WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Power Generation from Thermoelectric Generator (TEG)

Durgesh Dongre[a], Himanshu Mehakare[b], Parth Khadatkar[c],Pooja Yadav[d], Rajeshri Fulbandhe[e]

[a] Associate Professor, Department of Electrical Engineering, Priyadarshini J.L College of Engineering, Nagpur, Maharashtra, India 441306

A B S T R A C T

Power costs increasing, and environmental pollution and warming are issues that we are addressing at present. To scale back their effects, scientists are specializing in improving energy harvesting-based power generators. Thermoelectric generators (TEGs) have an ability to directly convert thermal energy into an electrical one via the Seebeck effect. Also, they're environmentally friendly because they are doing not contain chemical products, they operate silently because they are doing not have mechanical structures and/or moving parts, and that they may be fabricated on many varieties of substrates like silicon, polymers, and ceramics. Furthermore, TEGs are position-independent, present an extended operating lifetime, and are suitable for integration into bulk and versatile devices. This paper presents an in-depth analysis of TEGs and generating power as a non-conventional method by energy. Non-conventional energy systems very essential at this point to our nation. This project are often accustomed utilize the warmth energy into electricity for multipurpose use in less power (mW) electronic devices. this method should be economical, and simple to implement.

Keywords:Miliwatt power, Low power, Generation, Non-Conventional, Seeback effect

1. Introduction

.At present, the Energy crisis is that the main problem, there are obvious efforts to recover the waste energy and convert it into electricity using various sources of waste heat like in power plants, automobiles, cooling systems, etc. These efforts are conducted toward reducing the electrical generation cost and decreasing global pollution. However, fossil fuels are still the most source for producing electricity. Waste heat is classed supported temperature into a high grade (high temperature) and low grade (low temperature). Many thermal processes produced an infinite amount of waste heat at a low-grade temperature of 150 ℃ or less which is in most cases released to the environment or discarded through the cooling system. Globally, energy consumption is anticipated to rise by 71% while CO2 emissions may increase by quite 40%. Recovering low-grade waste heat could be a challenging task so researchers are working toward finding alternative and reliable ways to reuse this energy. Also, the recovered energy will help to extend efficiency and reduce the fuel cost of the thermal system.

2. Methodology& Modeling

2.1 Methodology -

TEG is based on SEEBECK EFFECT. When heat is applied to a circuit at the junction of

With different conductors, a current will be generated.

Working-

In our project, TEG is the main hero. TEG converts heat source directly into an electric source. When TEG gets hot from one side with the help of a heat source and another side is cooled by a cooling fan then electric energy gets produced. In TEG we implement a temperature sensor by which how much heat is needed to generate electric energy we come across to know. Whenever the heat gets increased electric energy also gets increased. It fully depends upon TEG capacity and how much to increase heat. After electric energy gets produced it flows directly through the switch to the DC-DC step-up chopper. The chopper will step up the voltage which gets from the input side in form of DC only. And that step up energy will give to the

Voltage regulator. In a voltage regulator, a fixed form of voltage we get directly flows towards the battery. The battery will store that energy in form of DC. When we need that energy in form of AC we give it to an inverter that is connected to the battery. The inverter converts the DC source to an AC source and that AC source is given to the LED bulb which is 5 watts. In this way, our project gets run completely.

