Efficiency Improvement by Using Solar Tracking System and Thermoelectric Generator

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doi: https://doi.org/10.21467/proceedings.118.36

ABSTRACT

In this paper maximum power point tracker battery charger is proposed for extracting maximum power from a photovoltaic panel to charge the battery. The output power of the PV system continuously varies with change in irradiance and temperature. It is a very important to improve the efficiency of solar panel. There are number of maximum power point tracking (MPPT) methods available to operate the PV system at maximum power point. The proposed system has used perturb & observe (P&O) MPPT algorithm for the design and implementation. And also describes thermoelectric power generation from waste heat from PV panel, utilizing generators that can convert heat energy directly to electrical energy.

Keywords: Solar PV System, Improved MPPT, Perturb and Observer, Thermoelectric Generator, Direct Energy Conversion.

1 Introduction

Solar energy is one of the most important renewable energy sources that have been gaining increased attention in recent year. Solar energy is plentiful; it is the best availability compared to other energy sources. The amount of energy supplied to the world in at some point by the sun is sufficient to power the entire energy needs of the world for one year. Solar energy is clean and freed from emissions, since it does not produce pollutants or by – products harmful to nature. The conversion of solar power in to electricity has many application fields. Recently, research and development of low cost flat -panel solar panels, tin-film devices, concentrator system, and many innovative concepts have increased.

In this paper we've presented the photovoltaic solar panels operation. The foremost way to increase the efficiency of a solar panel is to use a Maximum Power Point Tracker (MPPT), a power electronics device that significantly increases the system efficiency. Thus, an MPPT maximizes the array efficiency, thereby reducing the overall system cost. In addition, we plan to design the MPPT by using the algorithm of a specific MPPT method which is "perturb an observer" and implement it by employing a DC-DC Converter. We've found various sorts of DC-DC Converter. Among them we've selected the foremost suitable converter which is "BUCK" converter, for our design.

Thermo electrical generator converting heat energy to electrical energy. This thermoelectric generator is suitable power for space research, Satellites and even unmanned facilities. satellites are settled at the planets that so far from the earth. For example, thermoelectric devices are often utilized in used in vehicles to producing electricity using the waste heat of the engine also. Advantages of thermoelectric power generators are – Small size and less weight, Green Technology, increase the overall efficiency (5% to 8%), Alternative power sources of energy it requires less space and cost compare to other source waste heat to get the facility is to decrease the cost per unit of the device.

A solar tracker may be a device for aligning each day lightening reflector, solar photovoltaic panel or concentrating solar reflector or lens toward the sun. the sun's position within the sky varies with the seasons

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Proceedings DOI: 10.21467/proceedings.118; Series: AIJR Proceedings; ISSN: 2582-3922; ISBN: 978-81-947843-6-4

(elevation) even with the time of day because the sun moves across the sky. solar power devices function best when whenever pointed at the sun, so a soar tracker will hike the effectively of devices over any confirmed position, at the value of extra system complexity. There are several sorts of solar trackers, of various charges, quality, and performance.

2 Materials and Methods

Thermoelectric devices are semiconductor devise based on thermoelectric effect that can convert thermal energy directly into electricity. These solid-state devices use electron as their working fluid. Thermoelectric effect can be used both for power generation and for electronic refrigeration. These effects are often explained by to different electrically conductive materials connected together. When a temperature gradient is established between junction of materials – e.g., one junction is heated and the other cooled as in shown in fig.1, in voltage (seebeck voltage) is generated the thermocouple that is created can be connected to a load to provide electric power. This phenomenon of was discovered in 1821 by J. T. seebeck and is called the "seebeck effect".

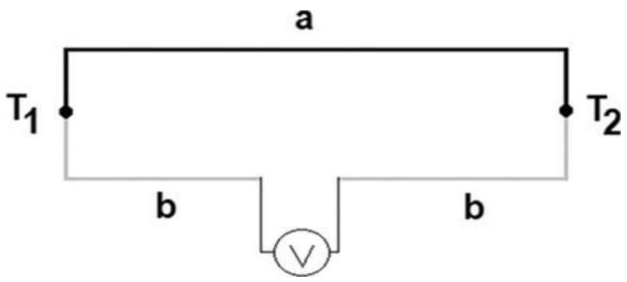

Fig 1: Seebeck Effect

The generated voltage (μV/K) is directly proportional to the temperature gradient. The seebeck coefficient α is a coefficient of proportionality and material -specific parameters. Vab=αab(T1-T2) [V] conversely, it is possible to convert electric energy into a temperature gradient. This complementary phenomenon known as the Peltier effect, was discovered by C. A. Peltier in 1834.If a voltage is applied across a junction and direct current flows in the circuit, a slight cooling or heating effect occurs at the junction. This effect is extensively used for cooling. A typical thermoelectric device is composed of a large number of semiconductor thermocouple, see fig 2. Thermocouple consist of n-type and p-type semiconductor pellets connected together with a metal plat by soldering. They generate seebeck voltage of hundreds of μV/K.

