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Low cost power generation using greenhouse gases in thermocouple

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ABSTRACT *Thermocouple is a sandwich between the Solar heat trapping Greenhouse and a simple Heat sink, which is made of thin aluminum sheets, the bottom side of heat sink is in connect with another thermocouple, which again touches to a metallic sheet that touches the geo thermal heated water source.*

Insulator is an important in this model, as a layer between the source and sink will be able to maintain the temperature difference between sink and source. We will use eco-friendly material as an insulator.

Current and voltage show the same trend with time hence output can be maintained under the conditions of the utilization of the further saving or the direct applying to the load. Variation in voltage can be regulated as DC voltage regulation

INRODUCTION

Thermo power production basically subjected to the coal, biomass, oil or natural gas, and in traditional ways using wood. Since the starting era of the space programs, nuclear energy is also introduced for thermo power production for providing the electric power to the space craft's. All of these came under the category of the polluted ways or bulky. The use of renewable energy will open an additional field of power production that can accelerate the concept of backup energy in houses. The solar power source can be used for smaller power consuming events like charging phone, lighting LED lamps, even can be stored for use during main power cut.

The threat of global warming has made it increasingly imperative that energy sources be developed that does not emit carbon dioxide or other greenhouse gases (GHGs). Globally, emissions of CO_2 are growing, and faster now than any time in the last 20 years [1, 2]. Despite the uncertainties that remain in climate modelling predictions and the consequences of higher atmospheric concentrations of CO_2, certain facts speak for themselves. The concentration of CO_2 in the atmosphere has been rising steadily for the last 200 years (from a pre-industrial revolution level of 280 ppm to a present-day level of over 380 ppm) [3, 4] and this growth rate has increased substantially over the last 50 years [5]. Various chemical compounds present in Earth's atmosphere allow direct sunlight (relative short wave energy) to reach the earth unimpeded. As the shortwave energy heats the surface, longer wave (infrared) energy (heat) is reradiated to the atmosphere. Greenhouse gasses absorb this energy, thereby allowing less heat to escape back to space, and trapping it in the lower atmosphere, this process is known as greenhouse effect [6].

Same phenomena can be applied with bounding the greenhouse gasses in a closed container, with one end covered with transparent glass sheet. That will absorb solar energy and can maintain high temperature for longer time. This energy can be utilized as hot junction of thermocouple for electricity production. In common thinking we assume that greenhouse gasses especially CO_2 traps the direct sun heat however solar rays contain very small component of infra - red radiation (IR) , it just stop the reflected IR from the surface of earth back to space. Alone CO_2 is not enough effective for the greenhouse effect.[7]

ENERGY CRISES

Increasing human civilisation and population put a huge demand of the electricity in modern age. The electricity sector in India had an installed capacity of 202.98 Giga watts (GW) as of May 2012, the world's fifth largest. Captive power plants generate an additional 31.5 GW. Thermal power plants constitute 66% of the installed capacity, hydroelectric about 19% and rest being a combination of wind, small hydro, biomass, waste-to-electricity, and nuclear [8].

The factor that has slowed the emergence of thermoelectric generators as a viable alternative for the production of electricity is the relatively low energy conversion efficiency, which is only about 5% to 7% whereas photovoltaic (PV) are now in excess of 20%. Unfortunately this low efficiency rating also had a negative impact on further research and development of thermoelectric generators (TEGs). However, comparing TEGs to PV panels by the watt rating is a grossly inaccurate comparison and makes it appear that TEGs are simply too expensive of an option. In this article the development and drawbacks of thermocouple at each stage has revealed that greenhouse gases produced by solar radiation can be used as heat source in a thermocouple.

Thermoelectric technology

Thermoelectric technology has been in wide spread commercial and industrial use for over 50 years yet the true value of thermoelectric has been seriously underestimated resulting in almost no advancements in the technology. In 1821, the German–Estonian physicist Thomas Johann Seebeck discovered that when any conductor is subjected to a thermal gradient, it will generate a voltage. This is now known as the thermoelectric effect or Seebeck effect. Any attempt to measure this voltage necessarily involves connecting another conductor to the "hot" end. This additional conductor will then also experience the temperature gradient, and develop a voltage of its own which will oppose the original. Fortunately, the magnitude of the effect depends on the metal in use. Using a dissimilar metal to complete the circuit creates a circuit in which the two legs generate different voltages, leaving a small difference in voltage available for measurement. That difference increases with temperature, and is between 1 and 70 micro volts per degree Celsius (μV/°C) for standard metal combinations [9].

