

# An Innovative Approach For Extraction Of Energy From Wastage Heat Dissipation From Vehicle Engine Heat-Up

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**Abstract**— The system proposed in this paper is an advance solution for generating the electricity from the waste heat dissipated from the vehicle engine heat-up. As we know almost every vehicle comprises of Internal Combustion (IC) engine and the maximum temperature it heats is about 700°C, this heat is dissipated in the air in the form of gases. So in our system we are utilizing this waste heat and converting it into electricity. By doing this it will increase the efficiency of an engine and also the environment will get less polluted. The technology behind this is Thermo Electric Generator (TEG) [1], and the component which used is called as TEG palate which efficiently converts heat energy into electrical energy. The maximum temperature TEG can handle is about 200°C to 300°C, which is then regulated by DC-DC converter to charge a battery using maximum power point tracking. This circuit will boost the voltage up to 12V and again with the help of Buck Booster the voltage will boost to (12v-15v). TEG works on the principle of Seebeck Effect, which is the direct conversion of temperature difference into electricity. The battery which is used is 12V 8A lead acid battery. The main feature of this battery is that it is a rechargeable battery. This battery can easily charge up to 3 mobiles and can lighten up the dc bulbs at home. This system is not only limited up to DC source, it can be converted to AC source with the help of Inverter circuit. The project is considered successful and ready to be launched in the real system implementation.

**Keywords**— Internal combustion (IC), Thermo Electric Generator (TEG), DC-DC converter, Buck Booster, Seebeck Effect, lead acid

## 1. INTRODUCTION

As the title mention this system will prove to be an effective alternative for extraction/ generation of desired energy from waste energy. According to energy conversation law, energy can't be created or destroyed it will be transformed from one form to another but during transformation there is a energy loss. In our system we are going to use this energy in an efficient way i.e. one of the daily used vehicle is our private cars. So as most of the vehicles are using internal combustion engine this produces a considerable heat and dissipated into the environment. We have proposed a system with a thermo-electric generation technique in which a direct energy transducers are used which produces the electrical power proportional to heat difference maintain around the transducer. Basically this transducer are working on the principle of thermo-couple technique in which it states that whenever there is a difference between the two

junction of a material made with a combined elements so that this temperature difference makes the electron flow between the two junction held at different temperature. The energy generated in terms of voltage is forwarded to charge pumping circuitry which boosts the current for further operation towards the useful utilization of energy. To enhance the efficiency and utilization a post generation module is implemented which generates the different form of voltages to drive and satisfy our daily needs like mobile charging, home dc as well as ac lightening.

### 1.1 THERMO ELECTRIC GENERATOR

TEG (Thermo Electric Generator) works on the principle of Seebeck Effect. It's a small device, by touching we can sense that the one side of TEG is warm and other side is cold. It has an ability to direct convert the temperature differences into electrical energy. This can be done by mounting the heating coil on one side and on the other by mounting the cooling assembly. TEG's are less bulky. By connecting the number of TEG's in series output can be increased. If it exceeds the max temp 300° C it can get damaged, but also can be easily replaced without any difficulty. It has got two wires positive and negative.

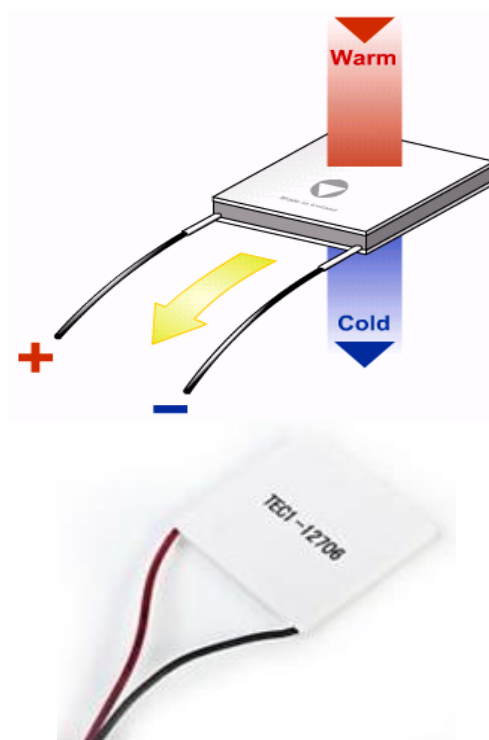


Fig 1. TEG Module

### 1.2 HEAT SINK ASSEMBLY

Heat Sink is a device which is commonly mounted on an electronic circuit for reducing the amount of heat flowing in the circuit. It acts as a coolant for the various components mounted on the same circuit. It takes excess amount of heat and dissipate it further away from the device. Due to which the temperature of a system remains balance. There are two types in heat sink, below shown in fig is a passive type. Another heat sink is active type for example: cooling fan of computer .



