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A Review on Design and Analysis of Power Generation from Waste Heat

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Abstract: ***This project presents research on electricity production using a combination of thermoelectric generators and thermoelectricity. Most of the heat energy in industry is dissipated as waste heat to the environment. This excess heat can be reused to produce electricity. The problems associated with global warming and the dwindling supply of fossil fuels have made improving the efficiency of any industrial process a priority. One way to improve efficiency is to develop methods that utilize waste heat is often wasted. Two promising technologies that were found to be useful for this purpose were thermoelectric generators and heat pipes. Therefore, this project involved making a bench type, proof of concept model of power production by thermoelectric generators using heat pipes and simulated hot air.***
Keywords: Waste heat, waste heat Recovery, TEGs, Temperature Measurement, Voltage Measurement, Electricity etc.

I. INTRODUCTION

In recent years, 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. Previous research shows that TEG as a waste heat harvesting method is useful. Due to distinct benefits of Thermoelectric generators, they have become a promising alternative green technology. Thermoelectric generator direct converts wasteheat energy into electrical power where it is unnecessary to consider the cost of the thermal energy input. The application of this technology can also improve the overall efficiency the of energy conversion systems.

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 “Seebeck effect”. The thermoelectric power cycle, with charge carriers (electrons) serving as the working fluid, follows the fundamental laws of thermodynamics and intimately resembles the power cycle of a conventional heat engine. Thermoelectric power generators offer several distinct advantages over other technologies..

II. PROBLEM DEFINITION

In recent years, global warming and restrictions on the use of energy sources have increased environmental problems in terms of emissions. The ability of the thermal power system to contribute to "green" technology, especially waste heat recovery from industrial emissions. A large amount of waste heat is discharged into the earth's environment, much of it at temperatures too low to be recovered by conventional generators. The proposed structure is a multi-part and multi-stage distributed network. The goal is to solve the problems faced by traditional single-stage systems and promote the application of TEG in the industrial environment.

III. OBJECTIVES

1) Finding a suitable method for electricity through the TEG module and collecting literature on the study.
2) To design the parameters of heat exchanger TEG
3) To develop much cleaner noise less cost effective different way of power generation method.

IV. LITERATURE SURVEY

1) *Jihad Haider, Jameel I. Ghozel,* "Recovering waste heat from low-powered diesel engine exhaust using thermoelectric generators, 20th International Conference on Thermoelectrics (2001), p. Recovering and using waste heat.
2) *Bibliography 2:* 2017 International Conference on Smart, Monitored and Controlled Cities (SM2C), Kerkena, Tunisia 59, 17, 19, February 17 , Document 2, we analyzed the thermoelectric generator and its technical parameters.

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3) *Document Review 3:* Ahad Hussain Aladdin, Shanshui Yang, Yazu Liu, Fang Cao, DC Bus, IEEE Transportation Electrification Conference 2017 2017 and Excerostite Heatmal Power Review with Cover Conditioning for IcE for Temperature Using Conditioning Power Supply for Asia | From the study of 2017, 3 documents, we have studied other types of refrigeration systems and different types of refrigerants.
4) *Documentary Study 4:* Arash Edwin Rise, IEEE Transactions on Electrical Energy Conditioning Systems, Transport Electrification for Thermal Waste Heat Recovery in Commercial Vehicles, 2018, p. 216, Document 4 study, we find out how to recover waste heat from automotive applications.
5) *Literary Survey 5:* T.J. Zhou, Y.Q. Cao, F. Yan and X.B. Zhao, Nanostructuring and Thermoelectric Properties of Semiconductor Tellurides, 2007 International Conference on Thermoelectrics. From Literature Survey 5 we learned about thermoelectric material and its properties.

