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EXPERIMENTAL ANALYZE OF SOME PARAMETERS FROM SOLAR PHOTOVOLTAIC INSTALLATIONS

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ABSTRACT

The paper presents a parameter analyses of on solar - photovoltaic plant (ambient temperatures, insolation, continuo voltage, continuo current, module temperature, electrical power) experimental obtained trough-distanced measurements, via Internet. The measured values, to be more suggestive, are graphically represented.

KEYWORDS:
photovoltaic cell, solar module, solar radiation, electrical power

1. Introduction

A photovoltaic system produces electrical energy proportional with the light intensity that hits the solar cells. The light intensity alternates as well during a single day, but also from one day to another. In this situation the given power by a photovoltaic system alternates in very large limits.

The light intensity is just one factor that affects the system power, together with ambient temperature, conversion lost from continuos current to alternative current, and other elements, like orientation, inclination angle, dust that are not studied in this paper.

2. PV system - parameter definition

Further we present some parameters definition that currently appears in the solar energy conversion, photovoltaic (photo = light; voltaic =produces voltage).

The solar radiation striking a surface at a particular time and place is called *insolation*. When insolation is described as power, it is expressed as a number of watts per square meter. It is usually presented as an average daily value for each month. On a sunny day, the total insolation striking the earth is about 1000 watts per square meter. Solar radiation received at the earth's surface is subject to variations caused by atmospheric conditions, the earth's position in relation to the sun, and nearby obstructions.

The sun's apparent location east and west of true south is called *azimuth* and is measured in degrees east or west of true south. Since there are 360 degrees in a circle and 24 hours in a day, the sun appears to move 15 degrees in azimuth each hour.

The sun's height above the horizon is called *altitude* and is measured in degrees above the horizon. When the sun appears to have just risen or set, its altitude is 0 degrees. When the sun is true south in the sky at 0 degrees azimuth, it will be at its highest altitude in the sky for that day. That time is called *solar noon*. Photovoltaic arrays work best when the sun's rays shine perpendicular (90 degrees) to the cells. When the cells are directly facing the sun in both azimuth and altitude we say the angle of incidence is "*normal*".

The *PV cell* is the basic photovoltaic device that is used in building block for PV modules. A group of PV *cells* connected in series and/or parallel and encapsulated in an environmentally protective laminate makes a *module*. The method in which PV cells are protected from the environment is known as *encapsulation*. P*anel* is a term used for a group of modules.

3. Experimental analysed PV system

The analyzed PV system is a Siemens product Typ M110, located on the F.H. Gelsenkirchen - Germany that was given in function since august 2003.

The solar modules that are used in this PV system are characterized by the technical dates presented in, table 1 and made from monocristal Silicon. The center of a module is built by 72 Solar cells, covered with a special front glass with a great light passing and protects the module from extremely weather conditions (ice, snow, rain and hail).

The hall PV system contains a number of 108 Siemens modules, figure 1. It is divided in 6 subsystems, where two Strings make each subsystem. In one String nine modules are in series connected. The Strings are connected to a.c. converter of Sunny Boy 2000 type. The technical performance of the integer system is presented in table 2.

Table 1 Technical dates of one module

Power	110W
Voltage by Pmax	17.5V
Non load voltage	21.7V
Current by Pmax	6.3A
Short-circuited current	6.9A
Surface	0.87m^2

Table 2 Performance of the integer system

Total power	11880W
Total voltage	1890V
Total current	6.3A
Total surface	95.9 m^2

The analyzed parameter evolution has been measured and registered on 7th July 2004. These parameters are ambient temperatures, insolation, continuo voltage, continuo current, module temperature and the obtained power.

Figure 1 PV System F.H. Gelsenkirchen

The ambient temperature and the insolation are presented in figure 2 and 3.

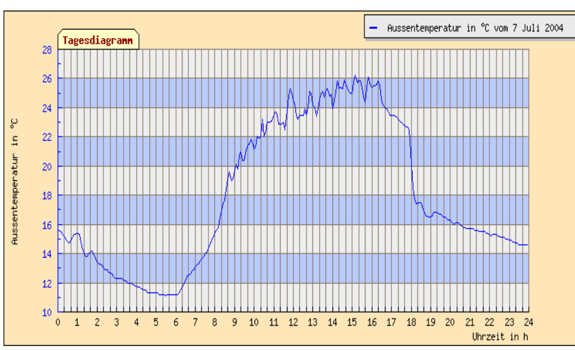

Figure 2 Ambient temperature

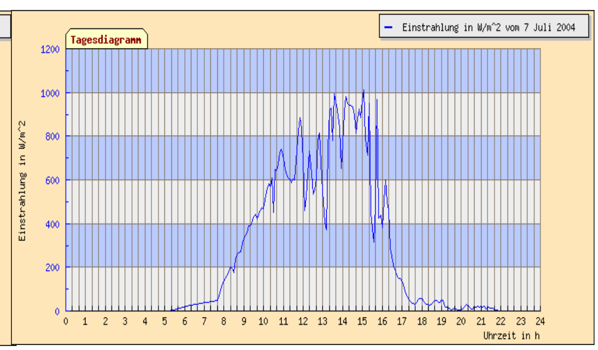

Figure 3 Insolation diagram

The minimum temperature value was registered between five and six a clock in the morning, 11^{0}C. After six a clock the ambient temperature began to grow and between 11 a clock and 16^{30} in the evening the highest temperature were observed, 26^{0}C - medium. This temperature evolution diagram shows us that the weather conditions during the 7th July 2004 afternoon were not stable.

