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# Power Generation System for Bike From Waste Heat

Pawar Dhiraj Rajendra[1], Javheri Omkar Rajendrasing[2] ,Agawane Nikita Pandurang[3], SomaseDipali Rajendra[4]
[*1]*Department of Electrical Engineering, S. N. D. College Of Engineering and Research Centre, Savitribai Phule Pune University, India*
[2]*Department of Electrical Engineering, S. N. D. College Of Engineering and Research Centre, Savitribai Phule Pune University, India*
[3]*Department of Electrical Engineering, S. N. D. College Of Engineering and Research Centre, Savitribai Phule Pune University, India*
[4]*Department of Electrical Engineering, S. N. D. College Of Engineering and Research Centre, Savitribai Phule Pune University, India*

Guided By: Prof. S. S. Yeole
[*]*Assistant Professor, Department of Electrical Engineering, S. N. D. College Of Engineering and Research Centre, Savitribai Phule Pune University, India*

***Abstract:***
*The main aim of this project is to develop much cleaner noise less cost effective different way of power generation method for charging the battery as well as to utilization proper only the requirement of usage, which helps to reduces the global warming as well as reduce the power shortages, load shedding and also we can transfer the portable generating unit. In this project the conversion of waste heat into generate electricity by using thermoelectric generator. Waste may refrigerator heat, vehicle radiator heat, laptop heat, even body heat can be used as a input source as a waste heat to generate electricity and it can be charged directly mobile battery and also stored in a rechargeable lead acid battery for further usage. And also waste energy human body locomotion also produce electricity body weight locomotion of the energy in to electrical energy by using electromagnetic induction principle.*

***Keywords:*** *Heat exchange, Seebeck Generator, Thermoelectric Effect, Thermal Conductivity, Waste Heat Usable*

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## I. INTRODUCTION

Due to the surge in environmental concerns and the increase in conservation efforts, energy harvesting research has experienced a rebirth in the last decade. Dramatic breakthroughs in available materials has also created opportunities for new applications of waste heat energy harvesting devices. In 1821 Thomas Seebeck discovered the Thermoelectric, or Seebeck, effect, which states that when the junction of two dissimilar metals is heated there will be a potential difference across them given by $V=S\Delta T$, where V is the voltage, S is the Seebeck coefficient, and $\Delta T$is the temperature difference.

Thermocouples are temperature sensors that utilize this effect by having two different metals soldered together. In conjunction with a separate temperature reference, the temperature is then read by scaling the output voltage. Thermoelectric modules take it a step further and connect multiple thermocouples composed of P and N type thermo elements together electrically in series and thermally in parallel, as can be seen in Figure 1. Thermoelectric modules have primarily been utilized in conjunction with the Peltier effect, which is the opposite of the Seebeck effect, as cooling devices because of the low efficiencies of the modules. However, with the availability of doped bismuth telluride for use in thermoelectric modules, the efficiencies have risen to a level capable of creating practical waste heat energy harvesting systems that use the Seebeck effect to generate electric power from a temperature gradient. Therefore, thermoelectric generators (TEGs) are being tested for use in various applications in efforts to reduce moving parts, increase mobility, decrease weight, and increase fuel efficiency.

An important application that has been receiving much attention recently is the use of TEGs as waste heat energy harvesters for internal combustion engines. Haidar and Ghojel tested a TEG constructed on the exhaust pipe of a diesel engine. Using four Hi-Z Technology, Inc. HZ-14 modules and active liquid cooling they achieved 42.3W of electric output from a temperature gradient of 237 degree C.

## II. LITERATURE SURVEY

* **Sugavanam .k .r "Transformer loss measurement And Power generation using Heat Flux sensor based Thermoelectric Device"**

Abstract:

Three phase transformers are the very important electrical equipment which are used in electrical power systems for step down and step up purpose. So it is essential to provide a better cooling system to it. The objective of this paper is to measure the heat loss accurately in transformer and to provide additional cooling system to it using a Thermo electric module. The thermo electric module is a sensor which acts as both actuator and sensor and it is used to measure the heat loss more accurately and to provide additional cooling to the transformer. Simulation is done using proteus software. It is shown that the conventional method for providing better cooling system has got many drawbacks. These demerits are overcomed using the proposed technique. Improvement in cooling system of transformer is achieved and the transformer operates below its rated temperature.

