Overview of Electricity Generation from Waste

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Abstract- Electricity generation from waste is rapidly growing that involves the conversion of various types of waste in to usable energy. This process is referred as waste-to-energy, and it offers a number of benefits including reducing waste in landfills, reducing greenhouse gas and providing a source of renewable energy. The purpose of making this project is to generate electric energy from bad materials like plastic, rubber, garbage and bad stuff even organic waste can be a part of this . Later store that electrical energy in the battery through the circuit and use for the later

Indexed Terms- Electricity Generation, Organic waste, Renewable Energy, Waste-to-Energy

I. INTRODUCTION

The rapid urbanization and industrialization of modern society have led to a significant increase in waste generation, posing substantial environmental and health challenges. Traditional waste management practices, such as landfilling, are becoming increasingly unsustainable due to their environmental impacts and limited capacity. However, waste can be transformed into valuable resource through waste-to-energy (WtE) technologies, which can generate electricity and heat while reducing the volume of waste sent to landfills. This approach not only mitigates the environmental impacts of waste disposal but also contributes to the diversification of energy sources, reducing dependence on fossil fuels and lowering greenhouse gas emissions.

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Further we are aware that Greenhouse gas emissions have become a pressing global concern, driving climate change and its associated impacts on ecosystems, human health, and the economy. The burning of fossil fuels, industrial processes, and land-use changes have significantly increased the concentration of carbon dioxide, methane, and other greenhouse gases in the atmosphere, leading to rising temperatures and altered weather patterns. As the world transitions towards a more sustainable future, understanding the sources, impacts, and mitigation strategies for greenhouse gas emissions is crucial for developing effective policies and technologies to reduce emissions and mitigate climate change. This paper explores the issue of greenhouse gas emissions, examining the current state of knowledge and potential solutions for reducing emissions and promoting a more sustainable future.

The benefits of waste-to-energy technologies are multifaceted. Firstly, waste can be a reliable and consistent source of renewable energy, reducing dependence on fossil fuels and lowering greenhouse gas emissions. Secondly, WtE technologies can significantly reduce the volume of waste sent to landfills, mitigating the environmental impacts of waste disposal. Additionally, waste-to-energy technologies can provide a stable and predictable source of energy, which can help to reduce energy costs and improve energy security. Furthermore, the implementation of WtE technologies can also create jobs and stimulate local economies, contributing to sustainable development.

This process also produces ash residue, which can be repurposed in various applications. One promising approach is to convert this ash into valuable products such as cement or concrete, thereby reducing waste and promoting a circular economy. This process not only mitigates the environmental impacts of waste disposal but also contributes to the development of sustainable construction materials.

By harnessing the potential of ash residue, we can create a more efficient and environmentally friendly waste management system.

II .DESIGN AND IMPLIMENTATION

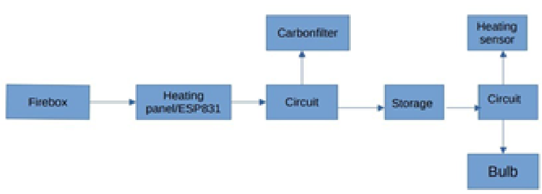

Figure No. 1: - Block Diagram

In this Block Diagram you can see when we burn waste materials and fire box then heat generating and heating panel starts to heat convert electricity and after that that electricity we can see by LED Bulb glowing and that electricity go to circuit and after that in battery and start storing power and when electricity store in battery then heating sensor turn on the output power supply and LED Bulb start glowing and smoke filter system start controlling pollution.

components	specifications
Carbon filters	0.5-50 microns
Led bulb	12v
Heating sensor	200c-1250c
Heat panels	12-24v
Battery	12v,5a
Fire box	1.2m(w)*1.2m(d)*3m(h)
Switch	12-16v
ESP8266	3.6v,170mah
Chimney (if required)	5-10 TPD/20-25 meters
Transformer	125kva
Ash box	2.0m^3 capacity/day
Segregated waste	

III. METHODOLOGY

A. Municipal Solid Waste (MSW) Collection and Separation:

Municipal Solid Waste (MSW) was collected from households, surroundings, and various public areas. The collected waste, which would otherwise decompose in landfills, was chosen as the raw material for the project due to its potential for energy generation. The MSW was manually separated into categories based on properties such as size, shape, weight, moisture content (dry/wet), and other relevant criteria. Special care was taken during the separation process to avoid toxic or hazardous materials such as medicines, injections, broken glass, and other harmful substances that could interfere with the subsequent heating process. This careful segregation ensures that only suitable materials are processed further, minimizing safety risks.

