

Testing and Development of Power Generation from Exhaust Gas of Motor Bike

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ABSTRACT

This project presents the investigation of power generation using the mixture of heat and thermo-electric generators. A majority of thermal energy in two wheeler silencer is dissipated as waste heat to the environment. This waste heat may be utilized further for power generation. The related problems of worldwide warming and dwindling fuel supplies has led to improving the efficiency of any process being a priority. One method to boost the efficiency is to develop methods to utilize waste heat that is usually wasted. Two promising technologies that were found to be useful for this purpose were thermoelectric generators and warmth pipes. Subsequently, this venture included creation a seat type, verification of idea model of intensity creation by thermoelectric generators utilizing heat pipes and reenacted sight-seeing. In recent years, heating and also the limitations in use of energy resources increase environmental problems with emissions. Additionally In industry, the greater part of the costs are a direct result of vitality (both electrical and heat), work and materials. Yet, out of them vitality would identify with the sensibility of the expense or potential cost assets and so vitality the board will help in cost decrease. The possibilities of thermoelectric systems' contribution to "green" technologies, specifically for waste heat recovery from two wheeler silencer exhausting flue gases. It results into broad research on green advances creating power. As waste heat recovering techniques, like thermoelectric generator (TEG) is developed. Its implementation in automobile vehicles is administered in some ways.

KEYWORDS: Waste heat from silencer, waste heat Recovery, Thermoelectric generator, Controller, Electricity

INTRODUCTION

Recent trend about the simplest ways of using the deployable sources of energy in to useful add order to scale back the speed of consumption of fuel furthermore as pollution. Out of all the available sources, the interior combustion engines are the foremost consumer of fuel round the globe. Out of the whole heat supplied to the engine within the variety of fuel, approximately, 30 to 40% is converted into useful mechanical work. The remaining heat is expelled to the environment through exhaust gases and engine cooling systems, leading to entropy rise and heavy environmental pollution, so it's required to utilized waste heat into useful work.

The Internal Combustion Engine has been an essential force hotspot for cars and automotives over the previous century. Directly, high fuel expenses and worries about outside oil reliance have brought about progressively complex motor plans to diminish fuel utilization. Thermoelectric generator direct converts waste-heat energy into wattage where it's unnecessary to think about the value of the thermal energy input. the appliance of this technology also can improve the efficiency the of energy conversion systems. A thermoelectric power generator may be a solid state device that gives direct energy conversion from thermal energy (heat) because of a gradient into power supported "Seebeck effect". The thermoelectric power cycle, with charge carriers

(electrons) serving because the working fluid, follows the elemental laws of thermodynamics and intimately resembles the facility cycle of a standard engine. Thermoelectric force generators offer a few unmistakable focal points over different innovations. They are incredibly dependable (normally surpass 100,000 hours of consistent state activity) and quiet operational Since they need no mechanical moving parts and need impressively less support.

- They are simple, compact and safe;
- They have very small size and virtually weightless;
- They are capable of operating at elevated temperatures;
- They are suited to small-scale and remote applications Typical of rural power supply, where there's limited or no electricity;
- They are environmentally friendly;
- They are not position-dependent; and
- They are flexible power sources.

In this project the conversion of the fundamental energy in to current. By using this energy fan will operates and also the energy is stored in an exceedingly battery. The control mechanism carries the A.C ripples neutralizer, unidirectional current controller and 12V, from this battery supply will pass to the inverter and it's accustomed drive AC/DC loads. The battery is connected to the inverter. This inverter is employed to convert the 12 Volt D.C to the 220 Volt A.C. This

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220 Volt A.C voltage is employed to activate the hundreds. We are using 8051 microcontroller AT 89S52 with 16*2 LCD display the voltage from the values of battery is measured with this unit. While TEP Transducer is used to detect the temperature inside the silencer through heat dissipated.

