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Thermoelectric Power Generation by Seebeck Effect

Abhishek Gupta[1], Ashutosh Gupta[2] ,Harshvardhan Yadav[3],Nitish kr. Singh[4],Mrs.Garima Singh[5]

Department of mechanical engineering, BBDITM. Lucknow. India

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Abstract – *The main objective of this work is to experimentally investigate the feasibility of employing hot and cold fluid and generating electricity through See beck effect. Power cost increasing, global warming, environmental pollution and declined in plain areas are issues that we are dealing with in present time. To minimize this effect many scientists have researched on improving energy harvesting based power generation. Thermoelectric generation(TEGs) have show their ability to convert thermal energy into electrical energy with the help of " seebeck effect" .It is also environment friendly because it do not contains chemical products. It operate silently because it does not contain mechanical structure or moving parts and it can be fabricated on many types of element like silicon, polymer & many more.It can be used on bulk parts and also flexible device this paper presents in detailed analysis of TEGs.In recent years, an increasing concern of environmental issues of emissions, in particular global warming and the limitations of energy resources has resulted in extensive research into novel technologies of generating electrical power.*

Keywords: **Thermoelectric Module, Thermoelectric Generator, Thermoelectric Material.**

1 .INTRODUCTION

1.1 Problem Statement

Some developing countries and most populated industrialized countries (India china Mongolia Korea) etc. have average of 3 to 10 hours of daily power-cuts because the increase in demand of consumer utilization electricity exceeds so that the production of electrical energy is lesser then the consumer demand. And also shortage of fossil fuel and coal i.e. about 60% of electricity is generated from fossil fuels. (Oil and gas) are imported from Arabian countries. So that pollution also may occur due to the combustion of this fossil fuel. And also the generating the power from these conventional sources may lead to harmful environment and pollute the nature. In the new generation they are depending upon the rechargeable batteries or diesel /petrol engine etc. when there is no power and at the time of load shedding. The use of generator is common in industrial and commercial sector. This ultimately increases the shortage of power and more cost. And also the people are not utilizing the power properly they were unnecessarily wasting the power and they are not designing the power consumption properly hence basically a low power production in that also wasting means in the future we live without light Now a days consumer demand is more then the power production that is the major difficulty to overcome.

1.2 Objective

a) To develop a eco-friendly electricity with the use of hot and cold fluid by using Seebeck effect. Thermoelectric power generator has no moving parts so it is noise free.

b) Our main focus is on minimize the use of fossil fuel and to develop electricity without noise.

c)To use this prototype model, in ice-cream making factory we can apply this concept to generate

2.LITERATURE REVIEW

M.Takashiri et al.[1] has been done Bismuth–telluridebased alloy thin film thermoelectric generator was fabricated by a flash evaporation method. The maximum output power of the thin film thermoelectric generator in this study is still not enough to apply as a power source for microelectronic devices. And for improving the performance of the generator they used hydrogen annealing process.

Bongkyun Jang et al.[2] has been using finite element analysis he concluded, as the substrate gets thicker the thermoelectric performance deteriorates due to thermal loss from the substrate. The thermo elements have an optimal length with the highest power High efficiency is obtained when the length of the thermo elements is large.

P. Phaga et al.[3] has been investigated low cost thermoelectric generator (LCTEG) and high performance to reduce costs of production. The thermoelectric power generation composed of small n-type (n-CaMnO3) and p-type (p-Ca3Co4O9) of 31 couples/ in2 and the use of thin copper plate and silver paint as electrodes. It was found that the mean voltage is ~121.7 mV, current is ~0.0121mA; power is ~1.47 μW.

Ahaad Hussein Alladeen, et.al.[4] achieved Thermoelectric waste heat recovery with cooling system for low gradient temperature using power conditioning to supply 28V to a DC bus, 2017 IEEE Transportation Electrification Conference and Expo, Asia Asia-Pacific), 2017 From literature survey 3 we studied different types of cooling system and different types of coolant.

T.J Zhu,et.al.[5] determined the nano structuring and Thermoelectric properties of Semiconductor Tellurides, 2007 International Conference on Thermo electrics From literature survey 5 we knew about thermoelectric material and its properties

3. METHODOLOGY :

In this proposing system we will going to make an Eco-friendly and renewable thermoelectric power generator that will provide electricity with no moving parts in place of petrol or diesel generator.

[1] To begin the experiment, we are using galvanized iron container in which we pour hot fluid and cold fluid in ice form in each container respectively.

[2] Now we are using thermometer to measure the initial and final temperature of hot and cold fluid.

[3] A DC motor fan used which indicates the electro-magnetic field is generated when its fan starts moving.

[4] In next step, inverter converts AC current to DC current.

[5] By using battery, we glow out the 3W bulb.