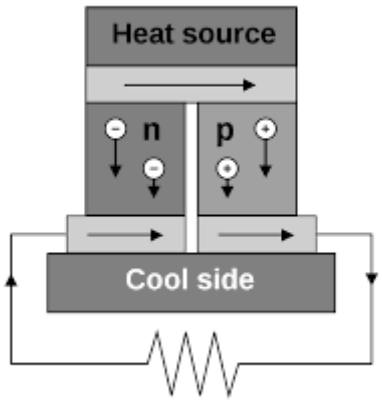

Fig 2: Principle of thermoelectric power generation

Proceedings DOI: 10.21467/proceedings.118
ISBN: 978-81-947843-6-4

Series: AIJR Proceedings
ISSN: 2582-3922

2.1 Thermoelectric Materials

The highest thermoelectrical conversion performance is achieved with heavily doped semiconductors. High electrical conductivity (σ), large seebeck coefficient (α) and low thermal conductivity of the materials (λ) are necessary in order to realize height performance thermoelectrical material. The potential to convert heat to electricity is quantified by the so-called thermoelectric figure-of-merit Z, which is defined as: Z=(α^2σ/λ) *[K-1] figure-of-merit Z varies with temperature. As shown in fig.3, the conversion efficiency is a function of operating temperature difference. An increase in the temperature difference provides an increase in heat available for conversion, so large temperature differences are available. It is more usual to specify a dimensionless figure-of-merit, which is equal to ZT, where T is absolute temperature. Only materials which possess ZT>0.5 are regard as thermoelectric materials. Established thermoelectric materials can be divided into groups depending upon the temperature range of operation:

- Low-temperature materials, up to around 450 K
- Middle- temperature materials, from 450 K to around 850 K
- High-temperature materials, from 850 K to around 1300 K

Alloys based on bismuth in combinations with antimony, tellurium and selenium are low-temperature materials. Middle-temperature materials based on lead telluride and its alloys. High-temperature materials are fabricated from silicon germanium alloys.

2.2 Thermoelectric Generators

A simple thermoelectric Generator consist of a series of thermoelectric cupels placed between two heat exchanger and a DC/DC converts. Heat from heat source follows through the thermoelectric couples and is dissipated through the heat sink into the ambient air, as shown in fig.4. electric power generated until a temperature difference is applied. A DC convertor changes the output thermoelectric voltage to the voltage required by the load.

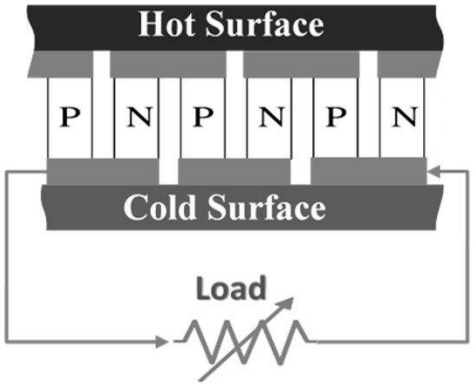

Fig 3: A simple thermoelectric generator

2.3 Maximum Power Point Tracking:

Maximum point tracking control technique is employed mainly to extract maximum capable power of the PV modules with respective solar irradiance and temperature at particular instant of your time by maximum point tracking controller. A number of algorithms are developed to trace the utmost point efficiency. Most of the existing MPPT algorithms suffer from the disadvantage of being slow tracking. Due to which the utilization efficiency is reduced. MPPT techniques proposed to obtain MPP operating point for an adaptive voltage stap changes based on the slop of the PV curve. To get changes in voltage step changes based on the slope of the PV curve.to get the changes in voltage step value from the PV curve acceleration and deceleration factors are applied within the next iteration steps. The adaptive voltage step change enables

the PV system to quickly track the environment condition variations. In this way more solar energy harvested form the PV energy system.

3 Theory

There are several ways to increase the produce electrical energy by TEG devices, of the way is by boosting the produced voltage boost converters and also modelling different TEG arrays such as series, parallel, and series-parallel connections supported the specified energy. A TEG device operates under various operating conditions due to the change of the temperature difference which is no easy to control it.
MPPT algorithm improves the performance of the system and operates the system in the optimal operation point to generate the maximum power. MPPT is an algorithm which has reference variable (voltage, current) according to variation of these variables, the algorithm will act to drive the converter through a generated pulse for tracking the maximum power point.

4 Advantages

- Less costly.
- Pollution free.
- We generate electricity from west heat it increases the overall efficiency of project.

5 Conclusion

Present method for electricity generation is converting thermal energy into mechanical energy by turbine the into electricity by using generator. Burning of this fuel cause environmental problem of radioactive pollution, global warming. Hence (coal, oil and gas) are the limiting resources resulting new technology is required. The project paper is tested and implemented. The system gives the best economical. Here the use of stepper motor in solar tracker enables accurate tracking of the sun and to light weight dependent resistor are used to determine the solar light intensity by the track of the maximum power point, whose PO MPPT is that the most famous method because of its simplicity and low cost.

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Proceedings DOI: 10.21467/proceedings.118
ISBN: 978-81-947843-6-4

Series: AIJR Proceedings
ISSN: 2582-3922