

# Automotive Thermoelectric Generator (Design and Building)

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## Introduction :

In light of the growing rise of oil prices, increasing demand of fuel, and the limited fuel sources, therefore the need to develop new techniques in order to improve the fuel consumption becomes greater, and the efficiency of vehicle systems should be promoted to be more environmentally friendly and economically as possible.

In the recent time the scientific researches tend to utilize the wasted energy (thermal and mechanical) to convert it into another useful form.

In internal combustion engines the fuel efficiency doesn't exceed 30%, whereas around 40% of fuel energy is wasted in exhaust heat and 30% is rejected through engine coolant .

After surveying the previous studies and scientific references related to the subject of this paper, it's appeared that the thermal energy can be used and converted into electrical one using chemical properties of some materials. This generated electrical energy is used to power electric appliances in the vehicle. To achieve this goal, a device driven by the thermal energy produced from combustion can be designed and installed around exhaust pipe to generate electrical energy which can be considered as an alternative to the traditional alternator in the vehicle. This device is called thermoelectric generator (TEG)

## Project Objectives:

1. The project has been mainly selected to find another source of electrical power in the vehicle which doesn't consume engine power unlike the alternator does.
2. Increasing engine power.
3. Decreasing fuel consumption.
4. Minor to decrease harmful emission.

## Project description:

Building a system that converts the waste heat energy of internal combustion engine into electrical energy to be used to operate electric appliances in the vehicle, and then remove or reduce using the alternator which leads to reduce fuel consumption , emission and increase engine brake power, figure 1.

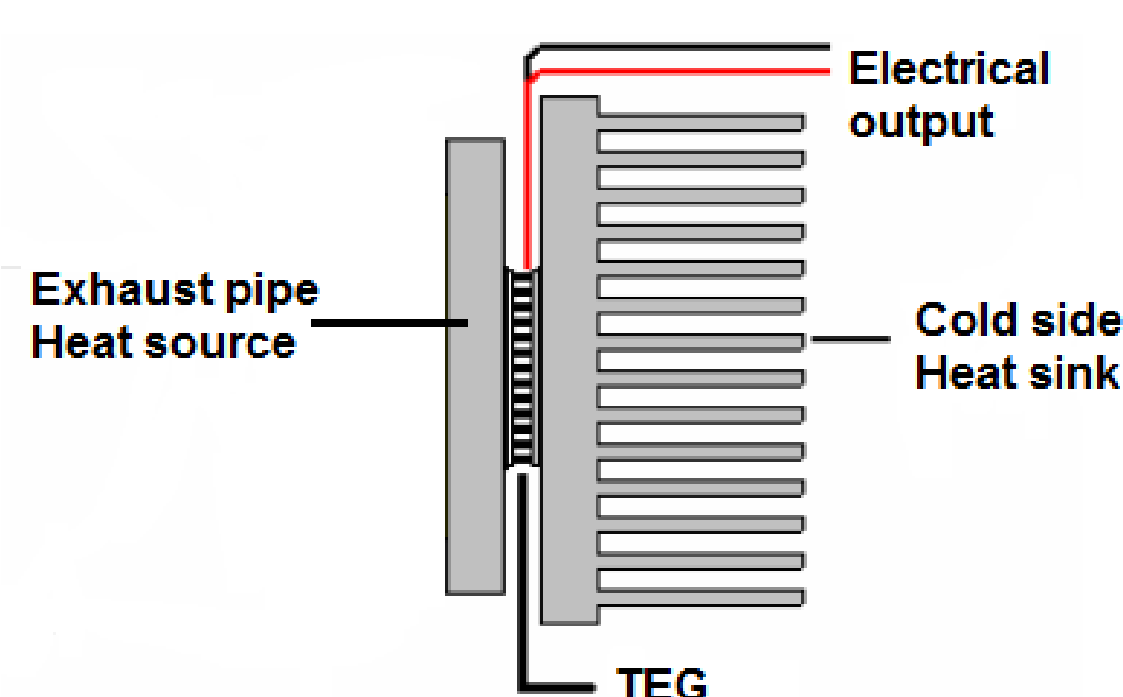


Figure 1: Electrical energy generation from heat.

## Overheat preventing safety system :

To save TEG's from overheating and damaging, the exhaust gases can be prevented passing along them and passing through bypass when the temperature exceeds 300 °C.

