



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Harnessing Waste Powering Future

Finalist's Name: Jainil Parikh

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Sponsor's Name: Shweta Upadhyay

Category: Environmental Engineering

Division: Junior (grades 6 - 8)

Abstract (250 words or less):

Harnessing Waste: Powering the Future

Abstract

The Harnessing Waste: Powering the Future project explores the potential of converting waste materials into a viable energy source. While recognizing the environmental concerns associated with traditional waste-to-energy methods like incineration, this study aims to identify sustainable alternatives that address both energy generation and waste management challenges. The primary objective is to assess the feasibility of waste-to-energy technologies in contributing to a more sustainable and environmentally responsible future.

Procedure

The initial prototype utilized a controlled combustion system to generate heat, which was then converted into electricity via a thermoelectric generator. Key components included a combustion chamber, heat exchanger, thermoelectric generator, and a data acquisition system to monitor temperature and power output.

Data Visualization: Voltage Generation from Waste Materials

A comparative analysis was conducted to evaluate the energy potential of different waste materials, including plastic, wood, and paper.

- Wood generated the highest voltage due to its high energy density.
- Plastic produced a moderate energy output.
- Paper yielded the lowest voltage generation.

These findings provide insights into material selection for optimizing future waste-to-energy systems.

Conclusion

Preliminary testing confirmed that controlled waste combustion could generate sufficient heat for energy conversion. However, efficiency remained low due to combustion challenges and greenhouse gas emissions. While the prototype successfully demonstrated the feasibility of waste-to-energy conversion, further research is needed to enhance efficiency, explore alternative combustion methods, and implement sustainable air quality control and ash disposal strategies. Future optimizations should focus on anaerobic digestion, pyrolysis, and biofuel production, as these methods maximize energy recovery while minimizing environmental impact. This project serves as a steppingstone toward a sustainable energy future, where waste is transformed from a liability into a valuable resource.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**