Field of Invention

This invention relates to the Internal Combustion engine in vehicles. Among all examination headings, squander heat recuperation (WHR) is generally worried, because of the across the board presence and high openness of reasonable assets. According to India Bureau of Energy Efficiency , the benefits of WHR includes reduction in the process consumption and costs, reduction in pollution and equipment sizes, and also reduction in auxiliary energy consumption. While there are various gadgets to satisfy WHR, thermoelectric generator (TEG) has been used in most car applications. A thermoelectric force generator is a strong s gadget which waste warmth vitality into electrical vitality which deals with seebeck effect. Foundation of Invention as of late, a dangerous atmospheric deviation and the impediments being used of vitality assets increment natural issues of emanations.

Background of Invention

Lately, warming and furthermore the confinements being used of vitality assets increment ecological issues with outflows. The potential outcomes of thermoelectric frameworks' commitment to "green" advances, explicitly for squander heat recuperation from silencer depleting pipe gases. Huge amounts of waste warmth are released into the world's condition quite a bit of it at temperatures which are too low to even think about recovering utilizing ordinary electrical force generators. The proposed structure is a dispersed multi-area and multi-stage arrange. The objective is to handle issues confronting the conventional single-stage framework and to propel TEG application in car settings.

Problem Definition

Vitality Intensive businesses require high temperatures to process their item. There is often still heat 'energy' left as a by product of processing that is frequently simply wasted, vented through smokestacks, and into the air. In same manner lots of heat is extracted engine from automobiles vehicles silencer which will be crated pollution. In such platform these type technique is useful to control the pollution, also wastage heat to be utilised in the form of power.

The potential outcomes of thermoelectric frameworks' commitment to "green" innovations, explicitly for squander heat recuperation from industry debilitating vent gases. Huge amounts of waste warmth are released into the world's condition a lot of it at temperatures which are too low to even consider recovering utilizing ordinary electrical force generators. The proposed structure is a disseminated multi-area and multi-stage arrange. The objective is to handle issues confronting the customary single-stage framework and to propel TEG application in car settings.Industrial Manufacturing like,

- Automobiles System
- Steel, Chemicals, Paper, Cement, Glass, Food Processing
- Oil and Gas Processing
- Gas Compressor Stations
- Refineries etc.

PROBABILITY OF HEAT RECOVERY AND AVAILABILITY FROM I.C. MOTOR

Waste heat is heat, which is generated in a very process by way of fuel combustion or chemical action, then "dumped" into the environment although it could still be reused for a few useful and economic purpose. This heat depends partially on the temperature of the waste heat gases and mass rate of flow of exhaust gas. Squander heat misfortunes emerge both from hardware wasteful aspects and from thermodynamic impediments on gear and procedures. for instance, consider consuming motor roughly 30 to 40% is changed over into helpful mechanical work. The rest of the warmth is ousted to the earth through fumes gases and motor cooling frameworks. It implies around 60 to 70% vitality misfortunes as a waste warmth through fumes (30% as motor cooling framework and 30 to 40% as condition through fumes gas). Fumes gases quickly leaving the motor can have temperatures as high as 842-1112°F [450-600°C] Consequently, these gases have high physical property, carrying away as exhaust emission. Endeavors is framed to style more vitality proficient reverberatory motor with better warmth move and lower exhaust temperatures; be that as it may, the laws of thermodynamics place a lower limit on the temperature of exhaust gases. Fig. 2.1 show full scale essentialness movements from devouring engines.

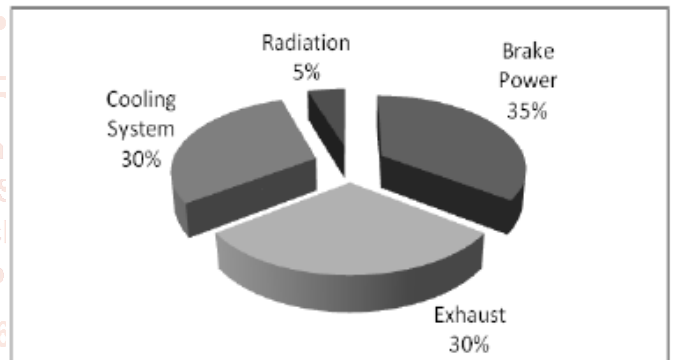


Fig.1 Total Fuel Energy Content in I. C. Engine

Table I. Various Engine and There Output

Sr. No.	Engine type	Power output kW	Waste heat
1	Small air cooled diesel engine	35	30-40% of Energy Waste loss From I.C. Engine
2	Small agriculture tractors and construction machines	150	
3	Water air cooled engine	35-150	
4	Earth moving machineries	520-720	
5	Marine applications	150-220	
6	Trucks and road engines	220	