The bypass is a pipe connected in parallel with the section of exhaust pipe that contains TEG pieces, This bypass should have two throttle valves, one is normally open and the other is normally closed, to control gas flow in main pipe and bypass, Figure 2

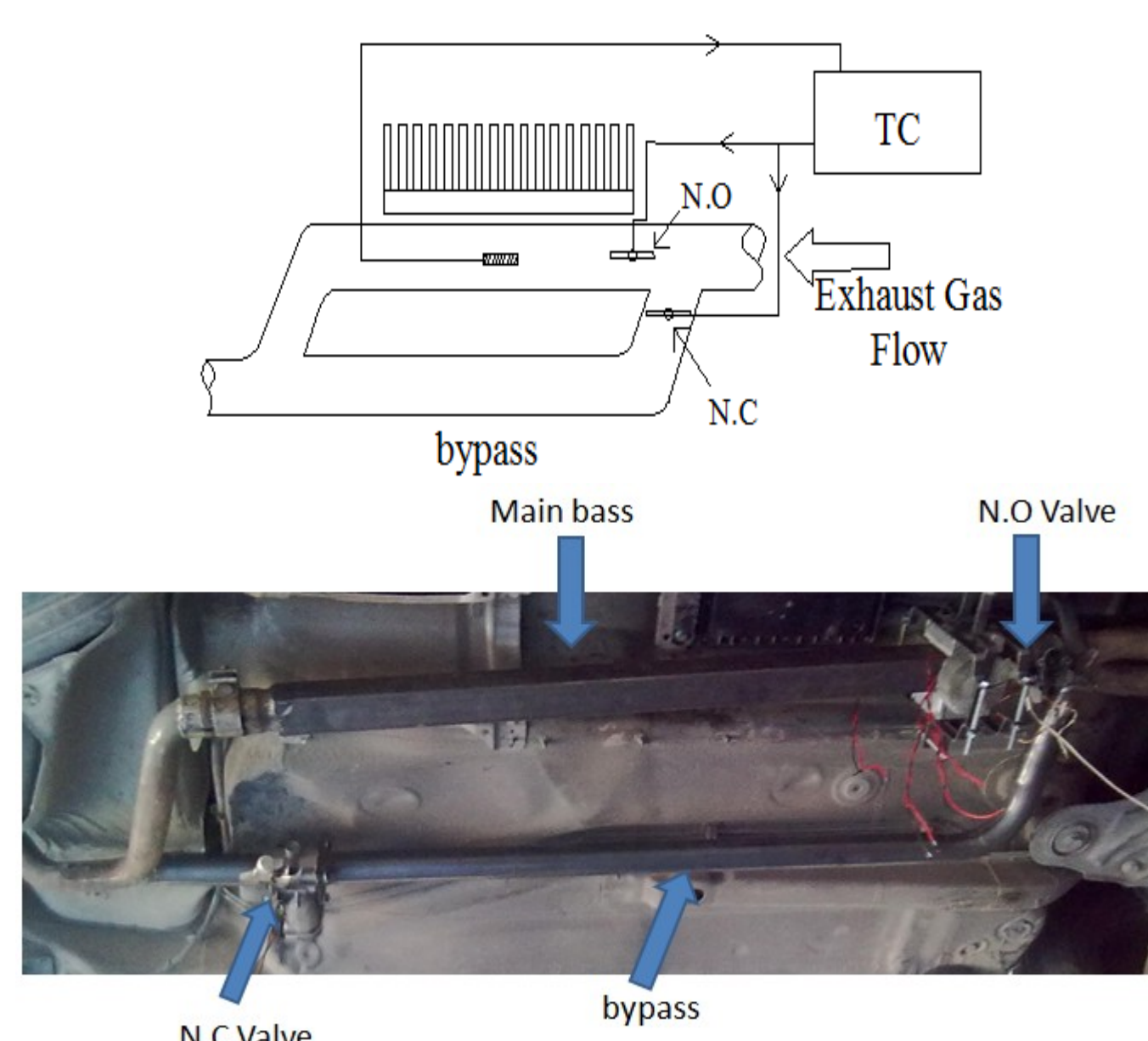


Figure 2 : Overheat preventing safety system

And by use a temperature controller that measure the exhaust pipe temperature and automatically operate the valves Figure 3



Figure 3: Temperature controller

The environmental air can be used to cool the other side of the TEG's, but it's necessary to increase the surface area of TEG's cold side in order to increase cooling efficiency. That can be achieved by using a heat exchanger which may be aluminum fins settled on the TEG's cold side, figure 4.

