

Kurdistan Regional Government-Iraq
Ministry of Higher Education and Scientific Research
University of Dohuk

Study and Analysis of
Wind and Wind Power at Dohuk
Governorate

A Thesis
Submitted to the Council of the College of Education/ University of Dohuk
In Partial Fulfillment of the Requirement for the Degree of
Master of Science

In
Physics

BY:
Laylan Bapper Hassan
B.Sc. (Dohuk University)

SUPERVISED BY:
Dr. Mohammed Aziz Saeed
Asst. Professor

October
2008

Shawel
1429

Gelareezan
2708

Abstract

In this thesis, routine daily values of wind speed and direction recorded at six agro meteorological stations in Dohuk governorate have been collected and analyzed for four years (2001-2005). The stations are (Dohuk dam, Zakho, Aqra, Hassania, Bateel and Agriculture College in sumel). The wind direction at each station has been analysed to evaluate prevailing wind direction. It can be seen that at Dohuk dam, Zakho, Bateel, Hassania and Sumel the northwest wind is prevailing while for (Aqra) easterly wind is prevailing wind.

The wind speed recorded at 2m above ground level, using manual and automatic anemometers. The recoded data were extrapolated to 10m and 50m through careful selection of height extrapolation formula.

Monthly and annual mean wind speeds at 10m and 50m for each location were calculated. The results are all shown in both tabulated and graphical forms. It was found that the mean monthly wind speed varies from minimum value (1.51 to 1.9) m/sec in December at Aqra to maximum value (3.36 to 4.23) m/sec in June at Aqra at 10m and 50m elevation respectively and with annual means ranging from (1.76 to 2.22)m/sec at Zakho to (2.67to 3.36) m/sec at Hassania.

The probability distribution of the local wind speeds can be reasonably well described by the Weibull probability distribution function; although it is recommended that monthly variability of local winds should be taken into consideration when estimating the Weibull fitting parameters. The results showed that this function can be fitted to the wind data reasonably at Dohuk

Governorate. The shape and scale parameters of Weibull distribution are determined by using the tables of Γ functions and Weibull probability distribution functions. The results are all shown and carefully analyzed. The selected wind data thereafter are used to determine the quantity of wind power and its potential energy on monthly and annual basis for each location under consideration.

The annual wind power densities estimated from wind speeds at 10 meters height are 12.60, 12.86, 13.00, 25.38, 37.81, and 15.56 W/m^2 for Dohuk dam, Zakho, Aqra, Bateel, Hassania and Sumel, respectively, while the corresponding values of wind power densities from winds at 50 meters height are 25.12, 25.63, 25.91, 50.60, 75.37, and 31.01 W/m^2 , respectively. The annual wind energy densities are 110.4, 112.63, 113.86, 222.37, 331.25, and 136.28 $KW/year/m^2$ at 10m, Dohuk dam, Zakho, Aqra, Bateel, Hassania and Sumel, and 220.05, 224.50, 226.95, 443.24, 660.27, and 271.63 $KW/year/m^2$ at 50m height, respectively.

The generated wind power in all sites were also determined using turbines of 4, 22, 50, 100 and 1000KW wind machine models and compared with hourly annual electricity demand in the study area and the results of the investigation are promising.