GreenWatt Energy Solutions

Problem Statement

Company: GreenWatt Energy Solutions (a renewable energy company specializing in wind power generation)

Background:

GreenWatt Energy Solutions operates a fleet of wind turbines that supply electricity to the national grid. Each turbine continuously generates large volumes of operational and environmental data, such as wind speed, generator speed, power output, and ambient conditions. Despite this wealth of data, predicting turbine performance in advance remains a challenge due to the high variability in wind conditions and the complex interactions between turbine components.

Business Problem:

Currently, the company faces difficulties in accurately forecasting power output from individual turbines. This unpredictability leads to inefficiencies in grid planning, reduced profitability, and increased maintenance costs. An accurate prediction model could optimize grid integration, improve operational efficiency, and reduce downtime.

Objective:

To develop a machine learning model that uses historical turbine and environmental data to predict **Target** (e.g., expected power output). The model should learn from features such as wind speed, turbine temperatures, generator speed, and ambient conditions, enabling the company to make data-driven decisions for:

- **Energy production forecasting** – improving grid scheduling and market bidding.
- **Turbine performance monitoring** – identifying deviations between predicted and actual power for fault detection.
- **Operational optimization** – enhancing turbine efficiency under varying environmental conditions.

Scope of Work:

- Analyze and preprocess turbine operational data (909,604 records across 16 features).
- Engineer features from environmental and turbine sensor data.
- Train and evaluate machine learning models for power output prediction.
- Provide actionable insights for operations and grid management.

Expected Outcome:

A predictive model that accurately estimates turbine power output in real-time, enabling GreenWatt Energy Solutions to increase operational efficiency, improve energy trading decisions, and reduce maintenance costs.

Dataset link: **https://drive.google.com/file/d/1L2j9bL1JvvNqC-X4slQKu4-n4Zk7fAWE/view?usp=sharing**