

Electricity Generation Using Solid Waste

Shreya. S. Khelagi¹, Triveni. R², Aishwarya. Phade³, Sarita. S. Melkundi⁴

^{1,2,3} Student, Dept. Of Mechanical Engineering, PDA College of Engineering, Kalaburagi, India.

⁴Assistant Professor, Dept. Of Mechanical Engineering, PDA College of Engineering, Kalaburagi, India.

ABSTRACT

The widespread adoption of Waste-to-Energy (WtE) technologies is driven by the urgent need for sustainable solid waste management (SWM) and diversified electricity generation. This research presents a comparative analysis of electricity generation via the burning of specific solid waste fractions (e.g., waste paper, wooden waste.). In this first we collect solid waste from every possible areas like hospitals, schools, colleges, offices, etc and separate the dry waste needed for burning, the waste is dumped into the fire box (metallic) which is resistance to fire, when the waste is burning the solar panel surrounding the box or chamber absorb the heat and light from it and glows the bulbs connected to them.

Keywords: Electricity, Solid waste, WtE

INTRODUCTION

India is the country which stands first for highest population which is 1.46 billion according to 2025 census. Hence the waste produced here is also higher, therefore waste to energy project is best suited for our country. We came with a unique idea of waste to energy unlike biomass power generation. It works quite different because the waste here we use is solid dry waste (like wood, papers, cardboards, small metallic things etc.) it avoids waste like plastic, liquid waste, and food waste. In this process we use metallic chamber for burning process, solar heating panels for heat and light absorption, LED bulb, heating sensor, 4V battery, resistor, circuits, exhaust, and a pipe connection for exhaust for hot air. This technology used to generate electricity from waste is considered more efficient, cost effective, and environment friendly comparatively.

PROBLEMS STATEMENTS

Uncontrolled and unprocessed waste accumulation in urban and industrial areas is leading to

severe environmental and health problems. Waste disposal in landfills consumes large areas of land and contributes to greenhouse gas emissions. Traditional methods of power generation depend heavily on fossil fuels, causing resource depletion and air pollution. There is a lack of awareness and implementation of waste-to-energy technologies in many regions.

1 Components:

1.1. Solar Heating Panel

Solar heating panel working “Generates electricity as a PV panel but also captures the heat that would normally escape, using it for hot water or space heating”.so as it captures the heat and light energy we use it to convert the heat and light coming from burning waste into electricity.



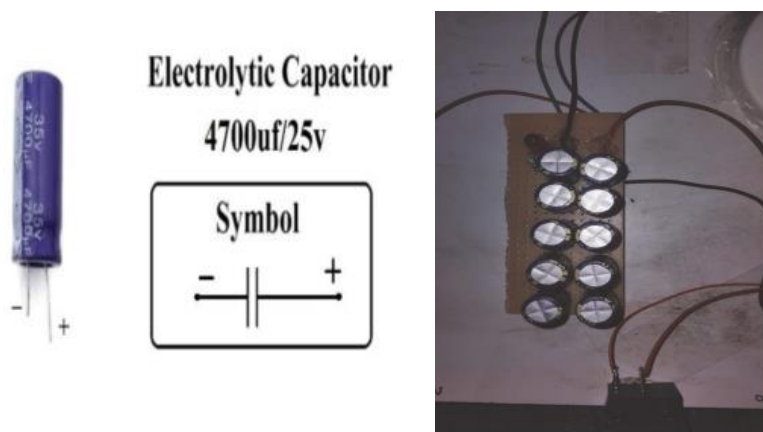
1.2. Heating Sensor

Heating sensors are an important component of many waste-to-energy technologies that involve thermal processes, here we are using this heating sensor to detect the heat flow through the circuits by glowing the LED bulb, it indicates the current is starting to flow through circuits.



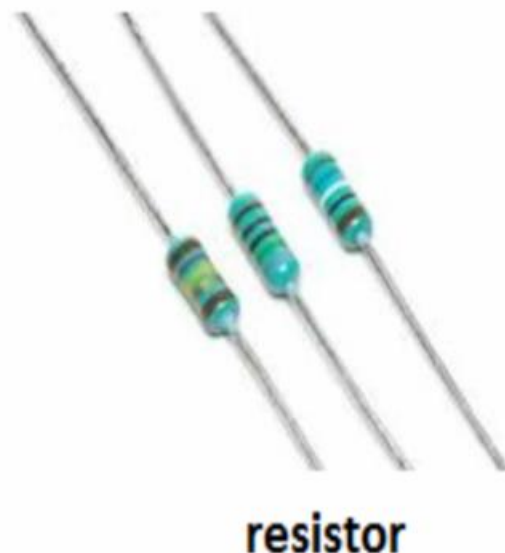
1.3. Capacitor

Capacitors are electrical components that store and release electrical energy, and they are commonly used in electrical systems to provide power factor correction, voltage regulation, and energy storage. In waste-to-energy plants that use thermal processes such as incineration, capacitors may be used in the electrical systems that produce electricity. These capacitors can help to regulate the voltage and power factor of the electrical output, ensuring that the electricity produced is stable and reliable.