Fig 2. Heat Sink

### 2. Diagram

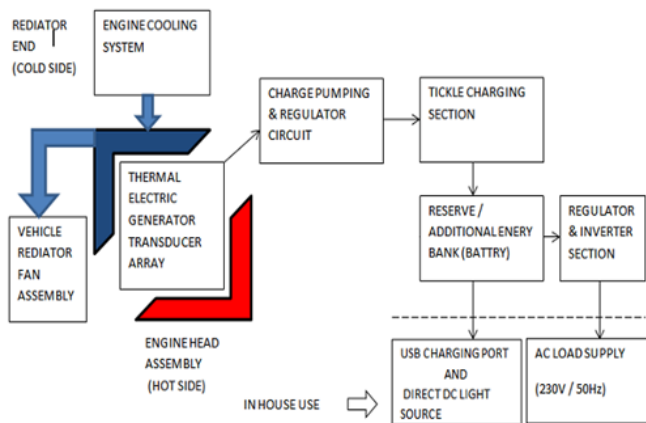


Fig. 3 Block Diagram

### 2.1 DESCRIPTION

As shown in the above figure at first there as a thermal electric generator which will generate the electricity and then will be given to the dc-dc converter circuit which will be further connected to the charger for battery charging with tickle charging technique to feed up battery in very short time. In order to maintain the temperature difference between hot junction and reference cold junction aluminum fin heat sink is mounted on the cold side with cooling fan assembly for the demonstration at local level. In real implementation of vehicle system this cooling mechanism will be linked to the engine cooling

system of vehicle. Also the battery health monitoring system is included in circuit.

On the output side, battery protection circuit is used to prevent the deep discharge by the load to ensure long battery life. we have incorporated the inverter circuit for generation of 230 Volts ac mains ac supply to drive ac load. At the same time USB charging ports are provided for smart phone charging directly to avoid ac-dc conversion losses from normal plug-in mains charger. This charger is considered to be one of the important part as, we all use a smart phones now a days generally consumes near about 900 Watts a month. So this system will help us to reduce that unnecessary wastage of the energy. With the same consideration of conversion losses in mobile chargers we have deployed a dedicated dc lightening source which can drive the dc lightening source directly. So all this design increases the overall efficiency of the system.

### 2.2 WORKING PRINCIPLE

#### [A] SEEBECK EFFECT

The Seebeck Effect directly is the conversion of temperature difference in to electricity. It is a classic example of an electromotive force (emf) and leads to measurable currents or voltages in the same way as any other emf.

#### [B] THERMO ELECTRIC GENERATION

In this we have one hot side and one cold side in between which there is an N- type region and P- type region. N- type region comprises of negative particles called Electrons and P- type region comprises of positive particles called Holes. With the help of wire the bulb is connected in between cold side. Here the hot side will provide heat to the N- type and P- type region due to which the electrons and holes both will get excited and will travel towards the cold side. Since the cold side is connected to the bulb with the wires the electrons and holes will flow through this wires and reach to the bulb which allow the bulb to glow. The current will get generated in the wire. So thermo electric generator is used for producing electricity with the help of hot and cold side.

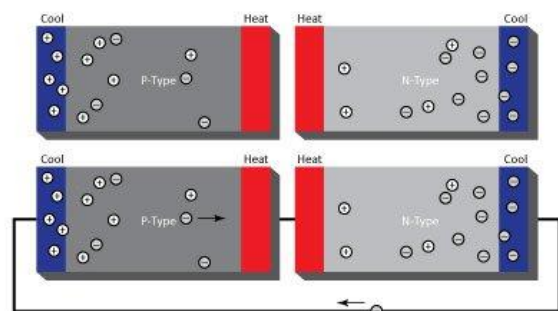


Fig. 4 Energy Generation

### 2.3 BATTERY

The Lead Acid battery is a Rechargeable battery which comes under the secondary batteries section. This are also called as Storage cell because they can store energy and recharge the battery. Lead Acid batteries are generally found on all automobiles, it is generally a 12v or 6v battery. now a days in UPS system also they are used. The main feature of this battery is that it has long life and the cost is also low. It's also safe to use.