B. Heating Process for Energy Conversion

The separated waste was then placed in a heating chamber for the energy conversion process. During this phase, a heating sensor and a heating panel were integrated into the system. The sensor monitored the temperature within the chamber, while the heating panel absorbed the thermal energy generated during the combustion of the solid waste Strict precautions were followed to ensure safe operation, including monitoring the heating levels to avoid overheating and ensuring the proper functioning of the sensors.

C. Energy Storage and Transfer

The electrical energy produced by the heating panels was directed into a circuit designed to regulate and manage the flow of current.

Capacitors were employed within the circuit to store the electrical energy generated from the heat. Once stored, the energy was transferred to a rechargeable battery, where it was preserved for later use. This stored energy was subsequently made available to an external load, providing a source of electrical power that could be used for various applications. The circuit components, including capacitors and resistors, played a critical role in ensuring that the current was stabilized and that the battery could efficiently charge without damage or energy loss.

D. Residue Management and Pollution Control

After the heating process, the residual byproduct, primarily in the form of ash, was carefully handled. If the residue was deemed useful for further applications (such as in construction or soil conditioning), it was collected and processed accordingly. Any remaining waste that could not be repurposed was safely disposed of. To manage air pollution from the heating process, the smoke generated during combustion was channeled into a filter control system. This filtration system was designed to minimize the emission of harmful pollutants, ensuring that the environmental impact of the process was reduced. The filtered smoke was released in compliance with pollution control standards, thereby aligning the project with environmental sustainability goals.

E. Software simulation

For calculating the electricity generation, System Advisor Model (SAM) software is used in this study. The System Advisor Model (SAM) is a performance and financial model designed software to facilitate decision making for people involved in the renewable energy industry. The simulated data gives the amount of electricity can be produced from the given number of waste as an input. In this study, the incineration process has been used in SAM. Incineration involves the combustion of organic substances contained in waste materials. It converts the wastes into ash and heat. Ash can be used in road making or in the steel industry. Incineration can reduce 90% volume of the waste.

IV. RESULT

A. Manual calculation for energy efficiency

Energy efficiency and waste to heat conversion possibilities are presented in this section. Incineration technique is considered to be economical compared to the other technologies . In this study, incineration technology is considered due to its simplicity. Wastes can be directly fed to feedstock, no other treatment is required in this process.

Net energy is calculated by this equation which was adapted from J.N. Fobil

Net energy (Ne) = gross total annual energy (Gte) – the energy required in drying the waste (Ed).

Ne = Gte – Ed

But the energy required for drying MSW to a constant weight (Ed) is given by the sum of the energy required to raise the temperature of the water in waste from its initial temperature to a vaporization temperature of 100°C (HI) and the energy required to completely vaporize the water in the waste at 100°C or heat of vaporization. It means that

Ed = HI+ HV.

Putting this into equation (1), Ne = Gte – (HI+ HV)

But, HI = mass (m) of moisture in MSW × heat capacity

(c) of water in MSW × change in temperature. This implies that

HI = m • c •

But, = final temperature (100°C) – the initial temperature of water in MSW assumed to be the average annual temperature.

And HV = mass (m) of moisture in MSW × latent heat of vaporization (cv). This also implies that

Hv = m • cv.

Putting the values of HI & HV from equation (3) & (4) into equation (2),

Ne = Gte – (m • c • + m • cv)

Energy efficiency of an incineration program

= Ne / Gte × 100%

CONCLUSION

Conclusion This paper highlights future sustainability. A steady supply of affordable, clean, and renewable energy sources with little harm to society or the environment is a major concern. In this project, we demonstrate how to successfully generate electricity from waste materials. After finishing our project, we checked to see if everything was operating as intended. Everything went smoothly, and the project successfully demonstrated how to successfully generate electricity from waste materials. The main objectives of waste to energy are the reduction of greenhouse gas emissions and the creation of fossil fuel alternatives.

Additionally, the creation of small, inexpensive, yet highly effective technology is necessary, along with the best method for getting rid of or using filter ashes and other leftovers from air pollution control devices.

The goal of this project is to create electrical energy out of waste materials like plastic, rubber, garbage, and other waste materials, store it in a battery via a circuit, and then use it to power the entire system. Therefore, in this project, we successfully demonstrate how to produce electricity from waste materials and successfully store it in batteries. Along with this, reducing carbon emissions is the biggest objective of this project and to lessen these waste's harmful effects on the environment and human health. Municipal solid waste, which is produced by industrial, commercial, and household activity, makes up a significant portion of waste management.

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