When the sun appears, after five a clock in the morning, the insolation grew up until eleven a clock, when, thanks a clouding over sky, the insolation value began to alternate between 400 and 1000 W/m^2. The insolation begins to fall after 16^{30}h, and reaches at 22h a value near to zero.

The module temperature diagram, figure 4, follows a similar curve like that described by the ambient temperature. Between 11h and 17h the module temperature reaches the highest value that alternates from 30^0C to 42^0C.

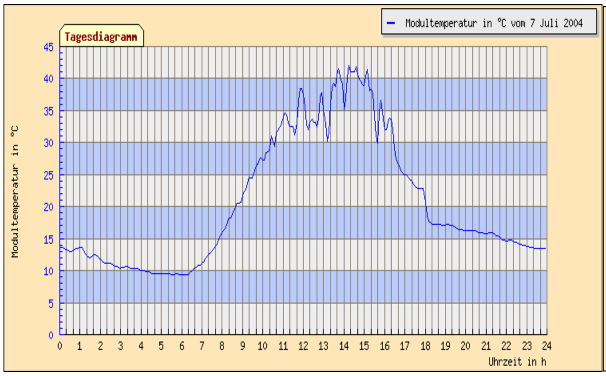

Figure 4 Module temperature

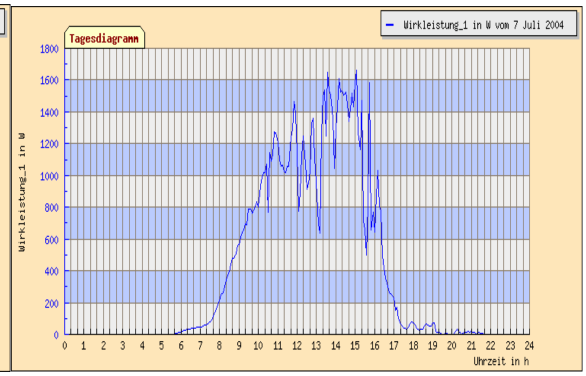

Figure 5 Obtained power

Figure 5 presents the evolution of the obtained power in one from six subsystems of the entire installation. After five a clock, when the sun appears, the power increase to approximate 1000W at 11 a clock. After 11 a clock, when the atmosphere condition become unsteady, the evolution of the power diagram changes in correlation with the weather. The maximum measured power of 1650W, was obtained between 13h and 15h.

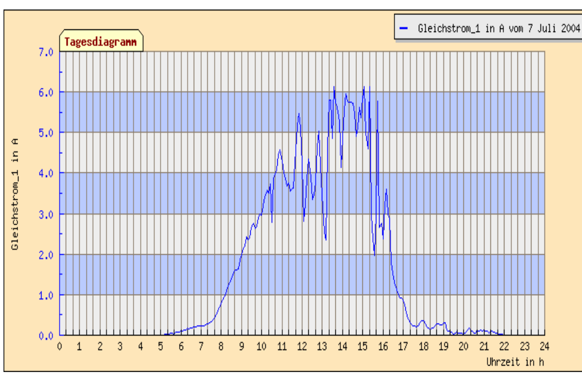

Figure 6 Continues current

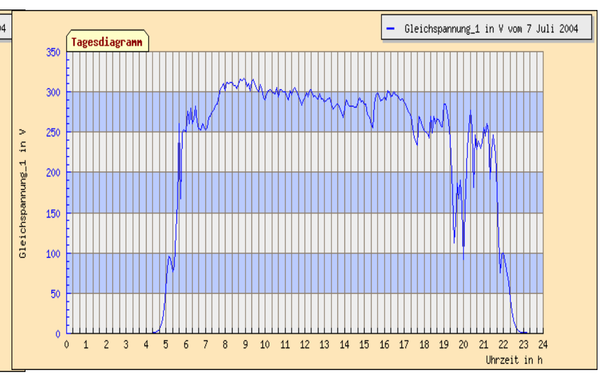

Figure 7 Continues voltage

Figure 6 and 7 illustrates the current and voltage evolution in correlation with the power diagram.

4. Conclusion

The paper presents the principal parameters of a PV system, observed during one day, the way they depend one from another and finally influences the obtained electrical power.

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