

# RENEWABLE ENERGY SUPPORT IN REPUBLIC OF MACEDONIA

**Minovski, D., Sarac, V., Bozinovski, G.,**

“Goce Delcev” University – Ship, Faculty of Electrical Engineering,  
22 Oktomvri bb, 2420 Radovis, Republic of Macedonia  
[dragancem@gmail.com](mailto:dragancem@gmail.com), [vasilija.sarac@ugd.edu.mk](mailto:vasilija.sarac@ugd.edu.mk)

**Bozinovski, G.,**

JSC "Macedonian power plants", 11. October 9  
1000 Skopje, Republic of Macedonia  
[goce\\_boz@yahoo.com](mailto:goce_boz@yahoo.com)

## Abstract

Republic of Macedonia is, highly dependent on energy commodities import. Apart the whole consumption of natural gas and oil, 30% from the total annual consumption of electrical energy is from import. In order to increase electrical energy production from RES Government of the Republic of Macedonia, together with Energy Regulatory Commission and Energy Agency brought new Energy Law and new regulations for renewable energy sources. For the different type of renewable energy source is determinate a tariff (preferential price of electrical energy) and the guaranteed period for using the status privileged producer of electrical energy from RES. Paper deals with national support and different background for increasing renewable energy sources in the energy sector in Republic of Macedonia.

## Keywords

Renewable energy sources, wind energy, solar energy, power plant, feed in tariff

## 1 INTRODUCTION

Located in the central part of the Balkan Peninsula with its continental climate, high mountain ranges and abundant water resources, the Republic of Macedonia has a great potential for using water power, solar energy, biomass and wind power for electricity production. In the following parts, the potential is discussed for renewable energy sources in the Republic of Macedonia:

### WIND ENERGY:

In the Republic of Macedonia, there are no wind power plants to date. The potential for using wind power by now has been barely explored yet. By now analyses have been performed by the hydro meteorological institute only with weather stations at several locations in the country. Yet the data for the sites constitute a very small sample only and are of limited use for determining the wind power potential for electricity production. According to pertinent studies performed by the Macedonian academy of sciences and art and based on satellite measurements, only the Stip and Radovis regions and the region around the river Vardar in the southeast of the country appear viable in terms of potential efficiency as locations for building wind power plants. Below is a map with wind speeds in regions of the Republic of Macedonia.

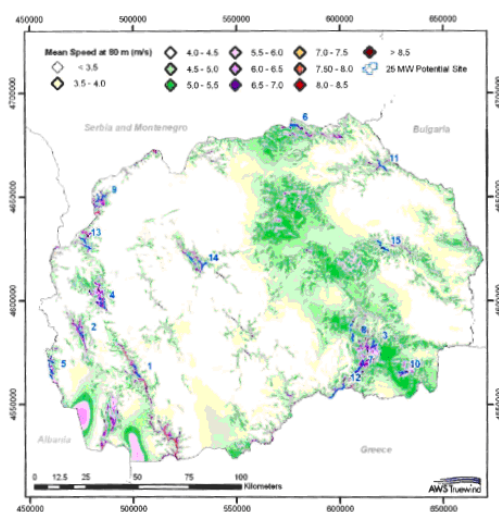


Fig.1.1. Map of wind speeds in the Republic of Macedonia

Both the above data and the data gathered by private investors imply that realistically, wind power plant projects in form of wind parks (with multiple wind power plants) are feasible in the Stip region with estimated total output potential of 80 MW, in the Radovis region with estimated total output potential of 50 MW and in the Demir Kapija region with estimated total output potential of 70 MW. The efficiency of wind farms on the suggested sites in Macedonia is estimated at 20-25 %.

#### SOLAR ENERGY:

The Republic of Macedonia is located between the 41st and 43rd parallel with higher intensity of solar radiation compared to more northern regions. As for other renewable energy sources, studies have been carried out and possibilities explored also for using solar energy. According to the data of the Macedonian academy of sciences and art, there are 2200 hours of sunshine in Macedonia on annual average. Intensity of solar radiation depends on local environmental and weather conditions and the terrain surface, with average annual solar radiation values around 1500 Wh/m<sup>2</sup>. The highest insolation values are reached in the southwest part of the country although the number of sunny days in the area is comparably less than in the southeast regions (around 100 days on average). The following picture provides a summary of the intensity of solar radiation in the Republic of Macedonia.

