STUDY ON THE PHOTOVOLTAIC PANELS CHARACTERISTICS — CASE OF TAMANRASSET SITE

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Received: 10 June 2019 / Revised: 16 august 2019 / Accepted: 30 September 2019 /

Abstract — The study focused on the determination of the characteristics of photovoltaic solar panels aiming at the knowledge of the operation and the exploitation of the photovoltaic stations to control the production of electricity by solar conversion. The parameters that influence the characteristics of the solar radiation and the grade of the materials that constitute the solar equipment Among the characteristics, the following parameters have been taken into consideration: Short-circuit current Icc, Open-circuit voltage Vco, Power output P, Effect of series resistance Rs and Yield ŋ. The measures were carried out at the Tamanrasset site using suitable equipment. The results showed that the intensity of the current produced depend on the intensity of the solar radiation and that a maximum of current has been obtained at the time Tsv.

Key words: Illuminance, Features, Photovoltaic panel, solar conversion, photovoltaic current.

1. Introduction

According to its geographical position, Algeria has one of the highest solar deposits in the world (05 billion GWH / year), with a duration of sunshine on the Sahara and the Highlands up to 3000 hours / year, according to specialists. In the case of Tamanrasset 3000 hours / year. The 13 MW solar photovoltaic station in Tamanrasset is part of the national renewable energy and energy efficiency program [1]. In this article, we will present the characterization of a photovoltaic panel. It consists in establishing characteristics of photovoltaic module, their nomenclature. These parameters which will be determined will allow us to know the evolution of different basic variables of exploitation a photovoltaic panel. Also, this study will help us to understand electrical and mechanical parameters of the photovoltaic on Tamanrasset site, which will lead us to understanding of the causes of the power loss of the photovoltaic module in middle of exploitation and the influence of certain important elements such as the illumination and the temperature and the parameters of the photovoltaic cells (I cc, V co, P, R s, R sh, ŋ, ff, HR, E, T) extracted from the current-voltage characteristics make it possible to compare different cells lit under identical conditions [3]. Experimental is represented which will allow us to know the actual characteristics in the lab.

Tabl 1: Characteristics of the mini station of Tamanrasset for production of electricity by photovoltaic [2].

Geometric coordinates	22°50’ N et 05°27’ E
Dimensions	Twenty Six (26) Hectares
Power	13000 K Wc
Injection voltage	30 Kv
project manager	SKTM (Shariket Khahrabawa Taket Moutadjadi)
Grouping Builder	YINGLI/CNTIC
Civil Engineering	SARL GGTS (Algerian company).
Control Organism	CTC. Sud
Start of work	06/12/2014
Deadlines for realization	Eight (08) months

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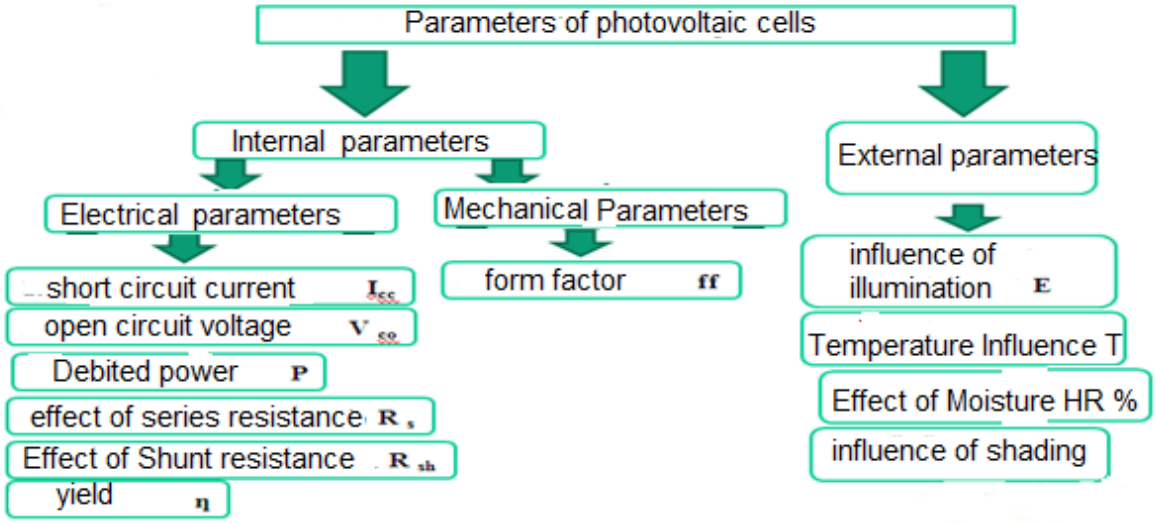

Figure1: Photovoltaic cell parameters [4].

