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Electricity Generation by Waste Material

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Abstract: **The purpose of the project is to control of solid waste generation and to reduce the pollution by generating electricity by heating process. The generation of solid waste is increasing along with the increasing of the population. we have been collected the solid waste and separated the solid waste by manually under the categories of size, shape, dry, wet, etc. we avoided glass, petroleum products which effects the heating process. While heating the solid waste the heating sensors, heating panels takes observes that and converts heat energy into electrical energy and storing energy for the purpose of charging the battery which used for the supply that energy for further purpose. The capacitors used to store that energy and with the help of resistors it resists the flow of the current.**

Keywords: **Electricity generation; Solid Waste Material; pollution control; Energy Conservation.**

1. INTRODUCTION

It is the unwanted or waste solid materials which are generated from human activities in houses, hotels, institutional, labs, agriculture, industries or any commercial areas. In India metro cities individually produces an average of 0.8 kg/ waste/ person daily. India has been generated municipal solid waste (MSW) estimated at 68.8 million tons per year. The average efficiency of MSW collection is 22% - 60%.

Annually the world generates 2.01 billion tones of MSW at least with 33% of that extremely conservatively not managed in an environmentally safe manner. Worldwide, per person waste generated per day averages 0.74 kg but ranges widely from 0.11 – 4.54 kg. Though they only account for 16% of the world's population, developed countries generate nearly 34% (683 million tons) of world's waste. By 2050 global waste is expected to grow to 3.40 billion tones. In INDIA 62 million tonnes of MSW generates each year. In this about 43 million tonnes (70%) is collected and 11.9 million tonnes (20%) is treated about 31 million tonnes (50%) is dumped in landfill sites.

- **1.1Types of solid waste on Origin**
  - Resindential
  - Institutional
  - Commercial
  - Municipal
  - Industrial
  - Agricultural
  - Open areas
- **1.2 Types of waste based on composition**
  - Garbages
  - Ashes and Residues

2. LITERATURE REVIEW

In today's era, most of the electricity generation largely depends on fossil fuels. However, thereserves of fossil fuels are currently depleting, since oil & gas are the least available sources. In recent years, due to increase in cost of non- renewable resources like coal, oil and natural gas, the cost of energy has also increase, be it energy in the form of household electricity or in the form of chemical energy of burning fuels. Thus, alternative sources like solar, wind, hydro and geothermal sources are now emerging as energy generation sources.

According to the World Energy Assessment (WEA, 2000), geothermal energy is one of the largest sources of renewable energy. However, it has certain limitations which imposelimits on the use of thermal energy for energy generation. Liu (2013) discussed likely factorsleading to the low growth rate of geothermal energy. The main factors include high initial investment, high exploration risk, long payback and construction time, difficulty to assess resource, and difficulty to modularize. Li (2013) also pointed out possible directions to accelerate the growth of geothermal power. One of the solutions may be the large-scale utilization of TEG technology.

Since 1821, many researchers have investigated the application of thermoelectric materials. Thacher (2007) developed a thermoelectric power generator using car exhaust heat.The maximum power output reached 255 W. Kajikawa and Onishi (2007) developed an advanced thermoelectric conversion exhaust system in a light truck. Maneewan and Chindarksa (2009) investigated the characteristic and performance of TEG modules for power generation at low temperatures. The unit achieved a power output of 2.4 W with a temperature gradient of approximately 150°C. The conversion efficiency was about 3.2%.

Niu et al. (2009) constructed an experimental thermoelectric generator unit; a comparison ofthe experimental results with those from the previously published numerical model was analyzed. Hsu (2011) developed a low-temperature waste heat system to utilize the car exhaust heat as well. When the engine rate boosted to 3500 RPM, 12.4 W of maximum power output was obtained at an average temperature difference of about 30°C.

