IMPROVEMENT OF EFFICIENCY OF PHOTOVOLTAIC CELL USING PELTIER MODEL AS A COOLING SYSTEM

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***Abstract-*: *As a great potential renewable energy source, solar energy is becoming one of the most important energies in the future. Performance of PV panel decreases with increase in temperature of the PV panel. Hence, output power of PV module drops with rise in temperature, if heat is not removed. The cooling of PV modules would enhance the performance of PV panel. In order to cool this thermoelectric system is used. Hybridisation of PV module with thermoelectric modules used to increase the overall efficiency of the solar energy conversion system by keeping temperature constant within the limits. Model of hybrid combination of PV–Thermoelectric has been developed and study of thermoelectric has done to illustrate its usefulness in hybrid model of PV an thermoelectric modules. This paper shows the performance of PV panel through augmentation of thermoelectric cooling system to increase overall electric conversion efficiency of PV array*.**

Keyword-: *Solar PV Panel, Peltier model*

I. INTRODUCTION

Solar energy is a vital energy source that can make environment friendly energy more flexible, cost effective and commercially widespread. Photovoltaic cell is not use for steam generation. For maximum efficiency and more steam generation. Concentrator, collector and receiver are developed to solve this problem. Solar concentrator is a device that allows the collection of sunlight from a large area and focusing it on a smaller receiver or exit. A conceptual representation of a solar concentrator used in harnessing the power from the sun to generate electricity. A solar collector is used to concentrate solar radiation onto a receiver where heat transfer to a fluid takes place. There are different types of solar collector used.

The sun is a sphere of intensely hot gaseous matter with a diameter of 1.39 $\times 10^9$ m. The solar energy strikes our planet a mere 8 min and 20 s after leaving the giant furnace, the sun which is 1.5 $\times 1.0^{11}$ m away. The sun has an effective blackbody Temperature of 5762 K. The temperature in the central region is much higher and it is estimated at 8 $\times 10^6$ to 40 $\times 10^6$ K. The solar energy strikes our planet a mere 8 min and 20 s after leaving the giant furnace, the sun which is 1.5 $\times 1.0^{11}$ m away. The sun's total energy output is 3.8 $\times 10^{20}$MW. Which is equal to 63 MW/m2 of the sun's surface? This energy radiates outwards in all directions. This energy radiates outwards in all directions. Only a tiny fraction, 1.7 $\times 10^{14}$kw, of the total radiation emitted is intercepted by the earth. The greatest advantage of solar energy as compared with Other forms of energy is that it is clean projected
Can be supplied without any environmental pollution. The benefits arising from the installation and operation of renewable energy systems can be distinguished into three categories; energy saving, generation of new working posts and the decrease of environmental pollution. A worldwide research and development in the field of renewable energy resources and systems is carried out.

During the last two decades. Energy conversion systems that are based on renewable energy technologies appeared to be cost effective compared to the projected high cost of oil. Furthermore, renewable energy systems can have a beneficial impact on the environmental, economic, issues of the world. At the end of 2001 the total installed capacity of renewable energy systems was equivalent to 9% of the total electricity generation By applying a renewable energy intensive scenario the global consumption of renewable sources by 2050 would reach 318 exa joules.

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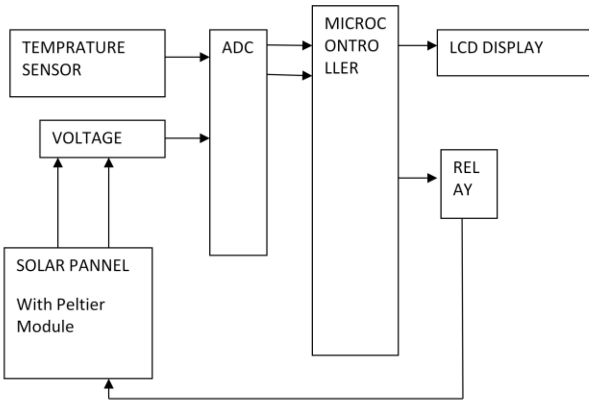
II. Working

- In this concept, photovoltaic's panel were used to integrate the extraction of light energy and thermal energy. The need of this project is to study of thermoelectric cooling effect to remove heat in the photovoltaic. The experimental results were subsequently analyzed and compared with the power generation efficiency of the examined photovoltaic. The use of thermoelectric cooling system improves the power capacity of the photovoltaic by 2%–20% and enhances the power generation efficiency of the



In this method, the solar panel is first tilted automatically in the direction of sun.

- The Solar panel traps the sun rays and stores energy and if the temperature exceeds above the specified limits then it is sensed and voltage is also measured with the help of voltmeter connected across it and measures voltage.
- After this two input of measurement that is voltage and temperature is given to the ADC Converter.
- The output of this A-D converter which converts the analog signal of voltage and temperature in the digital is given to the microcontroller.
- Then the LCD display shows temperature which exceeds beyond the limit and signal is sensed to relay.
- Then relay senses and gives signal to the Peltier model to reduce this temperature and the peltier model starts working and hence the efficiency of the solar panel is improved
- Then the output of this microcontroller is provided to LCD display.

