

GIS-based approach for assessing the Potential Sites of Large-Scale generation of Solar energy: A case study of Al-Hasakeh governorate, Syria

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Keywords: spatial analysis, renewable energy, area-solar radiation, solar energy potential, Al-Hasakeh, Syria

Abstract:

The north-eastern Syrian governorate of Al-Hasakeh (Fig. 1) has suffered over the course of the Syrian conflict. Despite its wealth of natural resources, the governorate has long been one of Syria's poorest regions and experience a major electricity outages as the access to electricity is 1-2 hours/day in most of Al-Hasakeh city and countryside. Besides the fact that that Al-Hasakeh governorate produces the bulk of Syria's agricultural produce, large territory (almost 30%) of total area defined as meadows and non-arable lands which receives intensive sunshine through the year and these lands would be a potential of large-scale solar energy production for electricity generation purpose.

Using geospatial analysis techniques, this research assesses the areas which would be defined as suitable for large-scale generation within Al-Hasakeh governorate and provides an estimation of the total maximum capacity of these lands for electric power production. Multi-criteria were applied including solar radiation, landforms (slope, aspect and elevation), as well as the major land use in that area.

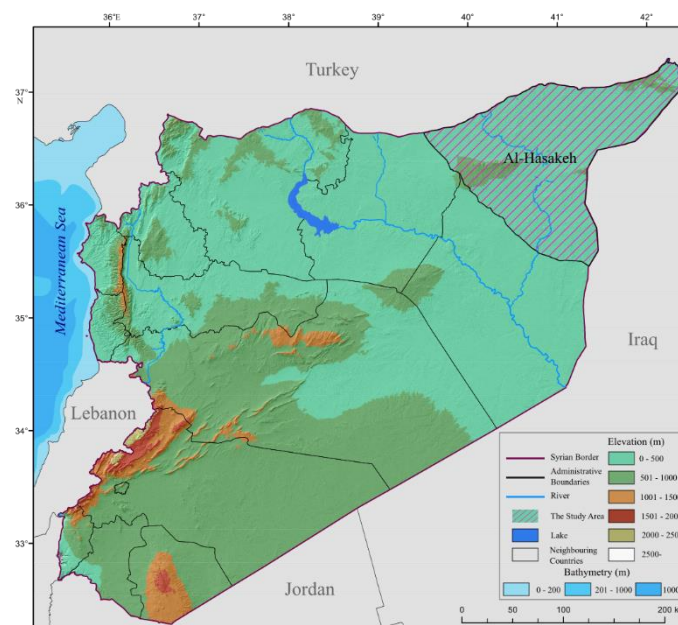


Figure 1. Al-Hasakeh governorate.
(Prepared by the author based on Open Street Maps, USGS data)

The results show that 48% of Al-Hasakeh territory is considered as technically potential areas for large-scale solar power investment (Table. 1) with regard to the landforms and the solar radiation intensity; these area defined as suitable is mainly located in the western and southern parts of Al-Hasakeh governorate, as the suitability index is increasing toward the western parts of the governorate (Fig. 2).

Governorate area (sq km)	Solar radiation mean (kW/m ²)	Total suitable area (sq km)	Potential site (sq km)	Estimated usable solar radiation of the potential site (GWh/year)	Estimated electric power production of the potential site (GWh/year)
23,334	1,358	11,164	1,285	1,745,220	225,133

Table 1. Suitable areas properties within Al-Hasakeh governorate

In order to determine the desirable site based on the areas located within the high suitability zone we use the minimum bounding technique and the result is rectangle site with an area of 1,285 sq km; the estimated usable solar radiation and electric power production of this area is provided in (Table 1), the calculation is based on the efficiency and performance ratio values.

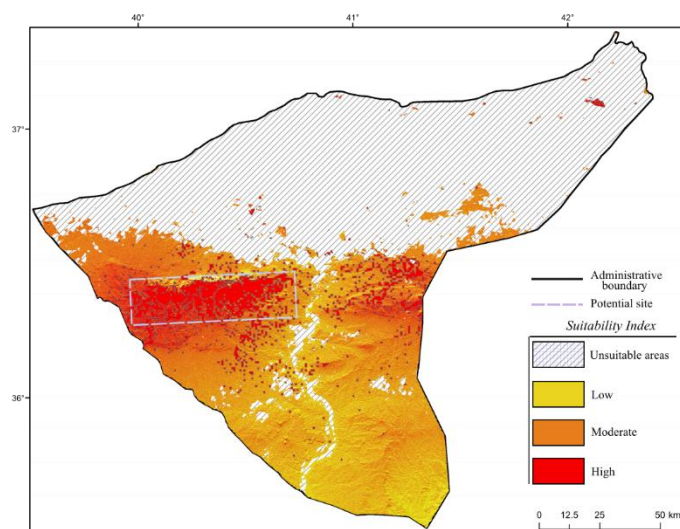


Figure 2. Suitability index map within Al-Hasakeh governorate (Prepared by the author using spatial analysis tools, ArcGIS)

The study has shown that Al-Hasakeh governorate has high estimated technical potential due to the high solar radiation received annually and the availability of large suitable areas related to geographical conditions for large-scale PV technology development.

Although Syria is a promising country regarding solar power investments, but challenges still remain in the post-Syrian conflict phase regarding the integration with renewable energy technologies as the poor structure and capacity of the electric transmission grids in Syria, lack of investments in clean energy, as well as the current political crises.

References

- ArcGIS Pro Documentation 2021. Area Solar Radiation (Spatial Analyst) <<https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/area-solar-radiation.htm>>.
- Mark Friedl, Damien Sulla-Menashe - Boston University and MODAPS SIPS - NASA. (2015). MCD12Q1 MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500m SIN Grid. NASA LP DAAC. DOI: 10.5067/MODIS/MCD12Q1.006.
- ACAPS, Syria Needs Analysis Project, Al-Hasakeh Governorate profile, 2014.
- USGS. SRTM data and USGS Landsat Level-1 Data Product. <<https://earthexplorer.usgs.gov/>>.