IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

"Air Preheater"

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Abstract:

The increasingly worldwide problem regarding rapid economy development and a relative shortage of energy, the internal combustion engine exhaust waste heat and environmental pollution has been more emphasized heavily recently.

Out of the total heat supplied to the engine in the form 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, resulting in to entropy rise and serious environmental pollution, so it is required to utilized waste heat into useful work.

The recovery and utilization of waste heat not only conserves fuel (fossil fuel) but also reduces the amount of waste heat and greenhouse gases damped to environment. The study shows the availability and possibility of waste heat from internal combustion engine, also describe loss of exhaust gas energy of an internal combustion engine. Possible methods to recover the waste heat from internal combustion engine and performance and emissions of the internal combustion engine.

Waste heat recovery system is the best way to recover waste heat and saving the fuel.

I. INTRODUCTION

The output of the engine exhaust gas is given to the input of the ignition system, so that the proper ignition is occurred. In this case, the efficiency of the engine is also increased.

The exhaust gas is given to the heating chamber as shown in figure. The exhaust hot air is used to pre-heat the input air into the ignition system. So far this type of system has not been introduced in two wheelers. So this may be very useful to two wheelers without any complication and maintenance. But the air pre-heater design depends on the exhaust pipe fitted to the particular two wheeler engine.

The design is simple, cheap and does not give any trouble to the engine. So far the vehicle which is used for this project has covered a distance of more than 500kms, without any complications.

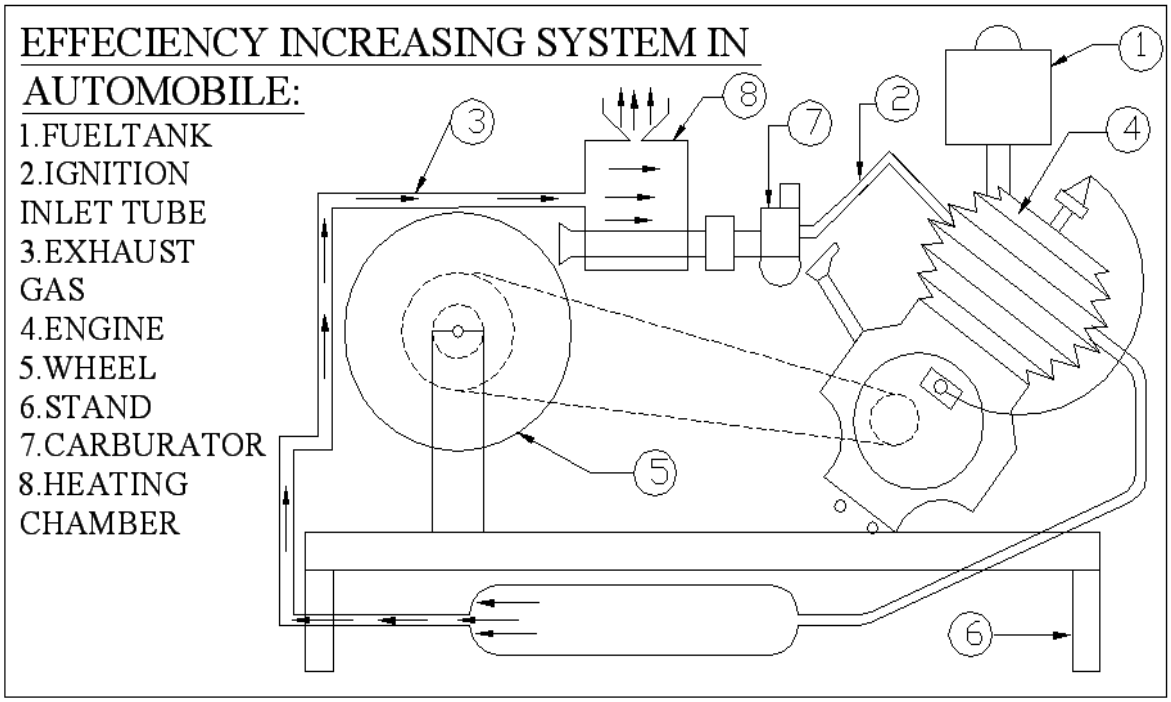
The concept of increasing the fuel efficiency of a petrol engine in this project, is to pre-heat the intake air which is flowing through the carburettor. The humidity in the atmospheric air affects the petrol vaporization in the carburettor. Therefore, by pre-heating the inlet air to the carburettor for a considerable amount, the vaporization can be ease and in turn complete combustion is achieved. Moreover by reducing the water vapour to the engine, the steam formation in the engine can be reduced pitting of the engine cylinder, piston and exhaust pipe.