Block Diagram-

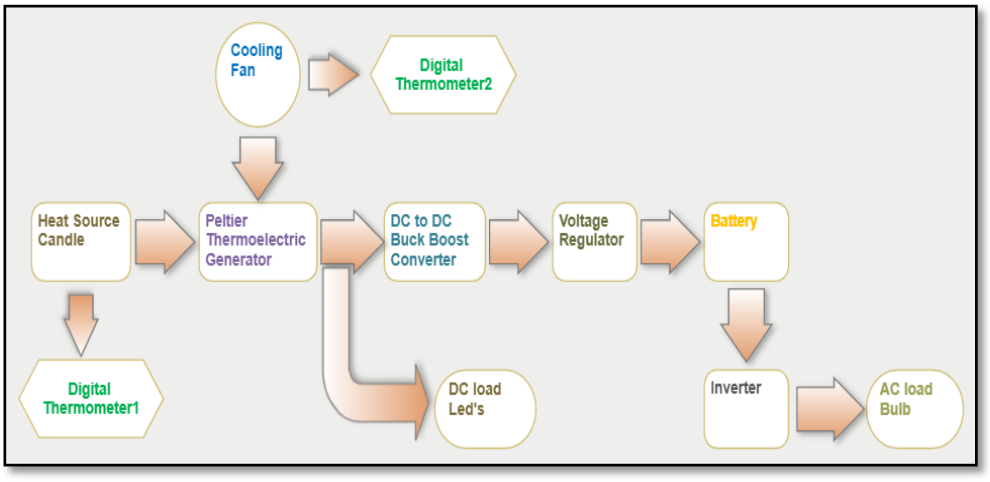

Figure 1: Block diagram of the model.

1. The heat from the candle is given to the hot side of TEG
2. Cooling is provided by a cooling fan to the cold side of TEG
3. Digital Thermometer 1 Shows the Temperature of the Hot side & Digital Thermometer 2 Shows the Temperature of the Cold side
4. The output of TEG is fed to DC to DC converter & DC load in Parallel
5. DC to DC converter output is fed to Voltage Regulator
6. The output of the voltage regulator is fed to the battery
7. The battery is connected to the inverter and the inverter to the AC load

Circuit Diagram

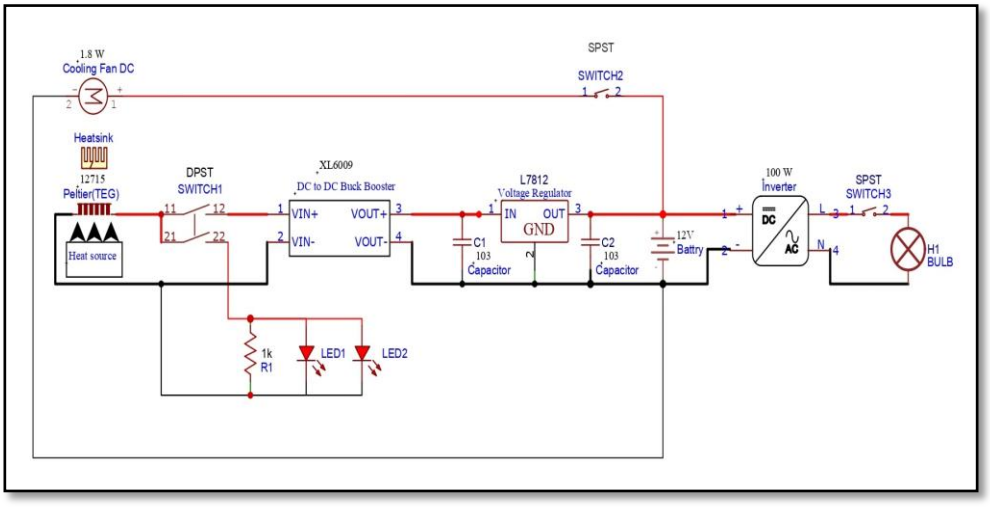

Figure 2: Circuit Diagram of Modal.

2.2 Modeling and Analysis -

Component used-

TEG-Devices that convert temperature differences into electrical energy.

Thermometer-To finds the Temperature difference between both sides of TEG.

DC fan- cools the cold side of TEG to maintain the temperature difference between both sides of TEG.

Buck-Boost converter- DC voltage is stepped up by the buck-boost converter.