The table I. shows that different motor and there power rangesrs. In general, diesel engines have an efficiency of about 35% and thus the remainder of the input energy is wasted. Despite recent improvements of internal-combustion engine efficiency, a substantial amount of energy continues to be expelled to the ambient with the exhaust gas.

Table II. Temperature Range from Diesel Engine

Sr. No.	Engine	Temperature in °C
1	Single Cylinder Four Stroke Diesel Engine	456
2	Four Cylinder Four Stroke Diesel Engine (Tata Indica)	448
3	Six Cylinder Four Stroke Diesel Engine (TATA Truck)	336
4	Four Cylinder Four Stroke Diesel Engine (Mahindra arjun 605 DI)	310
5	Genset (Kirloskar) at power 198hp	383
6	Genset (Cummins) at power 200hp	396

Ref. - This temperature was taken from survey of varied combustion engines.) Exhaustive survey was made for measurement of exhaust temperature from combustion engine of automotive vehicles and stationary engine it's shown in Table II.

Objectives

The current research is specializing in a technology, which is ready to convert the thermal energy contained within the exhaust gas directly into power. during this project concept it invented exhaust gas-based thermoelectric power generator for an automobile application. during this invention, the exhaust gas gases within the pipe provide the warmth source to the thermoelectric power generator. So, this project proposes and implements a thermoelectric waste energy recovery system from the exhaust heat from the inner combustion engine automobiles, including gasoline vehicles and hybrid electric vehicles. The secret is to directly convert the heat energy from automotive waste heat to electricity employing a thermoelectric generator. While the electrical power generation by such a system is ready to come up with continues to be relatively small at a maximum of 10 W from one TEG module, quick advancement in materials research can make the aspiring goal of producing higher watts by all methods for doable suggestion.

Project Principle

➤ **Seebeck Effect**

The Seebeck Effect is that the conversion of temperature differences directly into electricity. it's a classic example of an emf (emf) and results in measurable currents or voltages within the same way as the other emf. Electromotive forces modify Ohm's law by generating currents even within the absence of voltage differences (or vice versa); the local current density is given by,

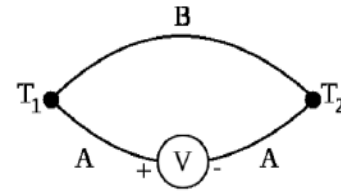
$$J = \sigma (-\Delta V + E_{emf})$$

Where, V the local voltage and σ is is that the local conductivity. normally the Seebeck effect is described locally by the creation of an electromotive field.

$$E_{emf} = -S \Delta T$$

Where S is that the Seebeck coefficient (also called thermo-power), a property of the local material, and ΔT is that the gradient in temperature T.

Seebeck found that if you placed a gradient across the junctions of two dissimilar conductors, electrical current would flow. The effect is shown below within the Fig.



Thermoelectricity means the direct conversion of warmth into electric energy, or contrariwise. in line with Joule's law, a conductor carrying a current generates heat at a rate proportional to the merchandise of the resistance (R) of the conductor and also the square of the present (I). A circuit of this sort is termed a thermocouple; variety of thermocouples connected asynchronous is called a thermopile.

