ELECTRICITY GENERATION AND CARBON EMISSION CONTROL FROM NON-BIODEGRADABLE WASTE MATERIALS



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PRESENTATION OUTLINE

- Introduction
- Motivation
- Objectives
- Methodology
- Project Description
- Hardware Implementation
- Results & Discussion
- Applications, Future scopes & modifications
- Conclusion

INTRODUCTION

- This thesis and project delve into the intersection of waste management and energy production, highlighting the potential of converting non-biodegradable waste into electricity while reducing carbon emissions. It emphasizes environmental stewardship, technological innovation, and economic viability. By repurposing waste as a resource and utilizing advanced waste-to-energy technologies, the aim is to address waste management challenges and combat climate change. The introduction serves as a call to action, inviting collaboration in exploring waste-to-energy conversion dynamics and charting a path towards a sustainable future where waste becomes a valuable resource for powering the world responsibly.

MOTIVATION

- **Sustainable Power Generation:** We have been inspired to undertake this project by the utilization of non-biodegradable waste for electricity production, promoting sustainable power and reducing dependency on fossil fuel combustion for energy needs.
- **Environmental Conservation:** Facing the Challenge of the environment by means of waste disposal from landfill and incineration, we are inspired to embark on this project to mitigate pollution, create a cleaner ecosystem, and combat environmental degradation.
- **Carbon Emission Reduction:** Capturing methane emissions and reducing fossil fuel consumption actively reduces greenhouse gas emissions and contribute to combating climate change and which has been inspired us to do this project.
- **Resource Conservation:** From waste-to-energy production, waste reduction and maximizing its value, contributes to economic sustainability through resource conservation. For this reason we are inspired to undertake this project.
- **Innovation and Technological Advancement:** Utilizing advanced technologies to optimize waste-to-energy processes, enhancing efficiency, accuracy, and environmental performance, we are greatly inspired to undertake this project.
- **Social Impact:** By establishing local benefits such as energy provision from waste, job creation, and economic development which create socio-economic opportunities within the community. This project inspires us.

OBJECTIVES

- To investigate the feasibility and effectiveness of waste-to-energy technologies in converting non-biodegradable waste materials into electricity.
- To assess the impact of waste-to-energy conversion on mitigating carbon emissions and contributing to sustainable environmental practices.
- To study about the possibility to recover energy from solid waste.
- To recycle plastic and generate electricity using it.
- To meet up the power supply for city dwellers and reducing space for new landfills.

METHODOLOGY

- Waste Material Analysis
- Pyrolysis/Gasification Experimentation
- Combustion System Development
- Electrical System Setup
- Mechanical System Integration
- Carbon Emission Control Integration
- Performance Evaluation
- Environmental Impact Assessment
- Economic Feasibility Analysis
- Documentation and Reporting

Required Components

- Capacitor
- Resistor
- Battery
- Light-Emitting Diode (LED)
- LED Bulbs
- Solar Heating Penal
- Peltier Device (Heating)
- Carbon Filter
- Exhaust Fan
- Heating Sensor (Starter)

