Colloque International « Journées des Géosciences de l'Environnement »
Oujda, 21, 22 et 23 Juin 2011 « Environnement et développement durable ».

Amelioration the performance of photovoltaic stations for pumping and lighting installed in the Douar Zragta of the rural commune of Isly Prefecture of Oujda Angad

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Abstract
In this paper we present the results on improving the performance of both photovoltaic (PV), lighting and pumping domestic Douar Zragta installed in the rural municipality of Issly. From the modeling of electrical PV panels we have deducted the losses of energy provided by the panels in the order of 15-20% and 10% due to the lack of tracking the sun. All these results allowed us to deduct losses of about 33% of the cost of the facilities.

Key words: Photovoltaic System (PV), lighting and pumping domestic PV panels, Pspice simulator, loss of energy, sun tracker, solar controller, solar batteries.

1. Introduction
Today, the sector of the renewable energy of photovoltaic (PV) represents the most realistic alternative that can address the issue of exhaustion of translational energy and environmental problem [1]. The eastern region has enormous potential in solar energy, it receives an amount of energy of about 2500 kWh/m² per year. This is very favorable for the installation of photovoltaic stations of pumping and domestic lighting, and thus their improvements through the PV systems that are currently news [1-2].

In this framework, we have installed under context Program United Nations of development (PNUD) Art Gold Morocco two stations, pumping and lighting domestic Douar Zragta to the rural municipality of the prefecture Isly Oujda Angad. The objective of this initiative is in the one hand contribute to the improvement of living conditions of the population of isolated sites, and in another hand promote PV systems made in the laboratory [2]. In this paper we present a description of these stations and the first results in terms of energy losses due to the absence of PV systems made in the laboratory [2] (MPPT control, tracking the sun, regulator charge / discharge , ...).

2. Results and discussions
2.1. Photovoltaic stations of pumping the water and domestic lighting
In (Figures 1 and 2) we are showns photographs of two PV stations of lighting and pump installed in Douar Zragta of the rural commune of Isly Prefecture of Oujda Angad. Station lighting (PV (700 W), classic

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controller, batteries (24 V), inverter DC / AC (1 kW, 24 V/220 V.) produces electric energy to light three hoses of an energy of about 1800 Wh per day. The pumping station (power 1.2 kW) produced over the sun, a quantity of water of about 20 tons per day.

Figure 1: Photovoltaic stations for domestic lighting.

**Figure 2**: Photovoltaic stations pumping for water

2.2. PV Station of lighting
2.2.1. The Electrical operation and the energy loss
We analyzed the electrical functioning of the PV panels used in the two stations. From the Pspice simulator we deduced the electrical model of PV cells forming the PV. In this paper, we present only the results for lighting station. The characterization obtained results for two solar radiations, are shown in (Figure 3.) It appears a very good agreement between experiment and simulation, and an optimum voltage of about 35 V. This value is very important that fixed by the batteries (24 V). Therefore this installation presents electrical energy losses [2]. To evaluate these losses we have experienced the full operation of the station and compared the results with those derived optimal in Pspice (Figure 4). The obtained results show that the power supplied by the PV
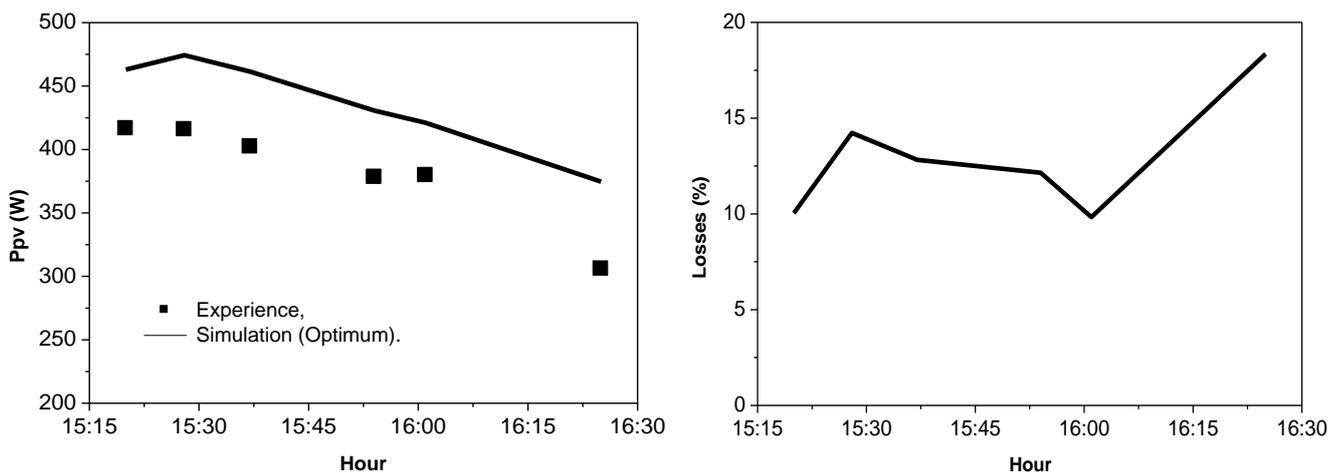
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panels is less than optimal. As shown in Figure 5, the energy losses can reach 20%. The economic study of these losses is estimated at 20% of the cost of the complete station. Also, we estimated the energy loss due to the lack of tracking the sun to 10% (13% of the cost of station).

