

## Electricity Generation By Using Exhaust Gases

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**Abstract**— Now-a-days technology is moving at a very faster rate. The conventional sources of energy are on a verge of extinction. So scientists are merging towards the use of non-conventional energy resources. But it also requires some kind of energy to convert it into another form. Our project is related to the utilizing the kinetic energy of exhaust gases of vehicle which is of no use. Our project is about the generation of electricity with uses of exhaust gases which are not used in any kinds of useful work. In this project the useless exhaust gases used for energy generation. The exhaust gases gives the rotary motion to turbine wheel and the dynamo which connected the turbine wheel converts this mechanical energy into electrical energy.

**Keywords**— *Kinetic Energy, Exhaust Gas, Electrical Energy, Turbine Wheel.*

### I. INTRODUCTION

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#### A. Problem Definition

In I.C engines, during the combustion process and the subsequent expansion stroke the heat flows from the cylinder gases through the cylinder walls and cylinder head into the water jacket or cooling fins. Some heat enters the piston head and flows through the piston rings into the cylinder walls or is carried away by the engine lubricating oil which splashes on the underside of the piston.

Internal combustion engines at best can transform about 25-35% of chemical energy in the fuel into mechanical energy. About 35% of heat generated is lost to the cooling medium, remainder being dissipated through exhaust and lubricating oil. In our project we are not using this wasted heat but we are using kinetic energy of exhaust gases.

#### B. Objectives

About 30-40% heat is dissipated through exhaust gases. The heat lost by exhaust gases has a very high velocity and pressure. So our main objective is to utilize the kinetic energy of the exhaust gases which are being wasted. By utilizing the velocity of exhaust gases a small generator can be run which

would be capable to generate the voltage or current which can be used for different purpose.

#### C. Proposed Solution

The exhaust gases of the engine are having high velocity and pressure. So by utilizing the velocity of exhaust gases a small generator can be run which would be capable to charge a cell phone. So, we are designing the setup which uses the high velocity of exhaust gases to run a small gas turbine which in turn runs a small generator which would be capable enough to generate power so that a cell phone can be charged.

**This set up also can be used:-**

1. To operate the various vehicles accessories such as head and tail lamps, side indicators, horn, IR sensors etc.
2. Above certain speed of engine the generator gives large output then required. So this extra output can be stored using a battery and can be used at times when the speed of the engine is low and the output required is less.

### II. DESIGN

#### A. Design Consideration

**For the design of the proposed model, the following considerations are made.**

1. The setup is so designed that it does not have any effect on the efficiency of the engine.
2. It can easily be mounted on the vehicle
3. The exhaust can be fully utilized as possible.
4. It must be light in weight.
5. It is simple in construction so as to fabricate locally with least available resources and skills.
6. It is of low cost, simple in construction and maintenance.

**The following special equipment's should be used in the design of proposed model**

1. Arc welding set with 3 mm welding rod.
2. Engineer's bench and vice.
3. Metal sheet cutter and saw.
4. Marking compass.
5. Files and general engineering

#### B. Design Calculations

\*When vehicle running at 20 km/hr.

$hw = 3.2\text{cm}$

We know that,

$\rho_g hg = \rho_w hw$

$hg = 25.6$

velocity of flow,

$$V_f = (2ghg)^{0.5}$$

$$= 22.41 \text{ m/sec}$$

Flow of exhaust gases,

$M_f = \text{Vel. of exhaust gases} * \text{area at the exhaust,}$

$$= 7.04 \times 10^{-3} \text{ kg/m}^3$$

Pressure measurement,

$$P_g = \rho g h_g$$

$$= 313.92 \text{ N/m}^2$$

Force measurement,

$$F_g = \text{Pressure} * \text{Area of exhaust}$$

$$= 0.09857 \text{ N.}$$

Torque measurement,

$$T = \text{Force} * \text{Distance between gases striking point and axis of shaft}$$