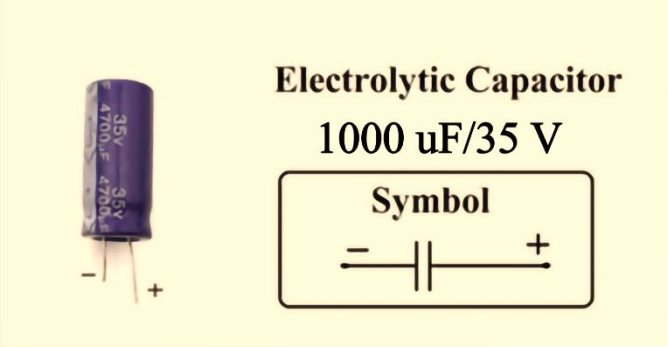


Fig: (1) Capacitor



Fig: (2) Resistor



Fig:3 Rechargeable Lithium- Ion battery

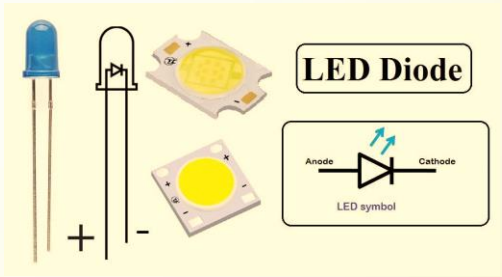


Fig: 4 Light-Emitting Diode

5v Heating Penal

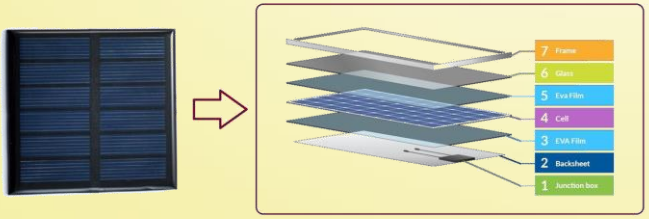


Fig:5 Heating Solar Panel



Fig: 6 LED Bulb



Fig: 7 Peltier Device (Heating)

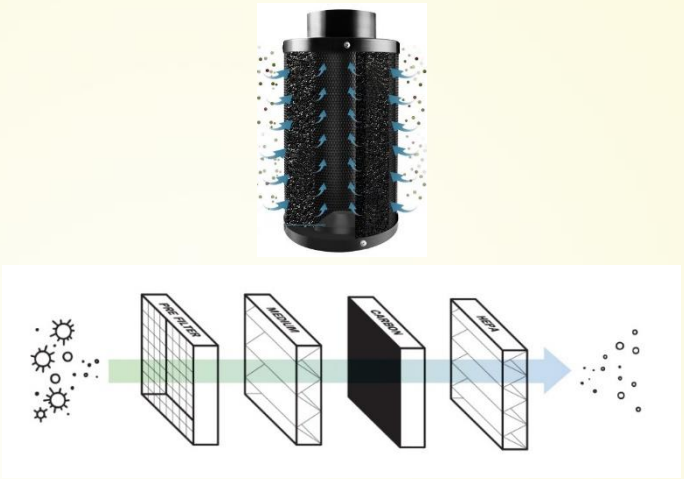


Fig: 8 Carbon Filter

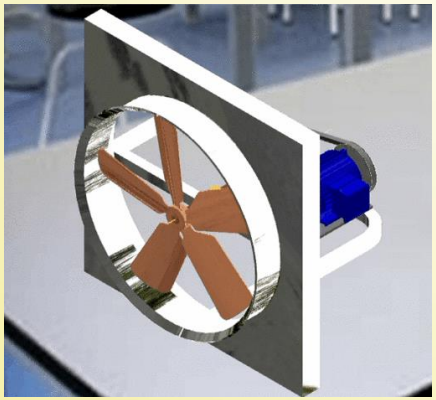


Fig: 9 Exhaust Fan

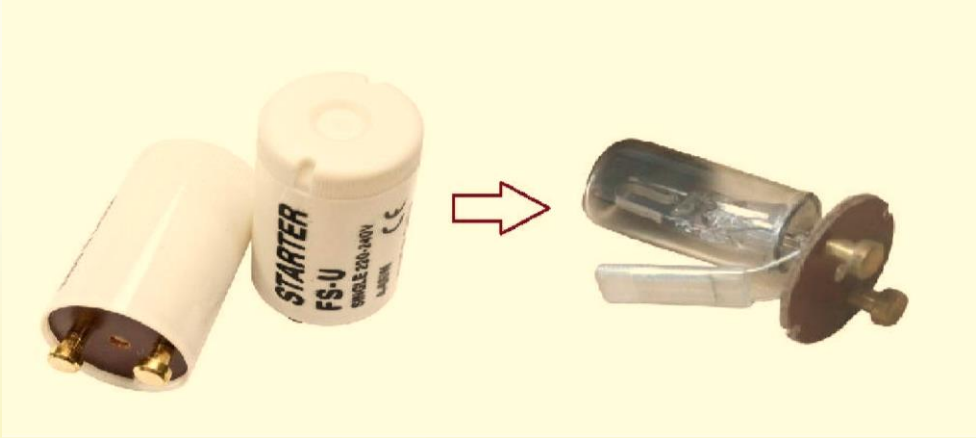


Fig: 10 Heating Sensor (Starter)n

Project Description

When we start burning the waste material in the burning box the heating panels will start collecting the heat energy generated in the burning box by waste material.

The heat energy collected by heating panel will be converted into the electrical energy.

The generated electrical energy will be seen in circuit box with led glowing. 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 it.