The pre-heating of inlet air to the engine can be achieved by fixing a heat exchanger inside the exhaust pipe. The atmospheric air is sucked through the heat exchanger to the carburetor. The air which is flowing though the heat exchanger gets heated by the engine exhaust gas. This reduces the water vapour in the inlet air and the temperature of the air is raised. The temperature raise causes complete combustion in the engine and it is also more suitable for warming up the engine in cold conditions.

The original exhaust pipe of TVS 50XL 50cc bike is cut into three segments. The muffler and the stay plates are removed from the pipe. They are perfectly welded together without any leak. A spiral baffle plate is welded in between the two concentric pipes. Two 18mm M.S tubes of length 20mm are welded at the extreme ends of the outer pipe, in opposite direction for all inlet and outlet.

In particular, this article describes the combustion air preheaters used in large boilers found in thermal power stations producing electric power from e.g. fossil fuels, biomass or waste.

The purpose of the air preheater is to recover the heat from the boiler flue gas which increases the thermal efficiency of the boiler by reducing the useful heat lost in the flue gas. As a consequence, the flue gases are also conveyed to the flue gas stack (or chimney) at a lower temperature, allowing simplified design of the conveyance system and the flue gas stack. It also allows control over the temperature of gases leaving the stack (to meet emissions regulations).



II. OBJECTIVE

- Increase Efficiency of engine.
- Use excess heat for combustion.

II. PROBLEM STATEMENT

In the Current System some amount of the energy is waste due to the Air Heating. Here silencer removes the exhaust hot air so the average of the vehicle is not getting good. Here we fabricate the model of fuel efficiency increasing system by using air preheated system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from exhaust and converts it to air preheat.

III. Scope

The energy recovery system is basically a device which utilizes the waste energy or it utilized the temperature of the gases. The energy recovery system has got wide range of the application in the future it can be a transient test methodology to measure the humidity and the temperature. The energy wheel is the transient system which enables to use the waste energy from the engines which enters the atmosphere at the high temperature.

The energy recovery system is device which can directly connected to the outlet of exhaust gas. Energy recovery systems are the system which can be use in the device like boilers, superheated, gas duct system. The energy

recovery system is the device which consume minimum energy does it help to the recovery energy at the minimum price.