V. BLOCK DIAGRAM

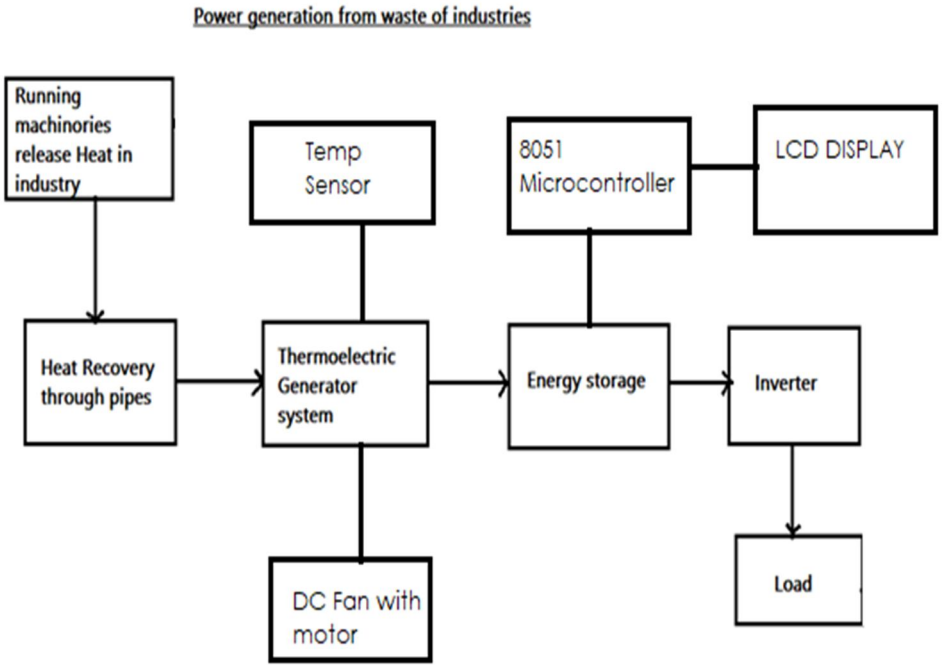


Fig. 1. Block Diagram system

In the concept of this project it has invented an exhaust gas based thermoelectric power generator for industries application. In this invention, the exhaust gases in the pipe provide a heat source for the thermoelectric power generator. Therefore, the project proposes and implements a thermoelectric waste thermal energy recovery system from exhaust heat from machines operating in industries. Using a thermoelectric generator is crucial to convert electrical energy directly from industries waste heat into electrical energy.

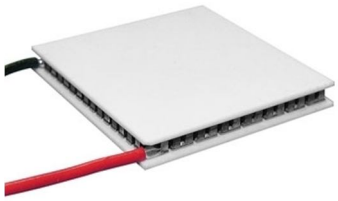


Fig.2. Peltier System

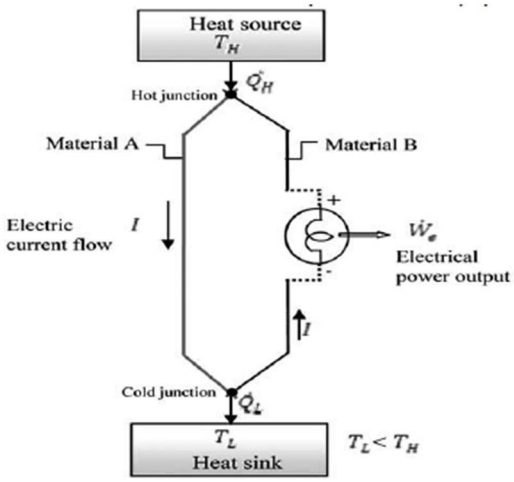


Fig.3. Working principle System

1) TEG consists of one hot side and one cold side. The hot side with higher temperature, will drive electrons in the ntype leg toward the cold side with lower temperature, which cross the metallic interconnect, and pass into the ptype leg, thus developing a current through the circuit.
2) If temperature difference is kept constant, then the diffusion of charge carriers will form a constant heat current, hence a constant electrical current.

VI. SCOPE

1) We can generate maximum power using series / parallel connecting thermoelectric generators
2) Body heat also generates heat, which is used to generate power to charge portable devices such as laptops and mobiles using TEG.
3) Installing the radiator on the vehicle means that the vehicle battery will be charged automatically.

VII. ADVANTAGES

1) Clean, low noise, low cost.
2) It is an unconventional system, does not require fuel
3) Easy maintenance, portable, low charging time (maximum temperature)
4) Promising technology to solve the power crisis economically.
5) Simple in construction, pollution free, minimizes transmission losses.
6) Wide application field # Requires less space
7) It can be used anytime and when needed.
8) Requires a small number of components.
9) We can charge any electronic device
10) Electricity can be used for many purposes
11) Effective and eliminate grid search.

VIII. DISADVANTAGES

1) Improper variation of temperature gradient difference can damage TEG, complex design.
2) Proper maintenance is required every time.

IX. APPLICATIONS

1) Thermoelectric generators are primarily used where power generation is low.
2) The amount of heat that is applied and dissipated in many vehicles. We can use this listening to power using TEG.
3) Automobile vehicles use TEG to generate heat used to generate electricity.
4) Recharge the battery where the waste heat is received.
5) Self-charging the battery by applying TEG to the radiator or two wheeler silencer pipe.

