

ELECTRICITY GENERATED BY WASTE MATERIALS



**DIRECTORATE OF
PROJECTS AND
RESEARCH**

**QIS COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)**

**(Approved by AICTE and Permanent Affiliation to JNTUK)
(NAAC 'A+' Grade & Thrice Accredited by NBA, New Delhi)
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(An ISO 9001:2015 Certified Institution)

VENGAMUKKAPALEM, ONGOLE-523272, A.P., INDIA



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the Community Resource Project entitled “**ELECTRICITY GENERATED BY WASTE MATERIALS**” is a record of the bonafied work done by **PATHAKOTA YAMINI (21495A0212)**, **KANDRA MANEESHA (20491A0240)**, **AKULA NAGANJANEYULU (20491A0250)**, **MALASANI VENKATA SAI NANDINI (20491A0251)**, **TUPAKULA RAMA CHANDRA REDDY (21495A0203)**, submitted in partial fulfillment of the requirement for the award of degree of Bachelor of Technology in **ELECTRICAL AND ELECTRONICS ENGINEERING** for the academic year **2023-2024**. This work is carried out under my supervision and guidance.

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ABSTRACT

Electricity generation by burning waste materials, also known as thermal waste-to-energy, is a process that involves converting waste materials into electricity by burning them in a combustion chamber. This process is a sustainable solution for waste management as it reduces the volume of waste sent to landfills while producing renewable energy. The methodology for electricity generation by burning waste materials typically involves waste collection, handling, and preparation, incineration, energy recovery, and ash management.

The generated electricity can be used to power local communities or industries or fed back into the national grid.

The process of electricity generation by burning waste materials provides a reliable source of electricity while reducing greenhouse gas emissions by avoiding the release of methane gas from landfills.

The world faces a growing challenge in managing waste materials, with traditional disposal methods causing environmental harm and resource depletion. This abstract outlines an innovative and sustainable approach to address this issue by harnessing waste materials for electricity generation. This method, known as Waste-to-Electricity (WTE), involves the conversion of various types of waste into electrical energy through advanced technologies such as incineration, anaerobic digestion, and thermal depolymerization.

The process begins by collecting and segregating waste streams, including municipal solid waste (MSW), agricultural residues, industrial byproducts, and sewage sludge. These diverse waste materials are then subjected to different Waste to Energy techniques depending on their composition and energy content. Incineration involves the combustion of waste at high temperatures, generating heat that can be converted into electricity through steam turbines or combined heat and power (CHP) systems. Anaerobic digestion utilizes microorganisms to break down organic waste, producing biogas, which can be burned for electricity generation or refined into biomethane for use in power plants or as a transportation fuel.

Thermal depolymerization transforms plastics and organic waste into synthetic oil, which can be further processed to generate electricity. The adoption of waste-to-energy technologies not only reduces the volume of waste sent to landfills, mitigating environmental pollution, but also offers a sustainable source of electricity. Additionally, Waste to Energy systems often incorporate emissions control measures to minimize environmental impacts, making them a greener alternative to fossil fuels.

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1. Motivation towards Problem Statement:-

There are several motivations for generating electricity from waste materials:

Environmental Benefits: It helps reduce the volume of waste in landfills, minimizing pollution and greenhouse gas emissions. This contributes to a cleaner environment and mitigates climate change.

Energy Recovery: Converting waste into electricity harnesses the energy potential in the waste, making productive use of materials that would otherwise go to waste.

Renewable Energy Source: Some waste-to-energy processes can be considered renewable energy sources, as waste is a continuously available resource.

Energy Independence: Waste-to-energy facilities can help reduce reliance on finite fossil fuels and provide a more localized energy source.

Economic Value: Generating electricity from waste can create jobs and stimulate economic growth, while also reducing waste management costs.

Resource Conservation: It conserves natural resources by utilizing waste materials instead of virgin resources for energy production.

