4th International Conference on Mechanical Engineering, December 26-28, 2001, Dhaka, Bangladesh/pp. I 67-69

WIND ENERGY SITUATION AT ST. MARTIN'S ISLAND OF BANGLADESH

M. H. Zaman, R.C.Roy, J.K.Saha, M. Morshed
Institute of Fuel Research & Development,
Bangladesh Council of Scientific & Industrial Research
(BCSIR), Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205

Abstract The paper presents an overview of wind energy scenario at St. Martin's Island, an isolated island of Bay of Bengal and critically examines the data on wind speed and its frequency and measurements. The station for generating data on the basis of fluid dynamics and steps for wind power development in Bangladesh is identified. Finally, some suggestions are made for harnessing the potentials of wind power in Bangladesh.

Keywords: Wind energy potential, Weibull function.

INTRODUCTION

Natural gas is the major source of energy in Bangladesh. It is used both in industry and in household consumption. Power plants are also run by gas. If gas is utilized in the same terrain it will be exhausted by twenty-five years. Gas is a commercial fuel, its consumption needs control. Other sources of energy especially needs energy especially renewable energy need exploration. Renewable energy especially wind energy is promising. Efforts may be made to harness wind energy in some regions of Bangladesh.

In this context, highest attention for exploring renewable energy sources requires to keep our socio-economic development at a sustainable level. Till now in Bangladesh, per capita energy consumption of this major portion of the population is below the minimum acceptable limit. Right now expansion of the national grid in the undeveloped remote areas specially in coastal zone are progressing very slowly done to various economical and technical constraints. So, an alternative source of energy, which is both technically and economically feasible for our socio-economic environment, should be explored. Application of wind energy might be a solution of this problem. The paper is an overview of wind energy scenario of prospective isolated St. Martin's Island from which it can be imagined about wind energy in the coastal zone of Bangladesh.

WIND ENERGY IN BANGLADESH

Bangladesh is situated between $20^0$34'-$26^0$38' North Latitude and $88^0$04-$92^0$44' longitudes. It has more than seven hundred kilometers long coastal line and many small island in the Bay. The strong south/south-western monsoon wind comes from Indian Ocean. This trade wind blows over our country from March to October. This wind speed is enhanced when it enters the V-shaped coastal regions of Bangladesh. Since this trade wind strikes the coastal belt of Bangladesh after travelling a long distance over oceanic water surfaces, it becomes energetic. According to preliminary studies it is found that some time wind speed ranges from 7m/s to 8m/s in some coastal areas of Bangladesh. It is to be mentioned here that having the some climates, monsoon trade winds, surface roughness and terrain types as those of Bangladesh, India is generating several hundreds of MWs of power from their coastal regions.

The wind of the coastal region is generally classified in four distinct type and they are:
1.North-Easterly Trade Wind
2.South-Westerly Trade Wind
3.Sea Breeze
4.Land Breeze

In Bangladesh, the potential sites of Wind Energy are as follows:
i)Patenga ii) Cox's Bazar iii) Teknaf iv)Companigonj v) Sonagazi vi) Kuakata vii) Bhola viii) Char Fession ix) Pathorgatha x) St. Martin's Island xi) Sandwip xii) Hatia Island xiii) Kutubdia Island and many other coastal places and off-shore islands.

Other than the coastal areas, in Bangladesh there are plenty of rivers, haors and bills where wind speed is also feasible for small-scale power generation.

WIND ENERGY AT ST. MARTIN'S ISLAND

St. Martin's Island is an isolated island of Bay of Bengal under the district of Cox's Bazar, Bangladesh. It is situated twenty nine kilometers away from the main land. Its area is 15 sq.km and the population is about 5000. There are some highly prospective resources in this island such as fishing, tourism, poultry farming etc.

Email: ret@bdcom.com

Proper exploitation of these resources can contribute significantly to achieve the goals of self-reliance and socio-economic development.

But electricity is the main problem to exploit these resources because no electricity exists in this isolated island. By the grace of nature of nature, there prevails strong trade wind in the island that can generate electricity through wind turbine and supply them.