2. Materials and methods

In the absence of data from the plant, the same types of characteristics were used in the context of a specific photovoltaic laboratory application to achieve a broad characterization of the parameters governing photovoltaic.This is the experimental part that will allow us to know the real characteristics in the lab.

The photovoltaic cell is illuminated by a desk lamp. With the lamp above the cell, do not move the lamp or the cell any further (Figure 2). By varying the resistance R of the potentiometer, different values of the intensity I are obtained. The value I = 0 mA is obtained by removing the resistor R from the mounting. The intensity - voltage characteristic of an electric receiver goes through the origin, unlike that of an electric generator.

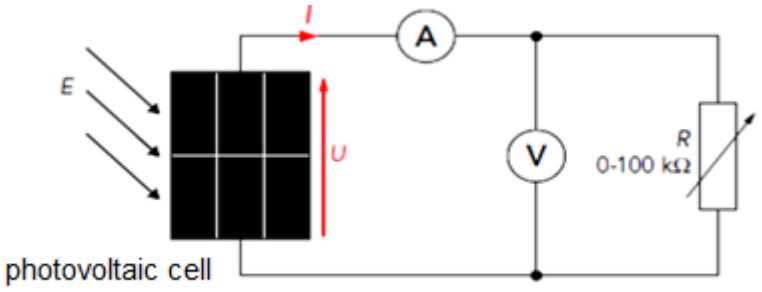

Figure 2: Diagram of assembly of a photovoltaic cell.

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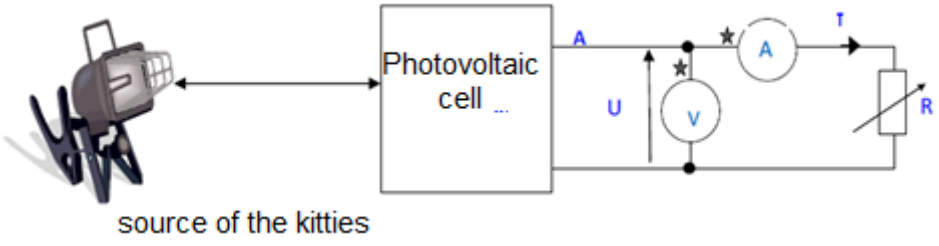

Figure 3: Diagram of assembly of the illumination to the photovoltaic cell.

An experiment was carried out by varying the illumination (E = 800W / m², 400W / m² and 200 W / m²) and we obtain the curve of Figure.4. Note that when the illumination increases, the short circuit current intensity (Icc) increases. We note that the curve of the characteristic I (V), is composed of 03 zones. In the first zone (between 0.2V and 1.6V), the current intensity remains constant with an increase in voltage, therefore the power delivered by the photovoltaic cell increases. In second zone (between 1.6 and 1.9 V), there is a very slow decrease of current in all curves. Usually this is the area where the maximum power of the cell is found. In third zone (greater than 1.9 V) the current decrease is very large in all the curves. in the end we observe that Vco which is bound to these curves is equal to 2 (Vco ≈2).

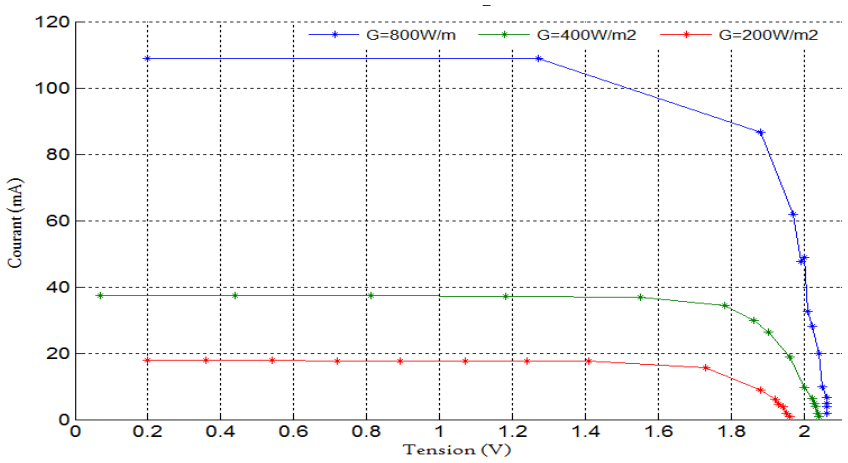

Figure 4: Influence of illumination on the characteristic I (V) e at T = 27 ° C (1): 800W / m²; (2): 400W / m²; (3): 200W / m².