Reduces Pollution: Proper waste-to-energy technologies can reduce air and water pollution compared to traditional waste disposal methods.

Energy Security: By diversifying energy sources, waste-to-energy contributes to energy security and resilience.

Waste Management Solution: It provides a sustainable alternative to land filling, which can be limited and environmentally harmful.

Encourages Recycling: When integrated with recycling programs, waste-to-energy can promote recycling by reducing the amount of waste sent to landfills.

These motivations highlight the environmental, economic, and energy-related advantages of generating electricity from waste materials.

2. Problem statement :–

Problem statements for generating electricity from waste materials can include:

Inefficient Conversion: The inefficient conversion of waste into electricity poses a challenge, with current technologies often yielding low energy outputs for the amount of waste input.

Environmental Impact: Inadequate waste-to-energy processes can result in harmful emissions and toxic by-products, impacting the environment negatively.

Resource Variability: The inconsistency in waste composition and availability makes it difficult to ensure a reliable and steady energy supply.

Technology Advancement: Developing cost-effective and efficient technologies for waste-to-energy conversion remains a challenge, particularly for smaller-scale applications.

Regulatory Hurdles: Complex regulations and permitting requirements can hinder the development of waste-to-energy projects, creating barriers for implementation.

Public Perception: Addressing public concerns and misconceptions about the safety and environmental impacts of waste-to-energy solutions is essential.

Economic Viability: Achieving a balance between the costs of waste collection, processing, and energy generation can be challenging, affecting the economic viability of such projects.

Infrastructure and Integration: Integrating waste-to-energy systems into existing energy grids and infrastructure can be complex, requiring extensive planning and investment.

Waste Management Practices: The efficiency of waste sorting and collection systems can affect the quality and quantity of waste available for energy generation.

Long-Term Sustainability: Ensuring the long-term sustainability of waste-to-energy solutions while considering future waste reduction efforts and changing waste composition is a pressing concern.

Addressing these problems is crucial for the successful implementation of waste-to-energy projects and the realization of their environmental and economic benefits.

3. Domain – Application & Software Development:-

➤ OTHERS

4. Proposed Solution :-

Generating electricity from waste materials is an innovative and sustainable approach to address both energy needs and waste management. Here's a proposed solution:

Waste-to-Energy (WTE) Facilities: Establish Waste-to-Energy plants that can burn or gasify various waste materials like municipal solid waste (MSW), agricultural residues, and industrial waste to generate electricity. These facilities can use incineration, gasification, or pyrolysis processes.

SDE Biogas Production: Utilize organic waste, such as food scraps and sewage, to produce biogas through anaerobic digestion. This biogas can be burned to generate electricity. **Landfill Gas Recovery:** Capture methane gas produced in landfills as organic waste decomposes and convert it into electricity using gas engines or turbines.

Thermal Depolymerization: Implement thermal depolymerization processes to convert plastic waste into crude oil, which can then be used to generate electricity.

Pyrolysis of Biomass: Use fast pyrolysis technology to convert biomass waste into biochar, biooil, and syngas. The bio-oil and syngas can be burned to generate power.

Advanced Plasma Gasification: Explore advanced technologies like plasma gasification to convert various waste materials into syngas, which can be used in gas turbines to produce electricity.

Co-generation (Combined Heat and Power): Implement combined heat and power systems to maximize energy efficiency by simultaneously producing electricity and useful heat for district heating or industrial processes.

Energy Recovery from Industrial Waste: In industries, recover and utilize the waste heat generated during processes to produce electricity through systems like Organic Rankine Cycle (ORC) or steam turbines.

Solar and Wind Integration: Combine waste-to-energy solutions with renewable energy sources like solar panels and wind turbines to ensure a consistent power supply.

