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[1] CRISTIAN P. CHIONCEL, [2.] LADISLAU AUGUSTINOV,
[3.] PETRU CHIONCEL, [4.] NICOLETA GILLICH, [5.] GELU OVIDIU TIRIAN

PERFORMANCE RATIO OF A PHOTOVOLTAIC PLANT

Abstract:
To be able to choose the right photovoltaic equipment, starting from modules through inverters, for grid connected plants, at least one year of consistent evaluations of system performance are needed. One of those performance parameters that allow the detection of operational problems and facilitate the comparison of systems is given by the final yield factor and the performance ratio.
Based on the grid connected photovoltaic plant at the University 'Eftimie Murgu' in Resita, injecting energy in the public grid since spring 2008, we define and analyze the performance ratio and the final yield factor. With these two factors given, we are able to assure a critic overview of the plant performance.

Keywords:
photovoltaic plant, ratio, final yield factor, monitoring

INTRODUCTION

To be able to choose the right photovoltaic equipment, starting from modules through inverters, for grid connected plants, at least one year of consistent evaluations of system performance are needed. One of those performance parameters that allow the detection of operational problems and facilitate the comparison of systems is given by the final yield factor and the performance ratio.

YIELD FACTOR AND PERFORMANCE RATIO FOR GRID CONNECTED SOLAR PHOTOVOLTAIC PLANTS

The International Energy Agency (IEA) for Photovoltaic Power System Program has define, based on existing experience, a number of performance parameter for photovoltaic plants, that are now concentrated in the IEC standard [1], concept that are only meaningful in the context of using regenerative energy sources, as photovoltaic plants, insular ore grid connected. The main parameters are performance ratio and the final PV system.
The performance ratio PR is defined as the energy output E_{pv} that is injected in the grid, AC part, divided by the nameplate d.c power $P_{maxG,STC}$, obtained in Standard Test Condition (STC - 1000 W/m^2, 25^{0}C) of the installed PV array. It represents the number of hours that the PV array operates at its rated power.

$$PR = \frac{AC - GridinjectedEnergy}{PVSystemEnergyInSTC} \qquad (1)$$

Performance ratio PR values are typically reported on a monthly or yearly basis. Another yield value is the final Yield factor. As the performance ratio, it expresses plant performance on the AC site. It is definite as the

monthly grid injected energy divided to the nameplate power of the photovoltaic generator in standard test conditions. The result offers an overview referring to monthly pro one kWp plant power, in the grid injected energy, ore the so called monthly specific energy production.

$$Y_f = \frac{E_{PV,AC}}{P_{\max G,STC}} \qquad (2)$$

PR values calculated can be also calculated for smaller intervals, such as weekly or daily. This is may be useful for identifying occurrences of component failures. Depending on geographical location and season the PR values fall normally within the range 0.2 to 0.8. If PR decreases yearly, this may indicate a permanent loss in performance. Ideal annual values for the performance ratio PR factor are between 0.8 and 0.84.

PR does not indicate the amount of produced energy, because a system with low PR in a high solar resource location might produce more energy than a system with a high PR in a low solar resource location. But however, for any given system, location and time an increase of the performance ratio PR supposes accordingly an increase of the final yield Y_f too.

If PR registers a deep decrease, that indicates events with significant performance impact, like inverters that are not operating proper. When the PR decrease moderate, this indicates that the plant has less sever problems. So, based on the performance ratio PR analyzes, it can be clearly identified if the systems work like plant ore problems exist, but not the cause.

GRID CONNECTED PHOTOVOLTAIC PLANT AT THE UNIVERSITY 'EFTIMIE MURGU' RESITA

The grid connected photovoltaic system [3] mounted at the University `Eftimie Murgu` Resita, has in his structure, following components: four high performance standard solar modules of type Multisol 150, manufactured by Scheuten Solar – Germany [6], with a total capacity of 740W/h; a Sunny Boy 1100 inverter and a completely online monitoring system [7] of the PV system: Sunny Webbox and Sunny Sensorbox (solar radiation, ambient and module temperature, wind speed and direction).

Figure 1. The solar photovoltaic modules at the "E.Murgu" University Resita

Figure 2. The equipment at the "E.Murgu" University Resita

PERFORMANCE RATIO AND FINAL YIELD FACTOR FOR THE GRID CONNECTED PV SYSTEM AT THE "EFTIMIE MURGU" UNIVERSITY

In this paragraph we will obtain an overview of the final yield factor Y_f for the grid connected photovoltaic system, from May 2008 until the March 2009.

