RSAC-UP Actively Moves Toward Solar Power Generation with ArcGIS

Client
Remote Sensing Applications Centre, Uttar Pradesh (RSAC-UP)

Industry
Renewable Energy

Organization Profile
Uttar Pradesh is the first and foremost state in the country to establish the first state Remote Sensing Applications Centre, Uttar Pradesh (RSAC-UP) in May 1982 at Lucknow. RSAC-UP has been utilizing the geospatial technologies of satellite remote sensing, Image Processing, GIS, GPS, LiDAR, Bathymetry, customized software development using AI, ML, DL, and AL methods in conjunction with geophysical surveys, soil and water testing techniques for assessment, monitoring, utilization, and management of various natural resources of the state with a view to achieving sustainable development.

Website
www.rsac.up.gov.in

Project
Geo-statistical Estimation of Solar Power Generation

Highlights
- Incorporating ArcGIS technology into RSAC-UP's operations has helped the organization overcome challenges like lack of functionality for advanced spatial analysis, interoperability issues with data sharing, and inefficiencies in resource management.
- ArcGIS' array of tools for spatial analysis has brought a whole new dimension to RSAC-UP's assessments of natural resources, infrastructure, and disaster scenarios.
- The System's knack for handling different data formats ensures smooth collaboration and data sharing, a game-changer for the organization.

Project Summary

Solar panels, also known as photovoltaic (PV) panels, are devices that convert sunlight into electricity. The basic principle behind solar panels is the photovoltaic effect, where certain materials can generate an electric current when exposed to sunlight. Solar insolation is converted into electric power by PV cells. With continued advancements in technology, manufacturing processes, and recycling techniques, the overall environmental footprint of solar panels can be further reduced, making them an essential component of a sustainable energy future.

RSAC-UP carried out a study for geostatistical estimation of solar power generation in Orai city, district Jalaun of Uttar Pradesh. The calculations done with the help of ArcGIS demonstrate the potential for mitigating environmental pollution through solar and clean energy. The goal of this research is to assess available and suitable rooftop areas using different GIS and RS techniques for installing PVs and estimating solar power generation in district Jalaun.

Solution & Benefits

For energy generation, researchers have assumed that a 1.7-meter square area produces 0.33 kW of energy per solar panel and 1 kg of coal generates approx. 8 kWh electricity. If coal has 66% carbon, then 1 kg of coal produces 2.42 kg of carbon dioxide. Solar panels have emerged as a key player in the transition to clean and renewable energy sources. Their environmental impact, when evaluated throughout their lifecycle, is significantly less detrimental compared to fossil fuel-based energy production. The goal is to develop eco-friendly and efficient methods that minimize resource consumption, reduce emissions, and improve the overall lifecycle environmental performance of solar panels.

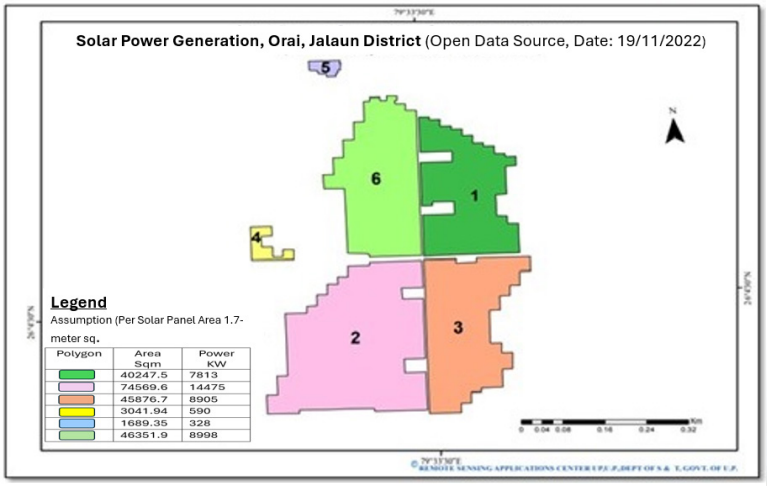
For this study, researchers selected a part of the solar power plant of the Orai district which is part of the Jalaun Solar Power Project. It is a solar photo-voltaic power generation station, spanning two villages -Kuhana and Shajahanpur in the Jalaun district of Uttar Pradesh. The researchers located the site using Esri's ArcGIS and calculated the total energy generation by this power plant.

The most used solar panels are 72 cells and 60 cells, which have a size of 2m x 1m & and 1.6m x 1m respectively. The solar panels will produce between 170 to 350 watts every hour. But this depends on the direct sunlight and weather conditions. It averages about 0.17 kWh to 0.35 kWh per solar panel. Group panel 1 has an area of 40247.5 m2 which produces energy of 7813 kW. Panel 2 has an area of 74569.6m2 with an energy generation of 14475 kW. Panel 3 has an area of 45876.7m2 with an energy generation of 8905 kW. Panel 4 has an area of 3041.94 m2 with a power generation of 590kW. Group panel 5 has an area of 1689.35m2 with a power generation of 328 kW. Panel 6 has an area of 46351.9m2 with a power generation of 8998 kW. The gross solar

power generation by the plant is approximately 41.109 MW. It has saved 12.435 tonnes of carbon dioxide production.

Additionally, incorporating ArcGIS technology into RSAC-UP's operations has helped the organization overcome some of the challenges it faced. The organization faced challenges like lack of functionality for advanced spatial analysis, interoperability issues with data sharing, and inefficiencies in resource management. Additionally, the lack of advanced mapping capabilities and seamless integration with AI, ML, DL, and AL methods posed challenges in producing visually compelling maps and leveraging cutting-edge analytics for decision-making.

ArcGIS array of tools for spatial analysis has brought a whole new dimension to RSAC-UP's assessments of natural resources, infrastructure, and disaster scenarios. The system's knack for handling different data formats ensures smooth collaboration and data sharing, a game-changer for the organization.



"Empowering RSAC-UP with ArcGIS technology is not just an upgrade—it's a strategic leap forward. From unravelling the intricacies of spatial analysis to seamlessly sharing data, ArcGIS is the compass guiding us towards precision, efficiency, and a future where geospatial innovation meets the pressing challenges of sustainable development."

– Project Team, RSAC-UP

Project Team Members:
1. Mr. Sushil Chandra, Scientist, SF & Head of CIP & DM Division
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3. Miss Fariha Fatima, Project Scientist
4. Mr. Vinamra Kaushik, Project Scientist