

# Electricity Generation from Bio waste

Kaviya A<sup>1</sup>, Sridhanya KS<sup>2</sup>, Nisha S<sup>3</sup>, Jermina Jasmine J<sup>4</sup>

<sup>1,2,3,4</sup>*Department of Electronics and Communication Engineering, Sree Sakthi Engineering College, Bettathapuram, Karamadai, TamilNadu 641104*

**Abstract**— Electricity generation from biowaste presents a sustainable and eco-friendly solution to meet rising energy demands while mitigating environmental impacts. Biowaste, comprising organic material from agricultural residues, food waste, and municipal solid waste, is a rich source of biomass. Through processes such as anaerobic digestion, gasification, and direct combustion, this biomass can be converted into biogas or syngas, which can then be utilized in power generation systems such as gas turbines, internal combustion engines, or steam turbines. The integration of biowaste-based power generation offers several advantages, including the reduction of greenhouse gas emissions, minimized landfill use, and the promotion of a circular economy by turning waste into a valuable resource. Additionally, biowaste-to-energy systems can be deployed at various scales, from small decentralized plants to larger centralized facilities, supporting both local energy independence and broader grid supply.

## I. INTRODUCTION

The global demand for electricity continues to rise due to rapid industrialization, urbanization, and population growth. At the same time, concerns over environmental sustainability and the depletion of fossil fuel resources have driven the search for renewable energy alternatives. Among these, electricity generation from biowaste has emerged as a promising solution, offering both environmental and economic benefits. Biowaste refers to organic waste materials generated from agricultural activities, papers. Traditionally, much of this waste ends up in landfills or is incinerated, contributing to environmental degradation through methane emissions and pollution. However, recent advancements in waste-to-energy technologies have transformed biowaste from a disposal challenge into a valuable energy resource. Electricity generation from biowaste not only helps reduce dependency on fossil fuels but also offers a range of environmental benefits.

It curtails methane emissions from landfills, reduces air pollution, and supports the concept of a circular economy by turning waste into a resource. Moreover, biowaste is abundantly available and often underutilized, making it a viable and sustainable feedstock for renewable energy production. Dry leaves, a readily available and abundant biomass resource, can be converted into electricity through various technologies. This renewable energy source reduces waste, mitigates climate change, and provides a sustainable alternative to fossil fuels. Biowaste-to-electricity systems rely on several key technologies, including anaerobic digestion, gasification, pyrolysis, and direct combustion. These processes convert organic material into biogas or syngas, which can then be used to generate electricity through engines, turbines, or steam generators. For example, anaerobic digestion involves the breakdown of organic waste by bacteria in an oxygen-free environment, producing biogas (mainly methane) that can be burned to generate power. Similarly, gasification and pyrolysis convert solid waste into syngas, a mixture of hydrogen and carbon monoxide, which can be used as fuel for electricity generation.

## II. LITERATURE SURVEY

The generation of electricity from biowaste has gained significant attention in recent years as part of global efforts to transition toward sustainable and renewable energy systems. A number of studies have explored the technological, environmental, and economic aspects of converting biowaste into electricity. This literature survey reviews key research on various technologies used for biowaste-to-energy conversion, the environmental and economic benefits of biowaste utilization, and the challenges that hinder large-scale adoption. The utilization of dry leaves for electricity generation represents a unique approach to renewable

energy, leveraging the vast quantities of dry biomass produced by natural processes. Dry leaves, often treated as waste, can be converted into useful energy through various technologies such as direct combustion, gasification, and pyrolysis. This literature survey reviews key studies that explore the potential of dry leaves as a bioenergy feedstock, focusing on conversion technologies, environmental benefits, economic feasibility, and challenges associated with dry leaf-based electricity generation. Electricity generation from dry leaves has become an area of interest within the broader field of biomass energy, particularly as the world shifts toward more sustainable and renewable energy sources. Dry leaves, a byproduct of seasonal shedding from trees, are often discarded as waste or burned in open fields, contributing to pollution. However, recent studies have explored their potential as a bioenergy feedstock for electricity generation. This literature survey reviews the various technological approaches, environmental benefits, economic feasibility, and challenges involved in utilizing dry leaves for electricity production. Several researchers have focused on the chemical and physical properties of dry leaves, which make them a suitable source of biomass energy. As lignocellulosic biomass, dry leaves contain a high percentage of carbon, which is necessary for energy generation. The study emphasized the need to manage the variability in moisture and ash content to optimize energy recovery. Research highlights the environmental benefits of biowaste-to-energy systems, particularly their potential to reduce methane emissions from landfills and contribute to waste management. Economically, biowaste energy systems offer cost savings in waste disposal, though the initial investment in technology remains a challenge. Despite their promise, technological barriers, feedstock variability, and policy gaps limit large-scale adoption, calling for further development to enhance feasibility and efficiency. Dry leaves are often available in large quantities, especially in urban and forested areas. Collecting and utilizing them as a renewable energy source can reduce leaf litter, which is often disposed of through burning, causing pollution. Leaves contain significant energy stored as cellulose, hemicellulose, and lignin, making them suitable for bioenergy applications. Studies have explored their calorific value, showing potential for electricity generation. Direct combustion of dry leaves can produce heat,

