**Optimal Areas for Combined Solar-Wind Plants in Pakistan**

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**Overview:**This project is focused on identifying optimal locations across Pakistan for establishing combined solar and wind energy plants. The analysis considers multiple environmental and demographic factors, including solar radiation, wind speed, land-use classification, and population density. The primary goal is to find areas where solar and wind resources are suitable for energy generation while minimizing the impact on highly populated regions and ensuring that the land is suitable for such installations.

The app allows users to define specific parameters, such as the minimum and maximum distances from a selected city, to focus the analysis on nearby regions. It also enables the filtering of areas based on solar radiation levels, wind speeds, and population density. This helps to pinpoint areas with optimal conditions for solar and wind energy production.

**Key Features**:  
The app offers a range of features that allow for detailed analysis and customization. Users begin by selecting a city from a dropdown menu, which automatically zooms the map to that city's coordinates. Once the city is chosen, users can set the **minimum and maximum distance** to define buffer zones around the city for analysis. These buffer zones help limit the search area, focusing on regions within the specified distances.

Users can also set the **population threshold** to ensure that only areas with a population density below a certain level are considered for energy plant installation. Additionally, input fields for **solar radiation range** (in Watts per square meter) and **wind speed range** (in meters per second) allow users to refine the analysis based on these key environmental factors.

**How to Use**:  
1) Select a City  
2) Set Parameters  
3) Run the Analysis  
4) View the Results  
  
**Datasets Used**:  
**ERA5-Land Monthly Aggregated:** This dataset provides solar radiation and wind speed data, crucial for assessing the suitability of an area for energy generation.  
**Global Population Surfaces (1975-2030):** Population data helps to filter areas with lower population densities, ensuring that energy plants are located in less populated regions.  
**Dynamic World V1:** This dataset is used to classify bare and non-bare land areas, helping to identify suitable land for energy production.

**Results**:  
By running the analysis, the app filters and identifies optimal locations for combined solar-wind plants that meet the environmental and socio-economic criteria. It highlights areas with the right conditions for generating renewable energy, while also considering land suitability and population density.