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THE WIND ENERGY SCENARIO IN COASTAL REGION OF BANGLADESH

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ABSTRACT

As a developing country, Bangladesh uses energy for its needs but she is encountering difficulties in supplying energy to maintain its economic growth. The demand for energy exceeds the available resources and this gap is projected to increase significantly in the near future. In this case of energy problem in Bangladesh Wind energy holds good prospect. The wind speeds of coastal regions of Bangladesh have been considered in the present paper. These data show a prospective source of wind energy in coastal regions in Bangladesh. Proper type of wind turbines may be designed and fabricated for the purpose of extracting wind energy. The wind speed in some regions is satisfactory for operating pumps and for generation of electricity. The wind turbine may also be useful to drive hand pumps used for irrigating agricultural land.

Keywords: Bangladesh, Wind energy, Wind data.

1. INTRODUCTION

Bangladesh is situated between 20°34' and 26°38' N latitudes and 88°01' and 92°41' E longitudes with nearly 150 million people living on 144,000 sq. km area. The high growth of her population makes difficult to meet up its energy demand. But there are no sufficient common sources of energy in Bangladesh. To overcome this situation, more searches of energy sources are a crying need. The prospect of wind energy as an alternative source of energy in Bangladesh needs to be examined because the oil and gas reserve of the country is very small. Bangladesh is an agricultural country and its agriculture needs supply of water for irrigating land. A recent study [1] shows that there is a surface water potential for a total of 54,700 pumps of 0.066 m^3/s capacity. About *50%* of these pumps are to be operated at a head of 6m or less, considering the terrain of the country. For driving these pumps either diesel engines or electric motors are used. These pumps can be driven with the help of windmills. For selecting the size and type of wind machine, the information about wind speed, direction and its duration should be known.

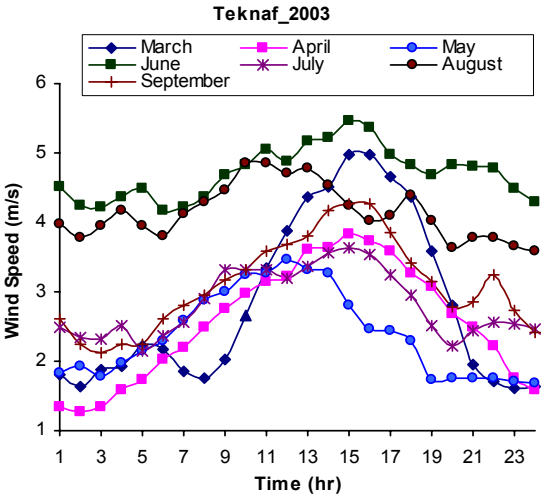
In this paper, an attempt has also been made to investigate the application of wind energy for irrigation and generation of electricity in coastal region of Bangladesh.

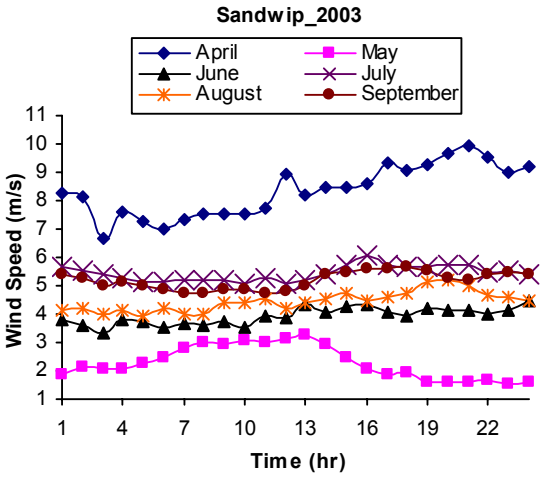
2. WIND DATA

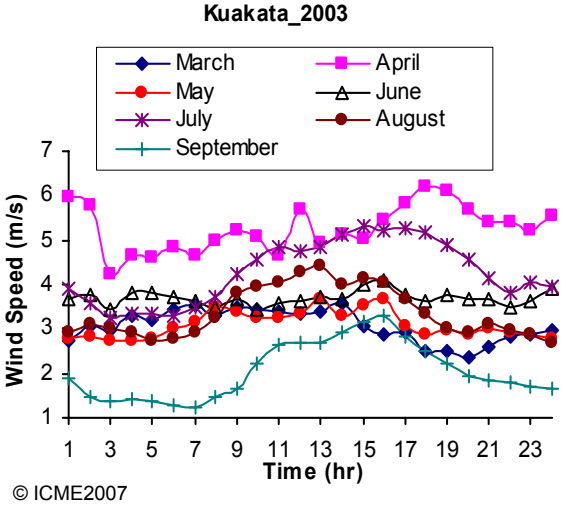
In Bangladesh, winds are available mainly during the Monsoons and around one to two months before and after the Monsoons [2]. During the months starting from late October to the middle of February, winds either remain calm or too low to be of any use by a windmill. Except for the above mentioned period of four months, a windmill if properly designed and located, can supply enough energy. The wind energy distribution during the year in such that about 55% is available during the time when need for water pumping is low and about 25% is available in the season when the need for water pumping is at its peak [3]. The wind speed of coastal area holds good prospect to make the best use of wind energy.