***Heat Exchangers: Thermal-Hydraulic Fundamentals and Design", Kakac et al., 1981**

Abstract:

Heat exchanger fouling is often dealt with in industrial applications through design (overdesigning heat transfer surfaces) and regular maintenance (shut-down and cleaning), both of which have economic consequences. Taking no care will ultimately degrade TE performance to an extent that the flow is severely restricted and the unit/device becomes inoperable. Fouling thermal resistance factors have been discussed for many common industrial environments by various researchers.

*** Pacific Northwest National Laboratory and BCS, Incorporated, Engineering Scoping Study of Thermoelectric Generator (TEG) Systems for Industrial Waste Heat Recovery, prepared for the U.S. Department of Energy, Industrial Technologies Program, (November 2006.)**

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***Atheer Muhammad Matar, Karrar S. Faraj**

Abstract

Due to the transformation of the electrical losses inside the electrical transformers into heat, its temperature rises, which affects the durability of the insulation and may cause it to collapse. Therefore, the transformers must be cooled. Since the losses of the transformer are proportional to its capacity, transformers can be cooled in several ways

***Aradhana Saket, Mrs. Seema Pal, Dr. A.K. Sharma**

Abstract:

Transformer plays an important role in electrical power system .There are many problems associated with Power loss in transformer but in this paper mainly focuses on efficient cooling system designed for overcoming heating and insulation losses. Ever since the invention of a transformer, we have been facing the trend of increasing its nominal power. Together with the increase of nominal power, losses in transformers increase as well, while a transformer's own capability of cooling decreases. The efficiency of the cooling is a crucial factor determining the operational safety and the life span of a transformer. Based on previous research works, this paper compares four cooling methods (air natural, air forced, air forced water forced and air forced water forced with coolant cooling) with the help of experimental setup. In this experimental setup comprises copper tube, air fan, water circulating pump. And the result better found in the air forced water forced with coolant cooling method.

## III.BLOCK DIAGRAM & WORKING PRINCIPLE

### 3.1 Working Principle:

Electricity generation the heat at outer side up to 100oc in atmosphere so it can be used as electricity generation so we used to converting heat energy to electricity as TEG in the above fig TEG one side placed the heat sink and cooling fan which ventilating the transformer so this fan working the double function 1$^{st}$ as transformer cooling other one is TEG heat sink temperature marinating.

After the generation of electricity we strode that energy in the battery through the charged controller as charged controller we used the buck boost .battery used to storage energy this battery can supply electricity to the cooling fan as shown in block diagram so that can help the free ventilation electricity to the transformer at least 60% energy can reduced the transformer cooling waste and also the according to newton law energy can not be distorted only it  transfer to one formed to another form so according rule we designed that project so it beneficial in future.