Numerical modelling of TEG systems has also been investigated. Esartea et al. (2001)analyzed the influence of fluid flow rate, heat exchanger geometry, fluid properties and inlet temperatures on the power supplied. Chen et al (2005) assumed that heat-transfer obeys the linear phenomenological heat-transfer law and studied the performance of multi-element thermoelectric-generators. Yamashita (2008) developed new thermal rate equations by takingthe temperature dependences of the electrical resistivity and thermal conductivity of the thermoelectric (TE) materials into the thermal rate equations on the assumption that they vary linearly with temperature. Freunek et al. (2009) described an analytical model for thermoelectric generators and found that the influence of the Peltier heat on the output power was about 40%. Eisenhut and Bitschi (2006) derived an analytic model based on convective heat sources. Liu (2012) presented the designs of electricity generators based on thermoelectric effects using heat resources of small temperature differences. Karabetoglu etal. (2012) reported the approach to characterizing a thermoelectric generator at low temperatures. Xiao et al. (2012) designed a solar thermoelectric generator using multi-stagethermoelectric module; the total conversion efficiency was 10.52%. Suter et al. (2012) established a numerical model for a 1kWe thermoelectric stack for power generation, whichmay help define the configuration and operating parameter range that are optimal from a commercial standpoint. Wang et al. (2013) presented a mathematical model of TEG and preliminary analysis of factors. Kim (2012)derived a model describing the interior temperature difference as a function of the load current of a thermoelectric generator (TEG) and the results showed approximately 25% of the maximum output power is lost because ofthe parasitic thermal resistance of the TE module used in the experiment.

Thermoelectric generation technology (2006), as one entirely solid-state energy conversion method, can directly transform thermal energy into electricity by using thermoelectric transformation materials. A thermoelectric power converter has no moving parts, and is compact, quiet, highly reliable and environmentally friendly. Therefore, the whole system can be simplified and operated over an extended period of time with minimalmaintenance. In addition, it has a wider choice of thermal sources. It can utilize both the high- and low-quality heat to generate electricity. The low-quality heat may not be utilized effectively.

Thermoelectric power generators offer several distinct advantages over other technologies:

They are extremely reliable (typically exceed 100,000 hours of steady-state operation) and silent in operation since they have no mechanical moving parts and require considerably less maintenance;

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- They are simple, compact and safe;
- They have very small size and virtually weightless;
- They are capable of operating at elevated temperatures;
- They are suited for small-scale and remote applications typical of rural power supply, where there is limits in process or no electricity;
- They are environment friendly;
- They are not position-dependent;
- They are flexible power sources.

The major drawback of thermoelectric power generator is their relatively low conversion efficiency (typically ~5%). This has been a major cause in restricting their use in electrical power generation to specialized fields with extensive applications where reliability is a major concern. Applications over the past decade included industrial instruments, military, medical and aerospace, and applications for portable or remote power generation. However, in recent years, an increasing concern of environmental issues of emissions, in particular global warming has resulted in extensive research into nonconventional technologies of generating electrical power and thermoelectric power generation has emerged as a promising alternative green technology. Vast quantities of waste heat are discharged into the earth's environment much of it at temperatures which are too low to recover using conventional electrical power generators. Thermoelectric power generation (also known as thermoelectricity) offers a promising technology in the direct conversion of low-grade thermal energy, such as waste-heat energy, into electrical power.

Probably the earliest application is the utilization of waste heat from a kerosene lamp to provide thermoelectric power to power a wireless set. Thermoelectric generators have also been used to provide small amounts electrical power to remote regions for example Northern Sweden, as an alternative to costly gasoline powered motor generators. In this waste heat powered thermoelectric technology, it is unnecessary to consider the cost of the thermal energy input, and consequently thermoelectric power generators' low conversion efficiency is not a critical drawback. In fact, more recently, they can be used in many cases, such as those used in cogeneration systems, to improve overall efficiencies of energy conversion systems by converting waste-heat energy into electrical power.

