

Wind Farm Planning and its Economic Analysis for Bangladesh in prospects to the development done in China

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Abstract— At present Bangladesh is confronting the issue with power as the production less contrasting with the interest. A lot of power is expended in urban territories particularly by ventures while in rustic or beach front regions a large portion of the individuals are far from its benefits. About 40 million of people are living in the 724-kilometer-wide coastal areas of Bangladesh. In addition, it is astonishing that during the time there is adequate breeze pass up which can deliver a mesmerizing amount of wind power. In any case, step by step the use of wind energy is expanding on the planet which lessens expenses of sustainable power source innovation, improves effectiveness. On this regard China is role model for other developing nations. It would be a decent elective arrangement rather than reliance on petroleum gas. Wind energy is principally potentially in beach front and seaward regions with solid breeze system. Wind energy is fundamental for guaranteeing environmentally friendly power energy for what's to come. The farming place that is known for Bangladesh needs the stockpile of water at perfect time for better yielding. The establishment of windmills will be particularly helpful for working the water supply siphons. This exploration features the plausibility of wind energy and depicts the vital strides to execute and create wind energy division in Bangladesh by utilizing the ideas and research carried out by its friend nation China. Strong strategies, rules, and declaration can be applied to make government, non-government association, and giver associations cooperate to create wind energy segment in Bangladesh.

Keywords— Bangladesh, China, Wind Speed Data, Economic Analysis, Wind Farm Development, Renewable energy.

I. INTRODUCTION

Wind power is the change of wind energy into helpful type of energy utilizing through wind turbines to make power. The power is straightforwardly relative to the wind speed. Petroleum produce are getting condensed step by step. The development pace of mechanical advancement in Bangladesh has loosened down because of the deficiency of energy supply. Wind energy can possibly limit our needs on conventional assets like oil, gas, and coal without doing a lot of harm to nature. With the development rate in GDP approaching to 7% in 2005, Bangladesh is one of the quickest creating economies on the planet. Roughly 51% of Bangladesh's populace, especially in the off-matrix regions, is with no entrance of power. With the inescapable exhaustibility of the non-sustainable power sources and the quickly developing energy request, the strategy creators of the nation in different approaches and institutional courses of

action have moved their concentration to such sustainable power sources like energy.

Bangladesh has a coastal area of 724 km along the Bay of Bengal [1]. Because of huge beach front belt alongside wind speed in certain locales, the capability of wind power is tremendous here [1]. In Bangladesh, power age is for the most part reliant on flammable gas, around 76.74% of power is being created from our gas save [1] and this level of power age utilizes 37% of all out gas utilization [1], while interest for gas utilization is expanding by about 8% every year [1]. We are still a long way behind than its normal development of sustainable power source, for example target 1000-1200 MW to guarantee the jolt for all [1]. As indicated by the paper by [4] sustainable power source and the rest 94% from petroleum products [3]. Another specialist [4] makes reference to about the conceivable capability of sun based photovoltaic and wind energy are evaluated at 50174 MW 4614 MW, separately, while the capability of energy from

biomass and little hydro power plant I evaluated to be 566 MW and 125 MW individually. The significant limitations of sustainable power source referenced in their paper are monetary, money related, political and mechanical. The present issues in regards to sustainable power source strategies can be fathomed with the production of a complete energy technique which would incorporate capable and impartial arrangements [3]. We are as yet falling a long way

behind in the logical utilization of this sustainable power source because of reasons, for example, absence of innovation and skill in this field [4]. Wind power could assume a significant job in tackling power emergency in Bangladesh [6]. A lot of data has been assembled in the previous two years on the wind energy potential along the beach front region of Bangladesh.