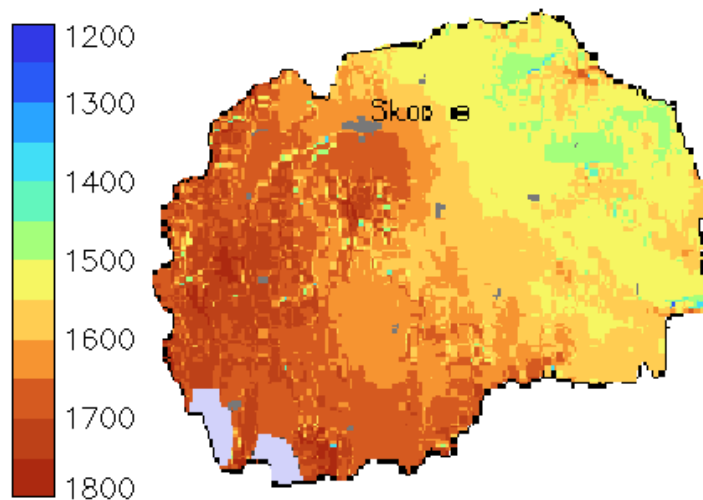


Fig.1.2. Intensity of solar radiation in the Republic of Macedonia

#### GEOTHERMAL ENERGY:

The Republic of Macedonia is rich in low to medium yield geothermal resources. Temperatures of the geothermal resources are not sufficient for exploitation for electricity production purposes yet perfectly facilitate their use in other applications. There is a traditional use of this type of energy for heating orangeries and public structures and for drying agricultural products. Currently the share of geothermal sources in total electricity consumption is very low at around 210 GWh annually, corresponding approximately to 0.5% in percentage terms.

#### WATER POWER:

The renewable energy source with the most prevalent use in the Republic of Macedonia today is water power. Depending on hydrological conditions each year, water energy participates in the country's total electricity consumption with 15 to 18 %. The share of small hydroelectric plants (SHEP) in total electricity consumption is at 2 %. According to studies from 1982, the theoretical water power potential of the country totals around 8863 GWh, thereof 5524.2 GWh technically implementable potential. The potential breaks down among the two river basins that share the territory of Macedonia, i.e., the Vardar river basin and the Crna river basin. The larger part of the potential belongs to the Vardar river basin with a total technical potential of 4560 GWh. The results of the studies indicate for the entire national territory a potential for around 405 small hydroelectric plants with a total output of 1087.5 GWh. The highest potential for building SHEPs is in the northwest of the country. The

following picture provides a summary visualization of the potential for building SHEPs in the Republic of Macedonia.

