

Increasing the Role of RES and Correct Assessment the Solar Potential of Bulgaria

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Abstract – In recent years the issue of scale utilization of renewable energy sources places great importance as recognizing that this is one way to prevent global warming and reduce dependence on countries with limited resources of organic fuels from imported ones.

Keywords – renewable energy sources, global warming

I. INTRODUCTION.

A. Increasing the role of RES.

In recent years the issue of scale utilization of renewable energy sources places great importance as recognizing that this is one way to prevent global warming and reduce dependence on countries with limited resources of organic fuels from imported ones.

The utilization of renewable energy in the world, including Europe and in Bulgaria passed the stage of emotional enthusiasm and can say that now is the stage of assessing the technical and economic realities.

EU energy consumption is growing steadily. Question arises to meet future needs, while increasing requirements for environmentally friendly energy. To meet the challenges of the future in 1997 was admitted to the White Book on renewable energy resources, which contains a strategy for their development. In 2000 this document was followed by the Green Book relating to security of energy. Both documents highlighted the importance of developing renewable energy.

From 2007 to the Member States of the EU have set the following targets.

* Energy consumption in Europe by 2020 to reduce by 20% in energy consumption in 2006

*The share of renewables in total consumption of energy sources to 12% in 2010 and 20% in 2020

*Share of biomass reaches 9% in the total energy in 2020.

In this context, assessing the achievable levels of utilization of each available RES. The targets are very high and achieving them is possible with intensive development and improvement of energy technologies transformation and is available on the market only a highly efficient, profitable and environmentally friendly systems and

products are compatible with existing and future architecture, construction and industrial technologies.

B. Policies and measures.

To reach our country to the 2010 indicative target maximum target: the share of renewables in gross domestic electricity consumption to reach 11% (Under favorable climate conditions) in terms of increasing consumption of electricity needed large complex targeted measures at the state level as well as for accelerated introduction of renewable energy and energy saving. Especially important is to limit and break the trend of absolute increase in power consumption not only through energy efficiency measures (energy efficiency), but end by redirecting consumers (especially industry) to alternative fuels and energy (at least by optimizing prices of electricity for business).

C. National policy to promote consumption.

In accordance with European legislation and in fulfillment of our commitments in the negotiation process and recommendations of the Commission in the Republic of Bulgaria Act was developed for renewable and alternative energy sources and biofuels. The main objectives of the law relating to the diversification of energy supplies, reduce the cost of imported energy resources and energy, increasing the capacity of small and medium producers of renewable and alternative energy sources and biofuels and other renewable fuels, environmental and creating conditions for achieving sustainable development at local and regional level.

The objectives will be achieved by promoting development and use of technologies for production and consumption of energy produced from renewable and alternative energy sources and promote the development and use of technologies production and consumption of biofuels and other renewable fuels.

This law achieved full harmonization with Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market and Directive 2003/30/EO to promote the use of biofuels or other renewable fuels for transport. The Act regulates the public relations to promote the production and consumption of electricity, heat and / or cooling energy from renewable and alternative energy sources, as well as production and consumption of biofuels. The provisions of the law is introduced for the production and consumption of biofuels,

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Yearly sum of global irradiation received by optimally-inclined PV modules

