SUSTAINABLE CAPSTONE PROJECTS (SCAP)
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CYPRUS INTERNATIONAL UNIVERSITY

DESIGN AND DEVELOPMENT OF A MICRO POWER PLANT FOR SUSTAINABLE ENERGY

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INTRODUCTION

The solar micro power plant project is all about bringing clean, renewable energy to the masses. Motivated by the need for sustainable and decentralized power, the project aims to provide reliable electricity, especially in remote areas. The benefits include reduced reliance on fossil fuels, lower emissions, and improved access to power for off-grid communities.

Objectives:

- Develop a sustainable solar energy system.
- Ensure accessibility in remote or unreliable power areas.
- Create a scalable solution for individual and community needs.
- Keep it affordable for widespread adoption.
- Minimize environmental impact with clean energy practices.

To sum it up, it's a small-scale solution with big-scale benefits for a cleaner and more accessible energy future!

MATERIALS USED IN CONSTRUCTION

Re-Used/Recycled Materials:

- **Mirrors;**
- **Pipes;**
- **Sheet Metal;**
- **Pressure Gauge;**
- **Safety Valve Pressure;**
- **Non Return Valve;**

Other Materials:

- **Turbine;**
- **Pump;**
- **Glue;**
- **Bearings;**

FINAL PRODUCT

In our project exploring solar power plant, a key focus was on testing the focal point of a our parabolic design. To achieve this, we collaborated with a nearby company to precisely cut mirror into long pieces, deviating from the traditional curved mirror approach. These cut mirror pieces were strategically arranged on a support structure crafted with precision by our CNC cutting machine.

The CNC cutting machine played a vital role in shaping the support structure, ensuring accuracy in dimensions and angles for the optimal arrangement of the mirror pieces to capture sunlight effectively.

We integrated a rotating mechanism, allowing the entire parabola to follow the sun's movement throughout the day. Additionally, we incorporated a movable feature, enabling the parabola to adjust its angle up and down based on the sun's position in the sky.

But how it works?

Well, A liquid circulates through the pipe, monitored by a pressure gauge and safety valve pressure, the parabolic reflector follows the sun, concentrating sunlight onto a pipe, sunlight heats the liquid, turning it into steam, the steam powers a turbine, generating electricity, after the turbine, the steam is condensed back into a liquid, the condensed liquid is returned to a storage tank, a pump recirculates the liquid through the system, restarting the cycle.

This closed-loop process continuously harnesses solar energy, converting it into electricity in an efficient and sustainable manner.

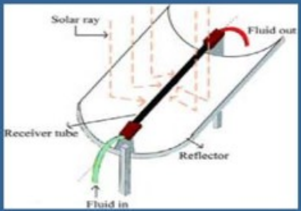

Figure 1. Parabolic Through Collector.

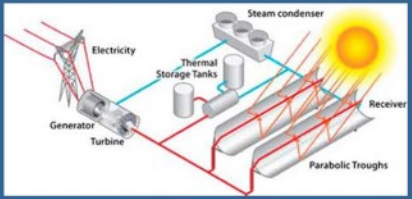

Figure 2. Solar Power Plant.

RESULTS AND DISCUSSION

In our prototype construction, we faced challenges in achieving the precise focal points, mainly due to issues with mirror cutting precision and limited resources. Mirroring the curved support structure proved tricky, causing deviations from our intended parabolic shape. Time constraints and material availability added complexity, preventing us from conducting thorough measurements and refinements.

These challenges highlight the importance of addressing limitations and refining our approach in future iterations. By recognizing these hurdles, we pave the way for a more thoughtful and phased strategy, exploring potential solutions, optimizing resources, and considering partnerships for enhanced mirror cutting precision.

Moving forward, documenting these challenges becomes a key aspect of our learning process. This documentation serves as a valuable resource, guiding us in future iterations and providing a foundation for collaboration. Despite these obstacles, our commitment to continuous improvement remains strong, and these challenges will undoubtedly contribute to the evolution and success of our micro solar power plant project.

CONCLUSIONS

The micro solar power plant project, featuring a parabolic trough collector and reflective mirror components, demonstrates a promising approach to solar energy. The project, despite challenges, stands as a commendable endeavor in advancing clean energy solutions.

The SCAP project has been instrumental in highlighting the potential of recycled materials to achieve impressive results. Through innovative approaches and resourcefulness, the project has demonstrated that recycled materials can be effectively utilized to create impactful solutions. This understanding not only contributes to sustainable practices but also opens doors to cost-effective and environmentally friendly avenues for achieving success in various projects.

REFERENCES

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