

# Cost-efficient and simple hands-on experiments for education in renewable energy systems

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## Syllabus

- Electricity basics with mechanical analogies
- Solar PV – basics, operation, power curves
- Wind turbines – basics, operation, power curves
- Energy sizing with storage
- Batteries and inverters
- Grid and decentralized ideas

## Outcome

- Designed a 7KWp Solar installation with 3 day battery backup.
- Inverter choice, array dimensioning, LCOE calculation.
- Location of panels and battery, maintenance requirements.

## Required equipment and tools

Multimeter  
20W Solar PV panel  
Small Rheostat for Rload  
DC motor 9V  
Batteries 9V and AAA  
Toy drone blades  
Reusable plug play circuitboard  
Various coloured LEDs  
Various resistors  
Connecting wires  
Electrical tape  
Old hair dryer or table fan with variable speed  
Spreadsheet software on PC (RPI or Linux possible)