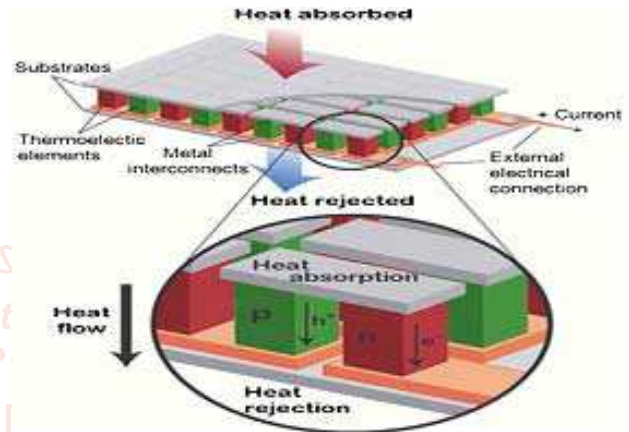


Figure 3: Thermionic Principle of Operation

Jean C. A. Peltier discovered a bearing inverse to the Seebeck effect: If a current passes through a thermocouple, the temperature of 1 junction increases and also the temperature of the opposite decreases, in order that heat is transferred from one junction to the opposite. the speed of warmth transfer is proportional to the present and also the direction of transfer is reversed if the present is reversed.

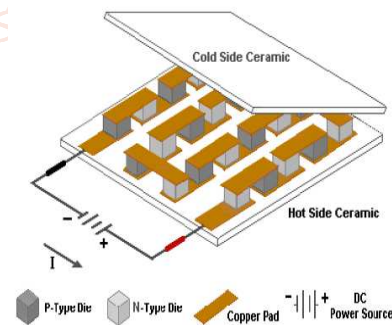


Fig. Internal construction of thermo- electric module

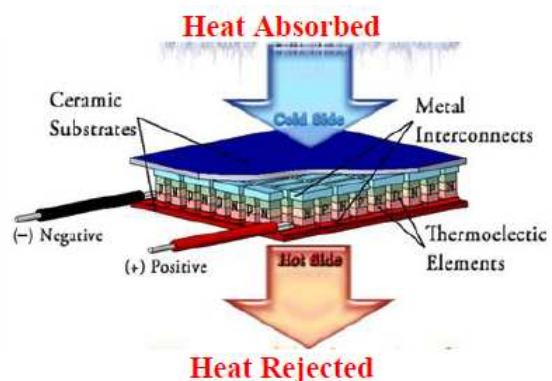
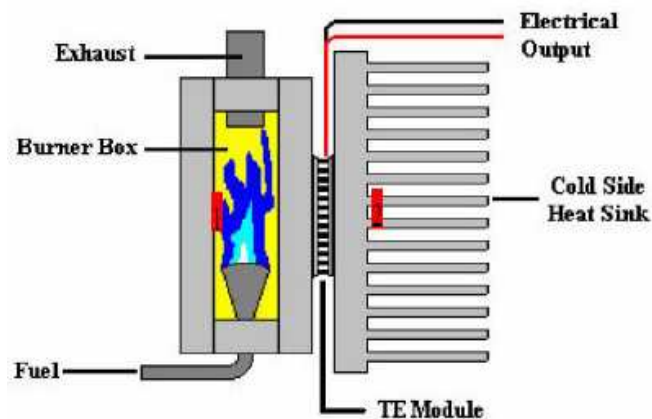