The batteries relate to the heat sensor and LED bulbs. Whenever the heat sensor will start conducting the batteries allow energy to flow will start conducting and LED bulbs will glow.

Block Diagram of the project

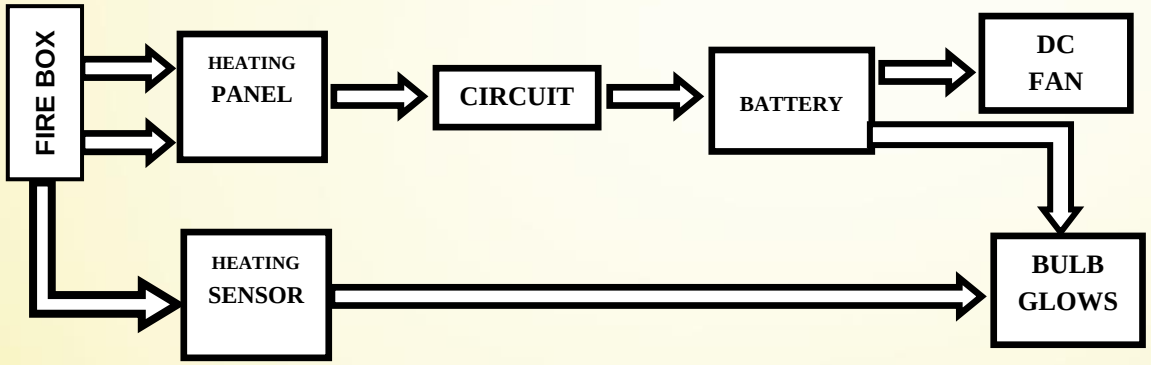


Figure:11 Block Diagram of the project

Circuit Diagram

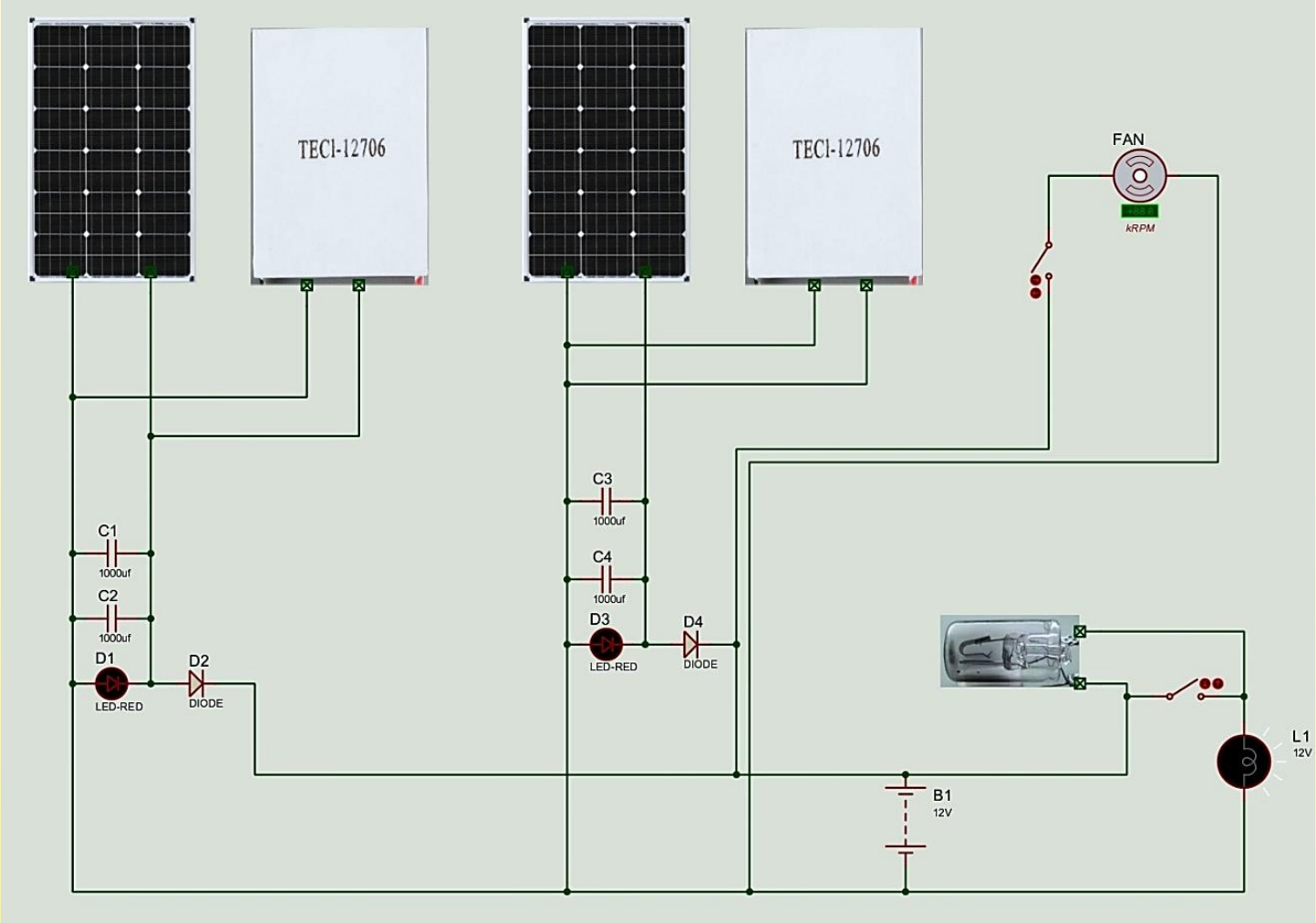


Figure:12 Circuit diagram of the Project

Schematic Views of the Project

