PORTABLE SOLAR THERMOELECTRIC REFRIGERATOR

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Abstract

The objective of this paper is to develop a mobile solar thermoelectric fridge for individuals residing in distant regions or for outdoor apps where there is no electricity supply. In order to generate hot and cold effects for heating and cooling applications, Solar PV module is used to supply the thermoelectric module with electrical energy.

Key words: Thermoelectric, cooling applications, solar PV module.

Introduction

One of the greatest engineering achievements developed in the 20th century is air conditioning and refrigeration. A solar-assisted thermoelectric module[1] produces zero emissions and, when provided with electricity, is capable of producing a temperature difference. The thermoelectric module technology pumps heat in a particular direction[2] after passing through a current that results in hot and cold side. Due to the fact that the energy is produced using solar, it is eco-friendly.

Methodology

Fig.1 shows a schematic diagram of a mobile thermoelectric solar refrigerator consisting primarily of a PV module, charging unit, storage battery, DC-DC converter and thermoelectric refrigerator. After receiving the solar energy, the PV module[3], [4] converts it into thermoelectric refrigerator electricity. It is important to note that the storage battery stores the excess energy produced by the PV module.

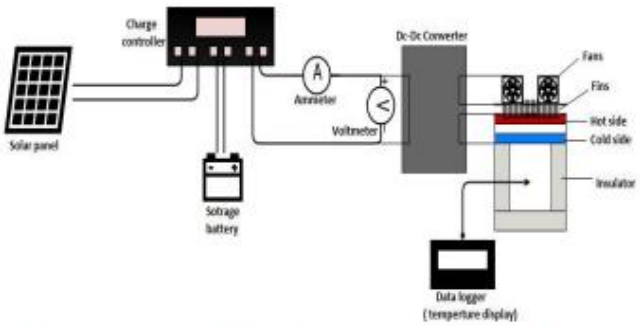

Fig. 1: A schematic diagram shows the connection of all main components of the refrigerator

The charging controller[5] plays a significant role in limiting the amount of power stored in the battery, and finally, the DC-DC converter is used to produce the required voltage to the refrigerator after converting the PV module's output voltage (12V) into the supply voltage (5V). The thermoelectric refrigerator consists of thermoelectric modules (TEM), each of the module consist of two sides, the first one is the cold side is placed inside the refrigerator and a well-insulated heating chamber is connected to the warm side. To improve the transfer of heat, small fans are introduced to cover the entire region of the fins to cool the warm side more effectively.

Conclusion

In this paper, a new mobile thermoelectric cooling system for both cooling and heating applications was intended and manufactured based on the thermoelectric module principle. It presented a detailed design methodology that can be used as an essential commercial application tool. To use renewable energy, to drive the refrigerator, solar energy was incorporated to power the thermoelectric module. It is also small in size and does not have any noise and vibration. Also, the heat received from standard refrigerators is negligible compared to the heat dismissed. The solar thermoelectric fridge would therefore be less environmentally damaging.

References

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