

WASTE HEAT RECOVERY USING THERMOELECTRIC GENERATOR FROM AN ENGINE

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ABSTRACT

The conventional method for generating electricity is converting thermal energy into mechanical energy then to electrical energy. In recent years, due to environmental issues like global warming, emissions, etc., are the limiting factor for the energy resources are required to generate electric power. Thermoelectric generators have emerged as a promising another green technology due to their diverse advantages. Thermo Electric Generator directly converts Thermal energy into Electrical energy. The application of this green technology in converting waste heat energy directly into electrical energy can too improve the overall efficiencies of energy conversion systems. In this paper we attempt to extract the waste heat energy from an automobile IC engine and then convert it into useful electrical energy, in addition to this arrangement mechanical force from an engine is also utilised for generating electricity by the means of installing generator coupled to the sprocket wheel between engine and wheel arrangement.

Keywords: Waste heat recovery, TEG, Engine, Sprocket wheel, Energy harvesting.

INTRODUCTION:

This invention relates to the Internal Combustion Engine. Among all research directions, waste heat recovery (WHR) is most concerned, due to the widespread existence and high accessibility of suitable resources. 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. A thermoelectric power generator is a solid state device which converts waste heat energy into electrical energy by see beck effect and pettier effect. The possibilities of thermoelectric systems' contribution to "green" technologies specifically for waste heat recovery from industry exhausting flue gases.

Vast quantities of waste heat are discharged into the earth's environment much of it at temperatures which are too low to recover using conventional electrical power generators. The proposed structure is a distributed multisession and multi-stage network. The target is to tackle problems facing the traditional single-stage system and to advance TEG application in automotive settings.

OBJECTIVE:

- The goal of this project was implement the most efficient and less polluting vehicle.
- By using the exhaust gas power generation we can reduce major pollution content.
- In existing we only use petrol source, it costs more and it is difficult to get in some places. So it combines both renewable and non-renewable sources.

We convert non use heat generation in silencer into useful power generation

EXISTING SYSTEM:

The existing system only used for the measurement of heat exhausted by engine but we are inserted the sprocket wheel in between engine and the wheel .so it will increase the power generation.

CONSTRUCTION:

The frame for housing an engine is fabricated with the help of square tubes and channels by metal cutting and metal joining process called welding. Frame arrangement also houses the wheel setup which is directly coupled to the engine crank wheel with the help of chain drive. The sprocket wheel with generator arrangement is coupled to the chain drive passing between engine and wheel setup, this generator is coupled to the battery for power storage. The TEG module is placed on the silencer arrangement whose terminals are also connected to the battery. The solar panel is mounted on the frame with the help of supporting frame arrangement; this solar panel is also coupled to the battery for power storage.

WORKING PRINCIPLE:

Whenever the engine get kick started it starts drives the wheel, there by rotating the sprocket wheel which get coupled with the help of chain drive. This rotation drives the generator which gets directly coupled with it, these rotation of generator generates electricity which get stored in the battery. Similarly due to the heat generated by the exhaust gas heats the silencer surface there by the heat get transferred to the TEG module which gets fixed to it. On its other end it experiences atmospheric temperature which is cool. This temperature difference creates voltage at its terminal and this generated current is stored inside the battery. In addition to this due to the solar panel the energy get generated and stored with the help of battery.

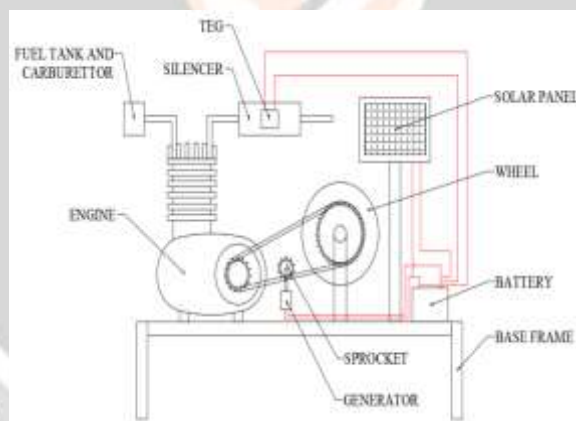
LAYOUT:

FIGURE 1: Experimental setup

HARDWARE COMPONENTS:**TEG MODULE:**

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 effect (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. 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 (a TEG) 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 electricity while in a temperature gradient.

ENGINE:

A two-stroke (or two-cycle) engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle during two crankshaft revolutions. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring at the same time.

Two-stroke engines often have a high power-to-weight ratio, power being available in a narrow range of rotational speeds called the "power band". Compared to four-stroke engines, two-stroke engines have a greatly reduced number of moving parts, and so can be more compact and significantly lighter.