The overall results show that need the DC-DC converter, MPPT controls [2] and the follower of the sun [3] to reduce energy loss and therefore the cost of the facilities. In the following we describe the tracker and the controller [4] in progress at the laboratory to reliability and reduce cost of installations.
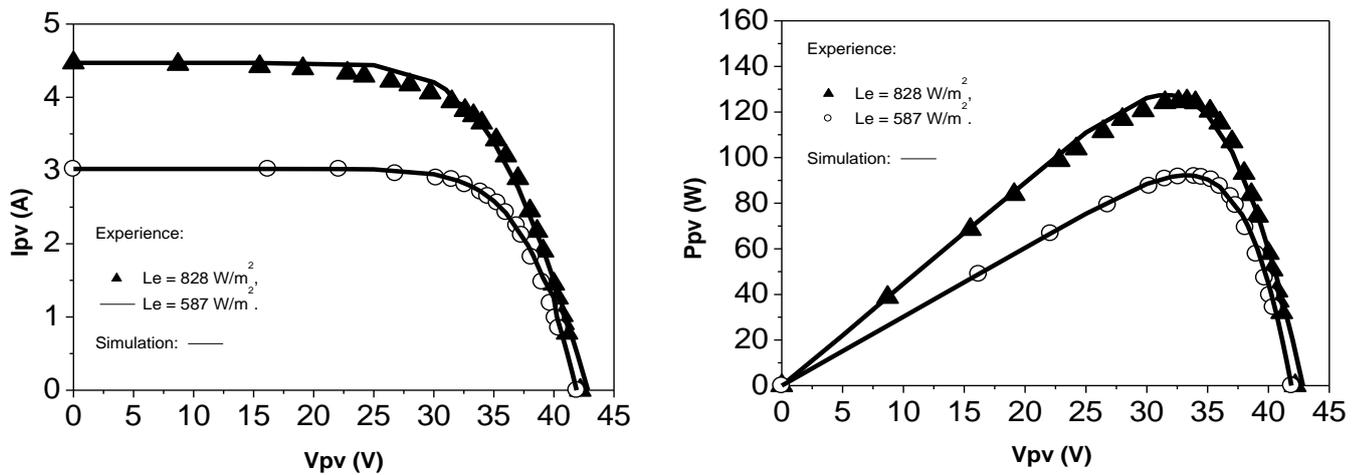
Figure 3: Simulated and measured Current-Voltage characteristics and Power-Voltage as a function of the solar irradiance.

Figure 4: Power measured and simulated (Optimal) of station PV lighting

Figure 5: Energy losses of the station PV lighting.

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2.2.2. Reliability of the PV stations by the monitoring of the sun
The further optimization by continuing trajectory of the sun is a technique that allows better use of photovoltaic cells [3]. Indeed, many works focus their interest on the continuation of the sun to maximize the capture of sunlight by keeping the active area of solar panels should be perpendicular to the solar radiation. Different guidance systems are available in commercial and offer trade in accordance with their forms for reporting gains of around 20-30% depending on the techniques and technologies used. In this context, we are currently conducting studies to reduce energy losses due to the positioning of the PV station of (Figures 1 and 2). This is based on the development of a control-based PIC microcontroller to control the tracking system in azimuth and elevation axes (Figure 6):

