Sustainable Development and Kish Island Environment Protection, using Wind Energy

Amir Gandomkar

***Abstract*—**Kish Islands in South of Iran is located in coastal water near Hormozgan Province. Based on the wind 3-hour statistics in Kish station, the mean annual windspeed in this Island is 8.6 knot (4.3 m/s). The maximum windspeed recorded in this stations 47 knot (23.5 m/s). In 45.7 percent of recorded times, windspeed has been Zero or less than 8 knot which is not suitable to use the wind energy. But in 54.3 percent of recorded times, windspeed has been more than 8 knot and suitable to use wind energy to run turbines. In 40.2 percent of recorded times, windspeed has been between 8 to 16 knot, in 13 percent of times between 16 to 24 knot and in 1 percent of times it has been higher than 24 knot. In this station, the direction of winds higher than 8 is west and wind direction in Kish station is stable in most times of the year.With regard to high – speed and stable direction winds during the year and also shallow coasts near this is land, it is possible to build offshore wind farms near Kish Island and utilize wind energy produce the electricity required in this Island during most of the year.

***Keywords*—**Kish Island, Wind energy, Offshore wind farm, Windspeed, Wind direction

I. Introduction

IN all over the history, people have used the wind energy in different ways. Over 5000 years ago, ancient Egyptian used the wind power to sail their sailboats on the Nile River. After that, Iranian people made windmills to grind their grains.According to Word Wind Energy Association's opinion by the end of 2010, the sum power of installed wind turbines will increase to 120000 MW. In the future years, wind farms of the coastal waters will play an important role in this development. These farms along with the wind farms in the continents and coastal wind farms will be applied in large scale for windmill electricity generation. World Wind Energy Association has recommended 1245 GW wind power energy in coastal wind farms of Africa and Middle East where most of Islamic countries are located for the year 2020, which is ranked after Europe with 3857 GW, suggested power in the second position.Discovering the actual value of oil and gas, today's world is looking for the replacement of this material with renewable energy source and many attempts have been accomplished for this purpose and in most area of the world, use of renewable source energy such as Solar energy, Geothermal energy and wind energy has a lot of growth and also in the future plans, a larger section of world energy source is allocated to the renewable energies. For the present time one of the energy which has attracted the attention of different countries, is the wind energy.

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By the end of 2005, 65 countries of the world will have used the wind energy for providing electricity energy which Germany, Spain, United State of America, India and Denmark have been the most pioneer countries in using the wind energy and installing and establishing of the world.

The development incompatible with environment cannot be sustainable. Using renewable energy sources such as solar energy, geothermal energy and wind energy can make sustainable development in a region.

Knowing wind energy and its features can help programmers in using this clean, free and renewable energy. Iran is located in the west wind region, and the common wind direction is from north-west to south-west in Iran. But in some regions of Iran, due to special regional conditions as well as the synoptic factors of atmosphere, the wind direction is different from the common wind direction in Iran. The wind speed is also higher than the average speed of west winds.

Iran has a lot of renewable and nonrenewable energy resources. Since Iran has a special geographic position, it has lot of solar and wind energy resources. Both solar and wind energy are free, renewable and adaptable with environment.

Perrier and etal [1] by the wind structure is measured at three different bulk air velocities ($u\infty$= 39, 148 and 271 centimeters per second) on an individual soybean leaf and is compared to structural effects on an artificial leaf (flat metal plate) in a small closed-circuit wind tunnel. The boundary layers were homogeneous for the metal plate, but only at the lower velocity for the soybean leaf. The boundary layer thicknesses decrease with increasing bulk air velocity for laminar flow regimes, whereas in the turbulent flow regime the boundary layer thickness greatly increases. The effect of turbulence on the soybean leaf boundary layer made the eddy diffusivities at least three times greater than in the laminar flow regime at the calculated roughness height above the leaf surface. The structure of the leaf boundary layer flow is comparable to that of the metal plate only at the lower bulk air velocity.

The grouping of observations based on the intervals between them is called clustering. The main purpose of clustering is to make groups which their inter group variety and dispersion

Frandsen and etal [2] shows that The proposed model for the wind speed deficit in wind farms is analytical and encompasses both small wind farms and wind farms extending over large areas. As is often the need for offshore wind farms, the model handles regular array geometry with straight rows of wind turbines and equidistant spacing between units in each row and equidistant spacing between rows. Firstly, the case with the flow direction being parallel to rows in a rectangular geometry is considered by defining three flow regimes. Secondly, when the flow is not in line with the main rows,

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solutions are suggested for the patterns of wind turbine units corresponding to each wind direction. The presentation is an outline of a model complex that will be adjusted and calibrated with measurements in the near future.

