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Offshore Wind Assessment and Analysis for South Western Mediterranean Sea

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Abstract : accuracy assessment and a better understand of the wind resource distribution are the most important tasks for decision making before installing wind energy operating systems in a given region, there where our interest come to the Algerian coastline and its Mediterranean sea area. Despite its large coastline overlooking the border of Mediterranean Sea, there is still no strategy encouraging the development of offshore wind farms in Algerian waters. The present work aims to estimate the offshore wind fields for the Algerian Mediterranean Sea based on wind data measurements ranging from 1995 to 2018 provided of 24 years of measurement by seven observation stations focusing on three coastline cities in Algeria under a different measurement time step recorded from 30 min, 60 min, and 180 min variate from one to each other, two stations in Spain, two other ones in Italy and three in the coast of Algeria from the east Annaba, at the center Algiers, and to Oran taken place at the west of it. The idea behind consists to have multiple measurement points that helping to characterize this area in terms of wind potential by the use of interpolation method of their average wind speed values between these available data to achieve the approximate values of others locations where aren't any available measurement because of the difficulties against the implementation of masts within the deep depth water. This study is organized as follow: first, a brief description of the studied area and its climatic characteristics were done. After that, the statistical properties of the recorded data were checked by evaluating wind histograms, direction roses, and average speeds using MatLab programs. Finally, ArcGIS and MapInfo soft-wares were used to establish offshore wind maps for better understanding the wind resource distribution, as well as to identify windy sites for wind farm installation and power management. The study pointed out that Cap Carbonara is the windiest site with an average wind speed of 7.26 m/s at 10 m, inducing a power density of 902 W/m², then the site of Cap Caccia with 4.88 m/s inducing a power density of 282 W/m². The average wind speed of 4.83 m/s is occurred for the site of Oran, inducing a power density of 230 W/m². The results indicated also that the dominant wind direction where the frequencies are highest for the site of Cap Carbonara is the West with 34%, an average wind speed of 9.49 m/s, and a power density of 1722 W/m². Then comes the site of Cap Caccia, where the prevailing wind direction is the North-west, about 20% and 5.82 m/s occurring a power density of 452 W/m². The site of Oran comes in third place with the North dominant direction with 32% inducing an average wind speed of 4.59 m/s and power density of 189 W/m². It also shown that the proposed method is either crucial in understanding wind resource distribution for revealing windy sites over a large area and more effective for wind turbines micro-siting.

Keywords : wind ressources, mediterranean sea, offshore, arcGIS, mapInfo, wind maps, wind farms
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