Bangladesh Power Capacity by Fuel types	
Fuel Type	Capacity in MW
Natural Gas	6587
Furnace Oil	1963
Diesel	683
Coal	250
Hydro	230
Import	500
Total	10,213

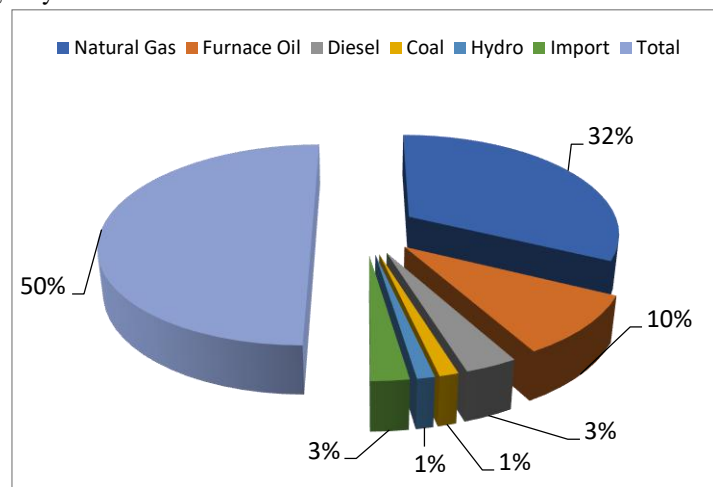


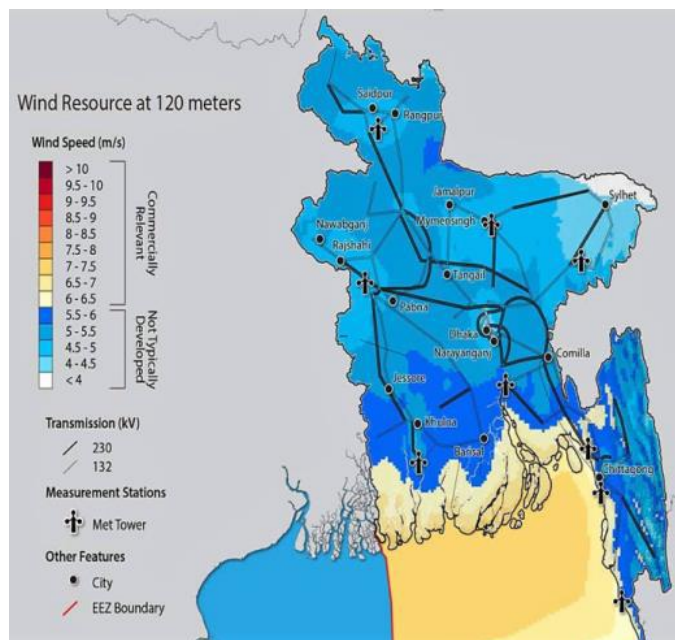
Table & Chart 1: Bangladesh Power production by types of fuel

Different examinations have been led on wind energy and its utility in beach front territories; and talked about the probability of the wind turbine. The wind speed at higher height and the possibility of utilizing enormous wind turbine need further examination. In this paper the present energy situation of Bangladesh is examined first, and afterward the possibility of utilizing wind turbine at seaward just as beach front area is likewise talked about. The current state of wind energy in Bangladesh and different nations on the planet are likewise exhibited to underline the imperative of moving towards wind energy. The target of this investigation is to concentrate on waterfront zones in the Bay of Bengal of Bangladesh coast, break down the deliberate estimations of wind speed and gauge the conceivable power age through the establishment of close to shore and seaward wind ranch to discover wind energy as a feasible answer for relieve the deficiency of electric power age in Bangladesh.

Mode of Research and Data

Bangladesh has absence of solid wind speed information unlike China which uses BeiDou Navigation Satellite System (BDS) and other form of measures [15]. Thus, Bangladesh has for some time been lingered behind to change over wind energy into power by utilizing wind turbines. During this investigation, various papers are

assessed to condense the related data. Additionally, remote detecting wind information is utilized for the Bay of Bengal locale (scope 200N-240N and longitude 87.50E-93.50E) to break down widely the breeze speed quality for the year 1990-2016. Day by day wind speed information (0-10 m normal) is determined from u and v segment of wind [4]. Ferret information representation and examination instrument are utilized to make wind map for the investigation zone.