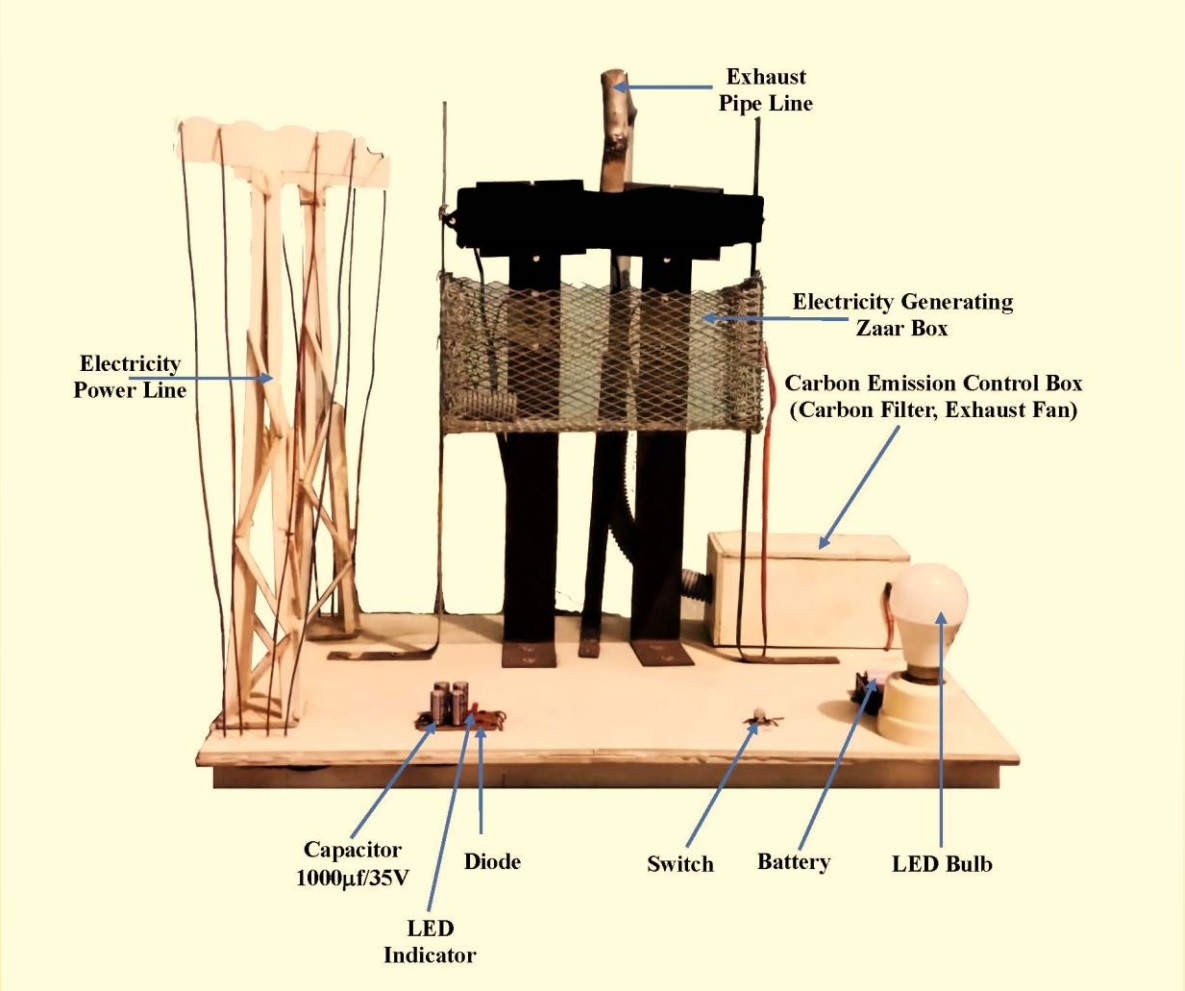


Figure: 13 Front View of the Project



Figure: (b) Top View of The Project



Figure: (c) Side View of The Project

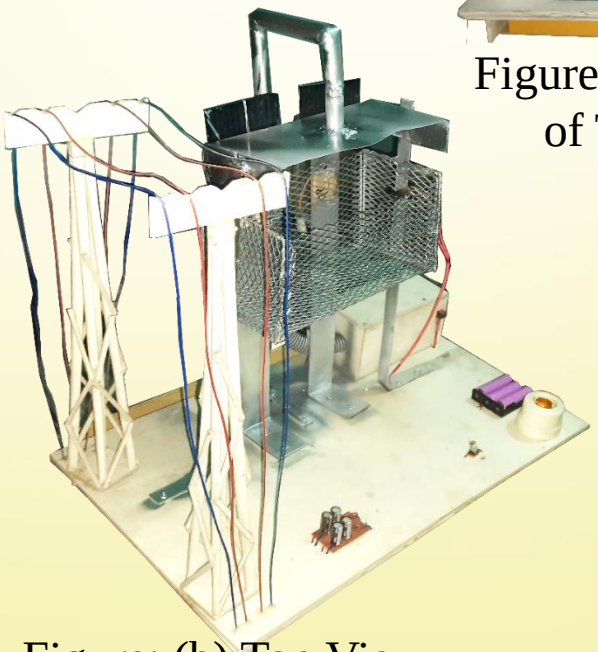


Figure: (b) Top View of The Project

RESULTS

Table: 1 Electricity Generation Data Sheet for Plastic

Observation No	Mass (Kg)	Voltage Rating (V)	Current Rating (I)	Energy Content (H.V) MJ/Kg	Electrical Energy P_{in} (MJ)	Electrical Energy P_{out} (Wh)