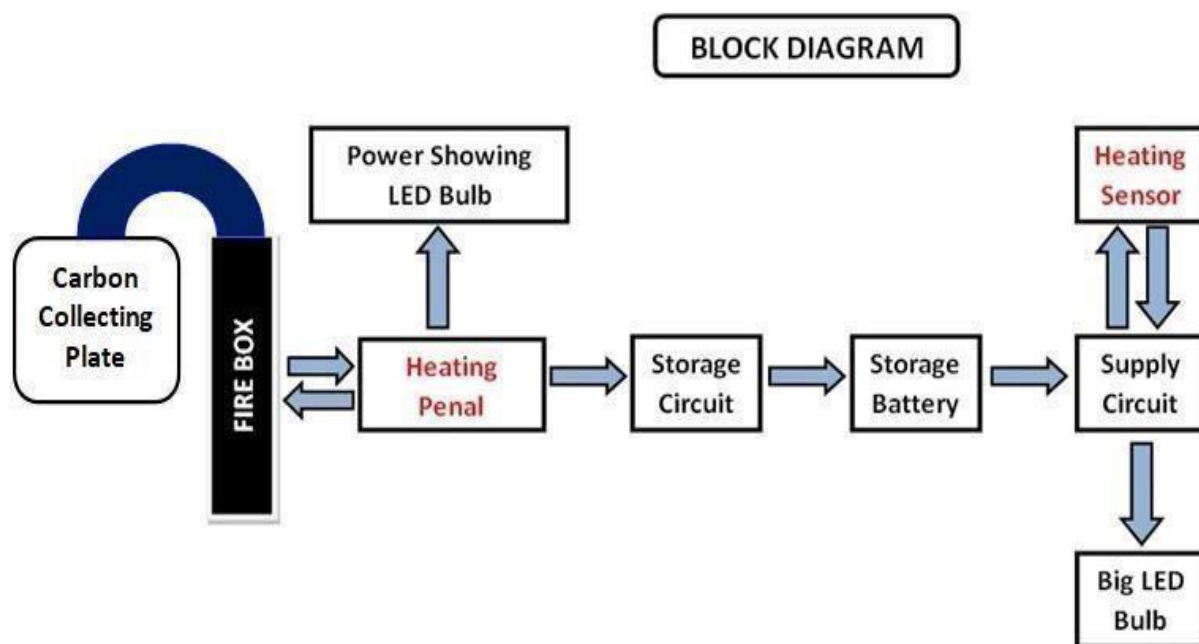
Efficient Grid Integration: Ensure efficient grid integration and smart grid technologies to distribute electricity generated from waste materials to the local power grid.

Environmental Safeguards: Implement strict emission control technologies to minimize the environmental impact of waste-to-energy processes.

Community Engagement and Education: Engage with communities to raise awareness about waste reduction and energy generation from waste, promoting a circular economy.

It's important to consider the specific waste streams, local regulations, and available technologies when implementing a waste-to-energy solution. Additionally, conducting feasibility studies and environmental impact assessments is crucial to ensure the sustainability of such projects.

4. Block Diagram/flow chart :



5. Detailed explanation of the proposed work :-

1) Collection of Waste Materials: -

The process begins with the collection of waste materials. This can include household waste, industrial waste, agricultural residues, and other organic and non-organic materials. It's essential to sort and categorize the waste to remove any hazardous or non-combustible components.

2) Pre-processing and Sorting: -

Before waste can be used to generate electricity, it needs to be pre-processed and sorted. This involves removing contaminants, recyclables (plastic, glass, metals), and non-combustible materials to ensure that the fuel for energy generation is clean and safe.

3) Combustion or Gasification: -

There are two primary methods for converting waste materials into electricity: combustion and gasification.

○ Combustion: -

In this process, the waste materials are burned directly to produce heat. This heat is then used to generate steam, which drives a turbine connected to a generator, producing electricity.

○ Gasification: -

Gasification is a more advanced technique. It involves heating the waste materials in a low oxygen environment to produce a synthetic gas (syngas) composed of hydrogen, carbon monoxide, and methane. This syngas is then used to generate electricity.