➢ The azimuth is the position of the sun in its daily movement from east to west.
➢ Elevation is the height of the sun above the horizon, which varies according to season.
 In our study, we adopt an approach based control method of programming a closed loop circuit using a programmable PIC 16F877. It also uses LDR light sensors for detecting the position of the light source, and two motors to move the panels along the two axes.
        The overall system design (Figure 6) allows us to track the maximum power point tracking (MPPT control), followed by the sun and a better control charge / discharge (next paragraph) numerically.
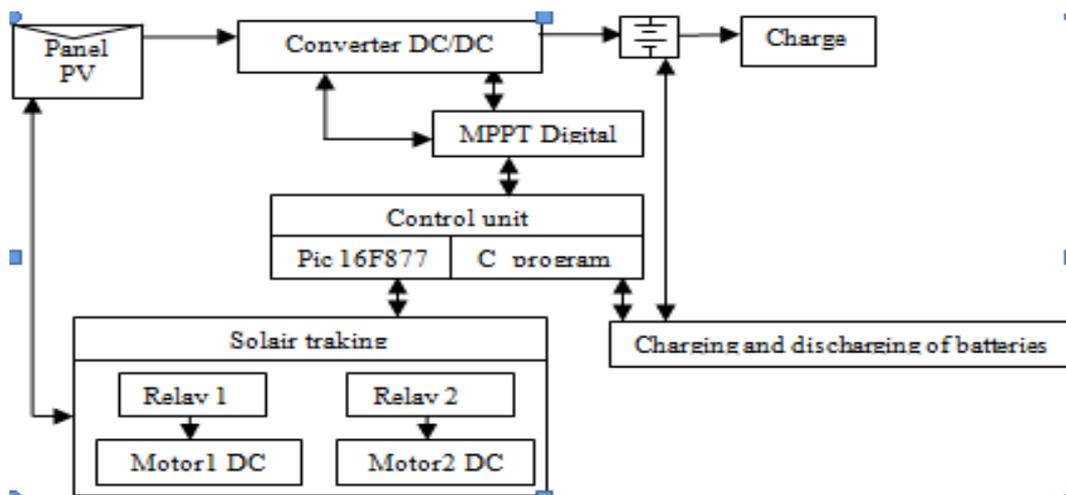

Figure 6: Synoptic diagram of the overall system

2.2.3. Block charge / discharge of solar batteries

To ensure reliable operation of photovoltaic stations lighting (Figures 1 and 2), we are conducting research on the block charge / discharge of solar batteries. The objective is to integrate in the same previous PIC microcontroller (Figure 6), controlling and management of the charge / discharge the battery. Our primary concern is to improve the management algorithms of solar regulators, and consequently increasing the life of the battery by avoiding the problems of gassing and deep discharge.
        The synoptic diagram of the PV system including the power charge / discharge is shown (Figure 7). It is based on the order of a DC / DC converter with a PWM signal (Pulse Width Modulation) [2] generated by

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a PIC16F877 microcontroller. Management charge / discharge of the battery are realized following the flowchart of (Figure 7) in three phase:

➢ 1st phase: normal charging or charging by a constant current (Bulk). This phase is characterized by the gradual increase in blood to reach about 80% of the state of battery charge.
➢ 2nd phase: charging by a constant voltage (absorption phase). It is characterized by a gradual decrease of the load current to the low values of the order of several tens of mA.
➢ 3rd phase (maintenance phase or floating) is then passed to a floating charge phase, that is to say, a constant voltage charge to keep the battery charged and thus compensate for losses due to self -discharge.
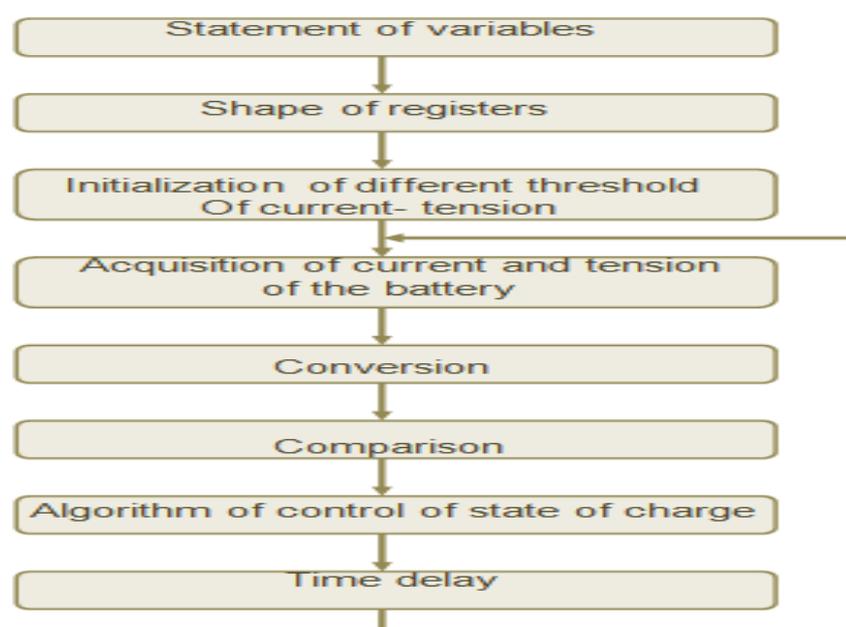

Figure 7: Organization chart control charge / discharge.

Conclusion

In this paper we have described the stations PV (lighting and pumping) and the electrical operation of the lights station. The results go up that it is not suitable and energy losses can reach 30%. These lines induce loss of 33% of the cost of installation. Looking ahead, we aim to improve reliability and the two stations by reducing all energy losses (installation, adaptation, tracking the sun, control charge / discharge ...) and the cost of installation.

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(2011) www.jmaterenvironsci.com