1	3.13	12	2.4	43.28	135.46	28.8
2	3	11.3	2	43.28	129.84	22.6
3	2.8	10.5	1.9	43.28	121.18	19.95

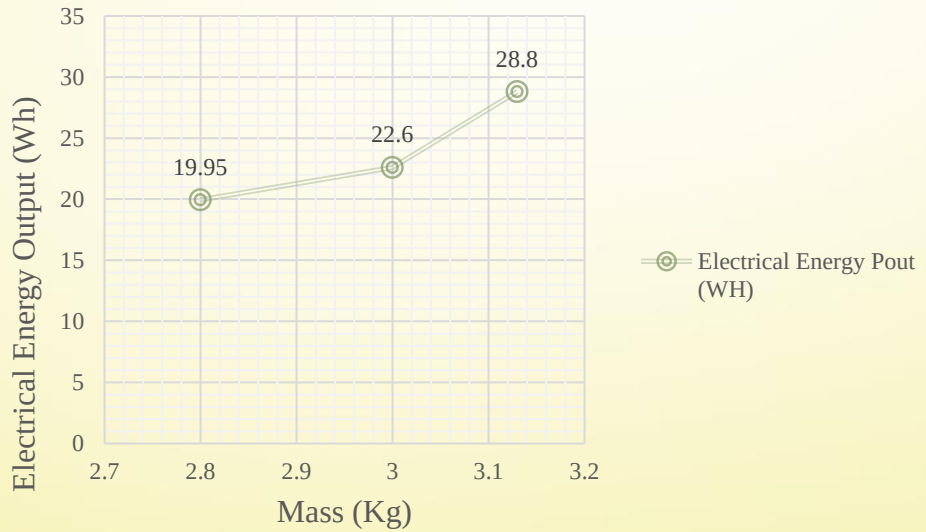


Fig:14 (a) Electricity Generation for Plastics

Table 2 : Electricity Generation Efficiency (%) η For Plastic

Electrical Energy P_{in} (MJ)	Electrical Energy P_{out} (Wh)	Efficiency η (%)
135.46	28.8	0.08
129.84	22.6	0.06
121.18	19.95	0.05