Figure 3 represents the monthly performance ratio; figure 4 the final yield factor for this period. A comparison between those two plant performances indicators are given in figure 5.

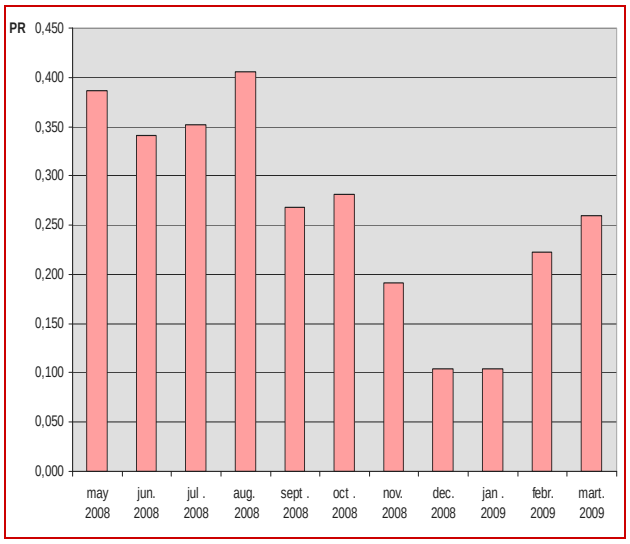

Figure 3. Monthly grid connected PV system performance ratio, May 2008 – March 2009

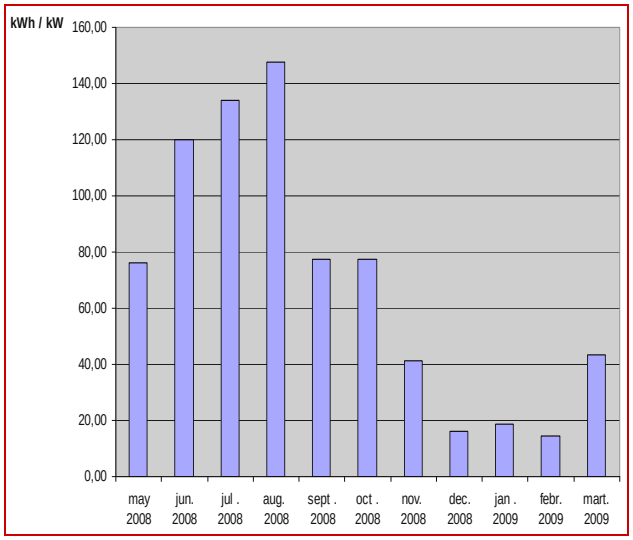

Figure 4. Final yield factor, May 2008 – March 2009

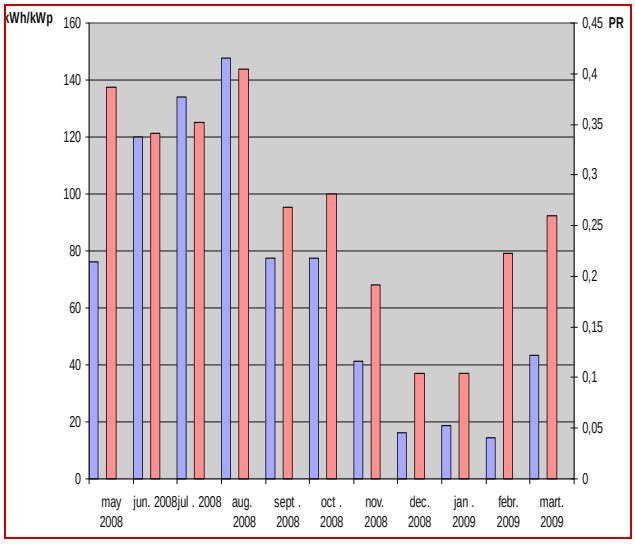

Figure 5. Comparison between Final Yield and Performance Ratio, May 2008 – March 2009

CONCLUSION

Based on the analyze of the final yield factor and the performance ratio of an photovoltaic grid connected plant, we can always have a overview of the plants performance and check in the right if we register system losses.

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AUTHORS & AFFILIATION

[1] CRISTIAN P. CHIONCEL,
[2] LADISLAU AUGUSTINOV,
[3] PETRU CHIONCEL,
[4] NICOLETA GILLICH,
[5] GELU OVIDIU TIRIAN

[1,2,3,4] UNIVERSITY "EFTIMIE MURGU" RESITA, ROMANIA
[5] FACULTY OF ENGINEERING HUNEDOARA, UNIVERSITY "POLITEHNICA" TIMISOARA, ROMANIA

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UNIVERSITY POLITEHNICA TIMISOARA
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