Inverter- Inverter convert output DC voltage of voltage regulator to AC

Voltage Regulator- The voltage regulator gives a constant voltage of 12V

Model-

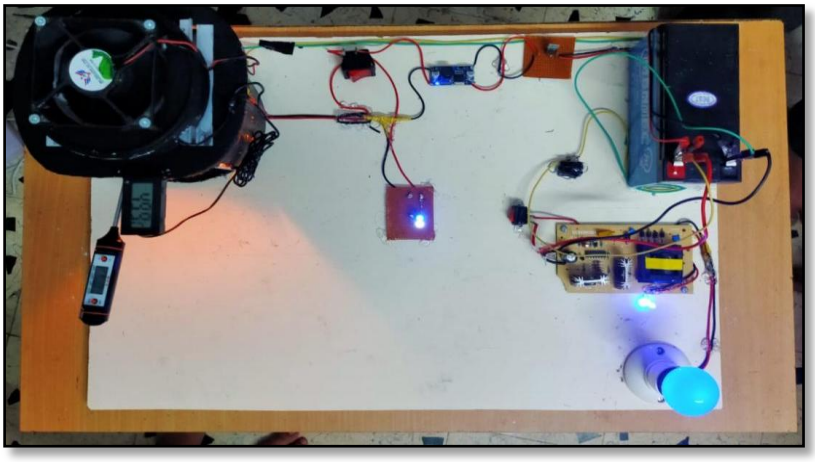

Figure 3: Thermoelectric power Generation modal.

3. Results and Discussion

After observing the table's different temperature differences there is a change in power. Voltage and Power are increasing with the increase in temperature difference. So we can conclude that TEG can be used to power low power electronic devices (mW)

SN.	T1 (degree)	T2(degree)	Delta T (T1-T2)	VTEG	ITEG	PTEG (VTEG*ITEG=mW)
1	179	51.0	128	2.66	5.12	13.61
2	159	50.0	109	2.59	3.34	8.65
3	141	49.2	91.8	2.54	2.21	5.61
4	130	49.1	80.9	2.53	1.82	4.60
5	99	48.2	50.8	2.34	0.10	0.23
6	92	48	44	2.15	0.01	0.02

Table 1. Observation Table

ASSUME:-

Thermometer 1 = T1

Thermometer 2 = T2

Temperature difference = Delta T

The output voltage of TEG = VTEG

The output load current of TEG = ITEG

Total Power of TEG = PTEG

4. Conclusion

TEG is used to supply low-power electronics (milliwatts) devices. Waste heat conversion into useful energy is beneficial per the present energy crisis. There are numerous advantages over disadvantages and a variety of application fields. The development in the future will lead to interesting applications.

Acknowledgements

We wish to avail this opportunity to acknowledge our profoundness in the department and extent our sense of gratitude to our guide Dr. A M. Mendhe for this valuable guidance, advice, and encouragement that has led to the successful completion of this project. Our sincere thanks to our honorable Principal Dr. A M. Shende for his genuine support and for providing us with the necessary facilities to carry out the work. We are

exceedingly grateful to our Head of Department, Prof. A. M. Mendhe for his co-operation in this project's completion. We also thank our parents for providing us with financial assistance and moral support for project completion.

REFERENCES

[1] A. Majumdar, "Thermoelectricity in semiconductor nanostructures", Science 303, 777 (2004).

[2] A. I. Boukai, "Silicon Nanowires as Efficient Thermoelectric Materials", Nature 451, 168 (2008).

[3] C. B. Vining, "An Inconvenient Truth About Thermoelectrics", Nature Materials 8, 83 (2009).

[4] Dr. Steven O'Halloran, Mr. Matthew Rodrigues, "Power and Efficiency Measurement in a Thermoelectric Generator", AC 2012-3976 (2012).

[5] Raşit Ahıska, Hayati Mamur," A review: Thermoelectric generators in renewable energy", International Journal of Renewable Energy Research, Vol.4, No.1, (2014).

[6] Cao D, Peng FZ. "Multiphase multilevel modular DC-DC converter for high current high gain TEG application", IEEE Energy Conversion Congress and Exposition; Atlanta, USA. pp. 4230–4237 (2010).

[7] Man Prakash Gupta, Min-hee S Sayer, Saibal Mukhopadhyay, Satish Kumar, "ON-CHIP PELTIER COOLING USING CURRENT PULSE "- 78-1-4244-5343-6/10/$26.00 IEEE (2010).