1.3.1 Heat recovery mechanism from the exhaust manifold

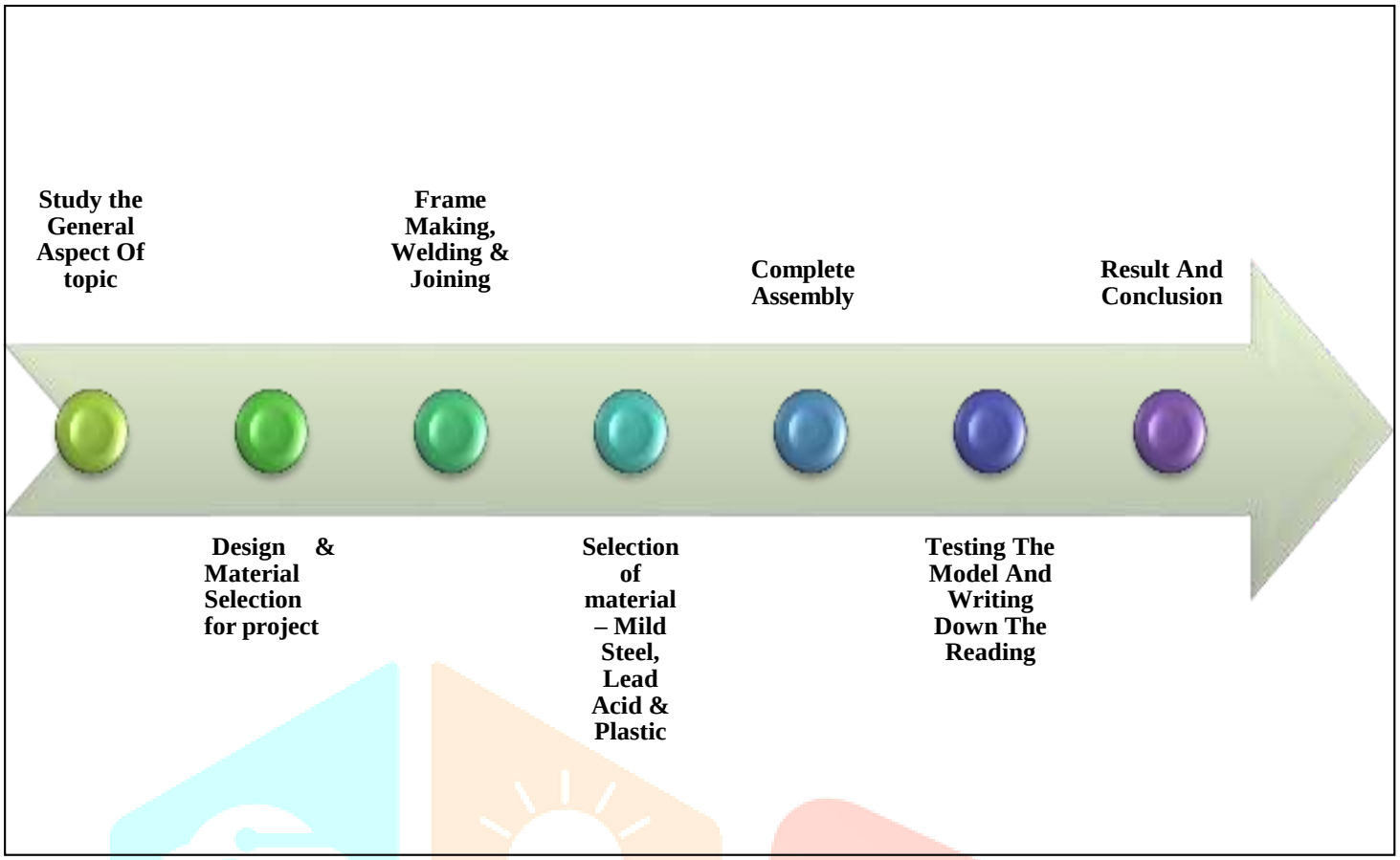
It is possible to design to effective heat transfer surface between the fuel pipe lines and the exhaust manifold such that the temperature of the heated petrol must not exceed 246 degree Celsius additional valve mechanism should be provided along the exhaust manifold, which switches the exhaust gas flow path from the exhaust gas petrol heat exchange surface to normal path when the temperature of the fuel exceeds the safe value.

1.3.2 Fuel pre-heating optimization to maximize fuel injector life and engine efficiency.

By experiment with higher working temperature, small droplets can be obtained. This is at the cost of lubrication properties which can reduce fuel injector life therefore test will be carried out to rich an optimum value of temperature for all round effect.

