

Fig. 5. Chart of monthly average irradiance of Craiova location

The graphs show that the annual average of global solar irradiation is 112.97 [kWh/m²] and the monthly average is between 38.13 [kWh/m²] and 193.13 [kWh/m²].

3 Solar irradiation measured

Measurement of solar irradiation was carried out with the monitoring equipment of a photovoltaic system located in Craiova (Fig. 6 and Fig. 7).



Fig. 6. Equipment for measuring weather parameters: 1- pyranometer; 2- anemometer.



Fig. 7. Window of monitoring system

Weather parameters were monitored online and stored on an SD card.

Data is downloaded in * CSV format that can be easily imported into Excel and then processed in the desired form.

To analyze the correctness of calculated values of irradiation (Fig. 2 and Fig. 3) in Fig. 8 and Fig. 9 there are depicted the graphs resulting from the recordings made with the monitoring system.

Also, for a comparison of monthly average irradiation obtained with BlueSol software (Fig. 5), in Fig. 10 the chart of the average monthly solar radiation obtained from the measurements.

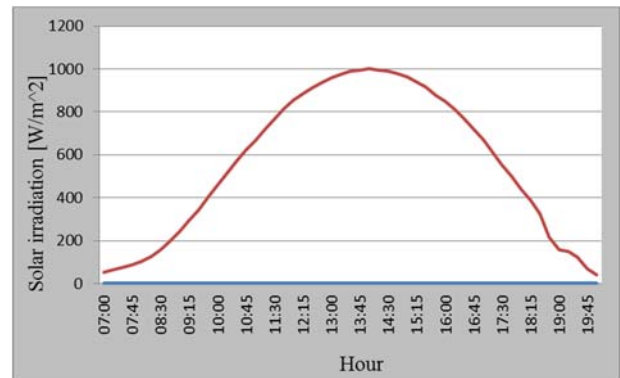


Fig. 8. Chart of global solar irradiation, measured on PV panel plane in 2016.06.21 for Craiova location

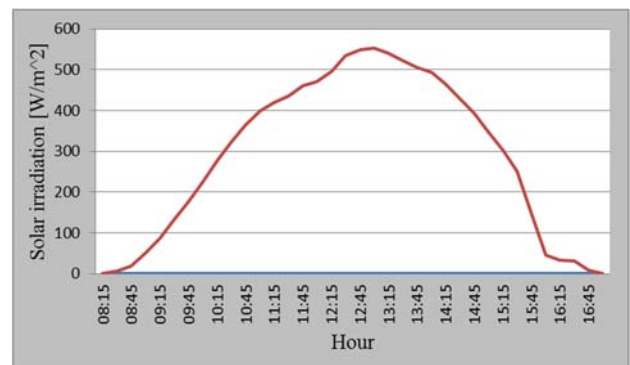


Fig. 9. Chart of global solar irradiation, measured on PV panel plane in 2016.12.21 for Craiova location

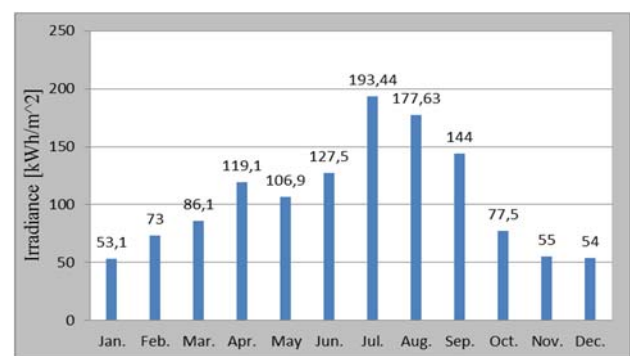


Fig. 10. Chart of monthly average irradiance measured on PV panel plane for Craiova location

As can be seen in Fig. 8 and Fig. 9 the measured solar irradiation values are higher than the calculated irradiation values because they were measured on the plane of the PV panels inclined at an angle of 30°. The calculated values were calculated for a horizontal plane.

4 Evaluate of energy production of a PV system located in Craiova

The photovoltaic system having a nominal power of 3 kW, located in Craiova and connected to the electrical distribution grid in Low voltage Single-phase alternating current a 230V have been experimented (Figure 11).



Fig. 11. PV system analyzed, located in Craiova

Using the BlueSol software, based on the available solar irradiation values at the Craiova location and the catalog data of the PV system equipment, the electric energy output of the analyzed system was estimated (Figure 12).

PV panels are made of Conergy 245 PJ polycrystalline silicon, with an efficiency of 15.4%. Also total system losses are about 14%.

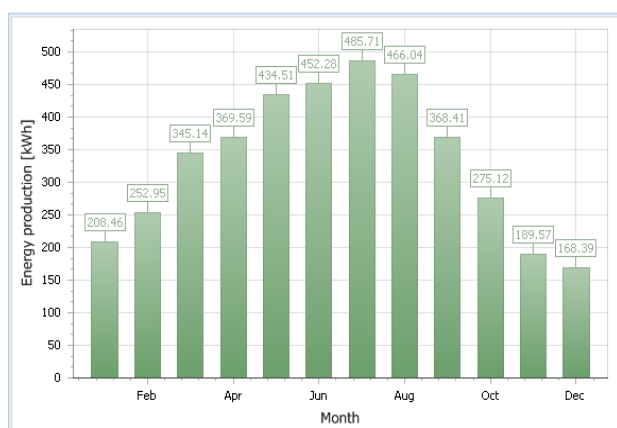


Fig. 12. Monthly energy production of PV system expected during the year

Summing up the monthly energy output results in an annual PV system energy output of about 4020 [kWh].

5 Conclusion

In this study was determined the solar irradiation by calculation and measurements, for a certain location. One could note that the measured values were close to the calculated values.

Also, the average annual radiation determined with the BlueSol software is 112.97 [kWh/m²], and the one obtained by the measurements is 105,6 [kWh/m²].

It must be highlighted that based on the information obtained on the solar irradiation available at that location, it is possible to estimate the energy output of the PV system.

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