Energy Patilpada Project Proposal

Patilpada 10kW Hybrid Project:

Project Overview:

Apeiro Energy

Apeiro Energy is a energy tech startup founded four years ago with a mission to revolutionize renewable energy solutions. Supported by incubators like iCreate, SocialAlpha, IIT Kanpur, and IIM Udaipur, Apeiro Energy focuses on developing smart vertical-axis wind turbines and hybrid energy systems. The company is committed to providing sustainable, efficient, and scalable energy solutions for remote applications, including microgrids, defense installations, and telecom towers.

Apeiro Energy has been actively working on wind-solar hybrid systems, leveraging renewable resources to offer uninterrupted power to off-grid locations. Their expertise made them the ideal partner for the CSR project in Ghoghatpada village.

The system will be designed to provide continuous 24×7 power supply. We aim to power 30 households, by installing a 10 kW microgrid, consisting of 5 x 2 kW hybrid wind turbines . A 20 kWh battery bank to store the generated power to meet daily energy demands of 20-30 units. To ensure reliability, the system will be slightly over-designed with a total capacity of 10 kW to manage contingencies. Additionally, a 2-kilometer-long transmission line will be installed to distribute power across the village. We also want to include 2 lights and 1 fan and a socket per household.

Patilpada village, located in Maharashtra, India, was selected due to its remote location and lack of reliable electricity supply. The cost of extending and maintaining electrical grid lines was prohibitively high. To address these challenges, Apeiro Energy proposed a wind-solar hybrid system tailored to meet the village's energy needs.

Objectives & Goals:

Social Objectives

The primary objective of the project is to provide reliable and sustainable energy to the villagers of Ghoghatpada. With access to electricity, villagers will be able to charge their mobile phones, run small appliances, and power critical lights even during harsh monsoons. These lights are especially important for monitoring fields and preventing animal attacks. The energy supply also supports children in the village by enabling them to study in the evenings, promoting education.

Additionally, we will train the community to be actively involved in maintaining the system, with guidelines provided for upkeep.

Environmental Objectives

By producing an average of 30 units of energy per day, totaling 10,500-12,000 units annually, the system will contribute significantly to reducing carbon emissions. The use of clean, renewable energy not only helps combat climate change but also promotes sustainability in a region that was previously reliant on non-renewable sources.

Financial Objectives

While the initial cost of energy may appear high due to the over-designed system and underutilization (as the battery bank often reaches full capacity), the project offers significant financial advantages. The cost of establishing a government power line would have been far more expensive, and a single repair during downtime or storm events could cost as much as the entire wind-solar system.

The community will pay a nomial fee of only 40-50 rupees per month for system maintenance.

Scalability

This project can serve as a model for other villages in the district. There are approximately 50-100 other villages in the region that could benefit from similar wind-solar hybrid solutions, with scalable systems that could provide sustainable energy at a fraction of the cost of conventional power lines.

System Design & Technical Specifications:

Wind Turbines

The system includes 5 vertical-axis wind turbines designed by Apeiro Energy, each rated at 1 kW. These turbines are optimized for wind speeds between 4 and 6 meters per second, ensuring efficient performance even in low-wind areas. Each turbine is mounted on a dedicated tower.

Hybrid Tower Setup

Each tower also supports two solar panels rated at 1 kW total, creating a hybrid energy tower. Each tower thus produces 2 kW of power. With three such towers, the total renewable power from the hybrid towers is 10 kW.

Battery Bank

A 20 kWh Lead Acid Battery Bank would be setup with 1 day backup.

Summary Table

Wind Turbines	Specification
Number	5
Type	Vertical-axis
Rated Power	1 kW each
Optimal Wind Speed	4 to 6 m/s
Tower Height	8 meters
Blade Material	Aluminum
Solar Panels	
Tower Panels	10 (2 per tower)
Panel Type	Polycrystalline, single-sided
Rated Power per Panel	545W
Total Solar Capacity	5 kW
Battery Bank	
Battery Type	Lead-acid
Number	16
Voltage per Battery	12 V
Capacity per Battery	100 Ah
Total Storage Capacity	Approx. 20 kWh
Village Distribution	**Details**
Number of Houses	30
Community Hall	1
Streetlights	8

Household Equipment	Quantity	Power Rating (Watts)
Fan	1	35
Lights	2	10W each (20 total)
USB Charging Port	1	10
Appliance Socket	1 (single-phase AC outlet)	Standard household rating

Electrical System and Distribution:

Inverters and Battery Bank

The system uses inverter connected to a custom-designed controller to manage power from wind and solar sources.

The battery bank is a crucial part of the setup. It consists of 16 batteries, each rated at 12 volts and 100 ampere-hours, giving a total storage capacity of approximately 20 kWh. Both wind and solar power charge this battery bank.

Wind Power Controller

The wind power controller, designed in-house, regulates the turbine speed and combines power generated by the three wind turbines. It manages when to engage braking or shutdown procedures based on current and voltage measurements. The controller also collects solar power data from sensors and sends all collected data to a monitoring dashboard.

The controller outputs approximately 50 volts to charge the battery bank. Solar power, on the other hand, is fed through the solar inverter to charge the batteries.

Power Conversion and Distribution

The inverters convert stored energy from the battery bank into single-phase AC power, which is then supplied to the village.

A 2-kilometer-long distribution line will be installed throughout the village to connect 30 houses. The distribution line also powers several streetlights.

Power Conversion and Distribution

Project Cost	
Product Costs / System Cost	Rs2,340,000
Delivery and Logistics	Rs64,500
Installation and Commissioning (Inc. O&M)	Rs350,000
Project Cost (ex. GST)	**Rs2,754,500**
Project Cost (inc. GST)	**Rs3,085,040**

The project cost covers O&M of 2 years and a follow on paid O&M model