Bulgaria

100 km

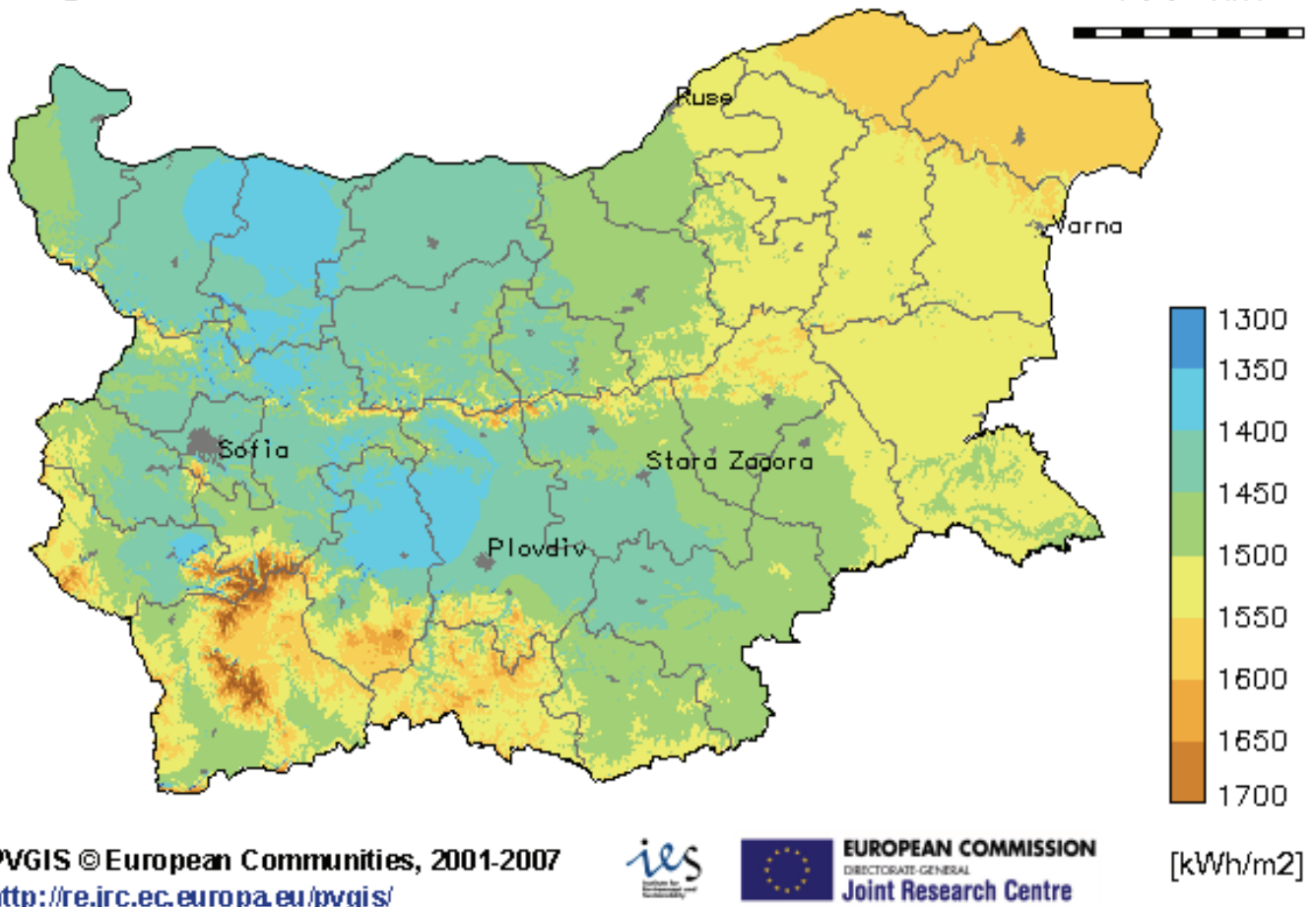


Figure 1: Annual total distribution of total solar radiation of PV module at the optimum slope 2001-2007

which will reduce emissions from the transport sector and the use of conventional fuels.

The Act provides for the development of national targets for:

- Promoting the consumption of electricity produced from RES.
- Promoting use of biofuels in transport sector.

II. POTENTIAL OF SOLAR AND WIND ENERGY IN BULGARIA.

A. Wind Energy.

According to recent forecasts of the European wind energy association, a trend of increased use of development of wind energy in Europe. Expected installed capacity of 28 400 MW in 2003 to reach 75 000 MW in 2010. and 180 000 MW in 2020. In 2020 electricity generated from wind turbines, will cover the needs of 195 million Europeans, or half the

population of the continent. According to EUROSTAT estimates of consumption of wind energy in the EU in 2010 will reach 10 000 ktoe. In Bulgaria there is little wind energy contribution to gross electricity production in the country. In 2001, the wind produced 35 MWh (3 toe), in 2003 -63 MWh (5.4 toe), and in 2004 - 707 MWh (60 .8 ktoe). This shows that development of wind energy in Bulgaria has accelerated.

B. Solar energy.

The theoretical potential of solar energy is defined as the average amount of solar heat for one year on one square meter of horizontal surface and is expressed in kWh/m².

Affordable solar energy potential is determined after taking into account of several key factors: the uneven distribution of energy resources of solar energy in different seasons; physiographic features of the territory, restrictions on construction and operation of solar systems in specific areas, such as nature reserves and other military facilities. World Energy Council (WEC) identified as a possible potential of solar energy worldwide 1 575 EJ / yr.

