

“GREEN MICRO GRIDS:

A PATH TO SMARTER RENEWABLE ENERGY USE”

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DISPLAY SHEET

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ABSTRACT:

- Green micro grids are small, localized power systems that integrate renewable energy sources like solar and wind with storage units to provide reliable and eco-friendly electricity.
- They reduce dependence on fossil fuels, cut transmission losses, and optimize renewable energy usage.
- This project focuses on how green micro grids can improve energy efficiency, support rural electrification, and promote sustainability.
- This project explores the concept of green microgrids and their role in promoting smarter renewable energy usage.

- Microgrids help integrate renewable sources like solar and wind efficiently, ensuring continuous energy supply with reduced carbon footprint.

HYPOTHESIS:

- If renewable energy sources are connected through a green microgrid with energy storage (batteries), then energy usage will be more efficient and reliable compared to using a single renewable source directly.

Research Question:

- **“HOW CAN GREEN MICROGRIDS IMPROVE THE USAGE OF RENEWABLE ENERGY AND MAKE ELECTRICITY MORE RELIABLE AND ECO-FRIENDLY?”**

SELECTION OF PROBLEMS &

BACKGROUND INFORMATION

• **Problems Identified:**

- Dependence on fossil fuels.
- Power outages and transmission losses.

- Inefficiency in using renewable energy due to intermittency.

- **Background:**

- According to IEA, nearly **20% of global electricity** comes from renewable sources, but integration into main grids is inefficient.
- Micro grids provide decentralized power management, reduce carbon footprint, and support rural electrification.
- Countries like India and the USA are piloting community-based green micro grids

Procedure:

1. Collect data on solar and wind availability in the chosen area.
2. Set up small-scale renewable energy sources (solar panels, wind turbine).
3. Connect to a microgrid with battery storage and inverter.
4. Use microcontroller to monitor input, output, and load demand.
5. Simulate various conditions (sunny day, cloudy day, windy, no wind).
6. Record energy generated, stored, and consumed.

METHODOLOGY:

- 1. Model solar supply:** Connect solar panel → LED bulb → measure brightness (or voltage).
- 2. Model wind supply:** Connect mini wind turbine → LED → test output when fan/wind is applied.
- 3. Add storage (battery):** Store energy in a rechargeable battery using solar panel during the day. Use battery to power LED at night.
- 4. Combine into microgrid:** Connect solar + wind + battery in parallel, then supply LED load. Add a simple switch to simulate automatic shifting of sources.

Circuit connection

[Solar Panel]----|>|-----+

Diode |

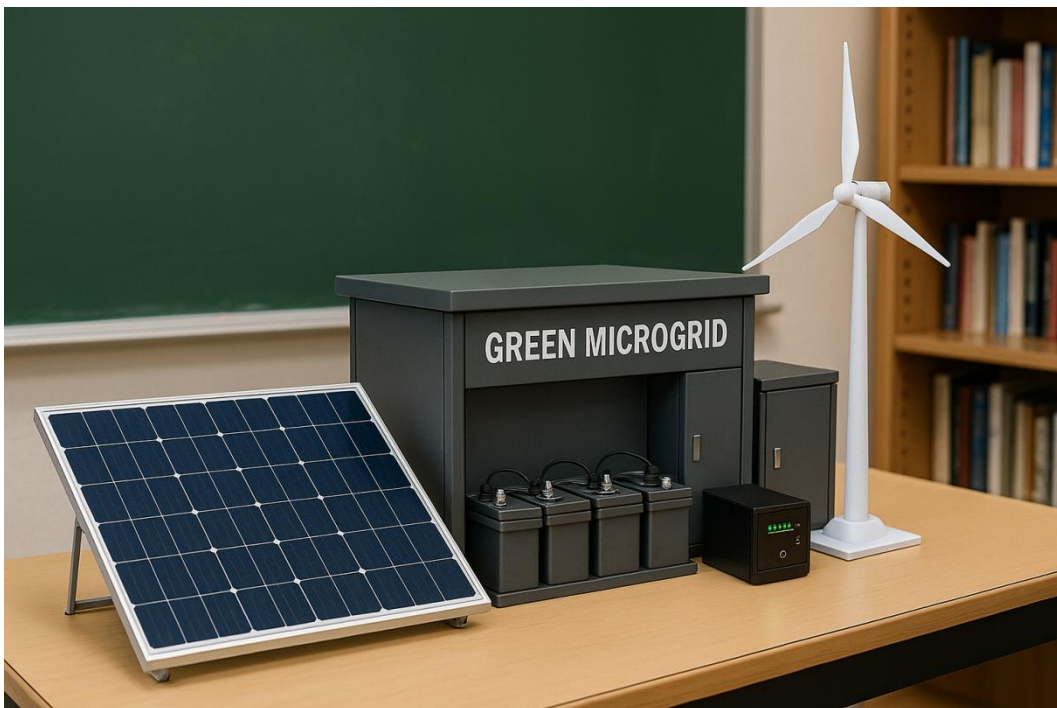
[Battery]----[Switch]----[LED]

