

HYBRID WIND-SOLAR POWER SOURCE FOR REMOTE FARMS IN VOJVODINA

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INTRODUCTION

- Preservation of endangered living environment, as well as survival on the planet Earth is the reason that there are more and more actions are taken for applying renewable energy sources (RES) in every-day life.
- In Serbia most of electric energy from RES is obtained by exploitation of the hydro potentials.
- The electric energy production from wind and solar energy has been considered very seriously.

INTRODUCTION

- Recently adopted long term strategy for energy supply in Vojvodina, northern Autonomous Province of Republic of Serbia, makes preferences for all kinds of RES.
- Extensive investigation on wind energy potential and solar irradiation showed that there are significant opportunities for their exploitation in Serbia and Vojvodina.

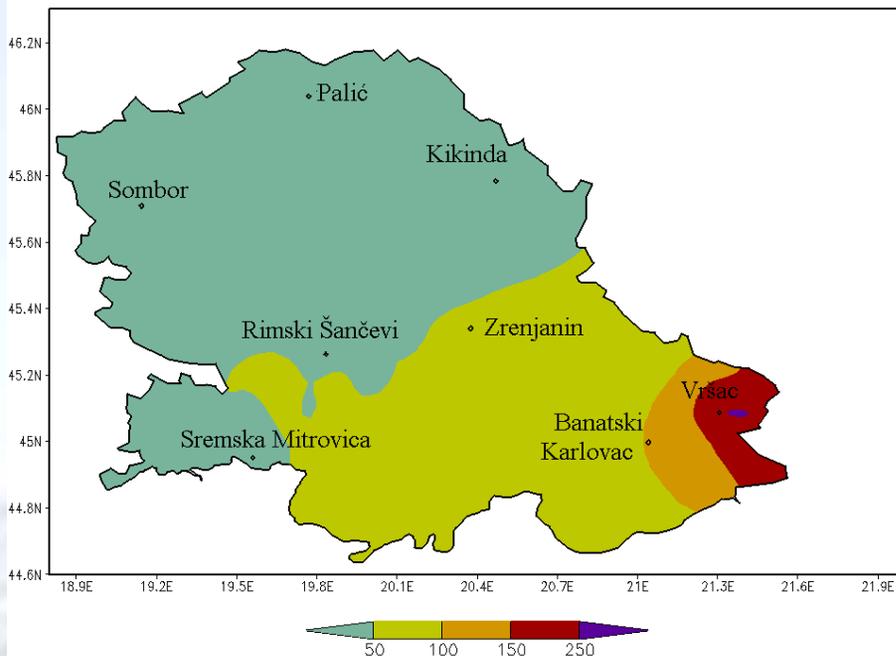
WIND POWER DENSITY

- The analysis of the energy potential of wind has been made according to 7-year-long measurements (2001-2007) of the wind speed and direction in eight meteorological stations in Vojvodina.
- From the statistic distribution of wind, the wind power density has been assessed for different heights (10m, 25m, 50m, 100m, 200m) and reported in “Wind Atlas of AP Vojvodina”.