IV. METHODOLOGY

I. Identification of problem
II. Idea of project
III. Collection of data
IV. Literature survey
V. Material selection
VI. Fabrication work
VII. Testing
VIII. Conclusion
IX. Submission of project



V. PROJECT FLOW CHART

From the flow chart, this project started with the objective of the project. The objective of the project must follow the title. The objective must fulfill the title Then follow up with design review about folding table and then study a lot of investigation about folding table. This is including study about several of stage, type of stage, types of material which suitable to make a stage. These tasks have been done through study on internet, books and others resources. After all information had been collected and gathered, the project continued with the design process. All the knowledge and lessons had been applied to make a suitable design for the project. After several design sketched, design consideration has been made and one of the designs have been chosen by using Pugh's concept selection. The solid modeling and engineering drawing by using solid works software the fabrication process progress use drawing as a reference. The process consist fabrication to all parts that have been designed by the dimension using various type of manufacturing process. The manufacturing process includes welding, drilling, bending, cutting and etc. During the fabrication process, if there have error occur, such as fabrication error, so the process needs to modification the process need to go back to the previous step and the process flow again, until no error occur the process can have been continued smoothly until the final product finished. Then, the draft report needs to be submitted to the supervisor for double checking if there had an error.

VI. WORKING

The heat exchanger is located in the engine exhaust pipe. The exhaust pipe consists of a muffler and stay plates etc. The heat exchanger is made up of 18 SWG M.S. plate. The inner tube is inserted tightly on the muffler tube. A spiral baffle plate arrangement is made in between the two concentric tubes so as to make a spiral path to the incoming air. So that the heat transfer to the air can be increased. Moreover, the air is flowing in counter direction to the exhaust gas; thereby effective heat transfer can be achieved.

The heat exchanger inlet is fitted with a pre-filter. The outlet is connected to a by-pass mechanism through a hose pipe. The by-pass mechanism is connected to the carburetor intake. The temperature of the air entering to the carburetor can be maintained constant for a particular degree centigrade. When the temperature of air is increased above the predetermined valve the thermal relay opens the butterfly valve (4- wheeler Application) and allows the atmospheric air to mix with the heater air from the heat exchanger. So the hot air is diluted with atmospheric air and reducing the temperature.

Suction Stroke

When the piston moves from TDC to BDC, (i.e., suction stroke) Vacuum is created which opens the intake valve. Due to the creation of vacuum, air is drawn from atmosphere and hydrogen gas from the electrolysis kit. Both the air and gas passes to the pre-heater, which is preheated and increases temperature by the external flow of exhaust gases. Now, the pre-heated air and H2 gas is passes to the carburetor in which the air+H2gas+petrol gets mixed in required proportions. Then the mixture is drawn into the cylinder up to the piston reaches BDC. At the end of suction stroke the inlet valve gets closed.

Compression Stroke

Now the piston moves from BDC to TDC, in which the air and hydrogen gas and the petrol mixture get compressed, which results in increase in temperature. At the end of compression stroke the piston reaches TDC at the time Power stroke will starts by igniting the mixture through spark plug. During this stroke both the valves are in closed condition.

Power Stroke

Thus the ignited mixture produces high power which pushes the piston downwards at high pressure from TDC to BDC. During this period the mixture gets burned completely as much as higher compared to other 4stroke Petrol engines due to, “Pre-heated air and Hydrogen gas”. Then the power obtained in the cylinder is transmitted to drive wheel through connecting rod, crankshaft and flywheel. Thus there is no timing delay in burning of mixture which results in decreasing of “Knocking”.

Exhaust Stroke

During this stroke the piston moves from BDC to TDC by opening the exhaust valve. The upward movement of this stroke blows out the burned gases outside the cylinder. When the piston reaches TDC exhaust valve closes and inlet valve gets opened and suction stroke starts.

After the exhaust stroke the exhaust hot gases passing into the heat exchanger through silencer. Then heat transfer takes place to the atmospheric air in heat exchanger then hot air is supplied to the engine through carburetor and due to this air fuel mixture burn efficiently which gives maximum efficiency.