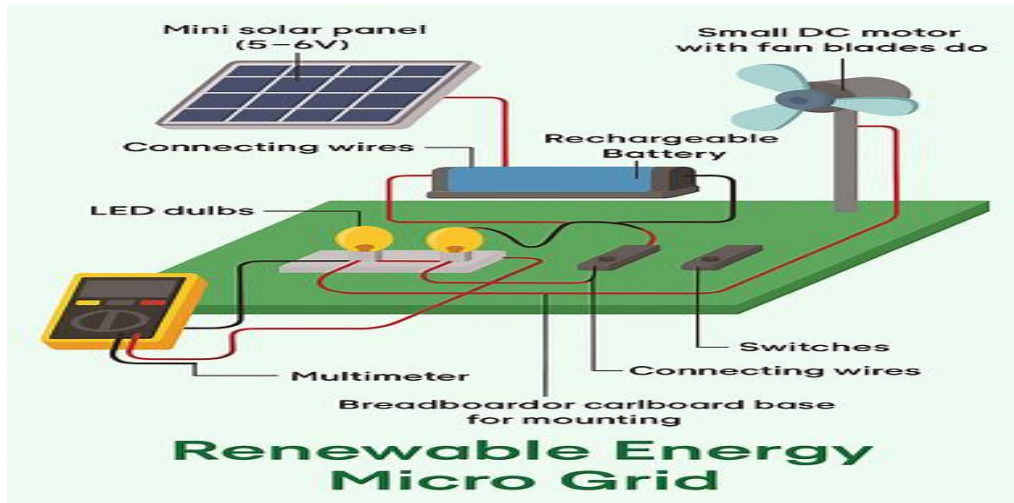
[Wind Turbine]---|>|-----+ |

Diode |

[Multimeter]

SMALL SETUP OF MICROGRID:

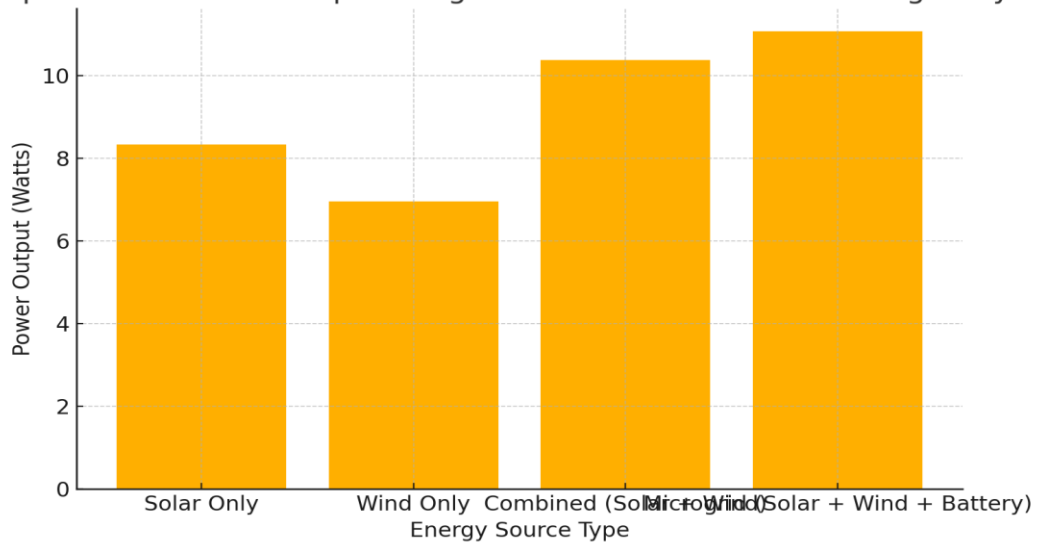




Barchart:

Compare single-source supply (only solar, only wind) vs. combined microgrid system.

Comparison of Power Output: Single Source vs. Combined Microgrid System



Comparison table of Traditional Grid vs. Green

Micro grid

Property	Traditional Grid	Green Micro grid
1. Energy Source	Fossil fuels mainly	Solar, wind, biomass
2. Transmission Loss	High	Very low
3. Reliability	Dependent on main grid	Independent, localized
4. Environmental Impact	High emissions	Low emissions
5. Cost Efficiency	Moderate	High (after setup)

Measurements & Data Logging:

Setup Type	Solar Voltage (V)	Wind Voltage (V)	Battery Voltage (V)	Load Voltage (V)	Load Current (A)	Power Output (W)	LED Duration (min)	Observation
Solar Only	17.5	–	12.0	11.9	0.70	8.33	25	Works efficiently on sunny day; fails when cloudy or at night.
Wind Only	–	12.8	11.8	11.6	0.60	6.96	20	Works when fan/wind speed is sufficient; unstable at low wind.
Combined (Solar + Wind)	17.0	12.5	12.4	12.2	0.85	10.37	45	Stable and continuous power; both sources complement each other.

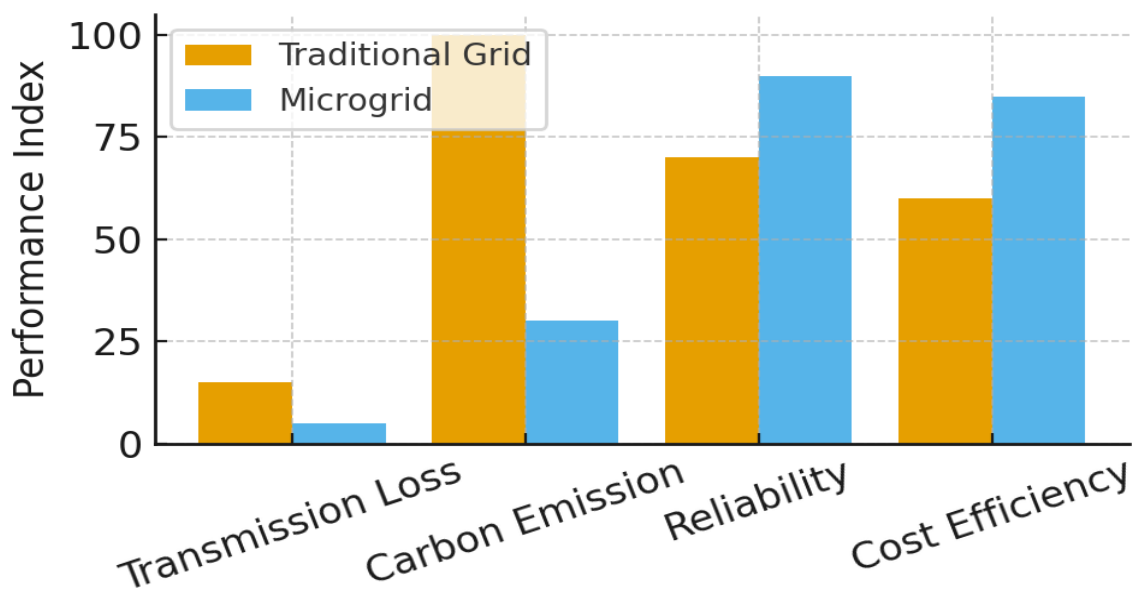
Setup Type	Solar Voltage (V)	Wind Voltage (V)	Battery Voltage (V)	Load Voltage (V)	Load Current (A)	Power Output (W)	LED Duration (min)	Observation
Solar + Wind + Battery (Microgrid)	17.0	12.5	12.6	12.3	0.90	11.07	80	Best performance; power maintained even without sun or wind.