2.2 *The influence of temperature:*

Will heat the photovoltaic cells (Figure 5).

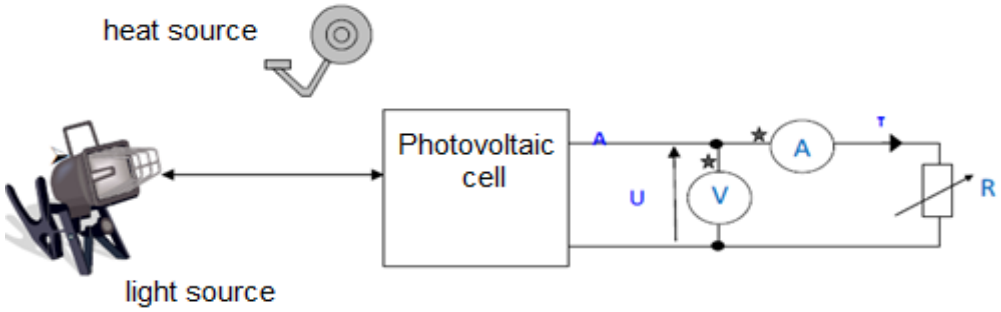

Figure 5: Diagram of temperature assembly in the photovoltaic cell.

An experiment was carried out by varying the temperature (T = 27 ° C, T = 38 ° C and T = 74 ° C) with the illumination, we obtain the curve of Figure 6. It is noted that when the temperature increases , the short circuit current intensity (Icc) decreases. It is found that the curves of the characteristic I (V) have the same pace and the zone of rapid decay of current has become faster when the temperature is increased. As a result, the open circuit voltage Vco decreases.

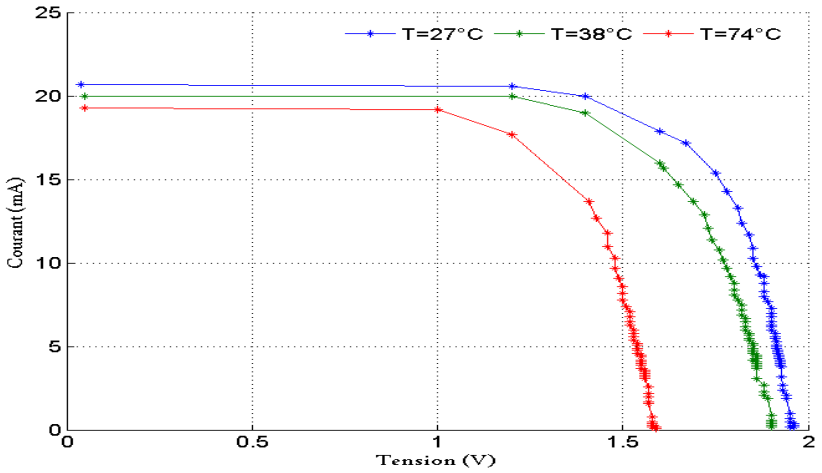

Figure 6: Influence of the temperature on the I (V) characteristic at E = 220W / m²
(1): 27 ° C; (2): 38 ° C; (3): 74 ° C

3. Results and discussions

The practical part of the laboratory was implemented and confirmed the behaviour of internal and external parameters involved in the production of photovoltaic electricity. We found that when illumination increases, its effect increases with characteristics I (V) and P (V).