$$= 4.92 * 10^{-3} \text{ Nm}$$

Power measurement,

$$P = 2\pi T N / 60$$

$$= 0.1186 \text{ W}$$

### C. Actual Setup Picture



**Fig. Mounting of Model on Two Wheeler's Silencer.**

### D. Construction and Working

As discussed above output of this device is D.C Current. It consists of frame made up of mild steel. The turbine is mounted on the shaft. At the both end of shaft bearing is attached. Due to these bearings the vibration of the shaft is reduced at very great extent and output in terms of shaft rotation is obtained accurately. Bearing is fixed between wooden plates by using press fitting method. Wooden are fitted to frame by using nut and bolt. On shaft gear with 70 teeth are mounted, and the gear with 22 teeth is in mesh with it which is mounted on D.C Generator. From D.C generator two output wires are taken out.

The whole assembly is mounted on the silencer of the vehicle at the end of muffler so as it will not affect the efficiency of the engine. The frame is made by taking

accurate dimension of the silencer and maintaining some tolerance.

When the vehicle starts, exhaust gas come out from the silencer at very high pressure and impinge on the turbine. Due to high pressure, turbine also rotates at very speed with shaft. Due to rotation of shaft gear with 70 teeth rotation of the gear with 22 teeth which is in mesh with it is also rotated, which is mounted on D.C. generator .Due to rotation of D.C. generator direct current is produced. The output of the generator at various RPM of the engine can be calculated.

## III. RESULT

### A. Advantages

1. It requires no external power to drive the generator.
2. Increased the efficiency of the engine with the same input.
3. Its weights does not have any effect on the efficiency of the engine.
4. Can be easily carried along with the vehicle.
5. It is simple in construction so as to fabricate locally with least available resources and skills.
6. It is of low cost, simple in construction and maintenance.
7. It does not give back pressure on the engine.
8. It does not affect the performance of the engine.
9. Capital cost is low.
10. There is no maintenance due to there is no friction available between moving parts.

### B. Applications

It is basically designed to generate the electricity this electricity we can be use it.

1. To charge a cell phone.
2. To operate the vehicle various accessories such as head and tail lamps, side indicators, horn IR sensors etc.
3. Above certain speed of engine the generator gives large output than required. So this extra output can be stored using a battery and can be used at times when the speed of the engine is low and the required output is less.
4. It can also be used to charge the digital cameras, I-Pod etc.

### C. Result Table

#### IV. Conclusion

- This paper explains how we can generate electricity

Particulars/sp eed	20	40	60	70	90
hw(cm)	3.2	6	8.3	9.7	11.9
hg(m)	25.6	48	66.4	77.6	95.5
Vf(m/s)	22.41	30.69	36.09	39.02	43.22
Mf(kg/m <sup>3</sup> )	7.04*10 <sup>-3</sup>	9.64*10 <sup>-3</sup>	11.14*10 <sup>-3</sup>	12.12*10 <sup>-3</sup>	13.18*10 <sup>-3</sup>
Pg(N/m <sup>2</sup> )	313.92	588.6	841.23	951.57	1220.12
T(Nm)	4.92*10 <sup>-3</sup>	9.24*10 <sup>-3</sup>	12.12*10 <sup>-3</sup>	14.94*10 <sup>-3</sup>	19.20*10 <sup>-3</sup>
P(W)	0.1186	0.4354	0.9654	1.4754	2.47

using exhaust gas. The turbine use waste exhaust gas and produce electricity. We use silencer for both power generation and rural electrification. The turbine produces electricity and it is stored using battery.

- For a speed of 20 km/hr , we get the 22.42 m/s velocity, mass flow rate is  $7.04 \times 10^{-3} \text{ kg/m}^3$ , Torque is  $4.92 \times 10^{-3} \text{ Nm}$  and The Power output is 0.1186 W.
- As the speed increases, the velocity, mass flow rate, torque and hence the power also increases.

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