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Portable Device for Thermo-Electrical Generation using Waste Heat

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Abstract: *In India, cooking stove is use in almost every house. During this, some amount of heat generated by flames is get wasted due to open air. Also, in summer, steel sheds gets too much hot due to heavy sunlight. In this project we are designed a portable unit of TEG plates to generate electricity from waste heat. This portable unit can be use with any sufficient heat generation sources like cooking stove, steel sheds, vehicle silencer and industrial furnace. Due to the temperature difference between two sides of TEG, a voltage (current) is produced. The produced voltage is not sufficient to store in battery. So the voltage is boosted up to required level using a DC-DC converter. The boosted up voltage is stored in battery which is used as a backup. Here this energy will be utilize to light up LED lights or to charge mobile phones. This feature will run on energy generated by TEG plates. So no external energy is required for this feature..*

Keywords: Energy generation, TEG

I. INTRODUCTION

In the 21st century dearth of energy and degradation of environment are among the major two problems. Thermoelectric devices provide a solution to such problems. Thermo electric devices are very small in size and therefore finds a wide range of application in areas like military, marine, space rovers, automobile industry, food and packaging industry etc. A thermoelectric generator is a device which converts thermal energy into electrical energy due to the presence of temperature gradient. TEG has many advantages that it has no mechanical parts, environmental friendly and maintenance is easy. Thermo electric generator (TEG) module is used here, which generates electrical energy from the excess heat generated and not used during cooking on gas stove. The waste heat can be utilized and therefore reduces the use of fossil fuels and thereby pollution can be reduced to some extent .

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II. OBJECTIVE

To satisfy the energy requirement of world is always a challenging task. This project proposes the development and implementation of portable model with thermo-electric generator (TEG) to produce electricity by utilizing excess heat from multiple heat generation resources. Objectives of system are as bellow:

- To design portable device to generate electricity.
- Utilize heat from hot surfaces to generate electricity using TEG plates.
- To harvests energy & store in battery.
- To calculate the resultant amount of energy generated from prototype and study of future possibilities.

III. METHODOLOGY

The thermoelectric effect is the direct conversion of temperature differences to electric voltage and vice versa via a thermocouple. a thermoelectric device creates a voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, heat is transferred from one side to the other, creating a temperature difference. At the atomic scale, an applied temperature gradient causes charge carriers in the material to diffuse from the hot side to the cold side.

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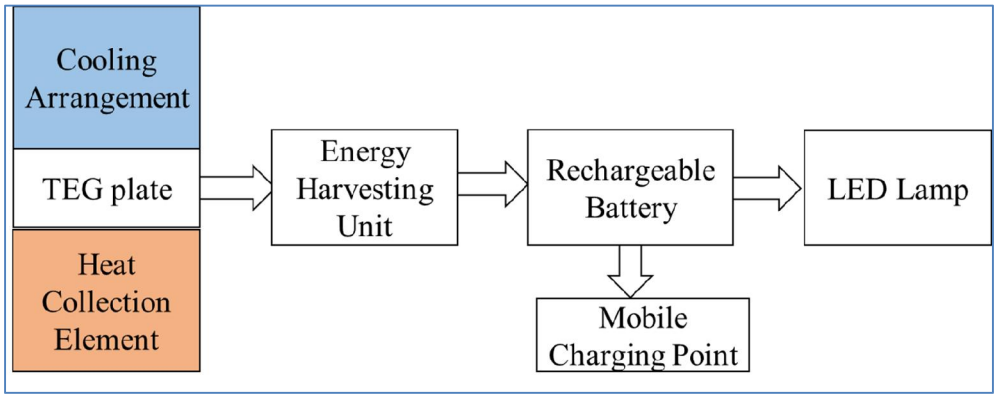
This effect can be used to generate electricity, measure temperature or change the temperature of objects. Because the direction of heating and cooling is affected by the applied voltage, thermoelectric devices can be used as temperature controllers. The term "thermoelectric effect" encompasses three separately identified effects: the seebeck effect, peltier effect, and thomson effect. The seebeck and peltier effects are different manifestations of the same physical process; textbooks may refer to this process as the peltier–seebeck effect (the separation derives from the independent discoveries by french physicist jean charles athanase peltier and baltic german physicist thomas johann seebeck). The thomson effect is an extension of the peltier–seebeck model and is credited to lord kelvin.

The seebeck effect is the electromotive force (emf) that develops across two points of an electrically conducting material when there is a temperature difference between them. The emf is calLED the seebeck emf (or thermo/thermal/thermoelectric emf). The ratio between the emf and temperature difference is the seebeck coefficient. A thermocouple measures the difference in potential across a hot and cold end for two dissimilar materials. This potential difference is proportional to the temperature difference between the hot and cold ends. First discovered in 1794 by italian scientist alessandro volta, it is named after the baltic german physicist thomas johann seebeck, who in 1821 independently rediscovered it. it was observed that a compass needle would be deflected by a closed loop formed by two different metals joined in two places, with an applied temperature difference between the joints. This was because the electron energy levels shifted differently in the different metals, creating a potential difference between the junctions which in turn created an electrical current through the wires, and therefore a magnetic field around the wires. Seebeck did not recognize that an electric current was involved, so he calLED the phenomenon "thermomagnetic effect". Danish physicist Hans Christian Orsted rectified the oversight and coined the term "thermoelectricity"



IV. RESULT AND ADVANTAGES

OUTPUT OF TEG UNIT:

Fig. : TEG output

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ADVANTAGES

- Excess heat energy will be utilize to generate energy.
- Eco-friendly-no byproduct/ pollution.
- Free of cost. Since waste heat act as input fuel.

APPLICATION

- Cooking stove
- Steel sheds
- Vehicle silencer
- Industrial furnace
- Chimneys
- Bonfire.

V. CONCLUSION

Satisfying energy requirement of world is crucial task. In this project, we are trying to implement a prototype which will be helpful for energy generation in future. We studied different energy generation system and designed one on the basis of knowledge obtained from other systems. Though deign is ready, actual implementation of prototype will begin in next phase of project, in which we will measure and analyze the output power generated by TEG system. To achieve a target temperature difference between two sides of TEG will be challenging

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