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A PRELIMINARY ANALYSIS OF OZAR WINDS FOR INSTALLATION OF WIND MILLS

Due to rapid world consumption of energy, scientists have to think of alternate sources of power, *viz*, solar energy, tidal energy, geothermal energy, wind energy etc. Efforts are made to utilise these energies for benefit of mankind.

In the present study an analysis of winds at Ozar for five years (1978-82) is undertaken with a view to the possibility of installation of wind mills in and around Ozar area as it is noticed that strong winds always prevail over this station for about four months in a year during day time.

It may not be feasible to effectively utilise wind power in every location. In general, plains where there is less resistance for flow of wind, will be more ideal. Wind energy can be converted into other forms namely, (*i*) storage of electrical energy in rechargeable batteries, (*ii*) pumping of water, conversion to mechanical energy & storage in fly wheels and (*iii*) conversion to chemical energy & storage in form of hydrogen and oxygen.

The wind power (p) in kilowatt; is

$$p = 2.14\ \psi A V^3 \times 10^{-3}$$

where, p = Wind power in kilowatt

ψ = Air density in slugs per cubic ft.

(Slug is a unit of mass & a slug = that mass to which a force of 1 lb will impart an acceleration of 1 ft/sec^2)

A = Projected area swept by turbine

V = Wind velocity in miles per hour

It is seen from the formula that power is directly proportional to the third power of wind velocity. Hence, wind velocity is an important factor for wind power. So strong wind is a very advantageous factor. Strong winds always prevail over this station for about four months in a year during day time. Various types of wind mills are available for different ranges of wind speeds and hence for areas of light winds, areas of moderate winds and areas of strong winds. Before installing a wind mill, proper planning is necessary to instal the right type of wind mill. This analysis of winds at Ozar will enable to choose the right type of wind mill in the region.

Since Nasik/Ozar lie in the central part of Nasik district and in the plains, installation of wind mills in the surrounding areas of Nasik will be of great use to utilise the same for pumping water. The annual rainfall in the region is of the order of about 60 cm.

The calculation of wind power criteria for proper planning of windmill etc are fully explained by the earlier studies by Albeez (1983) and Thomas (1981).

The cup anemometer is located in the observatory enclosure and the height of the mounting is 4.2 metres from ground. The synoptic hour observation every three hours is being recorded for speed and direction. The hourly wind observations for METARs other than synoptic hours for wind speed and direction are taken from the electrical recorder, which is mounted at a height of 18.3 metres from ground on the top of Air Traffic Control building. This preliminary study is undertaken for synoptic hours only and another detailed study will be undertaken based on hourly observations.

The usual height of rotors of wind mills is of the order of 10 metres. As there is an appreciable difference between the heights of the mounting of cup anemometer on which the wind analysis is based and the rotor of wind mills, the necessary correction can be applied using the logarithmic relation given below:

$$\frac{\bar{u}}{u^*} = 1/k \ln \left\{ \frac{u^* + N}{N + \upsilon/9} \right\}$$

where, $=$velocity at height z

u^*=friction velocity

k=0.4 (Constant)

$N=u^*.z$ (Macro viscosity)

υ=kinematic viscosity

NB : For smooth surface $N=0 \neq u^*.z$

The winds have been divided into five groups. The first group is light winds of speed less than 10 kmph denoted by symbol *L*. The second group is of range 10-15 kmph denoted by M. The third group 16-19 kmph denoted by S, the fourth group 20-29 kmph denoted by VS and the fifth group 30 kmph and above denoted by VVS. In the case of light winds *L*, the wind mills may not be operative. However, wind mills will be operative for remaining four groups M, S, VS & VVS. The reason for dividing the frequencies of occurrence of winds into these groups is to decide the type of wind mills to be employed and also to decide upon the uses to which the wind power could be put.

The number of observations for all the five groups were tabulated for each month. Thus, the frequency of occurrence in each group were tabulated for all the months. Frequency of occurrence for five years prepared and tabulated monthwise is shown in Table 2. This data is used for various kinds of analysis.

TABLE 1

Frequency of occurrence of winds for the period 1978-82

L	M	S	VS	VVS	Total
4,653	3,447	1,711	2,919	1,818	14,548
32%	23.7%	11.7%	20%	12.6%	