4.ASSEMBLY DESIGN:

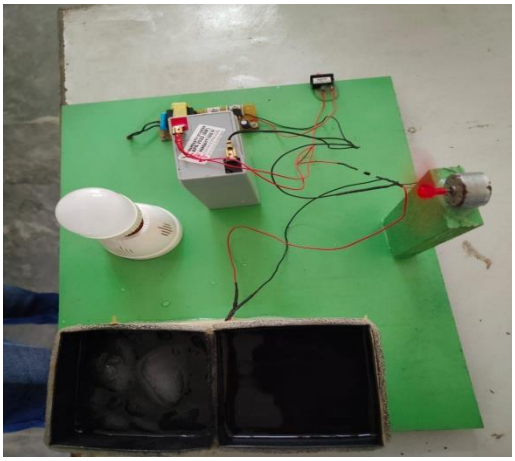


Fig-1:Assembly design

5.COMPONENTS:

1. Peltier junction 12 v energy generation
2. G. I Sheet to make chamber
3. Hot Water for heat generation
4. Ice to cool Peltier device
5. Brushless Dc motor 500 RPM
6. 6V power Storing battery
7. One DC to AC inverter
8. 3-watt LED
9. One air fan to be mounted on Motor shaft
10. Connecting wire

6.DESIGNING CALCULATION:

6.1 Working

In prototype project model, at initial stage the incoming voltage when temperature difference is created it develops 0.5v voltage.

After 20 min, its voltage decreases from 0.5v to 0.25 voltage.

After 40 min, its voltage decreases from 0.25v to 0.20 voltage.

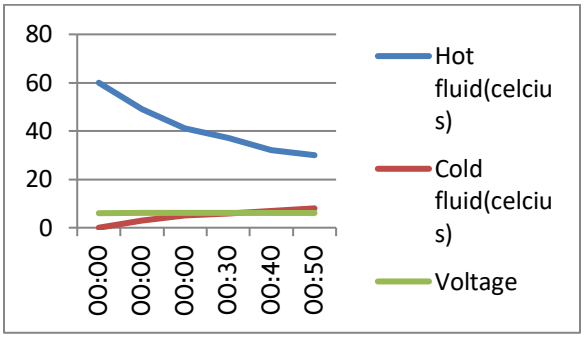
From observation table, first we take ice with 0°C and normal water. By heating the normal water to 60°C. Then we start taking observation after every 10 minutes, we get that hot fluid temperature is decreasing and cold fluid temperature is increasing periodically. The requires voltage is also increasing from 6 to 6.05 volt. Repeating this process until 50 min, we got that increment in voltage from 6 to 6.1 volt. This shows that our battery gets charged by 0.1 volt.

TABLE-1 OBSERVATION TABLE

Time (in min)	Hot Fluid (celcius)	Cold Fluid (celcius)	Voltage
00:00	60	0	6
00:10	49	3	6.05
00:20	41	5	6.075
00:30	37	6	6.08
00:40	32	7	6.1
00:50	30	8	6.1

7. CONCLUSION:

Below the graphical representation of Table -1 observation table



From the above graph we conclude that from the experiment we see that hot fluid temperature is decreasing and cold fluid temperature is increasing periodically. Voltage generated during temperature difference is increasing slowly.

A Thermoelectric power generation is successfully designed and assembled. It serves as providing electricity in hilly and rural areas where electricity can't be reached. It is a type of eco-friendly and renewable type of source to produce electricity. This system is often manufactured at relatively low cost using simple electronic parts. The thermoelectric power generation system is very important as it reduces the consumption of fossil fuel. It can also be used in ice-cream factory to generate electricity. However, the design is still in prototype stage . More tests got to be conducted before the efficiency, durability and reliability are often demonstrated. Additionally, many improvements can be made to make the system is more versatile, customizable and user-friendly.

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BIOGRAPHIES

Mr. Ashutosh Gupta was born in 2000 in Ballia Uttar Pradesh India. He is currently pursuing Bachelor of Technology in Mechanical Engineering from BBDITM, Lucknow(affiliated to Dr. A.P.J Abdul Kalam Technical University Lucknow).

Mr. Harshvardhan Yadav was born in 2001 in Ballia Uttar Pradesh India. He is currently pursuing Bachelor of Technology in Mechanical Engineering from BBDITM, Lucknow(affiliated to Dr. A.P.J Abdul Kalam Technical University Lucknow).

Mr. Abhishek Gupta was born in 1999 in Varanasi Uttar Pradesh India. He is currently pursuing Bachelor of Technology in Mechanical Engineering from BBDITM, Lucknow(affiliated to Dr. A.P.J

Abdul Kalam Technical University Lucknow).

Mr. Nitish Kr. Singh was born in 2001 in Lucknow Uttar Pradesh India. He is currently pursuing Bachelor of Technology in Mechanical Engineering from BBDITM, Lucknow(affiliated to Dr. A.P.J

Abdul Kalam Technical University Lucknow).

Mrs. Garima Singh was born in 1986 in Lucknow Uttar Pradesh India. She is an Assistant professor in BBDITM, Lucknow(affiliated to Dr. A.P.J Abdul Kalam Technical University Lucknow).