which can then be converted into electricity through steam turbines. However, dry leaves have high ash content, which can complicate the combustion process and require ash management solutions. Conversion of dry leaves into syngas (a mix of carbon monoxide, hydrogen, and methane) via gasification is a well-researched approach. Gasification of dry leaves can be efficient, especially with technology advancements in biomass gasifiers that can handle high-ash feedstock. Pretreatment of dry leaves, such as shredding, drying, and thermal treatment, can improve their energy conversion efficiency, particularly in gasification and pyrolysis. Utilizing dry leaves for electricity reduces the environmental impact compared to open burning, a common disposal method that releases pollutants and greenhouse gases. Dry leaves are typically low-cost and readily available, though collection and storage present logistical challenges. It has explored ways to improve cost-efficiency, including community collection programs and local biomass hubs.

### III. ELECTRICITY GENERATION BY BIOWASTE MODEL DESIGN

To generate electricity from bio-waste using fire, a mousetrap, wires, an LED, and a rechargeable battery, we can design a simple setup that harnesses the heat from burning bio-waste to produce electricity. 1. Convert Heat to Electricity (Thermoelectric Generator) A TEG module can generate electricity when there is a temperature difference between its two sides (one hot and one cool). Place the bio-waste in a small fire-safe container and ignite the TEG module above the bio-waste fire so one side of the module is heated. To keep the other side cool, place a small heat sink or cool it with air or water. Connect the TEG module to wires to capture the generated electricity.



2. Storing Electricity Rechargeable Battery Connect the output of the TEG to a rechargeable battery to store any generated electricity. a voltage regulator or a small charging circuit to ensure that the voltage is compatible with the battery and doesn't exceed its capacity.



3. Mouse Trap as an Emergency Switch mousetrap as a mechanical trigger or emergency cut-off switch. If, for example, the temperature gets too high, the mousetrap could activate a lever to distance the TEG from the heat source, preventing overheating.4. Powering the LED The generated electricity from the TEG module can be directly used to light the LED (if the output voltage and current match the LED's requirements) or through the battery, if stored energy is desired. Wires are used to connect the battery or TEG output to the LED. Ensure fire containment and ventilation.



4. solar panel: The DC electricity produced by the solar panel is converted into alternating current (AC) electricity by an inverter, making it suitable for powering appliances or being fed into the electrical grid. Modern solar panels have efficiencies ranging from 15% to 22%, depending on the type of cells used (monocrystalline, polycrystalline, or thin-film).



#### IV. CONCLUSION

The generation of electricity from biowaste represents a sustainable and innovative approach to address the growing global demand for energy while simultaneously managing waste effectively. This method leverages organic waste materials as a renewable energy resource, reducing dependency on fossil fuels and minimizing environmental impacts such as greenhouse gas emissions. By integrating technologies like anaerobic digestion, gasification, and combustion, biowaste can be efficiently converted into electricity, offering a dual benefit of waste management and energy production.

Moreover, biowaste-to-energy systems promote circular economy principles, enabling the recovery of valuable byproducts such as biofertilizers and heat. Despite its promising potential, challenges such as high initial costs, technology scalability, and policy support need to be addressed to maximize its adoption and impact.

In conclusion, electricity generation from biowaste not only contributes to sustainable energy solutions but also aligns with global efforts toward cleaner and greener development. Continued research, technological innovation, and supportive policies will be essential to fully harness its potential and integrate it as a vital component of the renewable energy landscape.

#### V. ACKNOWLEDGEMENT

This project and research are funded by Sree Sakthi Engineering College, Karamadai under the Engineers Day project of Electronics and Communication Engineering (ECE),

REFERENCE

- [1] M. Rios et al.” Electricity generation potential from biogas produced from organic waste in Mexico” *Renew. Sust. Energ. Rev.* (2016)
- [2] T.R. Ayodele et al “Economic and environmental assessment of electricity generation using biogas from organic fraction of municipal solid waste for the City of Ibadan, Nigeria” *J. Clean. Prod.* (2018)
- [3] A. Kumar et al. “ A review on technological options of waste to energy for effective management of municipal solid waste” *Waste Manag.*(2017)
- [4] A. Tozlu et al. “Waste to energy technologies for municipal solid waste management in Gaziantep” *Renew. Sust. Energ. Rev.* (2016)