EXPERIMENTAL APPROACH

Thermocouple electricity generation we deal with main three parts are source, insulation, and sink. Where source is kept at high temperature, the heat source is SUN to increase and

Volume : 3 | Issue : 7 | July 2013 | ISSN - 2249-555X

maintain the temperature of the source high using the green-house effect.

Source
In thermocouple generator source part is subjected to collect the energy from sun in the form of heat. The concept of collection of heat based upon the simple phenomena of increase in the wavelength of the falling radiation after refraction through a transparent glass sheet. Glass is transparent to wave of visible light but opaque to ultraviolet and infrared waves. Glass acts as valve of one way short. It allows the visible light to enter but prevent the longer wavelength to leave [10].

Data Collection from Source Part
Take an insulating container (so heat cannot be shared with surrounding). Having one face of larger area then another face (hence more solar radiation can enter the source). Further covered with the insulating screen of a tough material that under goes tolerate the stress of GHGs filled inside and heat up to range of 90-100^{0}C.

As shown in fig only four screws were used for fixing the transparent glass sheet. Here used screw was of length 20mm and of bore of 2mm. Thickness of the sheet chosen of thickness 4mm. Bottom side of the source part kept flat from middle, provision of its flat part under the consideration of the flat surface of the thermocouple used in this case. Rest part kept little curved for keeping away the source from the direct contact of the heat sink.

Fig.1. Source part inserted in double insulation of Glass wool and Wooden Block

Insulation provided by wool of thickness varies from 100mm to 200mm, whole model was placed inside of wooden ply box having walls thickness of 4mm. Only bottom side of area equal to the area of thermocouple leaves empty for attaching the thermocouple

EXPERIMENTAL SETUP FOR ELECTRIC OUTPUT
Connation of source with hot side of Thermocouple
Cutting the small part of the bottom portion from middle of thermocouple was attached (attached in a way such that it will not in direct contact of aluminium body) to the wooden block. Thermocouple G2-35-0315 used was manufactured in Tellurex Corporation 1462 International Drive in Traverse City, Michigan, 49686 United States of America. All the G2 Tellurex power generation modules also include an effective and smooth thermal interface material that eliminates the need for thermal grease during installation and use. Heat rejection side should not exceed 100˚C and the heat collection side will be on top when holding the module with red wires facing you and extending to the right. **Compliant, Ceramic material:** Alumina (Al2O3, white 96%)**, Bonding:** Proprietary (withstands 320˚C)**, Flatness/Parallelism:** Not more than +/- 0.025mm[11].

HEAT SINK
A heat sink is designed to increase the surface area in contact with the cooling medium surrounding it, such as the air. Approach air velocity, choice of material, fin (or other protrusion) design and surface treatment are some of the factors which affect the thermal performance of a heat sink.

The famous, popular, historic and notable 2N3055 power transistor in a TO3 case has an internal thermal resistance from junction to case of 1.52 °C/W. The contact between the device case and heat sink may have a thermal resistance of between 0.5 up to 1.7 °C/W, depending on the case size, and use of grease or insulating mica washer [12].

The most common heat sink materials are aluminium alloys [13]. Aluminium alloy 1050A has one of the higher thermal conductivity values at 229 W/m•K but is mechanically soft. Aluminium alloys 6061 and 6063 are commonly used, with thermal conductivity values of 166 and 201 W/m•K, respectively [14]. The values depend on the temperature of the alloy.

FINAL DESIGN OF THE SOURCE PART FOR ELECTRIC OUTPUT
In final design of the source part for electric output fixed amount of the GHG/GHGs was filled in the source part at constant pressure after converting the solar energy into heat energy using transparent glass sheet. That heat transferred to the hot junction of the thermocouple through the aluminium body of the thermocouple. Output from the thermocouple mounted in-between the heat source and sink is taken out undercover of the heat shielding of cylindrical shape mounted over the output wires. At out let is subjected to the millimetre for calculation of the output voltage and current generated.

