serbia:

- Development of the energy infrastructure.

- Diversification of energy sources to ensure security of supply.
- Introduction of modern technologies in energy sector (especially technologies that will encourage the economic development of the country).
- Reduction of the growth of final energy consumption.
- Increasing the energy efficiency.
- Increasing the use of renewable energy resources [7].

In National Strategy of Sustainable Development (2008) sector for renewable energy sources, the following goals have been defined [9]:

- Extensive research on potential of sustainable energy sources.
- Determining the technology for which the introduction of incentive measures and mechanisms is justified.
- Adoption of regulations (tax deductions, incentive prices, etc.) for stimulating the use of renewable energy sources.
- Increasing the scope of use of renewable energy sources.
- Education and awareness raising as an incentive for the inclusion in the production and the use of energy form renewable sources.

The Republic of Serbia has significant renewable energy resources to meet these strategies, and the Government of the Republic of Serbia has developed an energy development strategy for the period to 2025, with projections up to 2030, Fig. 1.



Figure 1. Development of the Republic of Serbia strategy for the development of energetics to 2025, with projections up to 2030 [10].

III. POTENTIAL OF RENEWABLE ENERGY SOURCES IN THE REPUBLIC OF SERBIA

Access to energy from renewable sources is one of the most important long-term policy decisions a country can make. Its development brings a number of benefits. One of the main

benefits is that renewable energy technologies in order to achieve sustainable development provide the opportunity to reduce carbon dioxide in the atmosphere, and thus slow down climate change [11].

Energy efficiency and introduction of renewable energy sources in production, transmission, distribution and consumption/satisfaction of energy needs in energetic sector are the most important mechanisms for combating climate changes [12].

The studies have shown that energy potential of the renewable energy sources can satisfy about 25% of electric power market needs in the Republic of Serbia [12]. In the future, it is predicted that the mainstay of energy independence of the Republic of Serbia will be renewable energy sources. However, the economic viability of renewable energy sources is only at the level of estimates. It is estimated that information on the cost-effectiveness of using renewable energy sources in the Republic of Serbia is very limited and needs to be confirmed.

Energy produced from non-fossil renewable sources represents renewable energy sources, including hydropower, solar energy, wind energy, geothermal energy, ocean energy, bioenergy. Some of the most significant are wind energy, solar energy, bioenergy and hydropower.

Regarding the wind energy, it has been estimated that the technically usable potential in the Republic of Serbia is 2300 GWh and that it can replace about 2% of total consumption of the electric energy. Existing wind data suggest that at several locations there are wind speeds between 6-7 m/s, while foreign experience suggests that this corresponds to an annual load of about 18-25%. Only the location of the top of Stara Planina, Midzor, with an established annual average of 7.6 m/s, can be classified as good, with an expected load of about 28% [13].

The Republic of Serbia has significant possibilities in the area of biomass combustions. It has been estimated that biomass energy potential of the Republic of Serbia is about 3.405 million ten (1 ten=1 ton of equivalent oil =11630 kWh =11.63 MWh). It consists of residues in the wood industry (1.53 million ten), the potential of agricultural biomass (1.67 million ten residues in farming, livestock, fruit growing, viticulture and primary fruit processing), while the potential of biodegradable municipal waste is estimated at 205 thousand tons. Biodegradable waste (except municipal waste) also includes waste edible oils and waste of animal origin (rendering slaughterhouse waste) in the total amount of 0.043 million ten/year [1].

A large part of the Serbian economy is based on agricultural production and agriculturally oriented industry. The northern part of the Republic of Serbia, the Province of Vojvodina and the territories along the Sava and Danube rivers are the main areas with the sources of biomass waste [14].

Solar energy is one of the energy potentials of the Republic of Serbia. Number of hours of solar radiation over most of the territory of the Republic of Serbia is much higher than in many European countries and is over 2000 hours. The average solar radiation is about 40% higher than the European average, but the use of this energy in production is still far behind the countries

of the European Union. Areas in the Republic of Serbia in which a large number of hours of sunshine are registered and the annual ratio of actual radiation and total possibilities make up approximately 50% of the territory.

Fig. 2 represents the annual average of day energy of global radiation on the horizontal surface.

