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A Review on Various Ways of Utilization of Waste Heat from IC Engine

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Abstract – *Nowadays problem of increase in pollution is a serious concern. In today's world some contribution to pollution is from exhaust of vehicles. Due to increase in vehicles the problem of pollution is also increased. Among the total energy supplied for combustion in IC engine, most of the energy is expelled to surrounding as waste and contributing to pollution. Due to this temperature of surrounding also increases, which leads to global warming phenomenon. So it is necessary to utilize the waste heat of the internal combustion engine. There are different methods to recover the waste heat of the IC engine. These different methods of waste heat recovery are reviewed and discussed in this paper shortly.*

***Key Words*: Waste heat recovery, internal combustion engine, Thermo electric generator etc.**

1. INTRODUCTION

In Today's world, energy plays an important role in development of society role. Energy is produced from fossil fuel which is depleting day by day .Most of the fossil fuels are used in the burning of IC engine of vehicle .These fossil fuels are burn in the IC engine of vehicles. Most of the energy is not converted into mechanical energy and remaining energy is released into atmosphere as a waste exhausts. So, waste heat recovery helps in reducing the fuel consumption and emissions.

Today various methods are known to us which help us to recover waste heats from the engine in the form of energy. Some of them are discussed and reviewed in this paper.

2. METHODS:-

2.1 Thermoelectric Generator

The automotive waste heat can be converted to electricity by using thermoelectric material. The thermoelectric generator for the electricity generation works on the principle of Seebeck effect. Energy source for thermoelectric generator is heat energy. It will operate till heat source is present [1].

Seebeck effect:-

When different conductors are maintained at different temperatures there is formation of voltage between these two conductors. The voltage generated depends on temperature difference [2].

Discussed thermoelectric generation utilizes the exhaust gas heat of an internal combustion engine. By keeping one side hot by exhaust gas from engine and the cold side is maintained with the help of water, due to the formation of temperature difference, voltage is generated and hence electricity is generated [3].

Thermoelectric elements are made from p type and n type semiconductor. Direction of current is from n type element to p type element [4].

2.2 Turbocharger

Due to burning of the fuel in the internal combustion engine, heat energy and exhaust gases are produced. Some part of heat energy is converted into mechanical energy and remaining heat energy is expelled to atmosphere . Hence these exhaust heat energy are utilized by using turbocharger to produce useful work.

Turbocharger increases the power output of engine using a turbine. Turbocharger also increases the efficiency of engine[5] .Turbocharger uses the kinetic energy of exhaust gases from the engine. Turbocharger increases the volumetric efficiency of engine. A turbocharged engine produces more power as compared to the engine without turbocharging. This improves the power to weight ratio for the engine [6]. Turbocharger consists of radial flow compressor which is driven by turbine. Turbine uses the kinetic and thermal energy from high temperature exhaust gas and produces power to drive the compressor [7].

1.3 Rankine cycle:-

In Rankine cycle, working fluid follows a closed loop and it is reused continuously. The components of Rankine cycle are turbine, condenser, pump and boiler. Waste heat is supplied to the boiler and then isentropic expansion of working fluid takes place at turbine. After turbine it is passed through the condenser where heat rejection at constant pressure takes place. After condenser, compression takes place through pump [8]. Waste heat recovery takes place at boiler.

Organic Rankine Cycle:-

Organic fluid is used as working substance in organic Rankine cycle instead of steam. Organic fluid used consists of low boiling point and hence it is used extract work from low temperature heat sources in an organic Rankine cycle. Organic Rankine cycle works on similar principle as that of conventional Rankine cycle [9].The temperature difference between source and sink should be maximum to recover high amount of waste heat from source. Conventional methods cannot be efficiently converting a low grade temperature heat into electricity [5].

Along with this other waste heat recovery methods are Piezoelectric Generation, Thermionic Generation, Thermo Photo-voltaic, etc [10].

3. CONCLUSIONS

From the above methods it is reviewed that, energy is saved through the waste heat recovery methods. Waste heat from exhaust gas is converted to electrical energy through thermoelectric generator. Energy can also be reused, as in Rankine cycle and Turbocharger. Due to waste heat recovery methods the emissions from the waste of internal combustion engine is also reduced, which helps in saving the environment.

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