VII. 3 D MODEL & DESIGN

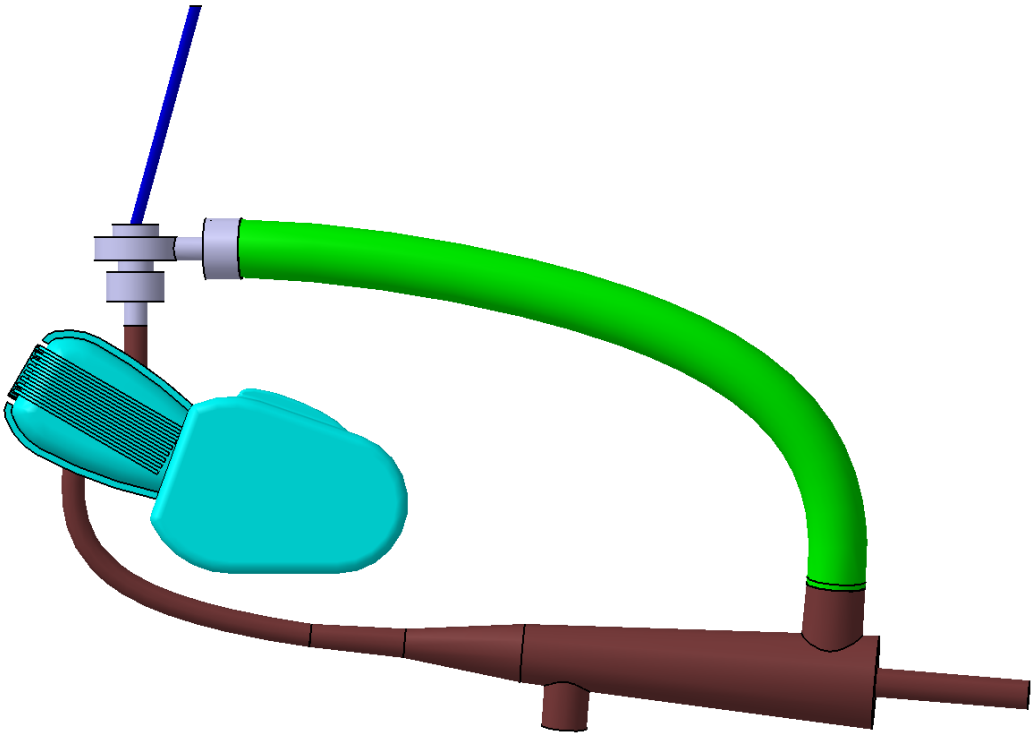


Figure: Product View

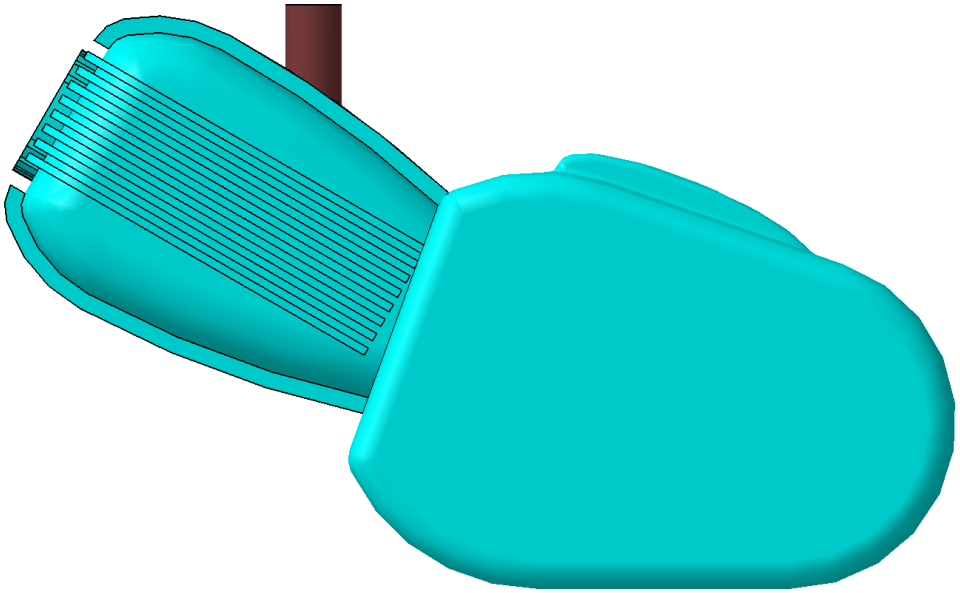


Figure: Engine

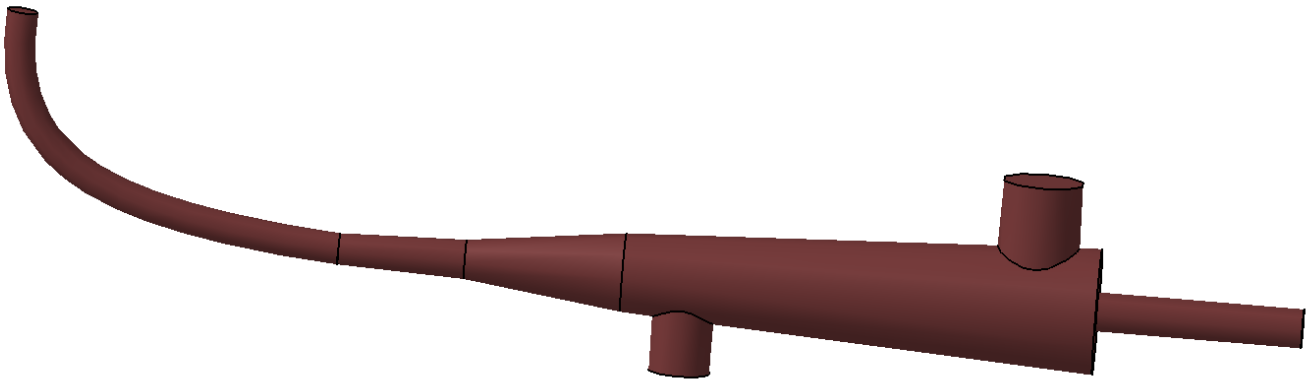


Figure: Exhaust

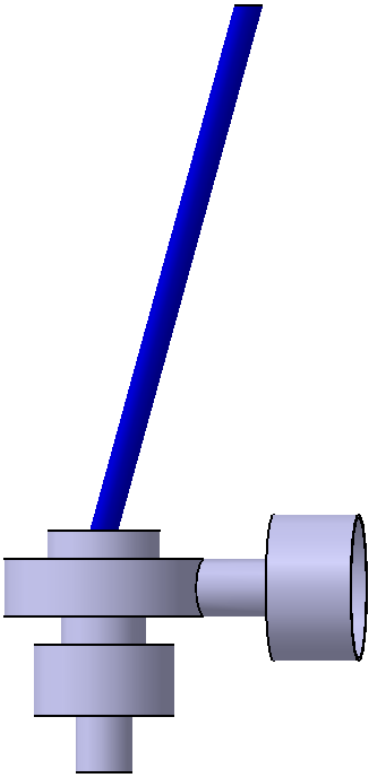


Figure: Carburetor

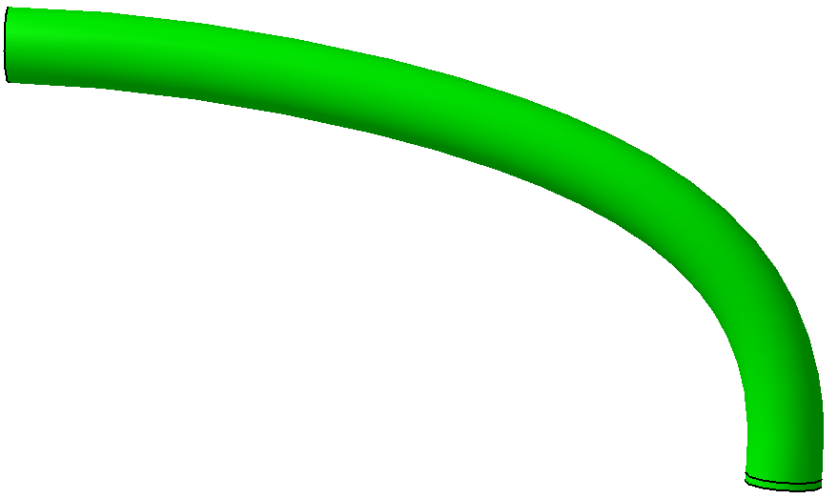


Figure: Connecting pipe

VIII. EXPERIMENTAL VALIDATION

Observation :

Engine speed = 5000 rpm

Torque = 43 N-m

Area of fuel tank = 0.1361 m^2

Density of fuel (petrol) = 740 kg/m^3

Observation Table :

Sr.No.	Time (min)	Without Air Preheating			With Air Preheating		
		Initial Fuel Level (m)	Final Fuel Level (m)	Difference (m)	Initial Fuel Level (m)	Final Fuel Level (m)	Difference (m)
1	5	0.120	0.09	0.03	0.120	0.096	0.025
2	8	0.120	0.075	0.045	0.120	0.083	0.037
3	12	0.120	0.054	0.066	0.120	0.065	0.055

Calculations :

Time for 1st reading = 5 min

Case 1:- without preheating system :

Initial petrol level in fuel tank = 0.120 m

Final petrol level in fuel tank =0.09 m

Difference between initial level and final level (L) =0.03m