China is the pioneer of universe of energy it is moving toward the finish of its multi-year plan of Energy Technology Innovation. The arrangement explicitly makes reference to wind energy as a center point, recognizing wind turbines with a megawatt (MW) creation limit of somewhere in the range of 8 and 10 MW as a key innovation. Before the finish of 2020, China plans to have 210 gigawatts (GW) of lattice associated wind energy limit. Its ability toward the start of 2018 drove the world with around 187 GW, contrasted with 89 GW for the US in runner up and 56 GW for Germany in third [10].

Wind energy isn't the main inexhaustible where China is the pacesetter. An ongoing report from the Global Commission on the Geopolitics of Energy Transformation, set up by the International Renewable Energy Agency, indicated China as the nation in the best position to 'become the world's sustainable power source superpower.'

Chinas Perspective

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Capacity in (MW)	12200	16000	31100	62700	75000	91424	114763	129700	149000	163670	184260
Production in (GW)	14800	26900	44622	74100	103000	134900	153400	186300	241000	305700	366000
Capacity Factor	13.8 %	19.2%	16.4%	13.5%	15.7%	16.8%	15.3%	16.4%	18.5%	21.3%	22.7%

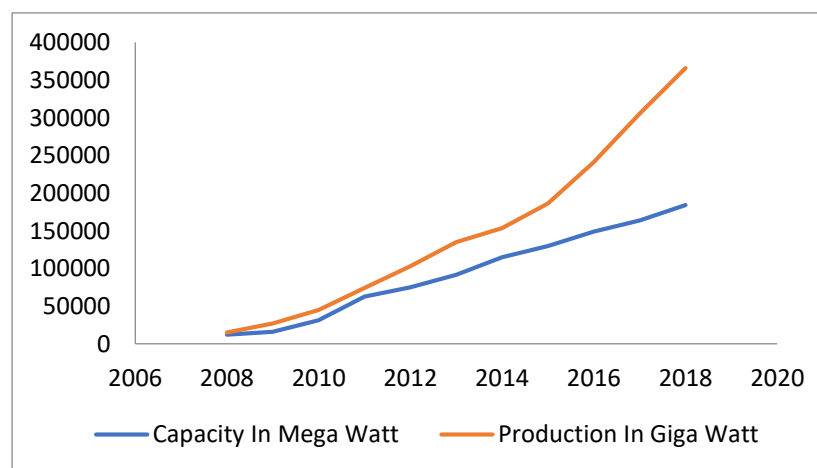


Table & Chart 2: China's Wind Power production in Last 10 years

All signs point towards wind control proceeding to have a focal impact in China's quest for a green future. The two its territory and long coastline are phenomenally appropriate for wind control, and the nation's potential wind control assets

are assessed to be around 2,380 GW (Table & Chart 2). At long last, a main situation in environmentally friendly power energy is helpful for fares of arrangements and innovation, which China is effectively seeking after-for instance

regarding its gigantic Road and Belt foundation venture. Chinese organizations are additionally effectively putting resources into sustainable power source organizations. Later on, efficient power energy will probably be provided by either Chinese equipment or by a Chinese-possessed organization.

China has outpaced every other nation with regards to the generation of renewable, and the equivalent goes for sustainable power source licenses. Starting at 2016, Chinese organizations and associations had 150,000 sustainable power source licenses, equivalent to 29 percent of the worldwide aggregate. For correlation, US organization and associations came in second with a little more than 100,000 licenses. In 2017, Chinese organizations and associations documented a sum of 76 percent of all sustainable power source licenses. Among them are some driven thoughts regarding the fate of energy generation that is truly quite out there. Through the official paper of China's Ministry of Science and Technology, researchers said they are now trying the innovation and expect to have it developed by 2050 [11].

It is another case of the nation seeking after a situation as the world's inexhaustible superpower and when nations like the US have all the earmarks of being pulling ceaselessly from putting resources into sustainable innovation.

Bangladesh Perspective

Bangladesh has a population of 146.2 million and enlivenment of electricity is 59.60%. In 2016 installed electrical capacity was 12229 MW and of which wind energy is 1.9 MW. Bangladesh has potential for wind energy capacity of over 20,000 MW, with wind speed of less than 7 m/sec.