**3.2 Block diagram:**

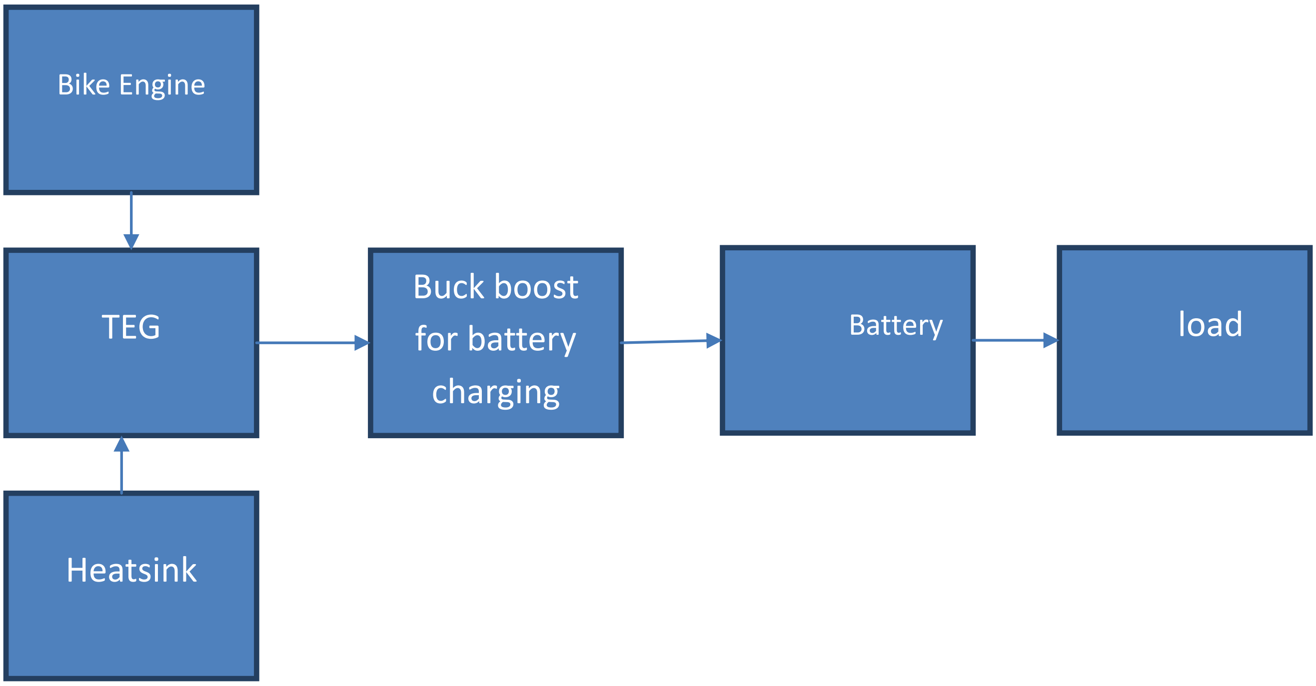


*Fig: block diagram*

**3.3. TEG (Thermoelectric Generator):**

**3.3.1. Working principle:**

A thermoelectric generator (TEG), also called a Seebeck generator, is a solid state device that converts heat flux (temperature differences) directly into electrical energy through a phenomenon called the Seebeck (a form of thermoelectric effect). Thermoelectric generators function like heat engines, but are less bulky and have no moving parts. However, TEGs are typically more expensive and less efficient. As shown in fig.

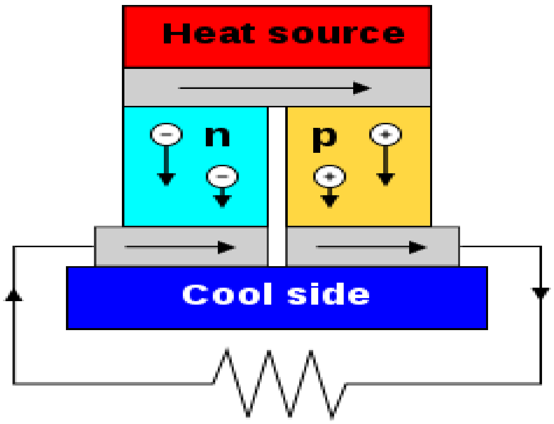


*Fig: Principle diagram of TEG*

Thermoelectric generators could be used in power plants in order to convert waste heat into additional electrical power and in automobiles as automotive thermoelectric generators (ATGs) to increase fuel efficiency. Another application is radioisotope thermoelectric generators which are used in space probes, which has the same mechanism but use radioisotopes to generate the required heat difference.

Thermoelectric materials generate power directly from heat by converting temperature differences into electric voltage. These materials must have both high electrical conductivity (σ) and low thermal conductivity (κ) to be good thermoelectric materials. Having low thermal conductivity ensures that when one side is made hot, the other side stays cold, which helps to generate a large voltage while in a temperature gradient. The measure of the magnitude of electrons flow in response to a temperature difference across that material is given by the Seebeck coefficient (S). The efficiency of a given material to produce a thermoelectric power is governed by its "figure of merit" $zT = S^2\sigma T/\kappa$

For many years, the main three semiconductors known to have both low thermal conductivity and high power factor were bismuth telluride ($Bi_2Te_3$), lead telluride (PbTe), and silicon germanium (SiGe). These materials have very rare elements which make them very expensive compounds.

