

Autonomous Solar Cooker with Photovoltaic Energy

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Abstract

In this paper, we propose the design and operation of a solar cooker (hot plate and box oven) by photovoltaic solar energy (Figure 1). The heating of these cookers is realized through thermal resistances, fed by the electric energy supplied by the photovoltaic (PV) panels, adapted by a DC/DC power converter of Boost type, provided with a specific digital control. The typical experimental results obtained, for a power of the photovoltaic panels of 600 Wc, and a frequency of the DC/DC converters of 30 kHz, show for an illumination and an ambient temperature that reach the maximum values respectively of the order of 947 W/m² and 24°C, powers at the input and at the output of the converter respectively of the order of 456.66 W and 444 W (i.e. an efficiency of 97%), a temperature of the thermal resistance of 660°C after 20 seconds of heating (i.e. 60°C/s). During 10 minutes of operation of the cooker, the oil temperature varies from 30°C to 123°C (i.e. 9.3°C/min) and reaches the maximum temperature which is 275°C after 40 minutes of heating. The tests on the heating of water and cooking oil show the good follow-up of the maximum power of the photovoltaic panels with the sun, and boiling times of water and cooking oil respectively of the order of 18 mn and 40 mn. All the results obtained are very encouraging and show the feasibility of the system of the cooker set up (Figure 1). This work is continued in order to reduce the cooking time by feeding the cooker with a power of photovoltaic panels of about 1200 Wc.

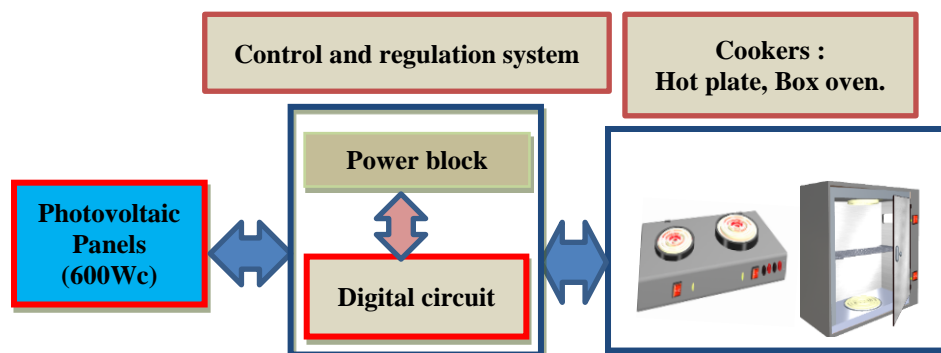


Figure. 1. Synoptic diagram of the cooker (hot plate and box oven), powered by PV panels.

Keywords : Solar Cooking, Solar Energy, DC/DC Boost converter, Digital Control Circuit, Electronic Bloc.

Recent Publications

1. A. LAMKADDEM, N. EL MOUSSAOUI, M. RHIAT, et al. System for powering autonomous solar cookers by batteries. *Scientific African*, 2022, vol. 17, p. e01349.
2. R. Khatri, R. Goyal, R. K. Sharma, (2021). Advances in the developments of solar cooker for sustainable development: a comprehensive review. *Renewable and Sustainable Energy Reviews*, 145, 111166.

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