Borlando and etal [3] by The analysis is based on a 3-year long time-series of measurements of the wind velocity from 11 anemometric stations located along the perimeter of the island. Since the present study was an analysis preliminary to the subsequent assessment of the wind potential of Corsica, we have worked only with wind intensities. Nevertheless, at the end of our analysis, we have also considered wind directions for the final interpretation of the results. The anemological regions are defined through the comparison of 15 different clustering techniques resulting from the combination of three distance measures and five agglomerative methods. As confirmed by geographical considerations, the results identify three distinct anemological regions: the eastern region (ER), the north-western region (NWR), the south-western region (SWR). The wind regimes are identified by means of a two-stage classification scheme based on a hierarchical cluster analysis followed by a partitional clustering. The final classification identifies eight regimes: the four wind regimes corresponding to the main weather patterns of Western Europe, as proposed by Plaut and Simonnet, and another four clusters corresponding to breeze regimes.

Reikard [4] shows that The regime-switching model uses a persistence forecast during periods of high wind speed, and regressions for low and intermediate speeds. These techniques are tested on three databases. Two main criteria are used to evaluate the outcomes, the number of high and low states than can be predicted correctly and the mean absolute percent error of the forecast. Neural nets are found to predict the state transitions somewhat better than logistic regressions, although the regressions do not do badly. Three methods all achieve about the same degree of forecast accuracy: multivariate regressions, state transition and regime-switching models. If the states could be predicted perfectly, the regime-switching model would improve forecast accuracy by an additional 2.5 to 3 percentage points. Analysis of the density functions of wind speed and the forecasting models finds that the regime-switching method more closely approximates the distribution of the actual data.

Elizano and etal [5] shows that In the case of the rapidly spinning load configurations, a finite power production at wind speeds below the theoretical cut-in speed can be observed, which can be explained in terms of inertia effects. During the measurement campaigns with high loads, we were able to observe bifurcations of the power curve, which can be explained in terms of instabilities arising in situations of transition from attached to separated flow. A full experimental Cp (λ)-curve has been constructed by operating the turbine under different load conditions and the findings are in good agreement with a variable Reynolds-number blade-element momentum model. The three proposed system configurations have been found to operate with a high aerodynamic efficiency with typical values of the power coefficient in the 0.40–0.45 range.

The windiest station in Iran is Manjil station with the annual average wind speed of 12.5 knots which itself alone is a separate zone. After that Sistan windy region which involves country eastern regions and internal plains, has a high windy power and in the most of its parts the wind blowing speed is noticeable. [6]

II. Methodology

To study of wind energy in Kish Island, we use a 10 year statistic of wind direction and speed at 3 hour time interval (8 measurements on a day during 00, 03, 06, 09, 12, 15, 18, 21 o'clock based on GMT) in Kish synoptic stations This information has been for the year's 1996 to 2005 A.D

III. Discussion

In this research, we studied the temporal distribution of wind using three – hour statistics (8 measurements on a day during 00, 03, 06, 09, 12, 15, 18, 21 o'clock based on GMT) of windspeed in Kish synoptic station from January 1st 1996 until December 31th 2006. It was found that high windspeed in this region starts from February and continue to June.

Kish Islands in the South of Iran is located coastal water near Hormozgan Province. Based on the wind 3-hour statistics in Kish station, the mean annual windspeed in this Island is 8.6 knot (4.3 m/s). The maximum windspeed recorded in this stations 47 knot (23.5 m/s). (Figure 1)

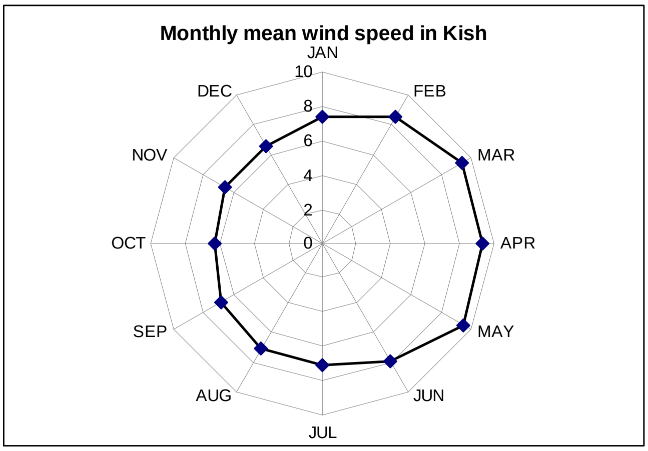

Fig. 1 Monthly wind speed in Kish Island

In 45.7 percent of recorded times, windspeed has been Zero or less than 8 knot which is not suitable to use the wind energy. But in 54.3 percent of recorded times, windspeed has been more than 8 knot and suitable to use wind energy to run turbines. In 40.2 percent of recorded times, windspeed has been between 8 to 16 knot, in 13 percent of times between 16 to 24 knot and in 1 percent of times it has been higher than 24 knot. In this station, the direction of winds higher than 8 is west and wind direction in Kish station is stable in most times of the year. (Figure 2)

