

Solar panels land for solar power generation





Overview

Large-scale Photovoltaics (PV) play a pivotal role in climate change mitigation due to their cost-effective scaling potential of energy transition. Consequently, selecting locations for large-scale PV power plants has gained worldwide prominence. Large-scale Photovoltaics (PV) play a pivotal role in climate change mitigation due to their cost-effective scaling potential of energy transition. Consequently, selecting locations for large-scale PV power plants has gained worldwide prominence in recent decades. Although massive studies have examined various siting criteria, land consolidation and cost-benefit feasibility issues are not often included due to the lack of a comprehensive and discretionary decision-making system. In this study, we introduced a three-stage framework combining DBSCAN clustering and cost-benefit analysis to identify the most efficient and cost-effective land parcels. The results indicate that while a total area of 425,191 km² is considered developable for PV installation in China, only 23% of that area (128,588 km²) are consolidated land parcels.

Solar photovoltaic Site selection Potential estimation Infrastructure investment.

The world is facing irreversible climate change accelerated by the overuse of fossil fuels [[1], [2], [3]], necessitating a clear shift away from fossil fuel reliance and toward renewable options within the energy mix [4,5]. However, the energy transition has deviated from its original path, which has been exacerbated by the COVID-19 pandemic and the ongoing ramifications of the Ukraine conflict. Consequently, a significant acceleration is needed across energy sectors and technologies [6]. More specifically, realizing the Net-Zero Emission (NZE) Scenario necessitates tripling spending on clean energy and infrastructure by 2030, with a shifting focus on emerging markets and developing economies [7]. Solar PV, one of the fastest-growing forms.

By providing a three-stage large-scale PV power plant site selection framework, this paper separates itself from similar studies in the following three aspects: (i) the introduction of GIS-based cost-benefit analysis into the site evaluation process improves the grid and road integration of potential sites, reducing construction costs and grid integration.

Numerous studies vary in scale, weighing methods (AHP, Fuzzy AHP, ANN), and selected criteria for renewable energy site selection. This section will review renewable energy site selection methodologies and criteria before focusing on large-scale PV power plant siting research, providing a theoretical



foundation for this article. To maximize the use of energy resources and achieve a more efficient system, it is essential to identify the ideal sites concerning various aspects. Multi-Criteria Decision Analysis (MCDA) has been widely used to take all criteria into consideration [[25], [26], [27], [28], [29], [30], [31]]. Among various MCDA methods, compensatory Decision Methods are widely used [32], such as the Weighted Linear Sum (WLS).

How much land does a solar power plant need?

A utility-scale solar power plant may require between 5 and 7 acres per megawatt (MW) of generating capacity. Like fossil fuel power plants, solar plant development requires some grading of land and clearing of vegetation.

Is solar energy a good option for land use?

However, recent studies based on satellite views of utility-scale solar energy (USSE) under operation, either in the form of photovoltaics (PV) or concentrated solar power (CSP), show that their land use efficiency (LUE) is up to six times lower than initial estimates [17, 18, 19].

How can land use & solar development benefit the environment?

Land Use & Solar Development Harnessing the sun's energy and converting it to electricity offers one of the most technologically viable and cost-effective means to produce pollution-free, sustainable power.

How to develop PV solar farms in China?

Land use policy for developing PV solar farms in China. Different from most developed countries, in China, urban lands are owned by the country, and rural lands are collective ownership. For this reason, the development of PV solar farms highly relies on the land use policy introduced by the government.



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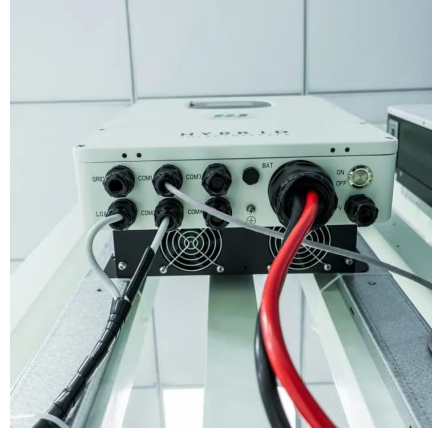


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Utility scale solar power plants require a significant amount of land due to the number of solar panels required. Modern plants require 5 to 15 acres per MW of capacity.



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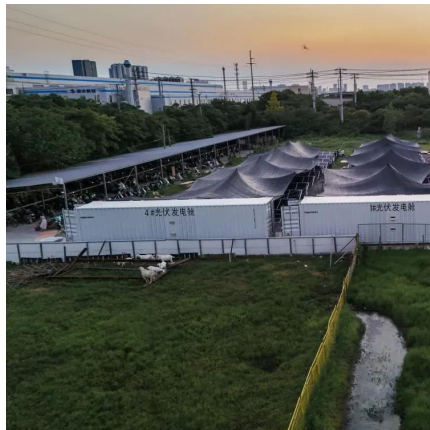
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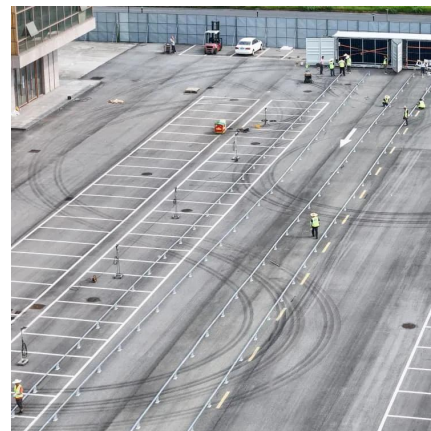


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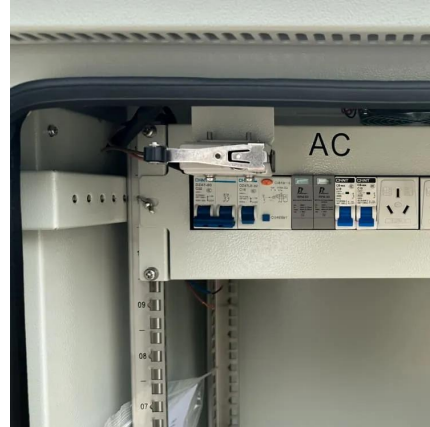
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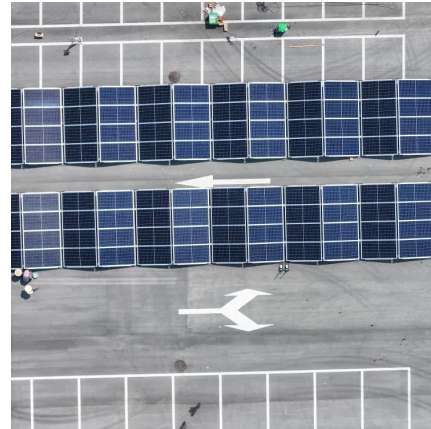
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