



“Design and Fabrication of Waste Heat Recovery using Thermoelectric Generator”

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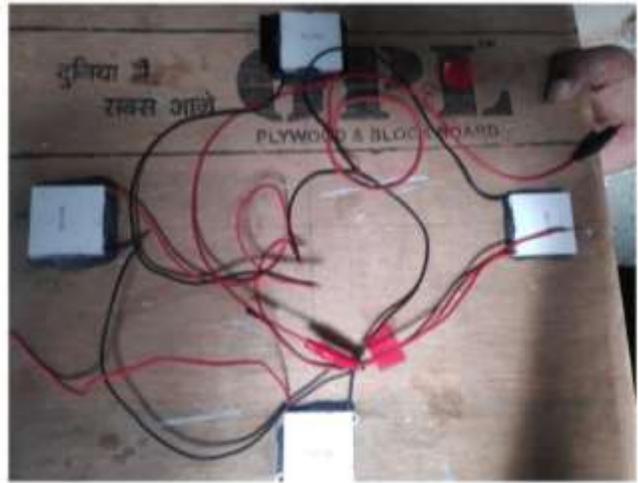
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ABSTRACT

Air conditioning is the process of removing heat and moisture from the interior of an occupied space to improve the comfort of occupants. With the rise in temperature around the world it is impossible to think of living without AC, especially in certain cities where the temperature rises up to 50° Celsius. The temperature of air coming out from condenser is about 50-60 degree Celsius. This waste heat energy can be harvested and turned into useful energy, which will be a step in the right direction. Being one of the promising new devices for waste heat recovery TEG is used nowadays. The project focuses on generation of electricity with the help of TEG. In this project, the TEG modules are placed in front of the condenser unit. This module will extract waste heat coming from the condenser and convert this into DC electrical energy. The electrical energy then stored into battery to operate various devices or to charge the battery.

1. INTRODUCTION

Electricity is one of the most important blessings that science has given to mankind. It has also become a part of modern life. Powering our appliances and providing comfort in our lives. In the modern technologies, the production of power is focusing on the renewable energy resources as the non-renewable energy resources are getting depleted. As we know renewable energy sources and technologies have potential to provide solutions to the long-standing energy problems for the world. The renewable energy sources like wind energy, solar energy, geothermal energy, thermoelectric energy, ocean energy, biomass energy and fuel cell technology can be used to overcome energy shortage in India. There are some technologies which implement the recycling of waste energy. The waste heat energy generated in a process and then transferred into the environment even though it could still be reused for some useful and economic purpose. One of the biggest sources of waste heat energy come from exhaust and flue gases and heated air from heating systems of large industries. Various studies have estimated that as much as 20% to 50% of industrial energy consumption is ultimately discharged as waste heat.

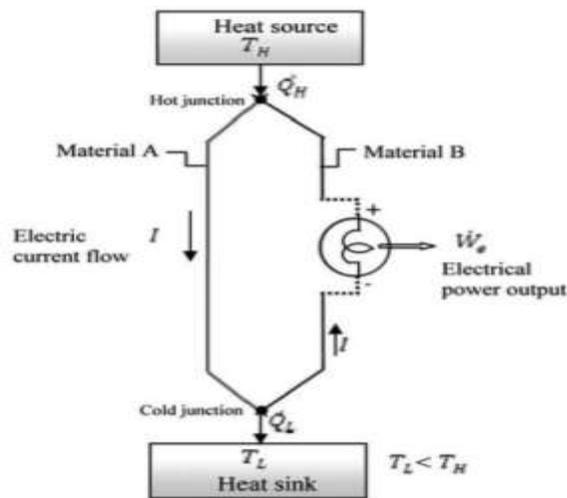
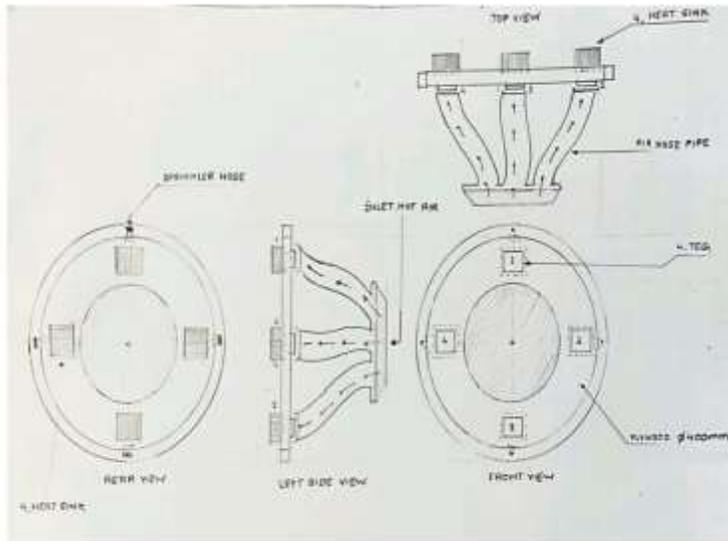