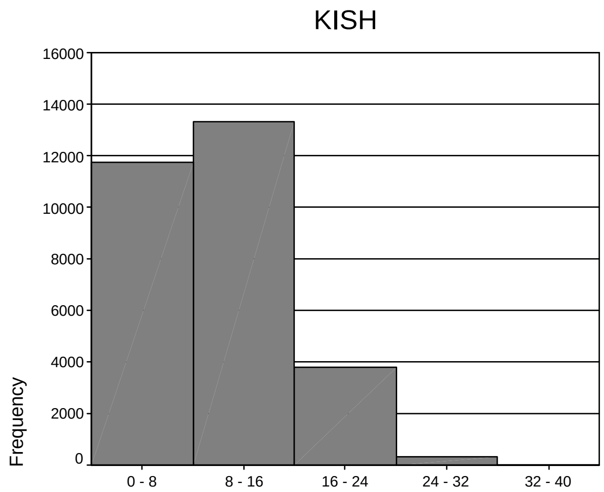

Fig. 2 Wind Speed Histogram in Kish Island

With regard to high – speed and stable direction winds during the year and also shallow coasts near this is land, it is possible to build offshore wind farms near Kish Island and utilize wind energy produce the electricity required in this Island during most of the year.

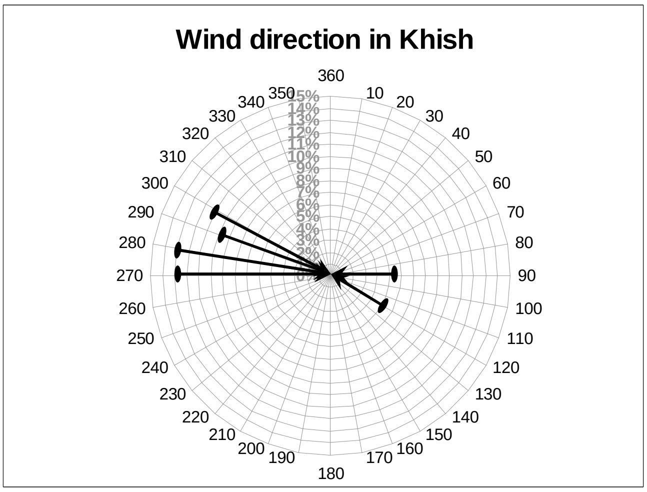

Fig. 3 Wind Direction in Kish Island

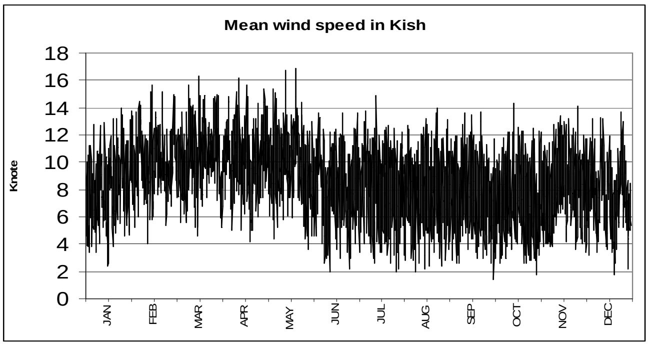

Fig. 4 Daily Wind Speed in Kish Island

IV. Conclusion

Based on the wind 3-hour statistics in Kish station, the mean annual windspeed in this Island is 8.6 knot (4.3 m/s).

The best months for using wind energy in Kish Island are February to May. By the way in other months of year we can use wind energy in parts of the day.

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References

[1] PERRIER, E. R., ASTON, A. and ARKIN, G. F, “Wind Flow Characteristics on a Soybean Leaf Compared with a Leaf Model”. Physiologia Plantarum, Volume 28, Issue 1, February 1973, pages 106–112.

[2] Frandsen, S., Barthelmie, R., Pryor, S., Rathmann, O., Larsen, S., Højstrup, J. and Thøgersen, M, “Analytical modelling of wind speed deficit in large offshore wind farms”, Wind Energy, Volume 9, Issue 1-2, January - April 2006, pages 39–53.

[3] Burlando, M., Antonelli, M. and Ratto, C. F, “Mesoscale wind climate analysis: identification of anemological regions and wind regimes”, International Journal of Climatology, Volume 28, Issue 5, April 2008, pages 629–641.

[4] Reikard, G, “Regime-switching models and multiple causal factors in forecasting wind speed”, Wind Energy, Volume 13, Issue 5, July 2010, pages 407–418.

[5] Elizondo, J., Martínez, J. and Probst, O, “Experimental study of a small wind turbine for low- and medium-wind regimes”, International Journal of Energy Research, Volume 33, Issue 3, March 2009, pages 309–326, 10.

[6] Gandomkar, A, “Wind Energy Potential Estimation in Iran”, 21st International Power Sistem Conference, Tehran, 2005.

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