III. THE DISTRIBUTION OF SOLAR RADIATION IN BULGARIA AND ANALYSIS OF SOLAR POTENTIAL.

Due to its southern exposure, and because of its relatively small clouds, Bulgaria receives a significant amount of total (direct and diffuse) radiation. In June, where is the longest day and the highest altitude of the sun, complete with serene radiation reaches approximately 9181h (m2.day). The average annual values in 5927 ranged from the most northern parts to 6160 Wh / (m2.day) for the south. The values for the total radiation in the cloudless sky are minimal in December - from 2441 to 2789 Wh (m2.day).

The average annual values of total radiation in the actual conditions of clouds in different regions of the country have ranged from 3835 to 4649 Wh (m2.day). The values of total radiation are greatest in July. Although in June the length of day is the greatest height and the sun reaches its maximum value due to the considerable cloudiness values of total radiation is less than in July.

According to data from the system PVGIS the European Union and Bulgaria data in Figure 1 and Figure 2 presents the distribution of total solar radiation on the surface of PV collector placed at the optimum angle corresponding to the geography of the area.

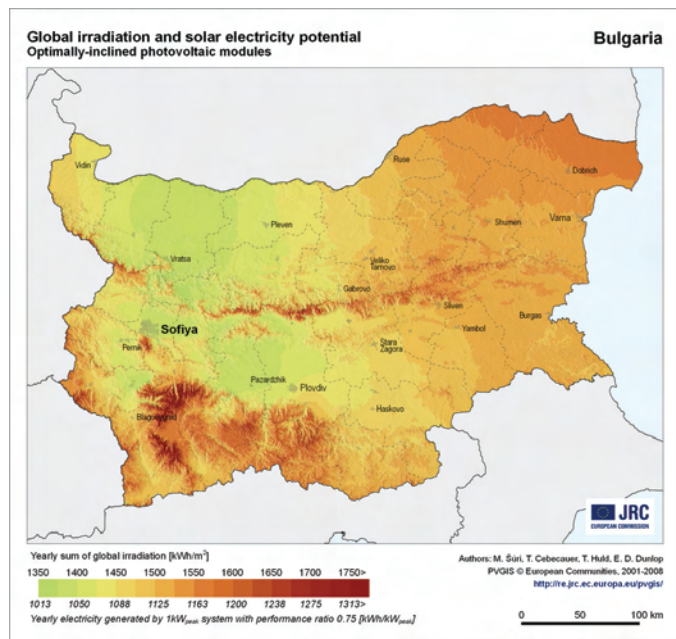


Figure 2: Annual total distribution of total solar radiation of PV module at the optimum tilt, 2001-2008



Figure 3: Annual average solar radiation on horizontal surfaces and on optimal angle

IV. ASSESSMENT THE POTENTIAL OF SOLAR RADIATION IN BULGARIA

The average amount of sunshine in Bulgaria is about 2 150 hours, and average solar radiation resource is 1 517 kWh m2. Generally receives total theoretical potential of solar energy incident upon the country for one year in the range of 13.10 ktoe. Available as an annual potential of solar energy utilization can indicate approximately 390 ktoe. As an official source for assessing the potential of using solar energy project under the PHARE, BG9307-03-01-L001, "Technical and economic assessment of renewable energy in Bulgaria. At the heart of the project are set out data from the Institute of Meteorology and Hydrology, BAS, all derived from 119 meteorological stations in Bulgaria for a period of over 30 years. After analysis of the databases is made regionalization of the country of solar potential and Bulgaria is divided into three regions, depending on the intensity of sunshine (Figure 3). Other potential map can be made by METEONORM, (Figure 4).

