A Geographical Spatial Analysis on the Benefits of Using Wind Energy in Kuwait

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Abstract : Wind energy is associated with many geographical factors including wind speed, climate change, surface topography, environmental impacts, and several economic factors, most notably the advancement of wind technology and energy prices. It is the fastest-growing and least economically expensive method for generating electricity. Wind energy generation is directly related to the characteristics of spatial wind. Therefore, the feasibility study for the wind energy conversion system is based on the value of the energy obtained relative to the initial investment and the cost of operation and maintenance. In Kuwait, wind energy is an appropriate choice as a source of energy generation. It can be used in groundwater extraction in agricultural areas such as Al-Abdali in the north and Al-Wafra in the south, or in fresh and brackish groundwater fields or remote and isolated locations such as border areas and projects away from conventional power electricity services, to take advantage of alternative energy, reduce pollutants, and reduce energy production costs. The study covers the State of Kuwait with an exception of metropolitan area. Climatic data were attained through the readings of eight distributed monitoring stations affiliated with Kuwait Institute for Scientific Research (KISR). The data were used to assess the daily, monthly, quarterly, and annual available wind energy accessible for utilization. The researchers applied the Suitability Model to analyze the study by using the ArcGIS program. It is a model of spatial analysis that compares more than one location based on grading weights to choose the most suitable one. The study criteria are: the average annual wind speed, land use, topography of land, distance from the main road networks, urban areas. According to the previous criteria, the four proposed locations to establish wind farm projects are selected based on the weights of the degree of suitability (excellent, good, average, and poor). The percentage of areas that represents the most suitable locations with an excellent rank (4) is 8% of Kuwait’s area. It is relatively distributed as follows: Al-Shqaya, Al-Dabdeba, Al-Salmi (5.22%), Al-Abdali (1.22%), Umm al-Hayman (0.70%), North Wafra and Al-Shaqeeq (0.86%). The study recommends to decision-makers to consider the proposed location (No.1), (Al-Shqaya, Al-Dabdaba, and Al-Salmi) as the most suitable location for future development of wind farms in Kuwait, this location is economically feasible.

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