Climatic feasibility survey for the construction of solar power plants in Fars Province by Fuzzy Overlay and AHP methods using GIS

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Extended Abstract

Introduction

Most of the energy consumed in the world comes from fossil fuels. Combustion of fossil fuels enters a huge amount of sulfur and nitrogen oxides, carbon monoxide and carbon dioxide in the atmosphere. Continuous increases in greenhouse gas emissions and rising fuel prices are key drivers behind more effective efforts to use renewable energy sources. Renewable energies include diverse sources of natural and accessible energy. Given that these energies are not ideal, their use reduces the consumption of oil products and creates jobs and reduces the amount of environmental pollution. The prospect of using this energy in Iran, as well as other developed countries, has become significant in the way that the government has made the necessary planning in the fifth development plan. Therefore, considering the global policies of developing these energies in our country, in order to solve problems and create employment, will be inevitable. Studies in this regard suggest that the development of the use of new energy can play a significant role in increasing the security of the country's energy system. Due to low latitudes, Iran has more capability to receive this energy. To exploit this energy, there is a need to build solar power plants. Solar panels used in solar power plants are converters of solar radiation into electrical energy. One of the most important issues in using solar energy is determining where to use it, which has a great impact on the efficiency of solar power equipment. Therefore, taking advantage of the potential of the climate can have a positive effect on the conservation of energy resources. In this regard, it is important to identify appropriate and prone areas where solar energy is sufficient and able to replace current energies.

Materials & Methods

The required data in this study was collected from the 'Iran's Meteorological Organization' for 30 years and was entered into the Excel environment and analyzed. In the Arc GIS software environment, the locations of the stations, according to their geographical coordinates, were added to the digital map of the area and the database was formed. To prepare the map of the climatic parameters, the layer for each parameter was first prepared using the IDW interpolation method in the Geo-statistical Analyst field in the ARCGIS software environment, and then, using the AHP method, an intra-layer weight was defined. By using the 'Reclassify' command in the ARCGIS software, each layer was classified into several classes and each class was classified according to its importance and mapped to it. Then, to obtain a final map representing potential regions, the interlayer weight was applied according to the importance and effectiveness of each layer. Then, by overlapping the weighted layers, using the 'Fuzzy overlay' command in the 'Spatial Analyst' section, a map of all-potential regions that represents the areas with high potential for the construction of the power

plant was obtained.

Discussion and Results

In order to quantitatively evaluate the climate of solar power plants in the study area, the layers obtained from the sunshine, cloudy, dust, relative humidity, altitude and precipitation have been weighted. For this purpose, the weight of the effective indices has been obtained using the AHP model. Then, using the 'Raster calculator' command in the ARCGIS software, weighted difference maps were obtained, and finally, using the 'Fuzzy overlay' command in the same software, the final map which is a combination of overlapping of the harmonious layers, has been obtained. At last, the final map was made up of a combination of overlapping harmonious layers and the selection of the regions with the highest capacity for the construction of solar power plants.

Conclusion

The method used in this study is important in determining the effective indices in locating solar stations as overlapping of the harmonious layers. This method is achieved by taking into account the relative importance of all the effective indices in the final layer, which can be more credible than other methods, because this algorithm, using degree weights, gives the power to decision- makers to place more important factors which in his view affect the problem more, in the problem with the same importance and due to this superiority, the results of this method has a better resolution.. Accordingly, the results show that Fars province has a high potential in terms of solar electrical energy which in the study area, the cities of Neyriz, Estahban and Fasa are more indicative in this regard and have higher potential. It can also be concluded that the total relative weight of all indices has a greater effect on locating and cannot be determined only by one or more of the indices.

Keywords: Climatic Survey, Solar Power Plants, Fars Province, Fuzzy Overlay Method, GIS