As of late, Bangladesh's first-historically speaking age of power from the wind at a 900 KW plant has directed in new trusts in age of intensity with least cost in the nation. The power plant situated close to the Muhuri Dam in southeastern Feni area, has four separate wind turbines of 225 KW each. Other than a few little wind generators have been introduced by BRAC 11 little wind turbines in different seaside destinations) and Grameen Shakti (two wind generators of 300W and 1 KW at its Chakoria Shrimp farm [9]. Their last quantitative outcomes would be anticipated with extraordinary intrigue. Grameen Shakti has set up four of its wind generators to control violent wind covers set up along the coast. The extension of the capability of wind energy will be essential with the goal for Bangladesh to accomplish its national vision of giving power to the entirety of its populace by 2020[7].

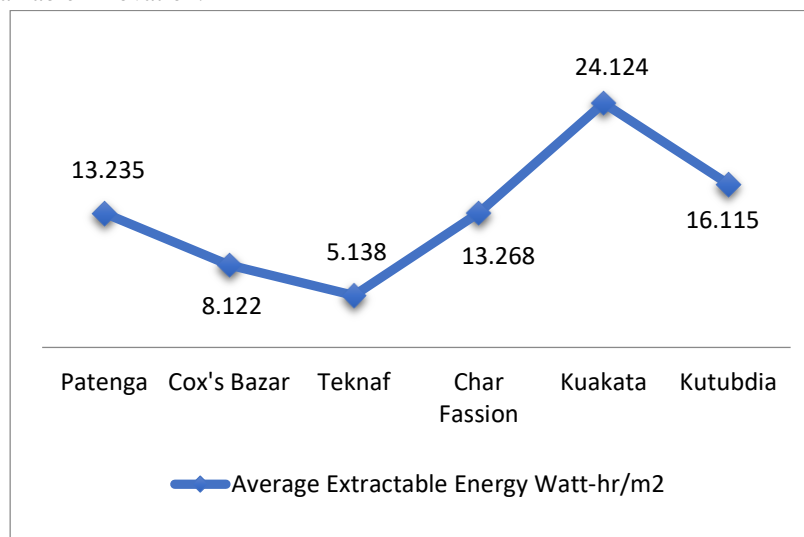


Fig.1: Location wise extractable wing energy in Bangladesh

Bangladesh has an anticipated power request of 10283 MW before the year over 2018. In spite of having an enormous coastline and generally huge region just 100 MW of that tremendous interest is anticipated to originate from wind control sources. Accordingly producing power from the wind

in the beach front territories can be transmitted to different areas of the nation through the high voltage transmission lines. Next to no activity and upkeep will be required during the entire life time of wind turbines and no fuel will be required for creating power from the wind [7]. The

significant issues are the expense related with the usage of the innovation and the absence of data about wind energy and issues identified with getting to pat information from solid and trustworthy sources. Absence of efficient checking and assessment alongside insufficient experience impedes the making of arrangements to back up this segment advancement in this nation. Feeble administrative impetuses have been fruitless in empowering private area interests in sustainable power sources.

II. RESULT AND DISCUSSION

Time arrangement of wind speed (0-10 meters arrived at the midpoint from 2008-2018years is drawn (Figure 2). It demonstrates that the example of wind speed changes marginally from year to year yet on a normal it differs inside 3-4 ms^{-1} , seen from red shading line. The dark shading line shows those 30 days running mean shifts inside 2-6 ms^{-1} .