There are many kinds of materials that have been used in TEG such as lead telluride (PbTe) and bismuth telluride (Bi2Te3). Otherwise, many synthetic routes of thermoelectric materials have been well developed and can improve the performance of the TEG, like mechanical alloying, hydrothermal, melt and growth and microwave synthesis.

Furthermore, it has been found that the nanostructure effectively reduces the thermal conductivity and leads to obtain a better figure-of-merit of Thermoelectric generators.

3. PROBLEM IDENTIFICATION

There is a growing demand for alternative sources of energy in the current world and extensive research work is being done to find out ways to do so as well as increase the efficiency of the existing methods.

Thermoelectric power generation has emerged as a promising green technology due to its many advantages. Thermoelectric generators use thermoelectric modules, a solid state device, which can convert thermal energy to electrical energy from a temperature gradient and works by using the Seebeck effect.

These can be utilized to harness waste heat that is abundant in homes and industries. In rural or remote areas, where electricity from the national grid is not available, thermoelectric generators can be used to power electronic devices.

This paper demonstrates the potential of thermoelectric power generation using Peltier plates and how it can be used to harness waste heat using a portable thermoelectric generator. The proposed system has been developed and tested. It can generate power which is useful for low voltage electric devices. The device is portable, cheap and user-friendly.

Electricity is one of the most essential elements of our daily life. It is used everywhere in our life. Electricity is a scarce resource and the demand for electricity is always increasing. Conventional energy generation plants use non-renewable sources of energy like gas and coal. With increased interest and existing limitations, a requirement arises for alternative

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sources of energy in the present world and a wide research effort is being performed to realize the ways to increase the efficiency of the existing methods. In Bangladesh load shedding is a very common problem. There nearly 64 % people are living in the rural areas of our country.

Due to lack of electrical energy load shedding is occurring on a regular basis and it is the most in the rural areas. During the hot season the load shedding is the most in areas. In some remote rural areas in our country electricity is not still available. More than a quarter of the rural population still lacks access to electricity and relies on fuel wood and kerosene for energy.

People need to suffer a lot due to lack of electricity in the rural areas. The power distribution system is lagging behind the ever-growing customer base, resulting in daily load shedding across the country. It is also common in city areas. Official data show the distribution system has not grown in synchronization with growth in demand.

Nowadays the crisis of energy has become a most important challenge in our country. It is very urgent to find alternative energy sources to solve the national big issues. In our country, solar based alternative energy producing systems are being used nowadays but this requires the sunlight to produce energy. Therefore more alternative energy harvesting techniques are very important nowadays from nature to fulfill the demand of national electrical energy demand for our country. Recently, research interest is growing in this area to find alternative energy sources. Currently research is also carried out worldwide on renewable energy sources while trying to make the current systems such as solar more efficient.

Design of solar-panel energy systems is presented in open literature. The Power Pot is a thermoelectric generator that uses heat to generate electricity is presented in. This product has been developed abroad and it is costly to bring in India. It will be hard for the poor people to afford it. In this paper a portable thermoelectric generator system has been developed using Peltier plates and waste heat. The system can produce electricity from the waste heat. Thermoelectric generators are mostly used to convert the waste heat so it is considered as a green technology. The developed system is cheap, portable, affordable and compact. It uses the seed Seebeck effect technique. The system is very user friendly and which is less costly.

4. METHODOLOGY USED

A thermoelectric power generator is a solid state device which can directly convert heat to electricity using the Seebeck effect. The Seebeck effect is a phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substance.

