RENEWABLE ENERGY DATA ANALYSIS IN DESERT REGIONS

PROJECT DESCRIPTION:

This project aims to identify the most suitable locations in the Egyptian desert for establishing solar and wind energy plants.
The team will analyze real meteorological and environmental data obtained from NASA to evaluate solar irradiance, wind speed, and other key climatic indicators.
This analysis will help determine the areas with the highest renewable energy potential, support sustainable energy planning, and guide future investments in Egypt's clean energy sector.

GROUP MEMBERS & ROLES:

Name	Role
Shahd Abdelnaby	Team Leader – Coordinated the project and contributed to all tasks including data collection, cleaning, and visualization.
Ahmed Hamada Sayed	Team Member – Participated in data collection, cleaning, analysis, and dashboard creation.
Esraa Atef	Team Member – Participated in data collection, cleaning, analysis, and dashboard creation.
Mohamed Hussien	Team Member – Participated in data collection, cleaning, analysis, and dashboard creation.
Dina Ayman Darwish	Team Member – Participated in data collection, cleaning, analysis, and dashboard creation.

TEAM LEADER:
shahd Abdelnaby → Team Leader

OBJECTIVES:

1. **Assess Renewable Energy Potential in Desert Areas:**

The main goal of this project is to evaluate the potential of 16 desert regions for generating renewable energy through solar and wind power. Using environmental and geographical data, we aim to identify which areas are most suitable for developing sustainable energy projects.

2. **Develop a Smart, Interactive Dashboard:**

Create an advanced Power BI dashboard that provides an intuitive and interactive visualization of all key indicators — including solar radiation, wind speed, temperature, elevation, and humidity. The dashboard will serve as a decision-support tool for energy planners and researchers.

3. **Compare Solar vs. Wind Energy Feasibility:**

Perform a comparative analysis to determine whether solar or wind energy is more efficient, cost-effective, and feasible in each region. The system will use analytical metrics to recommend the optimal type of renewable energy for each site.

4. **Identify and Rank the Best Locations:**

Classify and rank the 16 regions according to their renewable energy potential. The dashboard will highlight the top-performing regions and display them clearly for decision-makers, helping to prioritize investment in the most promising sites.

5. **Ensure Data-Driven Insights and Accuracy:**

Collect, clean, and analyze high-quality datasets from reliable sources to ensure accurate and trustworthy results. The project emphasizes data quality, completeness, and visual clarity throughout all stages of analysis.

6. **Support Strategic Energy Planning:**

Provide clear insights that can guide governments, investors, and researchers toward sustainable energy planning in desert regions — contributing to green transition and carbon reduction goals.

7. **Promote Environmental Sustainability:**

Encourage the use of renewable energy as a cleaner alternative to fossil fuels, helping to reduce CO_2 emissions and promote sustainable development in arid and desert areas.

TOOLS & TECHNOLOGIES:

1. **Excel – Used for data cleaning, calculations, and initial statistical analysis.**
Reason: Excel was chosen for its simplicity in handling tabular data and performing basic calculations efficiently.

1. **Power BI – Used for building interactive dashboards and visualizing results clearly.**
Reason: Power BI allows easy visualization of trends and patterns, helping in clear communication of insights.

2. **NASA MERRA-2 Dataset – Used to obtain wind speed, temperature, humidity, and air pressure data for different desert regions in Egypt.**
Reason: This dataset provides accurate environmental and meteorological data, which is essential for assessing potential wind and solar energy locations.

MILESTONES & DEADLINES:

No.	Phase	Main Tasks	Deliverables	Start Date	End Date
1	Data Collection	- Download NASA datasets - Define boundaries of Egyptian desert regions	Ready-to-analyze CSV	Oct 1, 2025	Oct 7, 2025
2	Data Cleaning & Preparation	- Format and clean the data - Link geographic coordinates - Calculate monthly and annual averages	Clean and integrated dataset for solar and wind energy	Oct 8, 2025	Oct 14, 2025
3	Data Analysis	- Analyze solar radiation and wind speed - Identify optimal regions - Generate descriptive statistics and comparison tables	Preliminary analytical report and comparison tables	Oct 15, 2025	Oct 21, 2025

4	Renewable Suitability Index (RSI) Development	- Build RSI formula (Normalization + Weighting) - Compute RSI for each region - Create preliminary suitability map	RSI map for each region	Oct 22, 2025	Oct 28, 2025
5	Future Forecasting (up to 2050)	- Use NASA climate projection data - Predict future solar and wind trends up to 2050	Forecast chart and energy trend report	Oct 29, 2025	Nov 4, 2025
6	Power BI Dashboard Development	- Create interactive solar and wind maps - Rank top 10 suitable locations - Build What-if investment scenarios	Fully functional interactive dashboard	Nov 5, 2025	Nov 14, 2025
7	Final Report & Presentation	- Write the final technical report - Prepare PowerPoint presentation for defense	Final report + ready-to-present slides	Nov 15, 2025	Nov 21, 2025