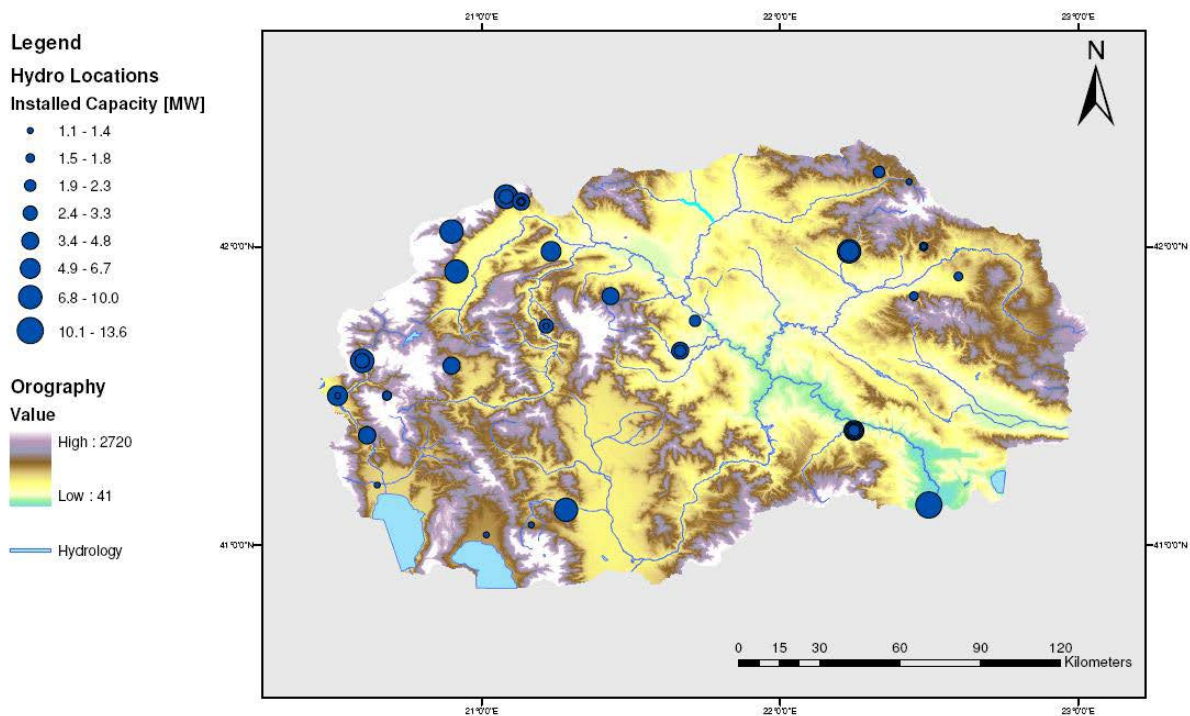


Fig.1.3. Suitability of locations for building SHEPs in Republic of Macedonia

## BIOMASS:

As is the case with other renewable energy sources, the potential for biomass in the Republic of Macedonia has not been examined in detail yet. According to some studies, Macedonia as a country with a developed agricultural and livestock sector actually boasts a fairly high potential for biomass. According to energy balance figures, the share of biomass in total energy supply in the Republic of Macedonia is 7.6 %. Biomass in general is the key energy source for heating in households. Based on the available data in Republic of Macedonia, total output potential for biomass can be estimated at about 117 to 167 MW.

## 2 SUPPORT OF RENEWABLE ENERGY IN REPUBLIC OF MACEDONIA

Republic of Macedonia is, like Republic of Slovakia, highly dependent on energy commodities import. Apart the whole consumption of natural gas and oil, 30% from the total annual consumption of electrical energy is from import.

In 2011, total electrical energy consumption was 8985.3 GWh, total electricity production was 6324.6 GWh (70.4% from electrical energy consumption) and import of electrical energy was 2660.7 GWh (29.6% from electrical energy consumption). Renewable energy sources in the total electrical energy production are with 23.22% or 1468.8 GWh and in the total electrical energy consumption are with 16,35%. In the electrical energy production from renewable energy sources 1272.8 GWh are from big hydro power plants (more than 10 MW installed power) and the rest 196 GWh (3% from the total electrical energy production or 2.2% from the total electrical energy consumption) are from small hydro power plants (less than 10 MW installed power) and sun power plants (photovoltaic power stations).

In order to increase electrical energy production from RES Government of the Republic of Macedonia, together with Energy Regulatory Commission and Energy Agency brought new Energy Law and new regulations for renewable energy sources. For the different type of renewable energy source is determinate a tariff (preferential price of electrical energy) and the guaranteed period for using the status privileged producer of electrical energy from RES (Table 1).

Table 1 Feed in Tariffs in Republic of Macedonia

<b>Small Hydro power plants</b>			
<b>Block</b>	<b>Monthly quantities of delivered electricity (kWh)</b>	<b>Feed-in tariffs (€ cents/kWh)</b>	<b>Guaranteed period (years)</b>
I	1 – 1.020.000	12	20
II	1.020.001 – 2.040.000	8	
III	2.040.001 – 4.200.000	6	
IV	4.200.001 – 8.400.000	5	
V	Above 8.400.001	4,5	
Wind Power Plants		8,9	20
<b>Electricity generation from BIOGAS power plants</b>			
<b>Block</b>	<b>Installed capacity(kW)</b>	<b>Feed-in tariffs (€ cents/kWh)</b>	<b>Guaranteed period (years)</b>
I	≤ 500 kW	15	20
II	501 – 2000 kW	13	
<b>PHOTOVOLTAIC</b>			
<b>Block</b>	<b>Installed capacity(kW)</b>	<b>Feed-in tariffs (€ cents/kWh)</b>	<b>Guaranteed period (years)</b>
I	≤ 50 kW	30	15
II	51 kW – 1000 kW	26	
<b>Electricity generated from Biomass</b>			
<b>Block</b>	<b>Installed capacity(kW)</b>	<b>Feed-in tariffs (€ cents/kWh)</b>	<b>Guaranteed period (years)</b>
I	≤ 1000 kW	11	20
II	1001– 2000 kW	9	