2. WORKING

A thermoelectric power generator is a solid state device that provides direct energy conversion from thermal energy (heat) due to a temperature gradient into electrical energy based on the 'Seebeck effect'. There is a need to implement such a heat recovery system where the waste heat obtained can be utilized not only for domestic purposes but for also various other industrial uses. In short, it is required to devise a system by which the low grade waste heat can convert into useful so that it can be utilized for various purposes.

The TEGs are connected in parallel circuit. Parallel circuit: If two or more components are connected in parallel, they have the same difference of potential (voltage) across their ends and they also have identical polarities. The same voltage is applied to all circuit components connected in parallel. The total current is the sum of the currents through the individual components, in accordance with Kirchhoff's current law.

The 4 TEG are connected in parallel and mounted on a wooden block. The wooden block is held in front of an outdoor AC unit and the heat release from the AC unit is harvested to convert the heat energy into electrical energy. The electrical energy generated can be measured by a multi-meter.

Fig 1.2: TEG as a Heat Engine^[1]

3. LITERATURE REVIEW

Basel I. Ismail and Wael H. Ahmed in their research work stated that, there is an increasing concern of environmental issues of emissions, in particular global warming and the limitations of energy resources has resulted in extensive research into novel technologies of generating electrical power. Thermoelectric power generators have emerged as a promising alternative green technology due to their distinct advantages. Thermoelectric power generation offer a potential application in the direct conversion of waste-heat energy into electrical power where it is unnecessary to consider the cost of the thermal energy input. The application of this alternative green technology in converting waste-heat energy directly into electrical power can also improve the overall efficiencies of energy conversion systems. In this paper, a background on the basic concepts of thermoelectric power generation is presented and recent patents of thermoelectric power generation with their important and relevant applications to waste-heat energy are reviewed and discussed.

4. ADVANTAGES

- Producing electricity directly from waste heat coming out of a condenser unit to run appliances.
- To provide valuable energy sources by reducing conventional energy source consumption.
- The heat energy from any sources can be used to generate electricity.
- Although the efficiency of the TEG is low, but more the source and more the TEG added can significantly increase the output energy.

5. CONCLUSION

After the calculations obtained and comparing it with the standard requirements of operating other appliances we can conclude that by increasing the number of TEG's or by increasing the temperature difference between the condenser surrounding and ambient temperature we can increase the efficiency of the system. By this we could be able to use alternative sources of energy rather than conventional sources of energy to run appliances by harvesting the waste heat coming out of the condenser.

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7. REFERENCE

1. Basel I. Ismail, Wael H. Ahmed: "Thermoelectric Power Generation Using Waste-Heat Energy as an Alternative Green Technology", Recent Patents on Electrical Engineering, 2009, Vol. 2, No. 1
2. Mohammed Habeeb Shareefl, Abdul Sajid: "Efficiency Calculation of a Thermoelectric Generator", ISSN (Online): 2319-7064 Volume 5 Issue 7, July 2016
3. Central electricity authority: "Executive Summary for the Month of Jan-2020"
4. Central Statistics Office: "Energy Statistics 2019"
5. Central Statistics Office: "Energy Generation, Programme, and Plant Load Factor"
6. Nesrine Jaziri, Ayda Boughamoura: "A comprehensive review of Thermoelectric Generators: Technologies and common applications", Energy Reports 2352-4847