- Mass of fuel (mf):-

mf = ρ*Area*L/Time

mf=740*0.01272*0.03/5

mf= 0.0564 Kg/min

- Thermal efficiency (ŋ):-

η= B.P./mf*C.V.

η=22.51*60/0.0564*42000

η=56.94%

Case 2:- with preheating system :

Initial petrol level in fuel tank = 0.120 m

Final petrol level in fuel tank =0.095 m

Difference between initial level and final level (L) =0.025 m

- Mass of fuel (mf):-

mf = ρ*Area*L/Time

mf = 740*0.01272*0.025/5

mf = 0.0470 kg/min

- Thermal efficiency (ŋ):-

η= B.P./mf*C.V.

η=22.51*60/0.0470*42000

η=68.32%

Result Table :

Sr.No.	Without Air Preheating Efficiency (η%)	With Air Preheating Efficiency (η%)	% Difference Efficiency (η)
1	56.94	68.32	11.38
2	60.73	73.86	13.13
3	61.33	74.53	13.20

The without air preheating efficiency is η=56.94% and with air preheating

Efficiency is η=68.32% so the difference is η=11.38 increase in efficiency for 1st reading.

Advantages :

Efficiency of the vehicle is increased.

Fuel consumption is less when compared to ordinary vehicle.

Less pollution.

Disadvantages :

Additional cost is required.

Additional space is required to install this arrangement in vehicles.

IX. CONCLUSION

This project is an attempt to reduce our dependency on foreign oil and reduce the tail pipe emission from automobiles and this was an attempt to design and implement this new technology that will drive us into the future.

Use of production pre heating will reduce smog-forming pollutants over the current national average. The first hybrid on the market will cut emissions of global-warming pollutants by a third to a half and later modes may cut emissions by even more.

The preheating of charge is beneficial in many ways. It is expected to increase power output of the engine by 11-15% due to the extreme homogeneity of the air-fuel mixture present in the cylinder during power stroke. This leads to maximum utilization of the specific heat of the fuel (C.V.=42000KJ/Kg) which results in an improved the thermal efficiency of the engine.

X. REFERENCES

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