3.1 *The influence of illumination***:** Note that when the intensity of the illumination increases, the maximum power increases to 162.996 MW with the yield growth of 4% due to the reduced adaptive resistance of 12.68 ° C. (Figure 7)

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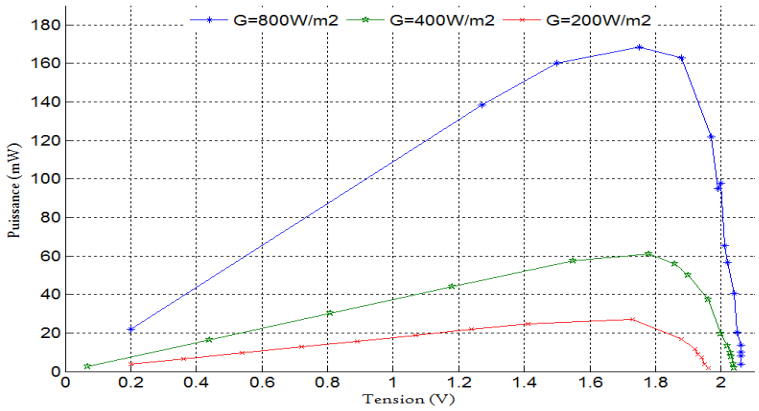

Figure 7: Influence of illumination on the characteristic P (V) e at T = 27 ° C.
(1): 800W / m²; (2): 400W / m²; (3): 200W / m².

3.2 *The influence of temperature***:** It is noted that when temperature increases, the maximum power decreases, and we note that the curve T = 27 ° C is greater than the other two curves. The P max after are decreasing (Figure 8):

- Graphe T=27°c, P max =28.724 m W, η=2%, R_{ad}=97Ω.
- Graphe T=38°c, P max =25.277 m W, η=2%, R ad=102.54Ω.
- Graphe T=74°c, P max =19.317 m W, η=1%, R ad=102.91Ω.

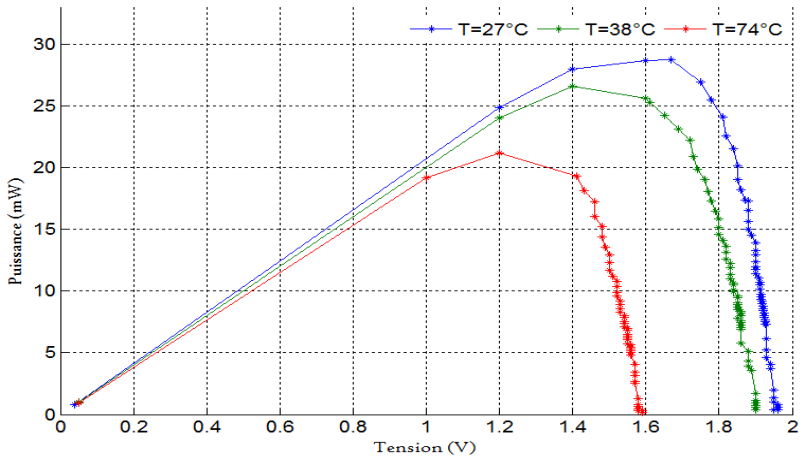

Figure 8: Influence of temperature on characteristic P (V) at E = 220W / m² (1): 27 ° C; (2): 38 ° C; (3): 74 ° C.

4. Conclusion

The characterization makes it possible to know the evolution of the characteristics of a photovoltaic cell in order to define the performances of the installation. In this work it has been shown that there are several parameters that make it possible to characterize a solar photovoltaic cell. These parameters are generally deduced from the characteristic (V). Other features that have been highlighted are the current I cc circuit current, the open circuit voltage V oc and the form factor FF of the component.

This work is a contribution to the study of the characterization of a photovoltaic power system interconnected to the medium voltage electrical distribution network. We have been able to describe the operation of photovoltaic power plants by spreading over each characteristic.

We were able to analyze the various parameters on which depend the electric power produced and especially the yield. Explanations could be provided with representative representations and curves.

This work also allowed us to see the different influences that the installation is subjected to. Also, the different effects were identified with relevant analyzes.

5. References

[1] Shariket Khahrabawa Taket Moutadjadi SKTM Tamanrasset (Introduction Générale sur l'exploitation et la Maintenance de la Centrale Photovoltaïque PPT).2015.

[2] Shariket Khahrabawa Taket Moutadjadi SKTM Tamanrasset (Introduction Générale sur l'exploitation et la Maintenance de la Centrale Photovoltaïque PPT).2016.

[3] A.Ricaud, Photopiles solaire de la physique de conversion photovoltaïque aux filières Matériaux et procédées.presses polytechniques et universitaires romandes 1997.

[4] R. Chenni, "Etude technico-économique d'un système de pompage photovoltaïque dans un village solaire ", thèse Doctorat, Constantine, 2007.