www.psemr.vojvodina.gov.rs

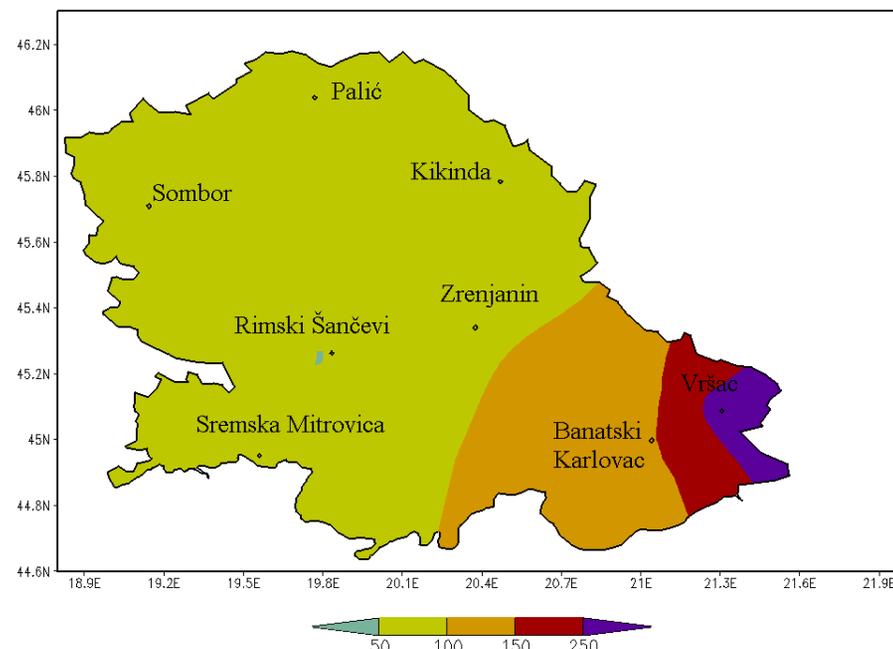
WIND POWER DENSITY

Gustina snage vetra [W/m²] na 10 m iznad tla $Z_o=0.03m$



height 10m

Gustina snage vetra [W/m²] na 25 m iznad tla $Z_o=0.03m$

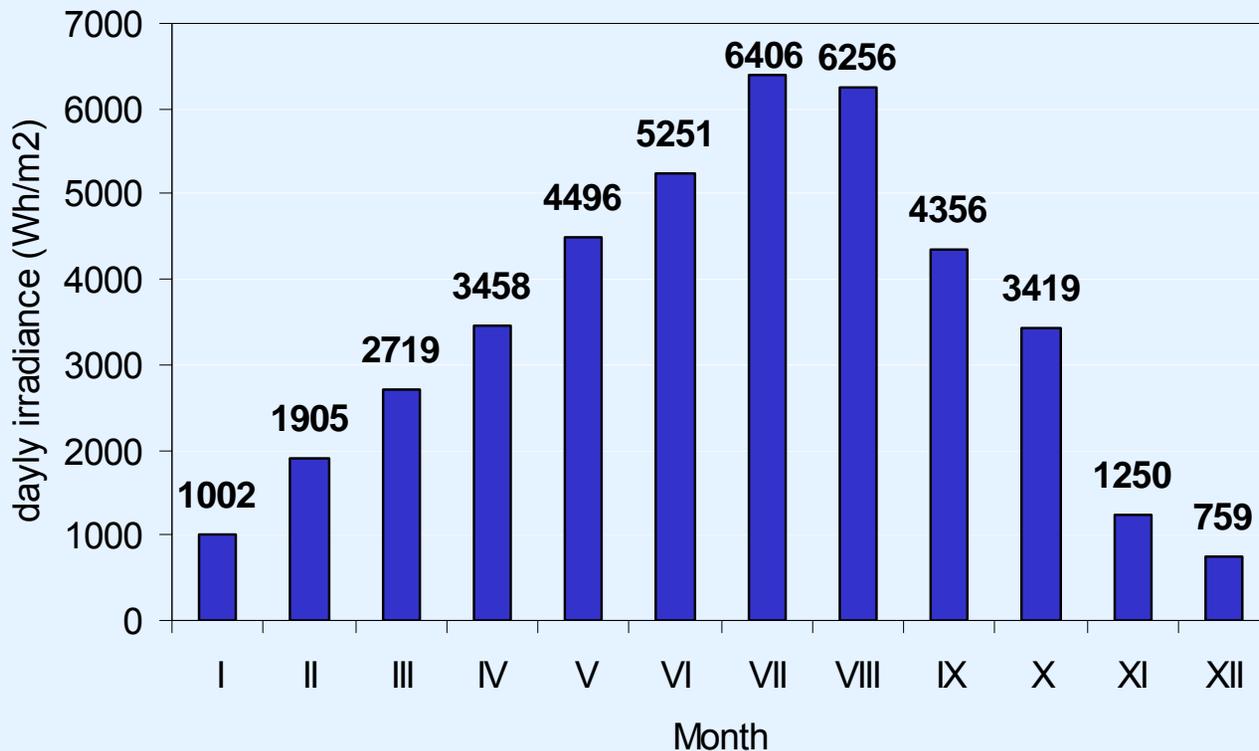


height 25m

SOLAR IRRADIATION

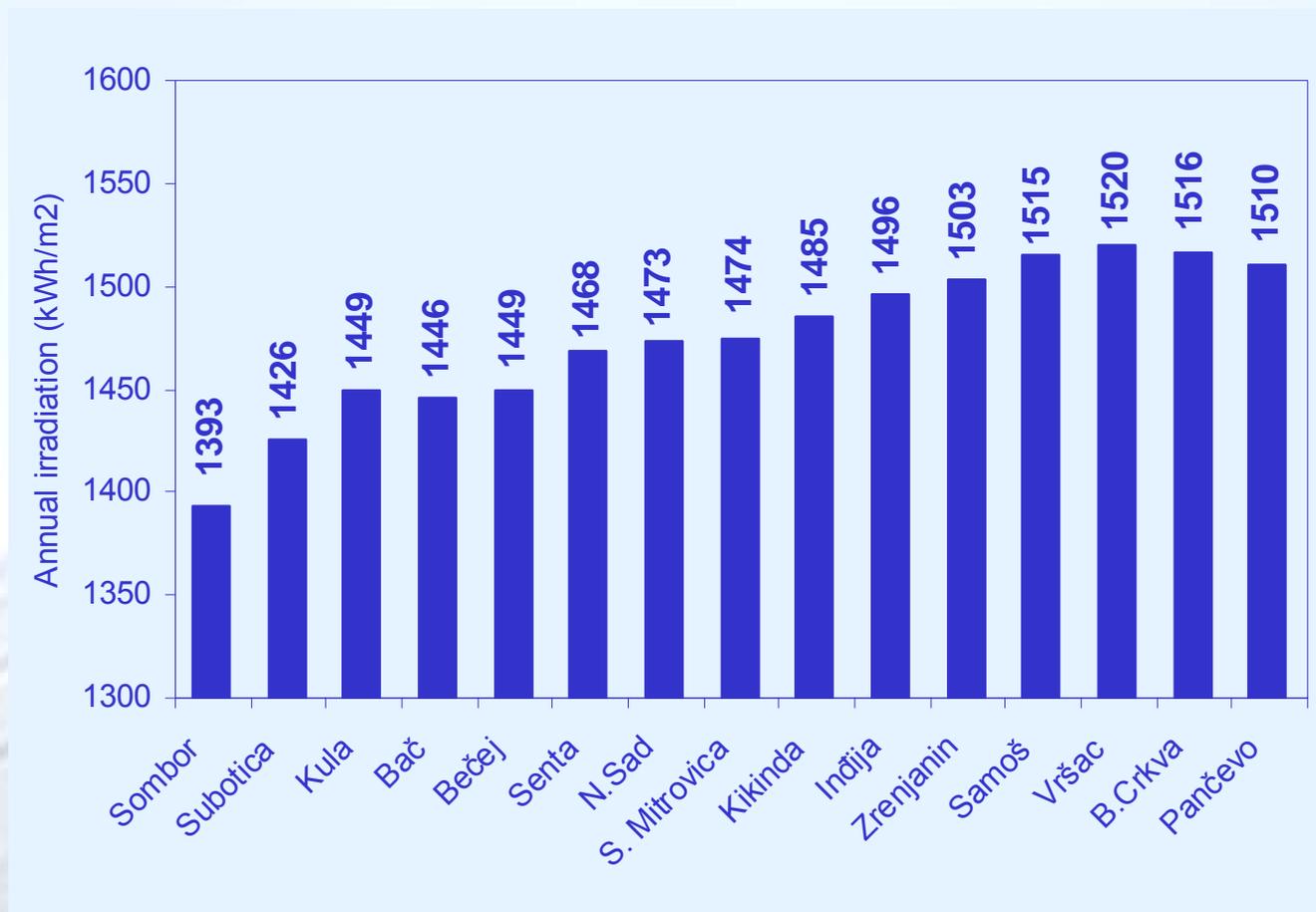
- Data based on the Republic Hydro-meteorological Service of Serbia for the territory of Vojvodina and by using the Photovoltaic Geographical Information System (PVGIS), data on the solar irradiation on the territory of the province can be obtained.
- The daily total energy of global irradiation is the least in December, making 760 Wh/m², and the greatest is in June with the value of 6400 Wh/m².