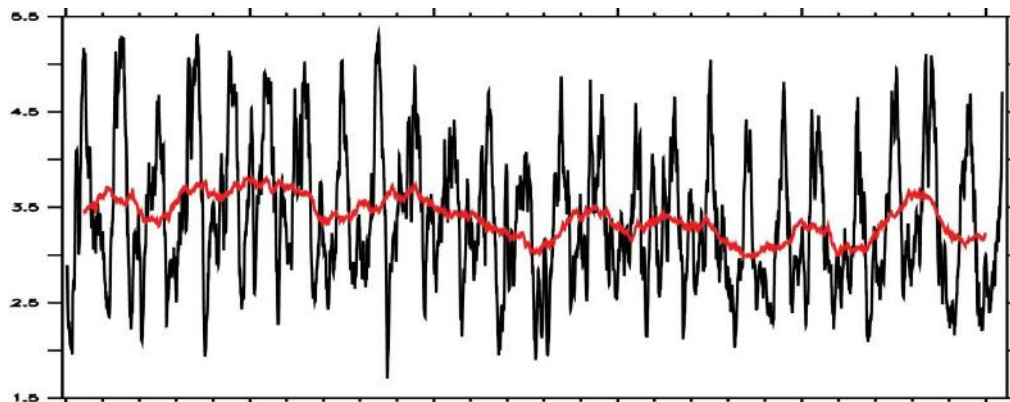


Fig.2: Wind Speed Time Series for past ten years in Bangladesh (2008-2018)

Month to month Climatology of wind speed from 2008-2018years (Figure 2), demonstrates that breeze speed more than 3.2 ms^{-1} for all time exist from the long stretch of April to August while other month it is low. Wind speed tops during the long stretch of June-August of every year.

Climatology of wind speed from 2008-2018years (Figure 1) shows that average breeze speed was more than 3.2 ms^{-1} for all time span from the period of April to August though in one more month it is low. Wind speed tops during June-

August month of every year. From (Figure 3), it demonstrates that seaward wind speed is in every case high during April-August month; different months likewise show higher seaward wind. In this manner from the investigation, we can presume that seaward wind control plant will be extremely compelling for Bangladesh, though beach front breeze plant likewise can be productive to create control during the period of April-August.

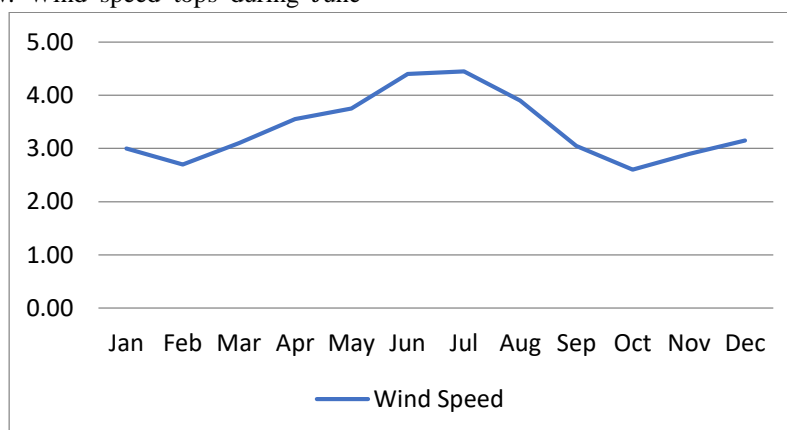


Fig.4: Month Wise Wind Speed Data

This breeze blows having a month to month normal speed from 3 m/s to 6 m/s over Bangladesh from March to

September [9]. When the breeze goes into the V-molded beach front locale of the nation, the speed of the breeze is

improved. During the rainstorm and around one to two months when the storm (7 months, March to September) there is the accessibility of wind as per primer investigations, (from the meteorological division, BCAS, LGED, and BUET). Conversely, from late October to February wind speed remains either quiet or excessively low. The breeze

speed arrives at the top during the long periods of June and July [9]. Park of wind turbines, arranged in beach front regions, can be associated with the power framework.