### 2.4 CHARGING UNIT

a) Trickle charging means battery will charge fast when the battery percent is 0 to 20% after the 20% it will provide a constant voltage to battery.

b) Trickle chargers are used on vehicles that are un used for long times and also the vehicle that are kept for display purpose in this trickle charging method is used so that charge is retained.

### 2.5 POWER INVERTER

A power inverter or inverter is a device or circuit which changes the Direct current (DC) to Alternating current (AC). Most of the equipment we use in our house runs on AC system. In this AC system Voltage and Current changes periodically. The circuit used for conversion from DC to AC is known as INVERTER. The inverter basically involves frequency or oscillations for implementing the Boost and inversion actions. The frequency is known as generation of pulses at some uniform and calculated pattern, for example a typical inverter frequency rated at 50Hz or 50 positive pulses per second. The fundamental frequency waveform of inverter is in form of square wave pulses. As we know that square wave is never suitable for operating sophisticated electronic equipment such as TV, music players, computers, etc.

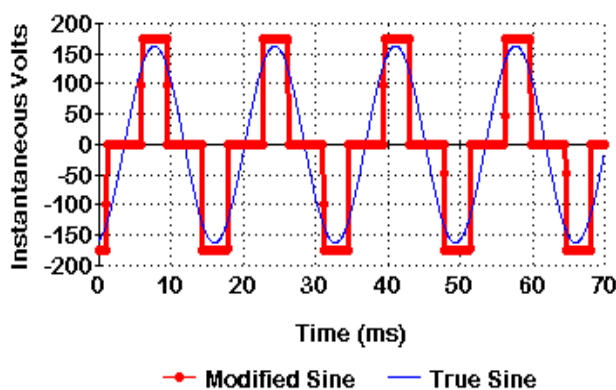


Fig. 5 Graph of time vs. instantaneous value

### LOAD SUPPLY

a) USB OUTLET WITH:

5V – 1A DC  
12V – 3A DC

b) AC OUTPUT WITH:

230V/ 50Hz/ 100W

### 3. CONCLUSION

The research says that TEG helps in smoothly conversion of heat energy into electrical energy. Such engines utilize only small share of the fuel primary energy converted to kinetic energy, however majority of fuel primary energy is wasted while dissipated in the ambient air as waste heat or as hot exhaust gas. TEG is used and then regulated by a dc-dc converter to charge a battery using maximum power tracking. Output can be increased by connecting the number of TEGs in series.

Thus by considering above said system, this system will definitely solve the problem of electricity utilization up to some extends by eliminating the use of some of the daily used appliances like charger and dc lightening. At the same time the energy generation method is pollution free so that it will help to build a green energy solution.

### 4. FUTURE SCOPE

As currently this system is proposed for utilization at own level so it can be incorporated in smart grid concept to provide unused energy by us to the grid so others can use this energy and will help in reduction of bills.

### 5. ACKNOWLEDGEMENT

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### REFERENCES

[1] Lauri Kutt, Matti Lehtonen, "Automotive Waste heat harvesting for electricity generation using thermoelectric systems-an overview," 2015 IEEE 5<sup>th</sup> International Conference on Power Engineering.

[2] P. Mohamed Shameer, D. Christopher, "Design of Exhaust Heat Recovery Power Generation System Using Thermo-Electric Generator," International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

[3] Capel, E.M.; Taib Ibrahim; Nursyarizal Mohd Nor; Hybrid Energy from Exhaust System; IEEE 7<sup>th</sup> International Power Engineering and Optimization Conference (PEOCO), 2013; pp. 134-138.

[4] Min, Gao; Rowe, D.M.; Conversion Efficiency of Thermoelectric Combustion Systems; IEEE Transactions on Energy Conversion, Vol. 22, Iss. 2, June 2007; pp. 528-534.

[5] Jadhao J S, Thombare D G. (2013), "Review on Exhaust Gas Heat Recovery for I.C. Engine," International Journal of Engineering and Innovative Technology | Issue 12 | June 2013 | ISSN: 2277-3754. (Journal)

[6] Hitesh Kumar G. Suthar, "Electricity Generation using Thermoelectric System from Waste Heat of Flue Gases," IJSRD - International Journal for Scientific Research and Development| Vol. 1, Issue 2, 2013 | ISSN (online): 2321-0613.