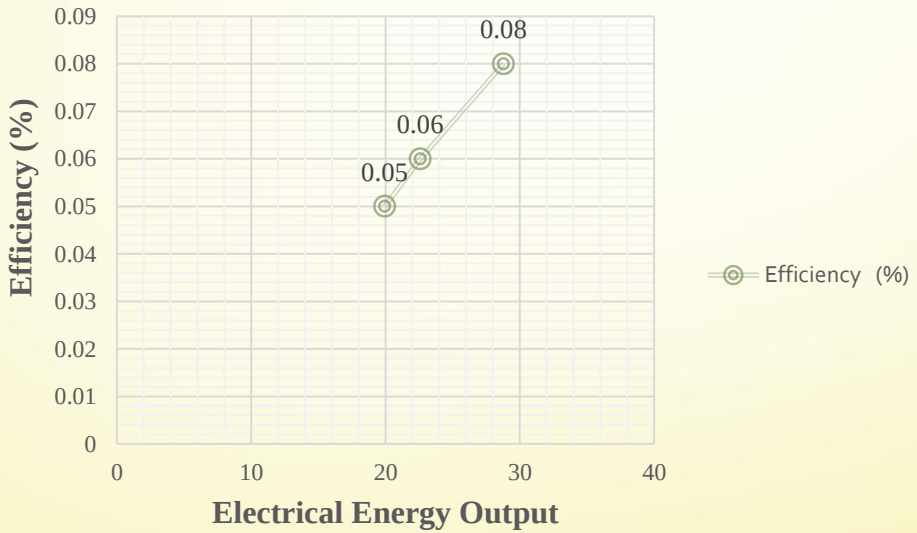


Figure : 14 (b) Electricity Generation Efficiency for Plastic

Table 3: Electricity Generation Data Sheet for Rubber

Observation No	Mass (Kg)	Voltage Rating (V)	Current Rating (I)	Energy Content (H.V) MJ/Kg	Electrical Energy P_{in} (MJ)	Electrical Energy P_{out} (Wh)
1	4.63	12	2.4	37	171.31	28.8
2	4.3	11.3	2	37	159.1	22.6
3	3.9	10.5	1.9	37	103.6	19.95

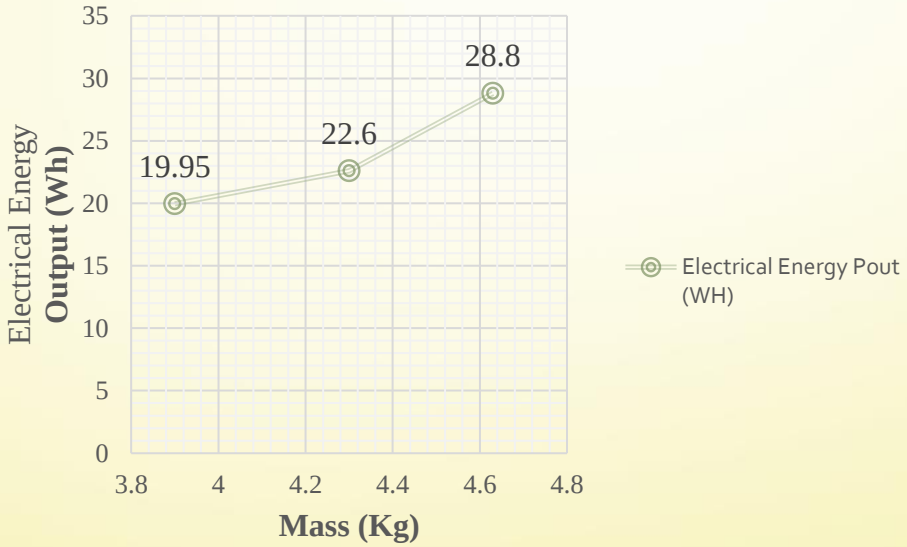


Figure : 15 (a) Electricity Generation for Rubber

Table 4 : Electricity Generation Efficiency (%) η For Rubber

Electrical Energy P_{in} (MJ)	Electrical Energy P_{out} (Wh)	Efficiency η (%)
171.31	28.8	0.06
159.1	22.6	0.05
103.6	19.95	0.04