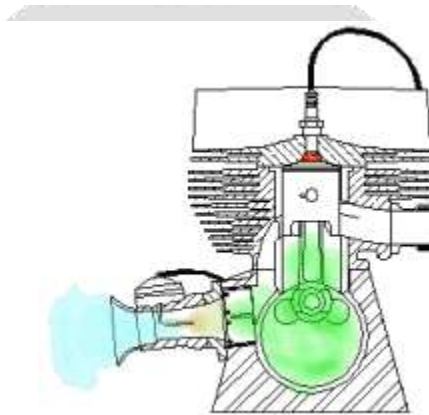


FIGURE 2: Petrol Engine

SPECIFICATION OF TWO STROKE PETROL ENGINE

Type: Two stroke engine
 Cooling System: Air Cooled
 Bore/Stroke: 50 x 50 mm
 Piston Displacement: 98.2 cc
 Compression Ratio: 6.6: 1
 Maximum Torque: 0.98 kg-m at 5,500RPM
 Brake Power: 563.153Kw

SPROCKET WHEEL:

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the **drive chain** or **transmission chain**, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed, and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain;

gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotates once, it causes the gear that drives the wheels to rotate more than one revolution.

DC GENERATOR:

A dc generator is an electrical machine which converts mechanical energy into direct current electricity. This energy conversion is based on the principle of production of dynamically induced emf.

SPECIFICATION:

Number of poles: 6
Speed in rpm: 1440rpm

SILENCER ARRANGEMENT:

STAINLESS STEEL:

The materials used for this project is corrosion resistant and machinable. The same material of stainless steel is used in the project for all project component. The project was subjected to drilling, grinding and welding so the material is selected by considering following aspects. Corrosion Resistance: stainless steel is alloy having chromium content in it which is corrosion resistive in nature.

Hence the stainless steel is used for aqua silencer. Electrical and Thermal

Conductivity: Stainless steel is an excellent heat and electricity conductor and in relation to its weight is almost twice as good as copper. This has made Stainless steel the most commonly used material to made utensils. **Reflectivity:** Stainless steel is a good reflector of noticeable light as well as heat, and that together with its low weight makes it an ideal material for reflectors in, for example, light fittings or rescue blankets. **Ductility:** Stainless steel is ductile and has a low melting point and density. In a liquid condition it can be processed in a number of ways. Its ductility allows products of Stainless steel to be basically formed close to the end of the product's design. **Odorless:** Stainless steel is the metal itself is non-toxic and releases no aroma or taste substances which make it ideal for packing sensitive product's design.

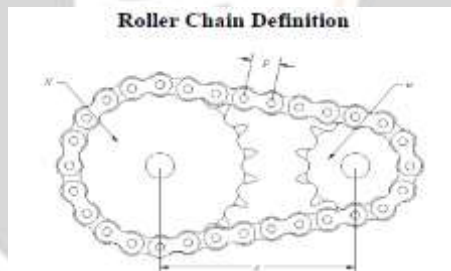
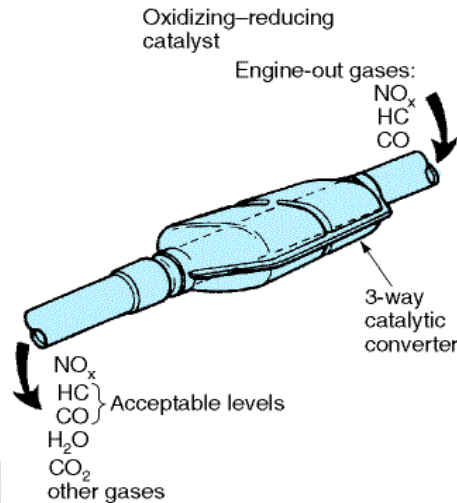


FIGURE 3: Chain Drive

Recyclability: Stainless steel is 100 % recyclable with no downgrading of its qualities. The re-melting of Stainless steel requires little energy only about 4 percent of the energy required to produce the primary metal initially is needed in the reprocessing process. **Weldability:** Stainless steel has high degree of weld ability. Hence it is used in many industrial applications.



OTHER COMPONENTS: Shafts specification ,Sprocket,Chain Sprocket,Ball Bearings.

ADVANTAGES:

- Continuous power generation is obtained with the help of this arrangement.
- Initial and maintenance cost is less.
- Simple in construction.
- Installation is easy, so it can be applicable for all model of vehicles

APPLICATIONS:

Use in automobiles as an alternate source of energy.
Can supply power to any other electrical appliances.

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