The total electrical energy produced from the “Privileged Producer” (from RES), according to the Energy law must be purchased by the MEPSO - Market Operator with the preferential price of electrical energy determinate by the Energy Regulatory Commission.

In order the impact of the new RES to the end price of electrical energy not to be more that 4%, the Government of the Republic of Macedonia make a decision to limit the installed capacity from different types of RES for the status “Privileged Producer” of electrical energy with preferential price. In the next table are presented the limits of installed capacity form different types of RES in Macedonia (Table 2).

Table 3 Government decision for maximum installed capacity from RES in Macedonia

Type of RES	Installed capacity per plant	Total installed capacity in Macedonia
Small Hydro power plant	Up to 10 MW	unlimited
Wind parks	Up to 50 MW	150 MW
Photovoltaic	Up to 50 kW = 2 MW Above 50 kW = 8 MW	10 MW
CHPP	Up to 3 MW	10 MW
Power plant on biogas/biomass	Up to 500 kW = 2 MW Above 500 kW = 8 MW	10 MW

### 3 CONCLUSION:

Republic of Macedonia like a European Union candidate country is prompted to implement EU directives and legislation for renewable energy sources. Feed in tariffs and guaranteed period for using this feed in tariffs are indicatives that in future there will be a lot of investments in RES. But frequent changes of the feed in tariffs are a very big negative impact for making investment decision for the investors. In the past 5 years feed in tariff for electrical energy from photovoltaic power stations was changed two times. With the first decision Energy regulatory Commission decide the feed in tariff to be 46 / 41 €cents/ kWh. The second changes was for decreasing the feed in tariff on 38 / 34 €cents/ kWh, and the last change was for decreasing on 30 / 26 €cents/ kWh. This decreasing of more than 35 % is a big negative impact for investors how has attend to invest in RES in Republic of Macedonia. Also the big negative impact is a Government decision to limit the installed capacity from RES how will be Privileged Producers of electrical energy in Macedonia with feed in tariff for produced electrical energy. In order to attract more investments and to increase electrical energy production from RES in Macedonia, Government must increase this limitation on the installed capacity and to keep feed in tariffs for electrical energy from RES unchanged for longer period..

### 4 REFERENCES

- [1] Janiček, F., Daruľa, I., Gaduš, J., Regula, E., Smitková, M., Polonec, L., Ludvík, J., Kubica, J.: Obnoviteľné zdroje energie 1. Technológie pre udržateľnú budúcnosť. Renesans, s. r. o., 2007. ISBN 978-80-969777-0-3.
- [2] Janiček, F., Gaduš, J., Šály, V., Daruľa, I., Regula, E., Smitková, M., Kubica, J., Pípa, M., Bindzár, M.: Obnoviteľné zdroje energie 2. Perspektívne premeny a technológie. Renesans, s. r. o., 2010. ISBN 978-80-89402-13-7.
- [3] Janiček, F., Minovski, D., Causevski, A., Krondijak, E.,(2008): Distributed Generation and Renewable Energy Sources in Republic of Macedonia, ELMA '08; Sofia, Bulgaria pp.64
- [4] Janiček, F., Minovski, D., Causevski, A., Šulc, I., (2009): Imapct from the wind power plants on the electric power system in the Republic of Macedonia, ENERGETIKA – EKOLÓGIA – EKONÓMIA '09,Novy Smokovec - Vysoke Tatry.
- [5] Internet side: [www.erc.org.mk](http://www.erc.org.mk)
- [6] Internet side: [www.mepso.com.mk](http://www.mepso.com.mk)