Group No. 56 – The Earth Saver
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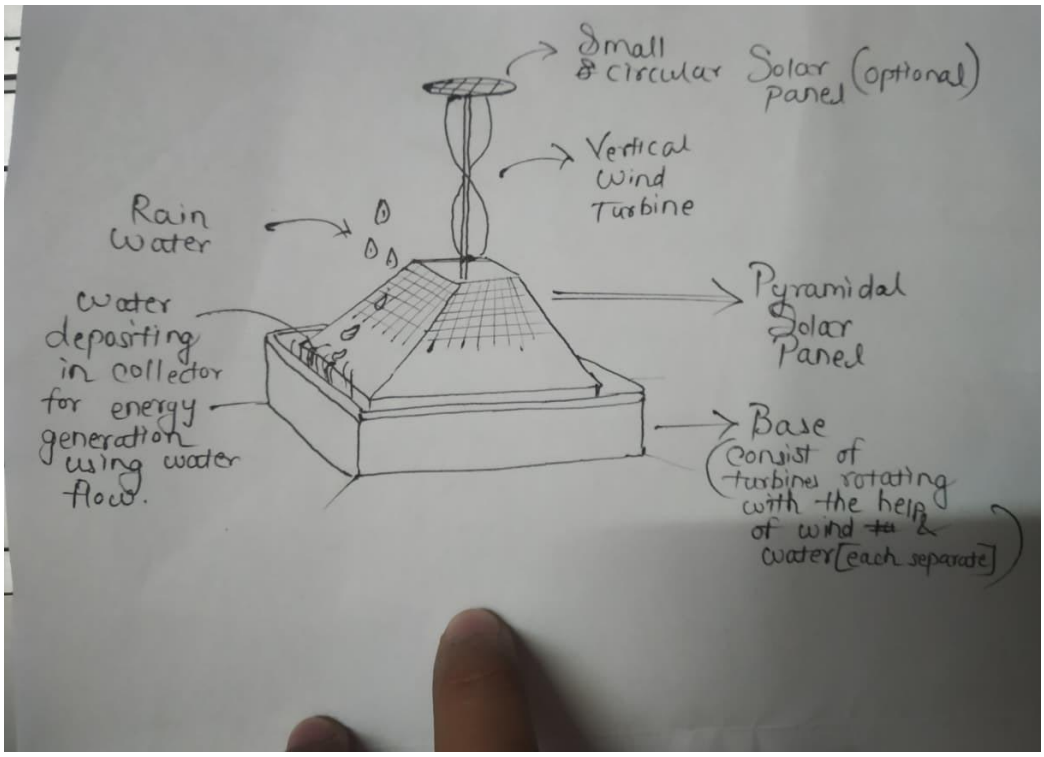
Project Title:
"Design of an Integrated Pyramid-Based Hybrid Renewable Energy System Using Solar, Wind, and Rainwater Harvesting"



1️⃣ Idea / Innovation

To design a **compact hybrid renewable energy system** that ensures **continuous energy availability in all weather conditions** by integrating:

- A **triangular pyramid solar panel** (primary source),
- A **vertical-axis wind turbine** mounted above it,
- A **rainwater collection and micro-energy generation system** at the base.

This system aims to reduce dependency on a single renewable source and improve reliability during **monsoon, winter, and cloudy conditions**.

2️⃣ Introduction

Conventional flat solar panels suffer from reduced performance during cloudy, rainy, and low-sun-angle conditions. Wind and rain energy are usually ignored at small scales due to low individual output. This project integrates **solar, wind, and rainwater energy harvesting** into a single structure, where solar remains the dominant source and wind and rain act as **auxiliary contributors** to enhance overall energy availability.

3️⃣ System Architecture (What is installed where)

🔺 Pyramid Solar Panel (Primary)

- 3 inclined solar panel faces
- Oriented in different directions
- Captures sunlight throughout the day without tracking

🌬️ Vertical Axis Wind Turbine (Top-mounted)

- Installed above the pyramid apex
- Operates with wind from any direction
- Generates power during windy, cloudy, or night conditions

🌧️ Rainwater Energy System (Base)

- Sloped pyramid panels guide rainwater downward
- Water collected via gutters
- Passed through a **micro DC turbine**
- Water stored or reused after energy extraction

4️⃣ Methodology (Step-by-step)

1. Design and fabricate a triangular pyramid mounting structure.
2. Install solar panels on each inclined face.
3. Mount a vertical-axis wind turbine on a support mast above the pyramid.
4. Add rainwater channels at the base leading to a micro-turbine.

5. Connect all energy sources to a **hybrid charge controller**.
6. Store generated energy in a battery and supply to loads.
7. Measure and compare energy output under different weather conditions.

5️⃣ Working Principle (Simple Explanation)

- **Sunny weather** → Pyramid solar panels generate maximum power.
- **Cloudy / windy weather** → Wind turbine contributes energy.
- **Rainy weather** → Rainwater flow produces small but useful power.
- All sources supply DC power to a common storage system.

Solar remains dominant, while wind and rain **improve availability and reliability**.

6️⃣ Expected Power Contribution (Prototype Scale)

Source	Nature	Typical Contribution
Pyramid Solar	Continuous (day)	**Main source (80–90%)**
Wind Turbine	Intermittent	5–15%
Rainwater System	Event-based	<5%

⚠️ Wind and rain are **supporting sources**, not replacements for solar.

7️⃣ Advantages

- Works in **all seasons**
- No solar tracking required
- Efficient use of rooftop space
- Self-cleaning solar panels due to rainwater flow
- Demonstrates sustainable and integrated design

8️⃣ Limitations

- Increased structural complexity
- Low power output from rainwater system
- Wind energy depends on local wind availability
- Suitable mainly for small-scale applications

9️⃣ Applications

- Smart street lighting
- Rooftop renewable units
- Remote sensor stations
- Educational and research projects

🔮 Future Scope

- Scaling the design for higher power
- Adding IoT-based energy monitoring
- Optimizing turbine size and placement
- Using stored rainwater for panel cleaning and cooling