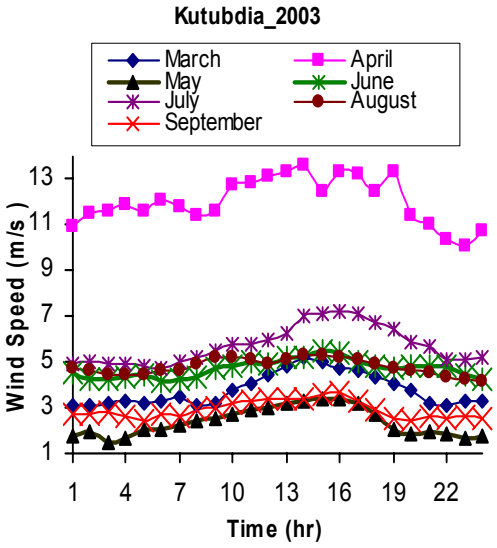
In this paper, wind data of coastal region in Bangladesh such as Teknaf, Kutubdia, Sandwip, Kuakata, and Mongla have been considered to evaluate the wind power availability. The peak rainfall occurs in the country during the months of June, July and August. But the peak wind speed above average occurs one to two months and in some cases three months before the peak rainfall occurs. The average wind speed in Bangladesh is available from the month of March, April and May. That's why in this paper, the wind speed data from March to September are considered. During this period windmills may be used for pumping water for irrigation if it had been previously stored in a reservoir. Rain water is available in this country from May to October. During the operating seasons, subsoil water from shallow wells can also be pumped up by low lift pumps run by windmills. Wind power can also be incorporated in electricity grid on a substantial basis and could add reliability and consistency to the electricity generated by the Kaptai Hydro electric Power Station during the dry season. This is due to the electricity generated by the Kaptai Hydro electric Power Station during the dry season. This is due to the fact that in dry season, the required water head becomes rather low for total

utilization of the entire generator. Thus power generation has to be curtailed during this period. So this deficit power could be compensated with the help of wind power plant. Characteristics of wind speed data of above mentioned coastal region have been studied from month of March to September, 2003.