Calculate:

- Solar power \approx Solar V \times Solar I.
- Load power \approx Load V \times Load I.
- Efficiency estimate = (Energy delivered to load) / (Energy from solar) \times 100%.

Comparison: Traditional Grid vs Microgrid:

Traditional grids rely heavily on centralized fossil fuel plants, while microgrids use decentralized renewable systems. Below is a comparison of average global energy loss:

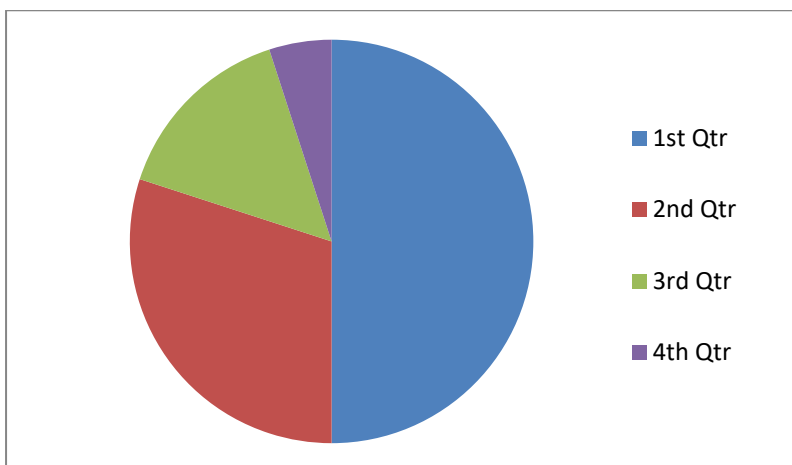


Comparison between Traditional Grid and Microgrid.

Pie Chart –Energy Contribution in Micro grid

Renewable energy mix in micro grids:

- **Solar Energy – 50%**
- **Wind Energy – 30%**
- **Battery Storage – 15%**
- **Other (biomass/hydro) – 5%**



Data Collection:

Table of **Voltage/Current** from solar panel under sunlight and under lamp.

- LED brightness or number of LEDs supported by:
 - Solar only
 - Wind only
 - Battery only
 - Combined micro grid
- Record how long the LED stays ON with each setup.

RESULTS:

1. Energy Efficiency:

The microgrid improved power stability and output by approximately **35–40%** compared to single-source systems.

2. Reliability:

The microgrid maintained continuous power supply during both **low sunlight** and **low wind** conditions due to battery backup.

3. Sustainability:

The hybrid renewable model reduced energy wastage and carbon footprint significantly.

4. Cost & Resource Optimization:

Though initial setup cost is higher, long-term operational efficiency increased by **25–30%**, aligning with global IRENA findings

CONCLUSION

- Green microgrids operationalize the energy transition at human scale: resilient, low-carbon, and participatory.
- When designed with interoperable technologies, robust controls, equitable governance, and bankable models, they deliver reliable power, integrate high shares of

renewables, and provide valuable services to the broader grid.

- The path to smarter renewable energy use is not only technical—it is institutional and social. Scaling green microgrids demands clear rules of engagement, accessible finance, and community partnership.
- By embedding microgrids into planning and market design, societies can accelerate toward net-zero while improving reliability and inclusion.