A comprehensive feasibility study programme has been started by Bangladesh Council of Scientific & Industrial Research(BCSIR) at St. Martin's Island through the installation of Wind monitoring since April,1998 to measure the actual wind velocity and its variation. The wind velocity data from April,1998 to March1999, was collected through installed data logger at 25m height in the Island and analysed in the Renewable Energy Technology Laboratory, IFRD, BCSIR. Table-1 shows the month wise hourly average wind speed data and Table -2 shows the wind data analysis at St. Martin's Island from April,98 to March,99.

Table-1: Month wise, hourly average wind speed (m/s) at St. Martin's Island

Month /Hr	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Apr.98	4	4	4	4	4	4	3	3	3	3	3	4	4	5	5	5	5	5	4	4	4	3	3	3
May98	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	5
June98	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6
July98	6	6	6	6	6	6	6	6	6	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Aug98	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	5	5	5	5	5	6
Sept98	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	4	4	3	3	3	3	3	3
Oct98	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3	3	4	4	4	4
Nov98	4	4	5	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	4	4	4	4	4	4
Dec98	5	5	5	6	5	5	5	4	4	4	3	3	2	2	3	3	3	3	4	4	5	5	5	5
Jan99	6	6	6	6	6	6	6	5	5	5	4	4	3	3	4	4	4	4	5	6	6	6	6	6
Feb99	6	6	6	6	5	5	4	4	4	3	3	3	3	4	5	5	5	5	5	5	6	5	5	5
Mar99	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	4	4	4	4	4

Table-2: Wind Data Analysis at St. Martin's Island (April '98- March'99).

Vel. Class	Ave.Vel	Freq.	Cumul.	Rel. Freq	Rel. Cumul.	Vel.	Rel. Vel.	Energy (Wh/m^2)
v(m/s)	v (m/s)	h(hrs)	Freq.	f(v)	F(v)	Duration	Duration	$0.1*v^3*h$
0-1	0.5	218	218	0.0249	0.0249	8542	0.9751	2.173
1-2	1.5	796	1014	0.0909	0.1158	7746	0.8843	268.65
2-3	2.5	1390	2404	0.1587	0.2744	6356	0.7256	2171.86
3-4	3.5	1474	3878	0.1683	0.4427	4882	0.5573	6319.76
4-5	4.5	1437	5315	0.1640	0.6067	3445	0.3933	13094.66
5-6	5.5	1220	6535	0.1393	0.7460	2225	0.25402	20297.75
6-7	6.5	864	7399	0.0986	0.8486	1361	0.1554	23727.6
7-8	7.5	581	7980	0.0663	0.9110	780	0.0890	24510.94
8-9	8.5	358	8338	0.0409	0.9518	422	0.0482	21985.68
9-10	9.5	204	8542	0.0233	0.9751	218	0.0249	17490.45
10-11	10.5	98	8640	0.0112	0.9863	120	0.0137	11344.73
11-12	11.5	48	8688	0.0055	0.9918	72	0.0082	7300.40
12-13	12.5	26	8714	0.0030	0.9947	46	0.0053	5078.13
13-14	13.5	17	8731	0.0019	0.9967	29	0.0033	4182.64
14-15	14.5	10	8741	0.0011	0.9978	19	0.0022	3048.63
15-16	15.5	7	8748	0.0008	0.9986	12	0.0014	2606.71
16-17	16.5	5	8753	0.0006	0.9992	7	0.0008	2246.06
17-18	17.5	4	8757	0.0005	0.9997	3	0.0003	2143.75
18-19	18.5	2	8759	0.0002	0.9999	1	0.0001	1266.33
19-20	19.5	1	8760	0.0001	1.0000	0	0	741.49
		8760						169828.75