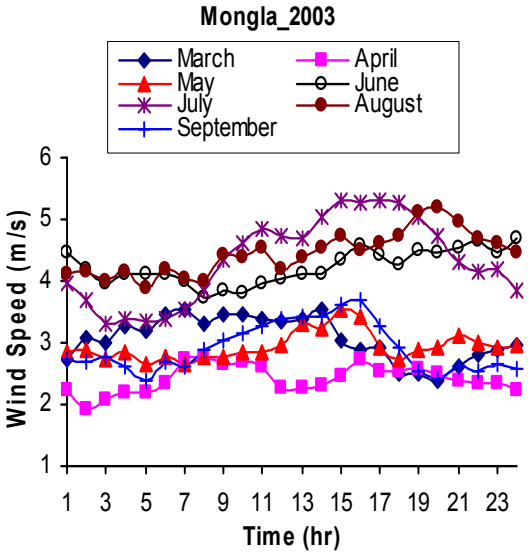
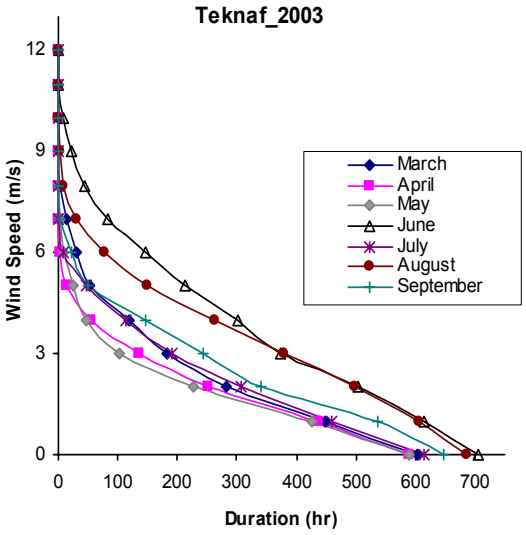
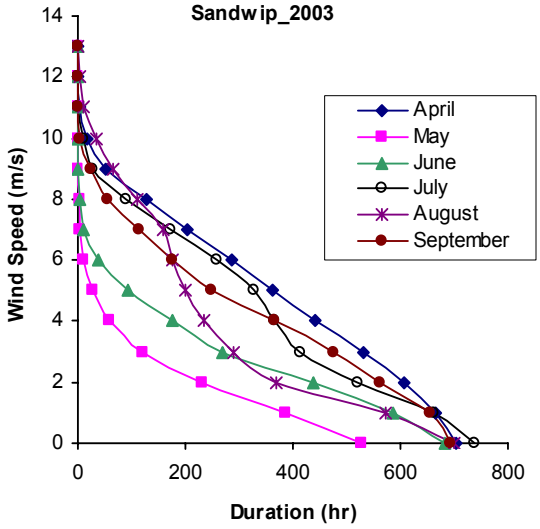
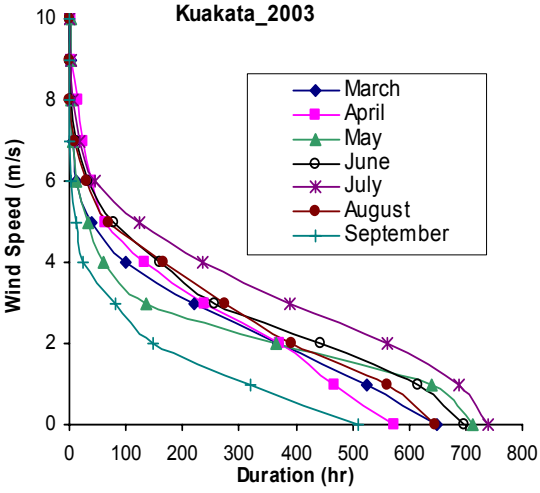


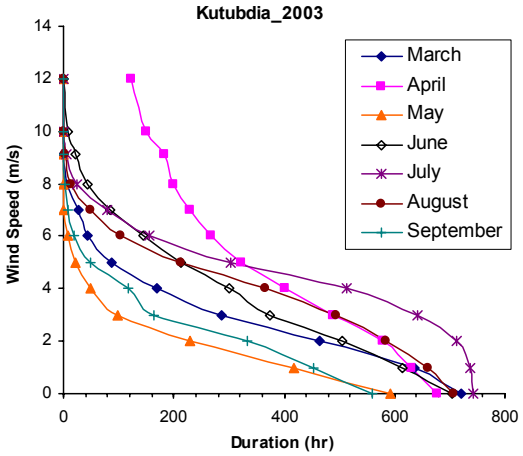
Fig 1: Mean hourly wind speed of different region of Bangladesh showing typical variation (2003)

The data have been used to compute the monthly average wind speed as shown in Table 1 and the energy availability for the stations presented in Table 2. Hourly wind speeds of the locations were plotted against the hour of day and it was found that for all the locations, the speed has a regular diurnal variation along with some fluctuation, and it attains a maximum value at around 10am-2pm local time. In all cases, there appears to be a seasonal effect and a stable wind speed is found for the month June. A typical case for Coastal region is shown in Fig. 1 and Fig. 2.









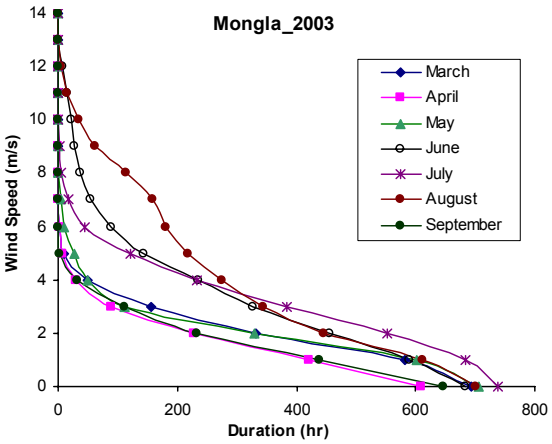


Fig 2: Velocity duration curve in various locations in Coastal region in year 2003

Table 1: Average wind speed in m/s at different location in coastal region in Bangladesh (2003)