Difference between the heat sink and source will generate the output in the form of electricity. Here heat will transfer in phase as first heat taken from hot water by the aluminium container and then it will transfer to the hot junction of the thermocouple; further heat will be lost from the cold junction by heat sink attached to it. Fraction of heat will be converted to the electric energy. Designed in such a way that there wills no leakage of GHG/GHGs through the source part of the thermoelectric generator.

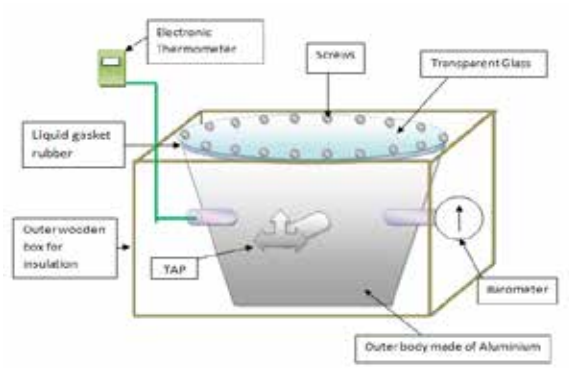

Fig2. Thermoelectric generator (drawing without insulation shown)

THERMOELCTRIC POWER GENRATION FROM SOLAR ENERGY
Output voltage and current
The results are influenced by Sun's path through the sky. Variation in output voltage as well as the current due to the maximum and minimum heating during the noon and evening/ morning time are shown in Fig 3

Volume : 3 | Issue : 7 | July 2013 | ISSN - 2249-555X

Correlation between the voltage and current

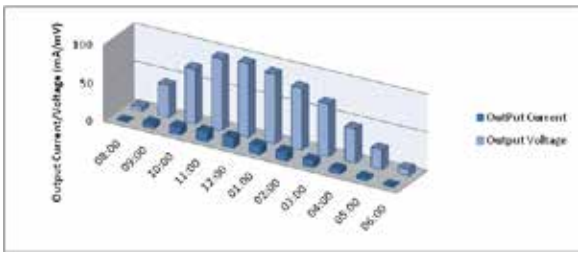

Fig.3.Here Y-axis Current/ Voltage from 0-100 mA/mV and X-axis Time from 08:00 am to 06:00 pm

Above graph show the same variation in output current and voltage. First the outcomes support the manufacturing recommendations proposed by tellurex. Current and voltage show the same trend with time hence output can be maintained under the conditions of the utilization of the further saving or the direct applying to the load. Up and down in Fig corresponds to the motion of sun through the sky are discussed here

5.3.2 Discussion
Voltage regulation
Variation in voltage can be regulated as DC voltage regulation. Many simple DC power supplies regulate the voltage using a shunt regulator such as a Zener diode, avalanche breakdown diode, or voltage regulator tube. If the stabilizer must provide more power, the shunt regulator output is only used to provide the standard voltage reference for the electronic device, known as the voltage stabilizer. The voltage stabilizer is the electronic device, able to deliver much larger currents on demand [15].

6 CONCLUSIONS
Single piece of thermocouple came around $ 60 with addition to the solar energy as the main source of power production. Output this thermocouple power production of 10-100 mV is maintain can be further decreased through large scale production by a factor of 25%-40%. This fulfils our aim of highly efficient and low cost method as compared to solar power plant.

Our aim is also to provide a technology that vast important in remote areas with huge amount of direct solar energy in India. The technology will be better utilised in these remote sensing areas. Even more it's applications to the space related missions, especially on the moon surface where the difference between the sun light and shadow is around 170^0C. This technology will be better utilised. Same conditions are in space around earth

Aim is to provide feedback for the industry of thermocouple production by subjecting it to use of the solar energy. Here proposal to trap the heat from solar radiation using the Green House Gases. That used for the hot junction of the thermocouple. This demands of large amount of GHGs trapped in a bounded green house. Even better option may be possible is the vehicles and industrial smoke. On applying the phenomena to a wider range an effective amount of GHGs can be removed from atmosphere.It will reduce GHGs thereby reducing global warming.

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