1.4. Resistor

Resistors are electrical components that resist the flow of current in a circuit, and they are commonly used in electrical systems to control current, voltage, and power. These resistors can help to control the flow of current to heating elements or other devices that generate heat, ensuring that the temperature is maintained within the desired range for efficient combustion.



1.5. Battery

Batteries are devices that store electrical energy chemically and can release it as needed to power electrical devices. One common use of batteries in waste-to-energy plants is to store excess energy generated by the plant during periods of low demand or low generation. This excess energy can be stored in batteries and used to supplement the plant's output during periods of high demand or low generation, providing a more stable .



1.6. LED Bulbs

LED bulbs are a type of lighting technology that use light-emitting diodes (LEDs) to produce light, and they are known for their energy efficiency, long lifespan, and durability. In waste-to-energy plants, LED bulbs may be used to provide lighting in various areas, including control rooms, storage areas, and maintenance facilities. LED bulbs consume less energy than traditional incandescent bulbs, and they have a longer lifespan, which can help to reduce energy consumption and maintenance costs over time.



2. METHODOLOGY

When we start burning the waste material in the burning box, the heating panels begin collecting the generated heat energy from the waste material. The heat energy collected by the heating panel will be converted into electrical energy. The generated electrical energy will be visible in the circuit box with an LED glowing, indicating that the generated electrical energy will transfer to the batteries through the power boosters. The batteries will not dissipate the energy back because a diode is connected to them. The batteries relate to the heat sensor and LED bulbs. Whenever the heat is sensed by the sensor, batteries allow energy to flow through circuits, and the LED bulb will glow, indicating current flow. When the solar panel/heating panel receives light from burning the waste the main 10-watt bulb connected also glows. The bulb glows for more than the burning period until the heating panels experience the heat. Depending upon the room temperature the time period may increase or decrease.

3. RESULT

- Feedstock Characteristics

The solid waste stream considered in this study consists of combustible dry fractions only, excluding plastics, food waste, and liquid waste. The composition is shown in Table 1.

Table 1. Composition of Solid Waste Feedstock

Component	Mass Fraction (%)	Lower Heating Value (MJ/kg)
Paper waste	55	14.5
Wood waste	35	16.0
Small metallic waste	10	~0.0075
Total	100	—

Metallic waste does not contribute to energy generation and is treated as inert material contributing to ash.

The weighted average lower heating value (LHV) of the combustible fraction is calculated as:

$$\text{Average LHV} = (0.55 \times 14.5) + (0.35 \times 16.0) = 13.6 \text{ MJ/kg.}$$

Theoretical Explanation of Feedstock Characteristics and Average LHV Result

The energy potential of a solid waste feedstock depends primarily on its **combustible components** and their respective **lower heating values (LHV)**. In this study, the solid waste stream is deliberately limited to **dry, combustible fractions**, namely paper waste and wood waste, while excluding plastics, food waste, and liquid waste. This assumption simplifies the analysis and reflects a controlled feedstock commonly considered in thermal waste-to-energy systems.

Role of Individual Components

- **Paper waste (55%):** Paper is largely composed of cellulose, hemicellulose, and small amounts of lignin, which makes it a reasonably good combustible material. Its LHV of 14.5 MJ/kg reflects moderate energy content typical of processed paper waste.
- **Wood waste (35%):** Wood contains higher lignin content compared to paper, contributing to a slightly higher LHV of 16.0 MJ/kg. This makes wood waste a stronger contributor to the overall energy output.
- **Small metallic waste (10%):** Metals are **non-combustible** and therefore do not release thermal energy during combustion. Their extremely low effective heating value (~ 0.0075 MJ/kg) is negligible and is ignored in the energy balance. Instead, metallic waste is treated as **inert material** that contributes to ash formation.

4. PROTOTYPE



REFERENCES

1. ELETRICITY GENERATION FROM MUNCIPAL SOILD WASTE, E-ISSN NO: 2454-9916, VLOME:10, ISSUE 5, MAY 2024.
2. GENERATE ELETRICITY BY USING WASTE MATERIAL, E-ISSN:2582-5208, VOLUME:04, ISSUE:12, DECEMBER2022.
3. GENERATION ELETRICITY FROM SOLID WASTE MATERIAL WAITHOUT AIR POLLUTION, E-ISSN:2664-7583, P-ISSN:2664-7575, IJOS 2023; 5(1):07-12..
4. ELETRICITY GENERATION FROM SOLID WASTE, VOLUME:3, ISSUE:2, 2020
5. ELETRICITY GENERATION FROM WASTE MATERIALS, ISSN: 2456-3315, VOLUME 8, ISSUE 5, 2023 IJRTI.
6. GNENRATION OF ELETRICITY USING SOLID WASTE, 45TH SERIES STUDENT PROJECT PROGRAMME (SPP) – 2021-2022.