4) Energy Recovery: -

The heat generated through combustion or the syngas produced in gasification is used to drive a generator, converting mechanical energy into electrical energy. This electricity can be fed into the grid or used locally.

5) Environmental Controls: -

To ensure that the process is environmentally friendly, various pollution control technologies are employed. These include scrubbers to remove pollutants, filters to capture particulate matter, and continuous monitoring to comply with emissions standards.

6) Waste Heat Recovery: -

The waste heat generated during the process can also be recovered and used for district heating or other industrial processes, increasing the overall efficiency of the system.

7) Residue Management: -

After energy recovery, there may be some solid residues left, typically ash. Proper disposal and management of these residues are crucial to avoid environmental impacts.

8) Environmental Benefits: -

Generating electricity from waste materials has several environmental benefits. It reduces the volume of waste in landfills, lowers greenhouse gas emissions by capturing methane from decomposing waste, and reduces the need for fossil fuel-based power generation.

9) Economic Viability: -

Waste-to-Energy facilities can be economically viable by generating revenue from electricity sales, reducing landfill costs, and potentially earning carbon credits for reducing greenhouse gas emissions.

10) Local Energy Production: -

Waste-to-energy facilities can be located near urban centres, reducing the need for longdistance transportation of waste and minimizing the environmental footprint.

11) Public Acceptance: -

Public awareness and acceptance of waste-to-energy technologies are essential. Proper communication and transparency about the safety and environmental benefits of the technology are key to its success.

12) Regulatory Compliance: -

It's crucial for waste-to-energy facilities to comply with local, state, and federal regulations regarding emissions, safety, and environmental impact.

Overall, generating electricity from waste materials is a sustainable and environmentally responsible way to both manage waste and produce clean energy. It contributes to a circular economy by turning waste into a valuable resource while reducing the environmental impact of waste disposal.

7. Components used and budget :-

S.No	Component/Software Used	Specification	Cost/Hosting Cost in case of web based application (Rs.)*
1.	Solar	70*70	150/-
		80*40	69/-
2	Inverter Circuit	DC TO AC Converter 220 volts,50 watts	500/-
3	Battery	12 volts,3 amps	600/-
4	Zar Box	-	85/-
5	LED	-	2/-
6	Connecting Wires	-	NA
TOTAL			1406/-

6. Photograph of the prototype/webpage/Application:



7. Conclusion and Future Scope of the Proposed Work:

Conclusion:

In conclusion, generating electricity from waste materials offers a promising solution to both environmental and energy challenges. By harnessing the potential of waste, we can reduce landfill waste, mitigate greenhouse gas emissions, and contribute to a more sustainable and renewable energy future. However, the success of such initiatives depends on technological advancements, efficient waste management systems, and continued research and innovation in this field. It is essential to explore and invest in waste-to-energy technologies to maximize their benefits and minimize their environmental impact.

Future Scope:

The prospects for electricity generated by waste materials, often referred to as "waste to energy," is promising. Here are some key points:

Sustainable Energy Source: Waste materials such as municipal solid waste, agricultural residues, and industrial byproducts can be converted into electricity, reducing reliance on fossil fuels and promoting sustainability.

Environmental Benefits: Waste-to-energy technologies can help mitigate the environmental impact of waste disposal by reducing landfill use and decreasing methane emissions from decomposing organic waste.

Technological Advancements: Ongoing research and development are improving the efficiency and cost-effectiveness of waste-to-energy processes, making them more competitive with traditional energy sources.

Energy Security: Waste-to-energy contributes to energy diversification and can help regions reduce their dependence on imported energy sources.

Circular Economy: Integrating waste-to-energy into a circular economy model supports the efficient use of resources, as waste materials are repurposed to generate electricity.

Policy Support: Many governments are implementing policies and incentives to promote wastetoenergy projects, which can create opportunities for investment and growth in this sector.

Local Solutions: Waste-to-energy facilities can be established at a local level, addressing both waste management and energy generation needs in communities.

10. Team member's group photo with prototype:-