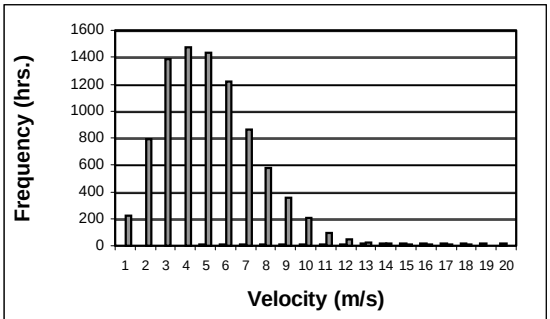

Fig.1:Frequency Vs. Velocity Graph

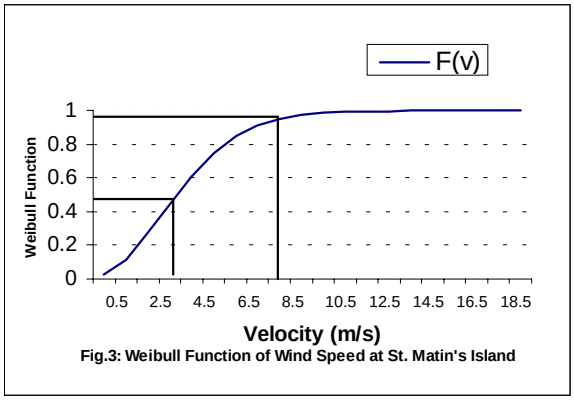

Fig.3: Weibull Function of Wind Speed at St. Matin's Island

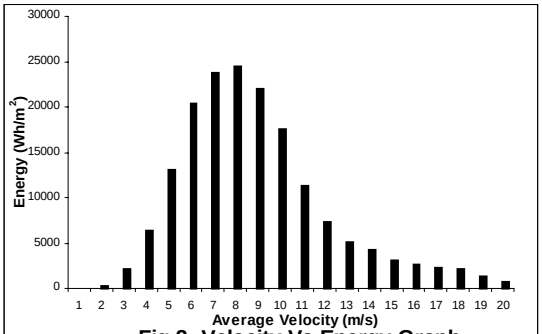

Fig.2: Velocity Vs Energy Graph

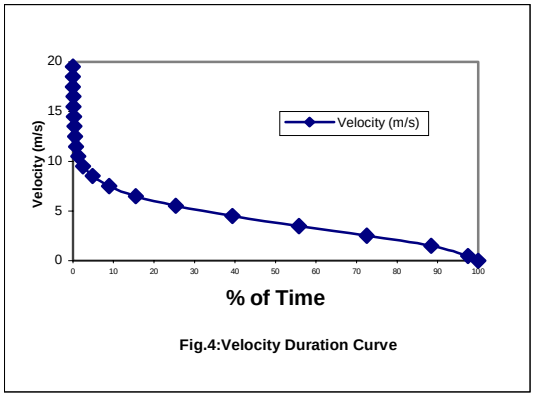

Fig.4:Velocity Duration Curve

Table-3: Approximate size of Wind turbines, their annual mean speed and utilization

Type	Annual Mean wind Speed (m/s)	Utilization
Small Scale (0.025-10 kW)	2.5-4.0	Mechanical pumping battery charger, lighting and television etc.
Medium Scale (10-100 kW)	4.0-5.0	Pumping, cold storage, lighting etc.
Large scale (>100kW)	>5.0	Grid connected purpose

CONCLUSIONS

From Table 2 and Fig 1 &2, we see that above 4 m/s the wind speed exists for 4882 hrs, which is 57 % time of the whole round the year and during this time energy can generate 138.9657 kWh/m^2. The annual mean wind speed $V = \frac{\sum v \times h}{\sum h} = 4.6 m/s$,maximum frequency is 1474 h at 4 m/s and maximum energy is 24510.94 w/m^2 at 8 m/s

From the weibull function curve (Fig.3) and velocity duration curve(Fig.3) and the wind generator of 10-100 kW capacity will generate electricity about 55% time of the whole year at St. Martin's Island.

REFERENCES

E.H. Lysen," Introduction to Wind Energy", SWD Steering Committee Wind Energy Developing Countries, Amersfoot, The Netherlands, May 1983

M.H. Zaman and M.F. Hossain, "Wind Electric Generator- an Overview", The Bangladesh Journal of Science and Technology, vol 1, no.1, January 1999, PP.17-27

R.C. Roy, " Evaluation of Wind Energy pattern for Chandana –Gazipur, Dhaka", The Thesis is submitted to the Department of Mechanical Engineering, BUET, August 1999

Desire LE Gourieres, " Wind Power Plants- Theory and Design", Pergaqomn Press Ltd., Headington Hill, Oxford OX3 OBW, England, 1982