Today, the thermal conductivity of semiconductors can be lowered without affecting their high electrical properties using nanotechnology. This can be achieved by creating nanoscale features such as particles, wires or interfaces in bulk semiconductor materials. However, the manufacturing processes of nano-materials is still challenging.

A thermoelectric module is a circuit containing thermoelectric materials that generate electricity from heat directly. A thermoelectric module consists of two dissimilar thermoelectric materials joining in their ends: an n-type (negatively charged); and a p-type (positively charged) semiconductors. A direct electric current will flow in the circuit when there is a temperature difference between the two materials. Generally, the current magnitude has a proportional relationship with the temperature difference. (i.e., the more the temperature difference, the higher the current.)

In application, thermoelectric modules in power generation work in very tough mechanical and thermal conditions. Because they operate in very high temperature gradient, the modules are subject to large thermally induced stresses and strains for long periods of time. They also are subject to mechanical fatigue caused by large number of thermal cycles.

Thus, the junctions and materials must be selected so that they survive these tough mechanical and thermal conditions. Also, the module must be designed such that the two thermoelectric materials are thermally in parallel, but electrically in series. The efficiency of thermoelectric modules are greatly affected by its geometrical design.

**3.4. Wastage heat from industry :**

It is estimated that about 3,143 TBtu of energy is wasted annually by the thousands of processes used in the U.S. manufacturing sector (excluding onsite steam and electric energy generation and distribution losses).[4] A large portion of this energy is exhausted into the atmosphere as waste heat.

A significant portion of waste heat is contained in gases which are discharged at ~300° F, even though the furnace or process environments that are the sources of the discharges may be operating at substantially higher temperatures. In a large number of industrial processes, large amounts of dilution air are added to reduce the temperature of the co-mingled exhaust in order to reduce capital and operating costs in flue system operations. In many instances the dilution air is added a very short distance from the furnace or process exhaust ports. Thus, high-grade heat is turned into low-grade heat. Effectively, the duct lengths or "residence times" for which the exhaust remains a source of high-quality heat are very short. Temperatures in the range of 300° F represent very low-quality heat and no commercially viable means of recovering this heat is available (Section 3.3 briefly discusses a future technology, piezoelectric generation, which may be applicable at these temperatures).

Many manufacturing industries offer several large opportunities for energy recovery. Aluminum, glass, metal casting and steel, all have process furnaces discharging high-temperature waste heat combustion gases and melt pool gases (such as, aluminum ~775°C and glass ~1,425°C). In some industries, this heat can be used to raise steam, preheat raw materials or combustion air, or be integrated with other processes at the manufacturing site. But in other industries there is limited opportunity to reuse this thermal energy. This makes TEG electricity attractive to these industries.

The opportunity to recover waste heat should be large in metals industries also which uses numerous heat treatment furnaces (with relatively clean flue streams of combustion gases only) and in chemical industry, where process heaters are widely used (direct-fired reboilers, reactors, etc.). Additional waste heat opportunities exist in lime kilns, cement kilns, etc.

## IV. ADVANTAGES

1.Simple to construction and installation.
2.Save energy.
3.New renewable source generated.
4.Engine efficiency increases.

## V.CONCLUSION

1. This project aims to find a possible way to recover the waste heat from the exhaust of I.C. engine as well as to design and fabricate one such system to serve the aim.
2. Experimentally it is found that when two thermoelectric generators are connected in series. This generated power either directly used to run some auxiliary devices of an automobile or may be stored in the battery and used later.
3. These auxiliary loads can be supplemented from battery to this system thereby reducing load on alternator.
4. The study also investigates the effect of engine speed on temperature difference and voltage generated.
5. The engine performance is unaffected by the designed system because heat extracted from the surface of the bend-pipe of the exhaust manifold which does not affected the working of engine. If higher temperature range is required then TEG module must be changed to higher temperature range (200˚C). Thus, the above stated system may be successfully implemented in different automobile engines, with slight changes.

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