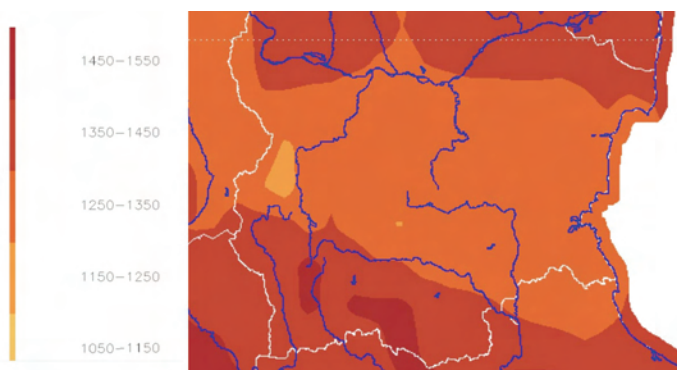


Figure 4. Potential data by METEONORM in kWh / m2 / Year

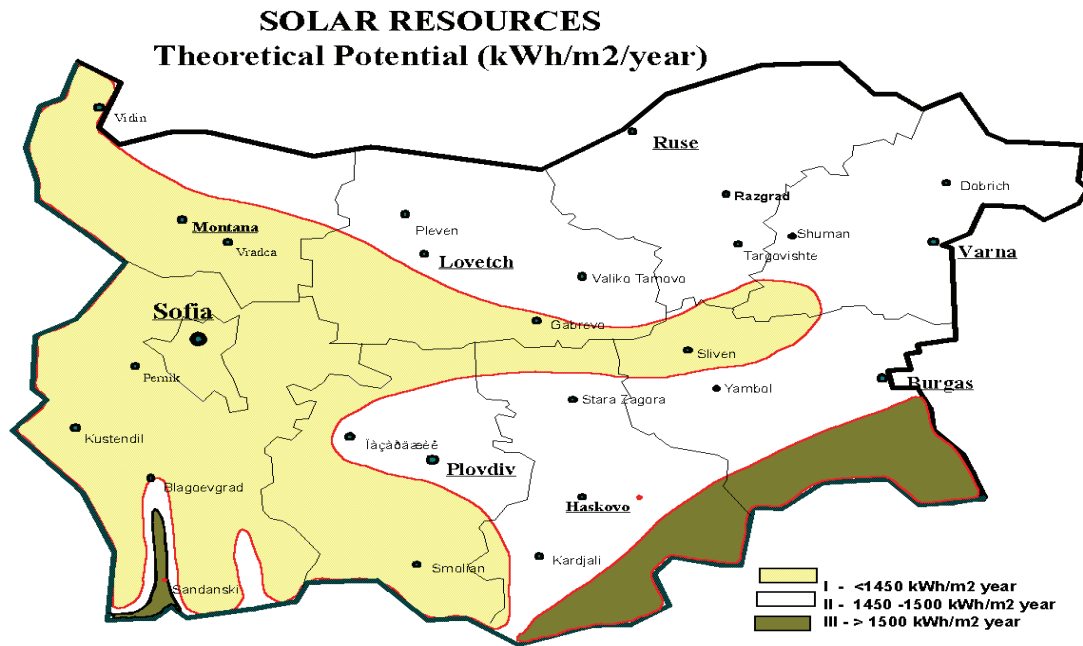


Figure 5. Theoretical potential of solar radiation in regions

V. CONCLUSION:

On Figure 5, a theoretical distribution of the solar radiation has been performed. On Figure 6 an attempt to analyze the annual average solar radiation (Figure 3) has been performed. A nonlinear regression is obtained with 2 parameters (latitude, longitude) and 30 coefficients for an equation of 7-th degree. As seen there is not much coincidence with the other solar maps as seen on figures 1,2,4 and 5.

As seen above, the data from the sources differs each other. Therefore it is necessary to create actual map of solar potential. The problem could be solved by at least annual measurement at different sites of the country. Also a data base must be performed in order to analyze the global changes during the years. This is necessary from the current point of view, targeting the era of the clean energies, where the solar energy takes one of the first places. Creating a detailed solar potential map will help the investors to take a fast and correct decision about building solar plants at different places. Also it is very important to have in mind the problems of shadowing, so the solar maps could be combined with topographic.

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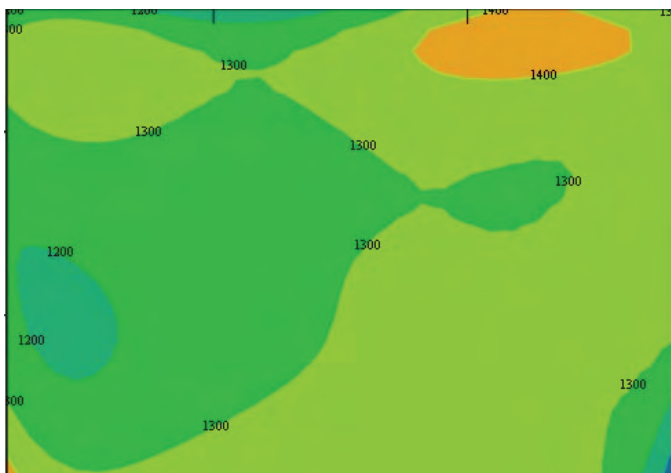


Figure 6 : Statistical data of solar radiation measurement, treated with regressional equation