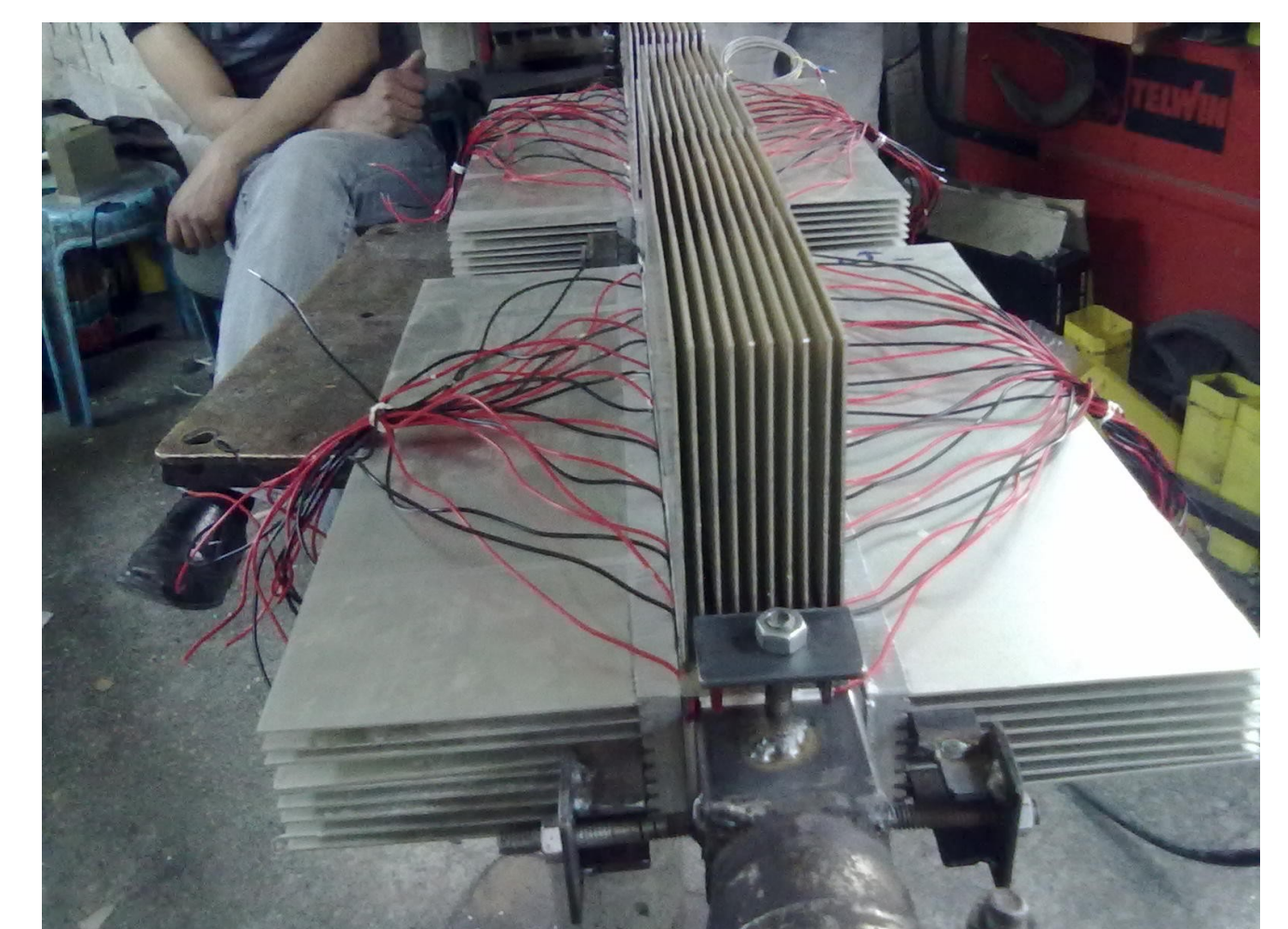


Figure 4.7: fins heat exchanger.

## Conclusion :

1. Percentage of reduced fuel consumption may reach 2%, and differs from vehicle to another and affected by driving mode, but it depends basically on vehicle electrical loads .
2. It should be noted that major vehicle manufacturers are making studies ,research and tests to apply this system in future vehicles.