***Project Idea***

**Predicting Suitable Solar Energy Potential in Buildings of Karachi**

DataScience

Syed Imran Jami

**Members**

**Usman Bin Hamid:**

SP23-MSCS-0014

**Javaria Ahsan**

SP23-MSCS-0036

**Project Overview**

Solar installation stakeholders face significant challenges in assessing building potential, often requiring costly and time-consuming site surveys. This project addresses this challenge by analyzing annual solar energy potential for Karachi's buildings using features from the data set.

**Business Value**

* Reduce assessment costs by quickly screening buildings for solar potential
* Support urban planning and renewable energy initiatives
* Help property owners evaluate solar investment opportunities
* Enable scalable solar adoption strategies across Karachi

**Data Source**

This dataset contains solar rooftop potential data (suitable rooftop area, installable capacity, estimated yearly electricity generation, and building type) at individual building structure level for a sample area of interest in Karachi. The data was gathered by extracting building rooftop footprint polygons from very high-resolution satellite stereo imagery of 0.5m resolution. The rooftop angle, obstruction, and shading were taken into account during suitable area calculation.

URL:<https://energydata.info/dataset/karachi-rooftop-solar-potential-mapping>

Key features

* Surface\_area: Total Surface area
* Potential\_installable\_area:Area in which panel can be placed
* Estimated\_building\_height:Height of Building
* Estimated\_tilt:the angle at which panel is placed
* Assumed\_building\_type (encoded):Type of building
* Peak\_installable\_capacity:maximum capacity of kv to install

**Business Questions**

1. How can the surface area of rooftops be optimized for maximizing the potential installable area for solar panels in Karachi?
2. What is the potential revenue from installing solar panels on rooftops with high peak installable capacity?
3. How does the energy potential per year vary across different assumed building types, and how can this inform targeted marketing strategies?
4. What is the relationship between estimated building height and energy potential per year for optimizing solar panel placement?
5. How can businesses leverage the estimated capacity factor to predict the efficiency and performance of solar installations?
6. What pricing strategies can be developed based on the unit installation price to make solar energy more affordable in Karachi?
7. How does the estimated tilt of rooftops affect the energy potential per year and what adjustments can maximize efficiency?
8. What are the cost-benefit analyses for different assumed building types when considering the potential installable area and energy potential per year?

### **Data Preprocessing**

Handle Missing Values:

Data Cleaning

Feature Engineering

Normalization and Scaling

Data Transformation

Outlier Detection and Treatment:

### **Algorithm**

### **Linear Regression**

Predicting continuous variables such as energy potential based on a linear combination of features

**Techniques**

 **Data Collection:**

* Gather data on building characteristics (e.g., roof area, orientation, material).

 **Feature Engineering:**

* Create new features like building height, roof tilt, and shading factors.
* Incorporate spatial data using GIS tools.

 **Model Training:**

* Split the data into training and testing sets.
* Train a Random Forest Regression model using the training data.

 **Model Evaluation:**

* Evaluate the model on the testing set using metrics

**Visualization:**

For visualizing solar energy potential in buildings in Karachi, consider the following techniques:

* **Heat Maps**: Show areas with high solar potential using color gradients based on energy output or installable area.
* **Bar Charts**: Compare energy potential across different building types or neighborhoods.
* **Scatter Plots**: Visualize relationships between variables (e.g., building height vs. energy potential)

 **Prediction:**

* Use the trained model to predict solar energy potential for new or existing buildings.

**Key Insights**

In predicting the suitable solar energy potential in buildings of Karachi, key insights may include:

1. **Identifying High-Potential Areas**: Recognizing neighborhoods or districts with the most rooftops suitable for solar installations.
2. **Economic Viability**: Estimating cost savings and return on investment for solar energy adoption in various building types.
3. **Optimal Installation Strategies**: Understanding the best roof configurations, angles, and orientations for maximizing solar capture.
4. **Impact of Local Regulations**: Evaluating how local policies affect solar adoption rates.
5. **Consumer Awareness and Education**: Highlighting the need for educational programs to increase community awareness of solar benefits.

These insights can guide stakeholders in implementing effective solar energy solutions.