Fig. Operating principle of thermo-electric module

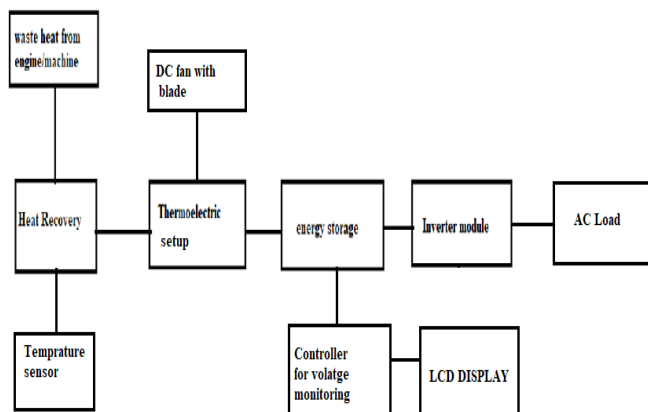
In Automobile

The fundamental focal point of vitality change is on three transformation areas chiefly fumes gas pipe (EGP), fumes gas distribution (EGR) cooler, and retarder. the foremost significant factors for the waste heat quality are power density and temperature range. The EGP is that the target of the foremost automobile waste heat recovery related research. The system contains an outsized portion of the full waste heat in vehicle. The gas flow in exhaust gas pipe is comparatively, stable. Fig. shows that TEG utilizing the exhaust heating for operation. With exhaust temperatures of 973 K or more, the temperature difference between exhaust gas on the recent side and coolant on the cold side is near 373 K. This temperature difference is capable of generating 10W of electricity.



Block Diagram

Power Generation from waste heat of Engine/Machineries



Project working

Non-regular vitality utilizing is changing over mechanical vitality into the electrical vitality. Here in this project a power generation arrangement is made. Use of thermoelectric principle makes this system efficient and reliable. In vehicles engine continuously run for their operation. It release large amount of heat. This is wastage heat. We utilized this wastage heat to produce electricity. In this way we can minimize some amount air pollution also. When we apply TEG with Heat sink module to wastage heat through heat pipe executed from silencer. Then at the same time TEG starts converting Heat energy into Electrical energy. We can measure this heat with the help of temperature sensor attached to the system. One DC fan is attached to system to indicate the flow and conversion of heat energy into Electrical energy. As the amount of temperature is increases, the flow of fan is also increases.

Generated electrical energy is stored in battery. This stored energy is supply to inverter to convert DC to AC. At the output AC load is obtain. This AC load is utilized to run various loads in same industry like, fan, AC, light etc. We also attached 8051 microcontroller (AT89S52) with LCD display to measure the amount of voltage stored and remaining in battery. In this way, whole system work. Start from wastage of heat dissipated through silencer in vehicles. Then conversion of heat into electricity. Indication of conversion electricity through DC fan and motor. Storage of electricity in battery. Conversion of DC voltage to AC voltage with help of inverter. Microcontroller attached to show the voltage present at battery. And last AC load attached to inverter. If such system utilized in all type of automobiles, the amount of wastage heat can be reduced and we can utilized into electricity. And also minimized air pollution problem cussing by vehicles.

The Scopes

1. By using thermoelectric generator connecting serial /parallel we will generate the ability for max level.
2. Even body heat also generate the warmth which will be utilizing by using TEG to get the ability to charge the portable equipment like laptop mobile etc.
3. By installed within the vehicle above the radiator means the vehicle battery will charge self.

ADVANTAGES

- Clean, Noise less, Cost is a smaller amount.
- This could be a Non-conventional system, No fuel is require.
- Easy maintenance, portable, Charging time is a smaller amount (maximum temp).
- Promising technology for solving power crisis to a reasonable extent.
- Straightforward in development, Pollution free, Reduces transmission misfortunes.
- Wide areas of application# Required less space
- It is use at any time when it necessary.
- Less number of parts required.
- we can charge any electronic devices
- Electricity can used for several purposes.
- Efficient and eliminate the grid searching.

DISADVANTAGES

Improper variation of gradient difference may damage the TEG, Complex design.

APPLICATIONS

- Thermoelectric Generators are basically utilized in where the ability production is a smaller amount.
- In many industries amount of warmth is executed and been wastage. we will used this heat for electricity using TEG.
 - In automobile vehicle produce heat which will be used for generating electricity by using TEG.

Recharge the battery any place squander heat is gotten. Self charging battery by fixing the TEG at radiator or bike silencers pipe.

CONCLUSION

Waste heat recovery entails capturing and reusing the waste heat from machineries in industries and using it for generating trade. it might also help to acknowledge the

development in performance and emissions of the machineries if these technologies were adopted by the assembly industries. If this idea of thermoelectric system is taken to the sensible level then there'll be great amount of electricity is generated, which is able to be accustomed run industrial load itself. Also great amount of wastage heat for pollution is additionally uses during this system in continue manner. And such industries also somehow help to safeguard the environmental pollution.

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