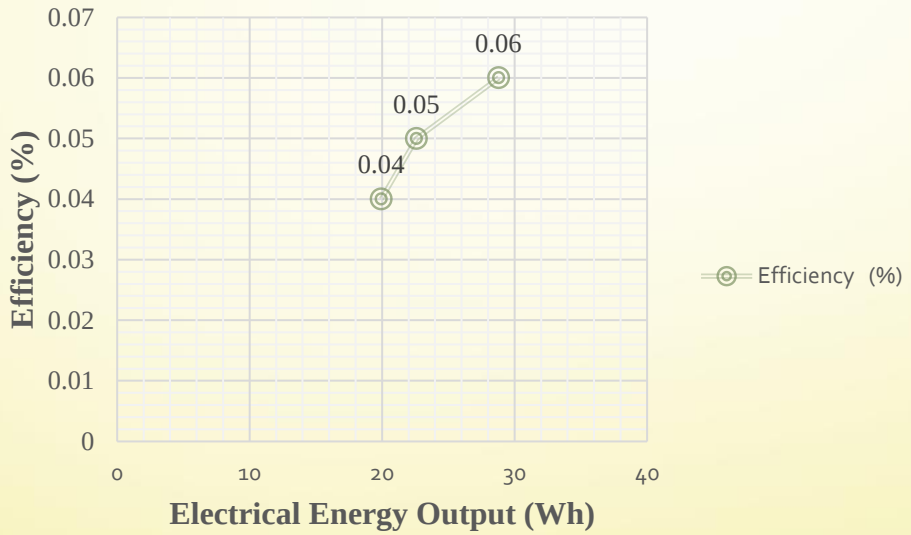


Figure: 15 (d) Electricity Generation Efficiency for Rubber

APPLICATIONS

Applications:

- Addressing Power Shortages
- Renewable Energy Source
- Environmental Benefits
- Resource Recovery
- Local Economic Development
- Government Policy Support
- Public Health Improvement
- Technological Advancement

FUTURE SCOPE & MODIFICATION

- **Advanced Waste-to-Energy Technologies:** Explore plasma gasification, microwave pyrolysis, and integrated biorefineries for more efficient and sustainable waste-to-energy processes.
- **Carbon Capture and Utilization (CCU):** Investigate methods to convert carbon emissions into valuable products like fuels and chemicals.
- **Integration with Renewable Energy Sources:** Assess combining waste-to-energy systems with solar and wind power to create hybrid energy systems.
- Smart Waste Management Systems: Develop IoT-driven systems for optimized waste handling and processing.
- **Policy and Regulatory Initiatives:** Advocate for supportive policies and incentives to promote the adoption of waste-to-energy technologies.
- **Community Engagement and Education:** Conduct outreach to raise awareness about the benefits of waste-to-energy solutions and foster public participation.
- **Interdisciplinary Collaboration:** Foster collaboration among diverse fields to drive innovation in waste management and energy generation.

Modification Pathways:

- Continuously monitor and evaluate existing systems for improvement.
- Incorporate stakeholder feedback to refine system design and operations.
- Stay updated on technological advancements and regulatory changes.

Foster a culture of innovation and collaboration within research teams.

Conclusion

- This project successfully demonstrates electricity generation from waste materials and pollution control using filtration systems. Through testing, the project exhibits reliable performance without issues, making it an excellent showcase of waste-to-energy technology. The interdisciplinary approach highlights collaboration between engineering, environmental science, and policy, emphasizing the importance of sustainability in energy production. While this chapter concludes, the journey towards a greener future continues, with challenges and opportunities awaiting further exploration and innovation.

When Bangladesh wants to become a prosperous and developed country within 2041, with the aim of implementing the government's commitment to bring the country under 100% electricity and the implementation of digital Bangladesh construction, the importance of contributing to the success of this project of generating electricity from waste materials is immense.

THANK YOU