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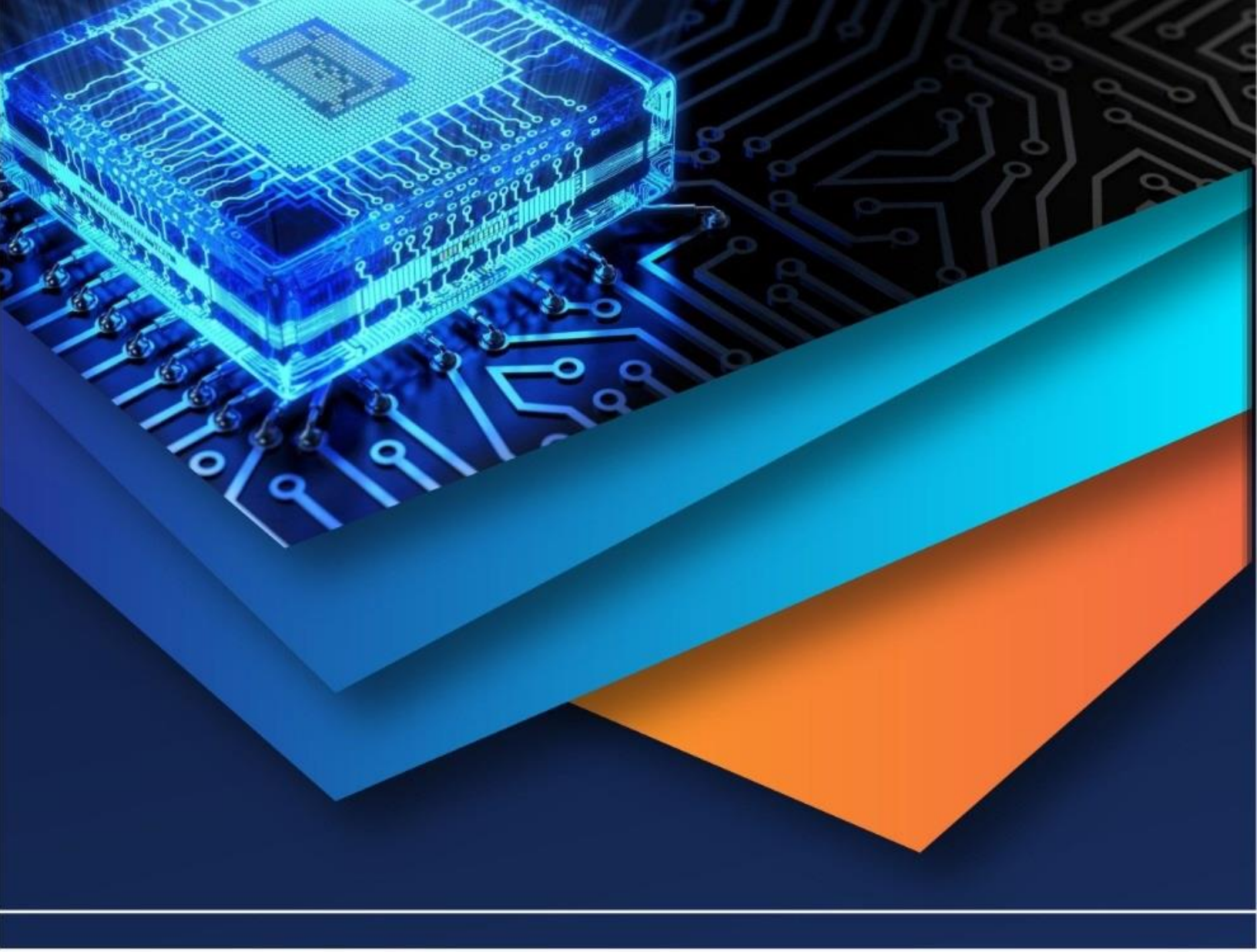
X. CONCLUSION

Waste heat recovery is the process of capturing and reusing waste heat from industries and using it to generate electrical power. It will also help document improvements in machine efficiency and emissions if these technologies are adopted by manufacturing industries. If this thermoelectric system concept is applied on a practical level, a large amount of electricity can be generated, which will be used to operate the industrial load itself. In addition, a large amount of polluting waste heat is also continuously used in this system. And these industries also help in one way or another to protect the polluted environment.

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