## **Problem Statement**

The dataset offers a rich source of information for examining how weather conditions influence renewable energy generation, especially solar energy. Understanding these relationships is key to optimizing energy production and forecasting renewable energy supply, as weather has a significant impact on solar radiation and wind energy. The problem is to analyze this relationship and predict future renewable energy generation based on weather patterns. This can help energy companies improve energy forecasting, optimize grid management, and plan for energy shortages or surpluses.

### **Approaches**

* **Correlation Analysis**: Analyze the correlation between weather conditions (e.g., temperature, humidity, cloud coverage) and renewable energy production (e.g., energy delta, GHI) to identify key factors influencing energy generation.
* **Time Series Forecasting**: Use time series models (e.g., ARIMA, Prophet) to forecast future energy generation based on historical data and weather conditions.
* **Machine Learning Models**: Apply supervised learning models (e.g., Random Forests, Gradient Boosting) to predict energy consumption or production based on weather features such as GHI, temperature, and wind speed.
* **Seasonality and Trend Analysis**: Identify and model seasonal effects and long-term trends in renewable energy generation across different months and hours of the day.
* **Anomaly Detection**: Detect anomalies in energy production and consumption related to unusual weather events, such as heavy rainfall or cloud cover, using unsupervised learning techniques.

### **Use Cases**

* **Renewable Energy Forecasting**: Predict future renewable energy generation, especially solar, based on expected weather conditions.
* **Energy Grid Optimization**: Optimize energy grid management by forecasting renewable energy production and adjusting for weather-related fluctuations.
* **Weather-Based Energy Efficiency**: Assess how weather patterns influence energy consumption efficiency and identify opportunities to reduce energy usage or enhance energy production.
* **Climate Impact Studies**: Analyze how long-term climate changes (e.g., rising temperatures or increased precipitation) could affect renewable energy production, particularly solar and wind energy.
* **Energy Supply and Demand Management**: Use weather-forecasting data to balance supply and demand in energy systems, ensuring more stable and efficient energy distribution.