SOLAR IRRADIATION



daily average global irradiation at last 30 years

SOLAR IRRADIATION



annual irradiation for some city in Vojvodina

ELECTRIC POWER SOURCE FOR FARM

- Aiming cost analysis of building electric distribution network to a farm, analysis was carried out for distributing electric power to the farm named "Rakićevi Salaši" near Čenej(2008.)
- electric power system consists:
 - power line of 20 kV, length 1,7 km,
 - transformer station poles of 20/0,4 kV,
 - transformer 160 kVA,
 - low-voltage line, length 0,76 km
- The price of the total investment was 77.000 €.

HOUSEHOLD CONSUMPTION IN VOJVODINA

- The average household consumption on the territory of Vojvodina on yearly basis is 4,9 MWh, making the daily consumption of 13,4 kWh.
- Mostly the smaller settlements and villages have less consumption than the daily average in Vojvodina.
- A farm, consisting of a household and smallholding, consumes about the average 14 kWh/day of electric energy.

THE NECESSARY POWER OF PV

- In order to satisfy 14 kWh/day electric energy consumption it would be necessary to provide:

north, north-western part of Vojvodina

14 kWp power of PV in December,

3,2 kWp PV module in June.

central part of Vojvodina

12 kWp PV module in December

3,1 kWp PV in June

south-eastern part of Vojvodina

11 kWp power of PV in December,

3,1 kWp PV module in June.

THE NECESSARY POWER OF PV

- If the installed power of the PV modules were chosen according to the average annual irradiation, then the

north, north-western part of Vojvodina

6,3kWp PV modules need to install,

central part of Vojvodina

5,7 kWp PV modules and

south-eastern part of Vojvodina

5,3 kWp PV modules.

THE NECESSARY POWER OF PV

- The surplus of the produced electric power on yearly level is achieved due to summer months. At the same time, in November, December, January and February a shortage of produced electric power occurs related to the needs.
- One of the ways to make up for the shortage of electric power is installation of wind generators.

THE POWER OF WIND GENERATOR

P _n =5kW	h=10m	h=15m	h=20m
	kWh/monthly		
Palić	83	99	112
Novi Sad	143	170	191
Vršac	478	568	640

COMPARATIVE ANALYSIS

- Adding the price of building the ***distributive system*** in the cost price of consumed electric power for a 30-year period, as well as maintenance costs, the sum of about 85.000 € is reached. In the same period electric power consumption is 154 MWh.
- The cost price of electric power for the farm owner is 0,55 €/kWh.

COMPARATIVE ANALYSIS

- The **hybrid system** would cost the owner about 120.000 € in 30 years. In this period such system produces 208 MWh of electric power on the northern part of Vojvodina, 246 MWh in the central part and 413 MWh in south-east Vojvodina.
- The price of electric power on the northern part of Vojvodina makes 0,58 €/kWh, 0,49 €/kWh in the surrounding of Novi Sad and 0,29 €/kWh in south-east regions of Vojvodina.

CONCLUSION

- Analysis of sun irradiation on the territory of Vojvodina indicate that there are sufficient potentials for exploitation of such energy type, and a reason more, that some countries located more on the north excel in the installed power in Europe. As far as energy potential of the wind is concerned, the south-east parts of the province are in more advantageous position than the others.

CONCLUSION

- In order to produce the same quantity of electric power in the same time interval, the least investments in the system would be needed in the south-east region of the province and the largest investments would be needed in the very north.
- As it can be seen, the building of electric power network is not cheap and directly depends on its length, but the building of a hybrid system also costs a lot. Therefore in the future it would be necessary to analyze the mutual influence of consumption, the distance of the facility and the price of investment in certain systems.

Thank you for your attention!

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