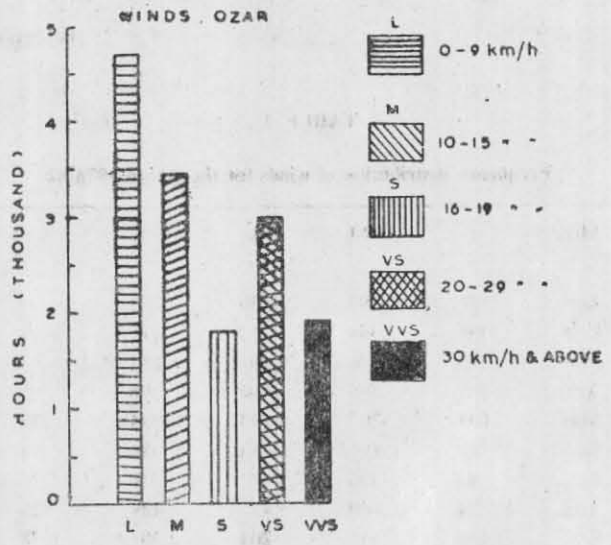

Fig. 1. Histograms for classification of winds

Conclusions — In the first type of wind analysis the number of 3 hourly observations for the entire period of five years falling into each of the five different groups L, M, S, VS and VVS were added up. Frequency of occurrence of winds falling in the five groups during the five years is represented in Table 1 along with the percentage frequency of occurrence falling into the five groups. Out of the total number of 14548 hrs, the frequency of occurrence of light winds L is 4653 hrs, the frequency of occurrence of M 3447 hrs, the frequency of occurrence of S 1711 hrs, the frequency of occurrence of VS 2919 hrs and the frequency of occurrence of VVS 1818 hrs. In terms of percentage the frequency of L= 32%, M=23.7%, S=11.7%, VS = 20% and VVS = 12.6%. Figs. 1 & 2 represent histograms for the classification of winds.

From Table 1, it is seen that there are 68% of occasions when winds are moderate, strong, very strong and very very strong. During this period wind mills can be effectively operative, Light winds are 32% of the total winds. Thus wind mills will be in operative only for short duration, also considering the fact that light winds prevail more often in night time than day time.

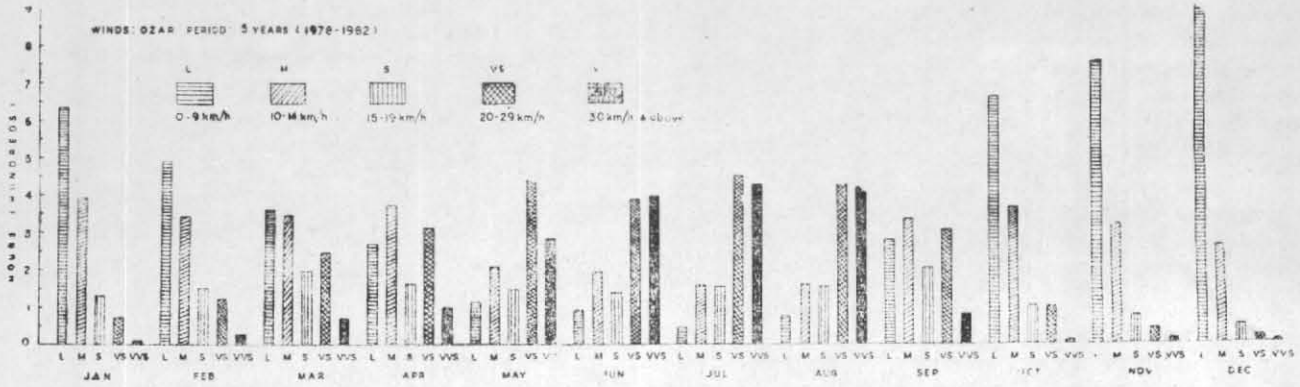

Fig. 2. Histograms of classification of winds

TABLE 2

Frequency distribution of winds for the period 1978-82

Month	L	M	S	VS	VVS
Jan	635	393	130	73	9
Feb	490	344	152	118	24
Mar	360	346	197	244	67
Apr	267	369	161	308	95
May	109	207	193	444	279
Jun	87	191	133	386	393
Jul	43	157	155	450	427
Aug	74	160	157	429	420
Sep	280	333	204	305	78
Oct	661	367	102	101	9
Nov	751	318	76	42	13
Dec	896	262	51	19	4

In the second type of analysis the number of occurrence of winds falling in each of the five groups L,M,S,VS and VVS are added up monthwise for the entire period of five years. It is seen from the Table 2 that Oct to Feb is the least favourable period to operate wind mills. May, June, July and August are most favourable months. During these months there is plenty of wind energy available. Further, May is a dry month when power cuts are more frequent. Therefore, wind mills can be effectively used in these surroundings during May to August.

The authors are grateful to Shri C. E. J. Daniel former Regional Director, Bombay for providing data and encouragement. Thanks are also due to Shri P.K. Misra, present Regional Director for going through the manuscript and giving suggestions for improvement. The authors are also grateful to S/Shri H. A. Shaikh and R. S. Dube of Nasik office for helping in the computational work etc and to Smt. Jeyapunisa M. O. Madras for typing the manuscript.

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21 March 1986