III. PELTIER MODEL (COOLING SYSTEM)

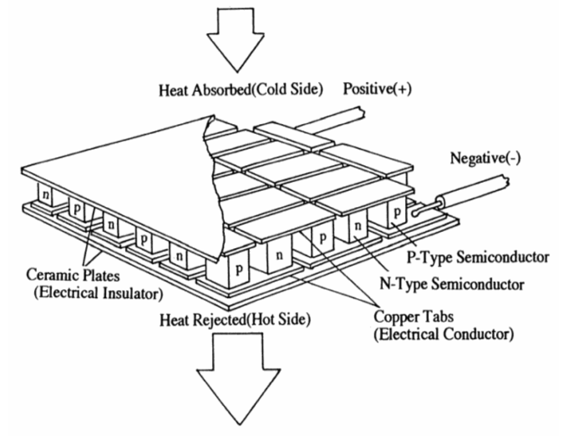


Fig : Internal Structure

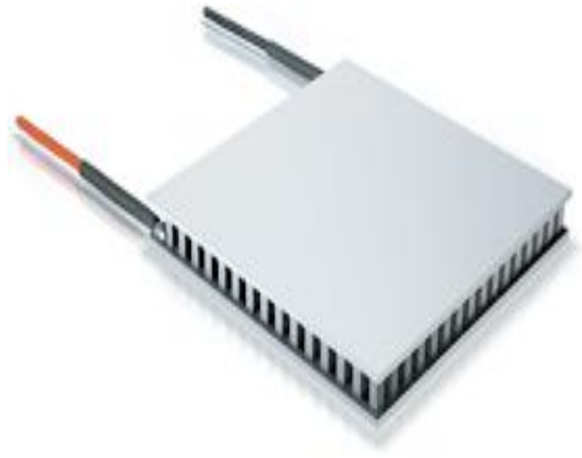
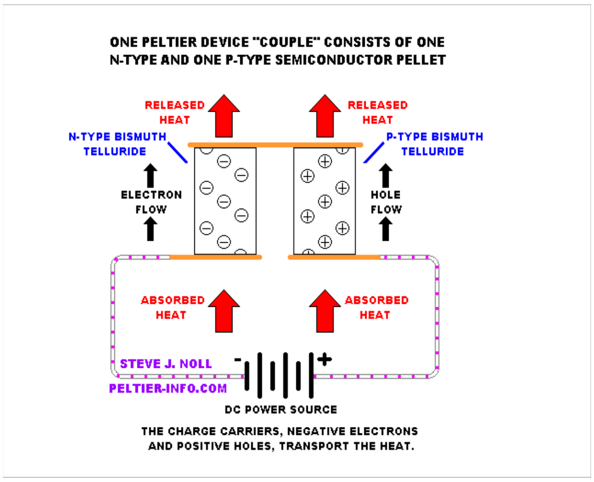


Fig : External Structure

- TEM is composed of p-type and n-type thermo elements electrical connected in series and thermally parallel with electrical insulation is provided by two ceramic plates which serves as foundation for the module.

- As TEM is bi-directional device which can be operated in Heating/Cooling mode or Power generation mode, this working portability is used in BIPV system for cooling PV module and to generate additional electrical energy.
- To develop efficient and cost effective Building Integrated Photovoltaic System (BIPV) temperature rise is more as heat transfer due to convection is not possible from rear side of the BIPV and Thermoelectric system are to be combined and hybrid model of BIPV/TE system needs to be developed.
- Thermoelectric technology provides alternative to traditional methods of power generation, heating/cooling and generation from waste heat. Thermoelectric module can convert heat energy into electrical energy directly.
- Thermoelectric phenomenon was observed by Seebeck. A small amount of power is generated by TEM(Thermoelectric module) if temperature difference is maintained between two terminals or it can operated as a heat pump based on Seebeck/Peltier effects.
- TEM possess salient features of being compact, light weighted, noiseless in operation, highly reliable, maintenance free and no moving or complex parts



IV. DESIGN AND HEAT TRANSFER ANALYSIS OF SOLAR PANEL

In design part, the symmetric section of PV Panel of 0.9 watt has taken which has size of 0.1m0.06m. On lower side of PV panel copper is selected as a heat conducting material due to its high thermal conductivity for attachment of thermoelectric module

V.TYPES OF COOLING

1. Passive Cooling
2. Active Cooling

5.1 Passive Cooling

- Passive heat removal in building integrated photovoltaic (BIPV) relies on circulation of air in an opening or air channel, instead of a duct, behind the PV

- A theoretical analysis of driven air flow in such an opening behind a façade integrated PV showed a maximum of 5 °C temperature reduction in averaged monthly temperature resulting in a net 2.5% increase in yearly electrical output of the PV

5.2 Active Cooling

- Active cooling of PV relies on air or water flow on the front or back of the PV surface
- Water flow on the front surface of a free standing PV has decreased cell temperature of up to 22 °C along with decreasing reflection losses from PV surface yielding an 8%–9% increase in electrical power output

VI.ADVANTAGES AND DISADVANTAGES

ADVANTAGES

1. By using this peltier model the efficiency and output is improved
2. Simple in design
3. No moving part
4. Requires little maintenance
5. long life
6. Non-polluting

DISADVANTAGES

1. Not suitable for extremely cold climates
2. Location - must be positioned in an area with suitable solar exposure *(i.e. south side of desired area)*
3. It is little costly

VII. CONCLUSION

This paper shows the application of thermoelectric cooling system for PV module for the enhancement of electric conversion efficiency and life of PV module. Results shows that at low temperature 25^0C of the PV panel there is improvement in efficiency of PV module. The detailed analysis of the model indicates that performance and life enhancement of PV module could be achieved with 25^0C cooling without loss of power.

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