Locations	Month						
	Mar	Apr	May	Jun	Jul	Aug	Sep
Teknaf	2.85	2.56	2.39	4.71	2.83	4.14	3.11
Kutubdia	3.78	12.02	2.37	4.71	5.73	4.78	2.92
Sandwip	NA	8.34	2.28	3.93	5.44	4.44	5.18
Kuakata	3.07	5.26	3.10	3.69	4.28	3.37	2.03
Mongla	3.07	2.41	2.94	4.23	4.34	4.44	2.92

Table 2: Theoretical available power of different location in coastal region in Bangladesh (2003)

Locations	Months	Avg. wind speed (m/s)	Theoretical Available power (W/m^2)
Teknaf	Mar to Sep	3.23	22.11
Kutubdia	Mar to Sep	5.19	86.65
Sandwip	May to Sep	4.93	72.66
Kuakata	Mar to Sep	3.55	27.35
Mongla	Mar to Sep	3.48	25.52

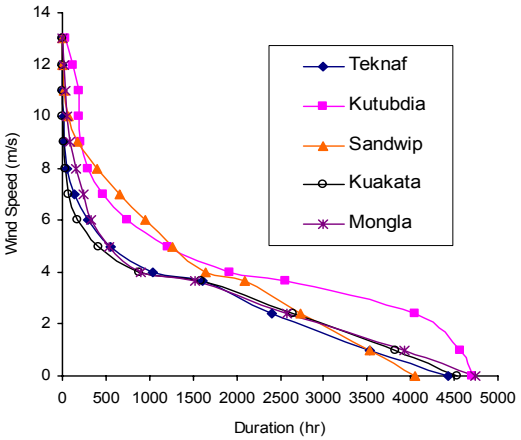


Fig 3: Variation of velocity duration curves among various location of coastal region

From Fig. 3 and Table 2, it is found that the average wing speed in Kutubdia is above 5m/s (March-September) and about 2.57m/s (5 knot) for 4000 hrs in those six months. At this available speed a wind plant can operate both for generation of electricity and for driving pumps [4]. But the average wind speed of rest of the location is below 5m/s and 2.57m/s (5knot) for 2500 hrs, at this available speed, these locations may not be recommended for electricity generation, these locations may be recommended for pumping purpose [5]. As the average wind speed of above all location is more than 3.2 m/s, hence sailwing rotor is recommended as its starting speed is around 2 m/s [6].

The wind power per unit area of approach is proportional to the cube of wind speed [7] and it can be expressed as $P/A = 0.6\ V^3$ where P/A is in W/m^2 and V is in m/s. This wind power represents the strength of wind, and theoretically maximum 59% of this power can be extracted. The wind power, P/A is plotted in Figure 4 to show the strength of wind in different location.

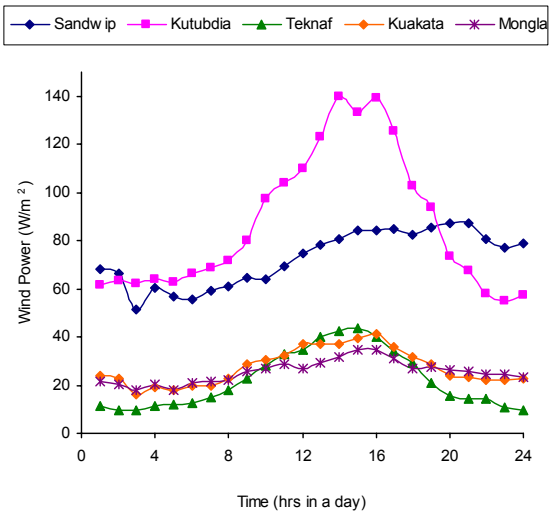


Fig 4: Wind power in different location in coastal region (March-September, 2003)

Figure 4, also shows that in Sandwip the average wind power is about 86.65 W/m^2 which is higher than other location.

3. DISCUSSION

The wind data presented here may be helpful for lifting water and electricity generation in coastal region in Bangladesh which may solve energy problem in the country to some extent. In some location like Kutubdia in coastal region, the wind speed is expected to be reasonably sufficient for installing wind plant for generation of electricity. In these areas, the transmission of electricity is either expensive or impossible. So the supply of electricity from main transmission line is so much expensive and uneconomical. The installation of wind plant for generating electricity will be very useful for such areas. Wind plants should be made popular to the users, and the owners should be encouraged to make it with locally available materials.

4. REFERENCES

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5. NOMENCLATURE

Symbol	Meaning	Unit
A	Rotor swept area,	m^2
P	Theoretical power,	w/m^2