Generally, electric power includes three following components regarding cost analysis, Capital & Investment cost, Operation & Maintenance cost and Fuel Cost[14].

$$LCOE = \frac{\left[\left(\sum_{t=-n}^{t=1} \frac{I_t}{(1+i)^t} \right) \right]_{Construction} + \left(\sum_{t=0}^{t=n-1} \frac{F_t + O \& M_t - D_t + T_t}{(1+i)^t} \right)_{production}}{\left(\sum_{t=0}^{t=n-1} \frac{G_t}{(1+i)^t} \right)_{Production}}$$

The fuel cost in wind power generation is null.

$$LCOE_{wind} = \frac{\sum_{t=1}^{t=n} \frac{I_t + O \& M_t - PTC_t - D_t + T_t + R_t}{(1+i)^t}}{IF \sum_{t=1}^{t=n} P_t}$$

- $LCOE$ = Generation cost
- I_t = Investment made in one year
- $O \& M_t$ = Operations and maintenance cost in one year
- PTC_t = Production Tax Credit
- D_t = Depreciation credits
- T_t = Tax Levy
- R_t = Royalties or land rents
- F_t = Fuel Cost
- IF = Intermittence factor
- P_t = Electrical generation capacity in one year
- G_t = Electrical energy generation in one year ($G_t = IF \times P_t$)
- n = Generation period duration
- i = Discount rate.

Especially for wind power, fuel cost will be zero. Economic costs and benefits on the levelized cost to produce offshore wind power prove that terrain plant production cost is approximately double of it. Along this factor other key point for economic arrangements is energy conversation and transmission [14]. The transformation of the vitality of the breeze into more helpful structures should be possible utilizing a rotor fitted with sharp edges or sails (Figure: 5).

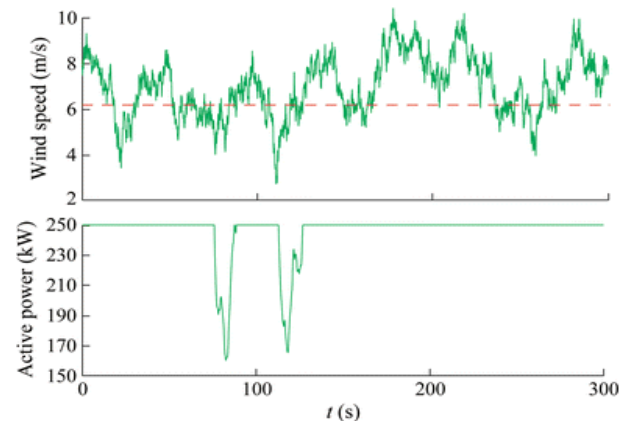


Fig.5: Output power of wind farm with power control capability

The administration needs to genuinely think about what's going on somewhere else on the planet, look for the proper cutting edge innovation and desperately attempt to duplicate

this significant procedure in our nation, especially in the rustic beach front regions in the south, south-west, and south-east. In this unique circumstance, it is cheering to realize that the Bangladesh Power Development Board has started ventures through the marking of an agreement with ReGen Powertech to finish a breeze map for Cox's Bazar, Kutubdia, Khepupara, Feni, and Chittagong. This should empower us to locate the correct spot to take advantage of wind vitality. In addition, the whole wind mappings directed by various associations was in coastal yet it is normal that breeze mapping in seaward will give acceptable outcome with respect to wind speed. Hence, it is foreseen that there is a major possibility to produce wind control in Bangladesh with legitimate consideration.

III. CONCLUSION

The Wind supplies top notch, clean and condition inviting vitality administrations [1]. To encourage further activities, a broad investigation on wind control plausibility ought to be done in various pieces of Bangladesh to pick the most ideal choices for various scale wind control factory. Picking an inappropriate site would give a negative point of view for the future activity plan and could affect to move to one side from this thriving alternative for illuminating the intense power emergency in Bangladesh. Wind turbines require relatively less space than the normal power station. The turbines can be put in the remote area, for example, seaward, mountains. Bangladesh can profit monstrously by participating and sharing any others reasonable mechanical ability and involvement with the gathering of wind assets. The legislature needs to set up certain appropriations and monetary motivating forces to advance sustainable power source advances in the nation. 100 percent personal duty exclusion for any constant square of intensity for a long time in the initial 15 years of activities can be applied. Lower customs and extract obligations for determined hardware can be drilled. The further broad examination ought to be finished by setting up area savvy wind information assortment station at various statures.

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