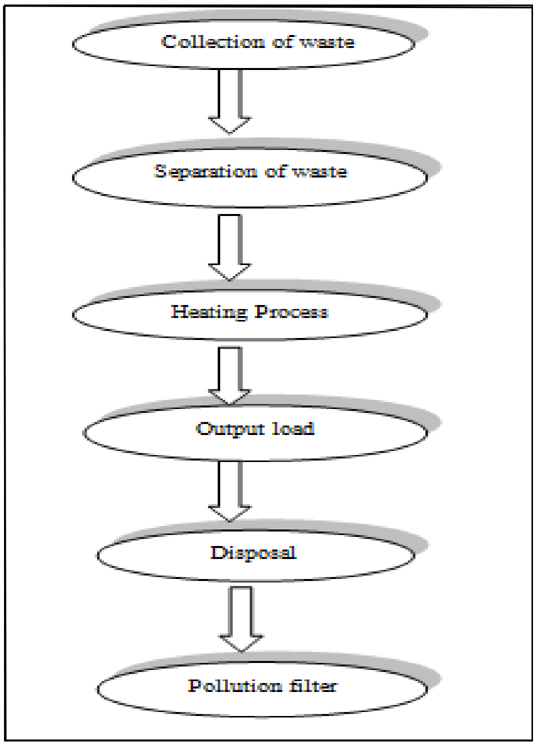

Figure 1. Methodology

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5. MATERIALS USED

5.1 MUNICIPAL SOLID WASTE:

It is the first and for most material which is the important for this project. In this only collecting the municipal solid waste which consists of papers, cardboard, plastic, wood, etc.

5.2 HEATING PANEL:

Heating panel is the material which is used for converting the heat energy into electrical energy. It works by allowing heat, to generating flow of electricity. Simply this heating panel converts heating or light energy into electricity or electrical energy.

5.3 DC MOTOR

It is the device that converts the electricity into the mechanical work. It works on the physicist Law that states that "the current carrying conductor placed in a very magnetic and force field expertise a force".

5.4 LED BULB:

When an acceptable current is applied to the leads, negatrons area unit ready to recombine with electron holes among the device, cathartic energy within the kind of photons. This impact is termed electroluminescence.

5.5 CAPACITOR:

It is a component which has the ability to store energy in the form of an electrical charge producing a potential like a small rechargeable battery.

5.6 RESISTOR:

It is used to reduce the flow of current, to divide voltages. It controls the flow of the current and resist it's the flow of the current.

5.7 HEATING SENSOR:

It is used to convert the heat energy into electrical energy. When this is heated by the heating it takes that heat and converts that heat energy into electrical energy.

6. BLOCK DIAGRAM

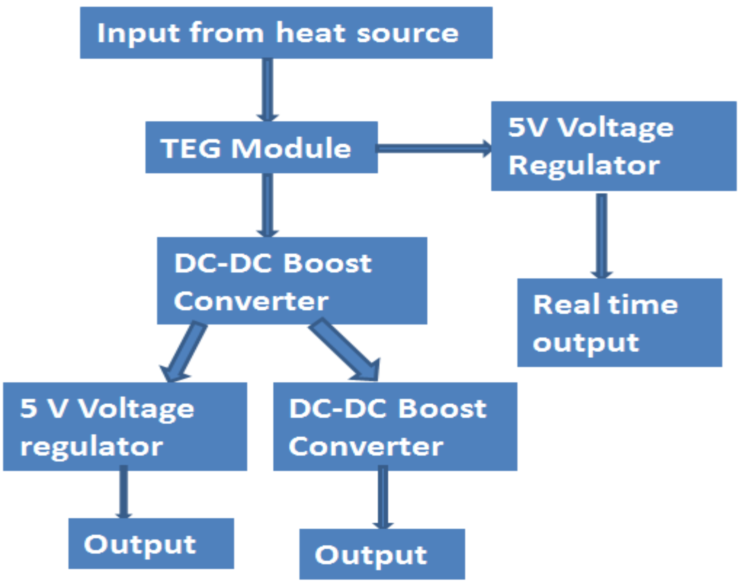

Figure 2: Block diagram of the whole system of the thermoelectric generator using Peltier plates and waste heat.