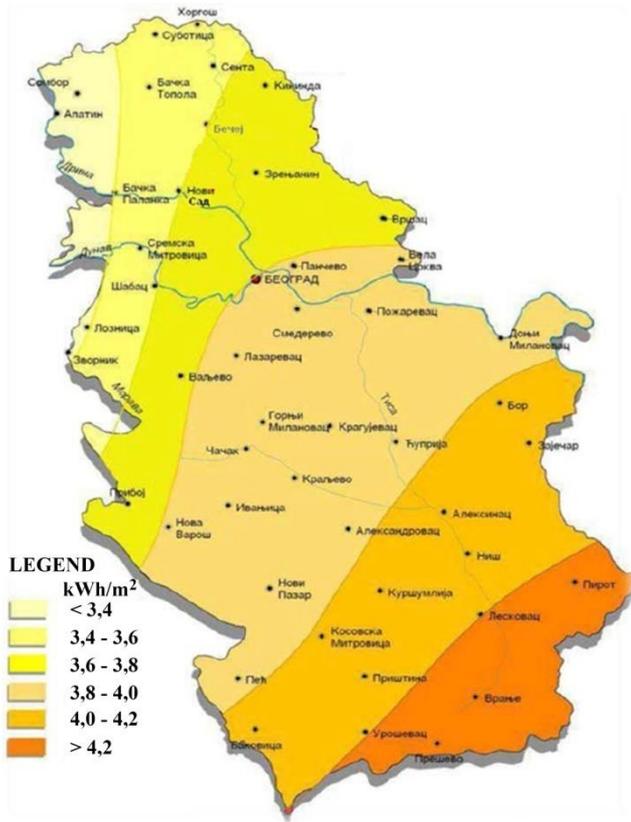


Figure 2. Annual average of day energy of global radiation on the horizontal surface [14].

There are different ways of using solar energy: heating with solar energy and converting solar energy into electricity, which is done in two ways, by concentrating solar energy and photovoltaic collectors (panels). An advanced method is the direct production of electricity by photovoltaic panels [15].

In addition, the Republic of Serbia has a rich geothermal potential of over 2300 GWh per year. The use of geothermal energy encourages the importance of developing spa, health and recreational tourism. The most developed geothermal areas are in Vojvodina, and spa towns Vranjska, Sijerinjska and Jošanička Banja have the highest water temperature.

The draft strategy for the development of energy in the Republic of Serbia for the period to 2025, with projections until 2030, states that the potentials of renewable energy sources in the Republic of Serbia are significant and are estimated at 5.65 million ten per year. Of this amount, more than 60% is biomass potential, the use of which is currently estimated at about 30%

of the available potentials. The available technical hydro potential participates with about 30% in the total potentials of renewable energy sources. Half of this amount has been already been used. Regarding the other renewable sources, currently only the use of geothermal energy is partially monitored and balanced [1].

On Fig. 3 the projection of capacity building for electric energy production using renewable energy sources is presented.

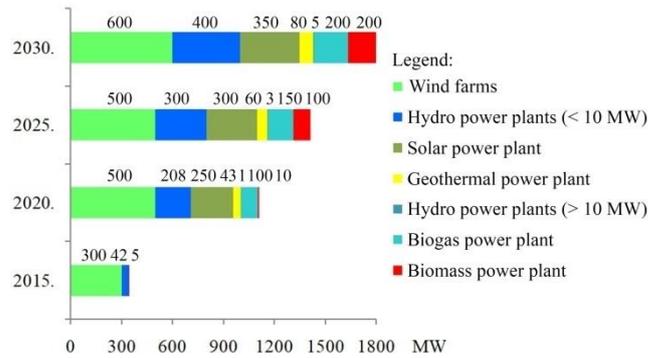


Figure 3. Projection of capacity building for electric energy production using renewable energy sources [1].

Legal framework for the use of renewable energy sources in the Republic of Serbia is reflected in the fact that Serbia, in the process of joining the European Union will shape its legal regulations on renewable energy resources in accordance with European Union legal regulations.

It is interesting to note that the funding of renewable energy sources is one of the crucial factors in the development of any country. The challenge is to provide appropriate financial instruments that will enable renewable energy sources to become common and to maximize their potential in the market [16].

IV. CONCLUSION

In recent years, renewable energy sources have played an increasing role in energy production. Various environmental constraints, such as limiting carbon dioxide emissions from electricity generation to prevent the greenhouse effect, strongly emphasize the benefits of renewable energy sources. One of the strategic goals of the State should be to support the construction of new capacities for the utilization of renewable energy sources. Renewable energy production should also be increased to reduce import dependence and increase energy security.

At the end of this presentation, we can conclude that the Republic of Serbia has significant energy potential, but unfortunately not sufficiently exploited.

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