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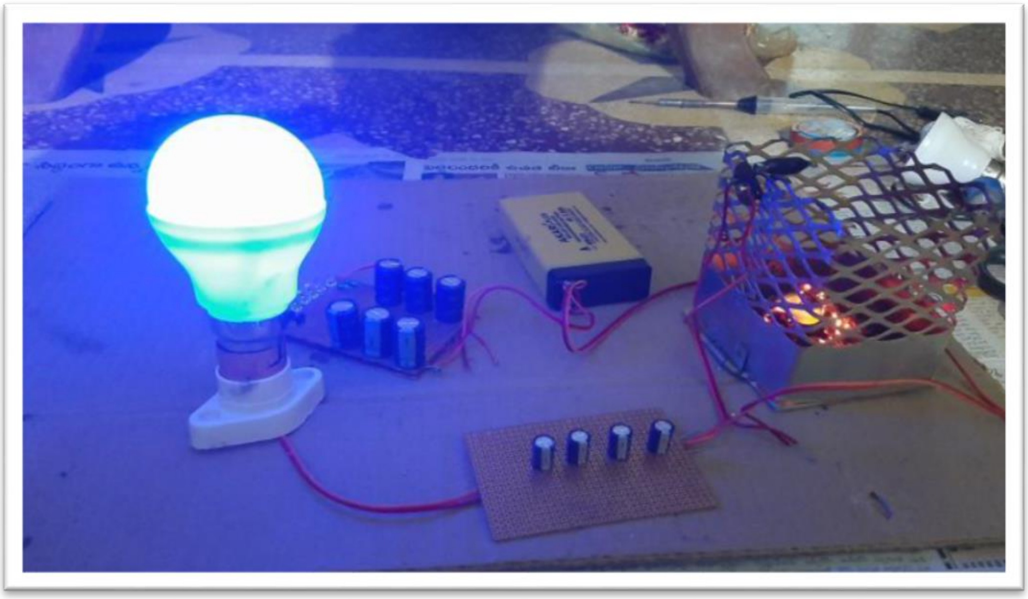

Figure 3: Project Implementation

Table No.1 Power Generation

Material	Timing	Temperature	Max. Electricity generating Voltage	Electricity Generating Time	Electricity Generating Min. Temperature
250 gm wood	20-30min	300 degrees	7V	30 min	100 degrees
250gm wood+plastic	25-40min	300-600 degrees	10 V	40 min	100 degrees

7. FUTURISTIC SCOPE

To generate electricity from solid waste in order to reduce the wastes by heating process and by reducing the pollution by using the pollution control filter. To convert the heat energy into electrical energy by using the heating sensors and heating panels. As well as the municipal, industrial, agricultural, commercial waste can be converted into energy (electricity) by the heating process. And unwanted things could be converted as useful things. So as like management of solid waste problem could be solved.

8. EXPECTED OUTCOME

To Generate Electricity from Waste Heat Using Peltier Module - In the year 1821, a famous scientist named Johann Seebeck revived the concept thermal gradient which is developed in between two various conductors and this can generate electricity. In relation to the thermoelectric effect, there is a concept called as temperature gradient in the conducting substance which produces heat and this outcome in charge carrier's diffusion. This heat flow in between the hot and cool substances developed voltage difference. So, this scenario has discovered the device thermoelectric generator, and today, our article is on its working, advantages, limitations, and related concepts.

9. CONCLUSION

In the world the solid waste generation is increasing day by day everywhere. In order to control that solid waste generation by controlling the pollution for the purpose of generation of electricity. In this project we show that how to generate electricity from solid waste successfully by the process of heating. We cannot control the pollution completely but we can control the pollution for up to some extent. We can generate electricity from solid waste by the process of heating and we can supply that electricity for the use. We are reducing the solid waste and biogas without decomposing in the landfill sites. Thus, we can say that we completely show that generation of electricity from solid waste by the heating process.

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