

Offshore and Onshore wind Farming in Bangladesh and Developing Countries

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Extended Abstract

There is a huge growth in harvesting wind energy in developed and in emerging economy countries. Except couple of countries, wind energy growth is insignificant in developing countries. Bangladesh, a developing country has high interest in wind and other renewable energy. This presentation will explore on the ways to turn the interest into reality with the marriage between big wind turbine OEMs and Bangladesh ship builders & local engineering resources to serve an untapped market of developing countries.

Growing Ship building Industry: Bangladesh has growing ship building industry with over 100 ship yards. Most of the ship yards support domestic demand. But, two ship yards (Ananada Shipyards and Slipways Limited and Western Marine Shipyards Limited) are exporting small and medium size ships to Denmark, Mozambique, Tanzania, Germany, The Netherlands, Finland, Pakistan, New Zealand and other countries. More than 10,000 skilled and 150,000 semi-skilled workers are there in Bangladesh ship industry. With available cheap skilled and semi-skilled labor, it is claimed that ship owners can save at least 15% production cost by using Bangladesh ship yards [1].

Wind Mapping, site development and electrical grid design: Limited study was done in wind mapping in Bangladesh. No systematic and extensive study is done to make wind model yet. Meteorological data cannot be used as they use limited height and often their data is influenced by obstructions. Bangladesh center for Advanced Studies (BCAS) in collaboration with Local Government and Engineering Department (LGED) did some yearlong wind data collection at 25 meter in several coastal islands and coastal areas. Based on that, wind energy exploration in coastal area looks promising. At 25 meter, average wind speed (over the year) found ranging from 3.95 to 4.71 m/s at 5 coastal area/ islands. [2]

At 50 meter height at one coastal island (Kutubdia), wind speed found 5.1 to 5.8 m/s. In this case, the mast was on the roof of local met office building. Obstruction and turbulence effect was present. [3]

Wind speed is normally measured by anemometer mounted on different heights of a mast. Care needs to be taken during design to make sure the mast or mounting devices of anemometer does not influence the wind speed. Physical obstruction can also affect the result. Modern anemometer mast uses solar or battery power supply to store and transmit the logged data.

Sodar is kind of remote wind speed sensing device that use sound and Doppler Effect principle. Lidar is another kind of remote wind speed sensing device that uses laser light and Doppler Effect principle. Sodar and Lidar machines are normally used to confirm accuracy of the mast mounted anemometer results. But, advances in Sodar and Lidar technology and affordability added their use in wind farms and wind mapping. Scanning LiDAR technology is capable of scanning a range of 10 to 30 km with precision. Thus, it can save millions of dollar on mast construction cost. [4]

Another important item on wind turbine site selection is bathymetry or the water depth of the sea. The cost of wind turbine structure goes up with the increase of water depth. For offshore site selection, a bathymetry mapping, seabed foundation, hazards, load structure information are needed for the design of the structure. Also, harbor, port and marine sanctuary need to be considered.

In USA, the US department of energy provides utility scale land based wind map at 80 meter height. National Renewable Energy Laboratory and AWS Truewind LLC, Albany, NY developed the resource maps of contiguous United States. Per US Department of Energy, Areas with annual wind speed of 6.5 m/s or higher at 80 m height are considered suitable for development. [5] Bangladesh needs similar efforts to create a complete wind map of land and offshore area. Bangladesh has a dynamic cost line, funnel shape and about 580 km coast line. At 1st step, a complete wind mapping needs to be done on coastal islands, near coast line and offshore area with maximum depth of 25 m. In 2nd step, whole land area of the country and sea area with the depth of 25 to 50 meter can be mapped. In 3rd step, sea area with the depth of 50 -75 meters can be mapped. Bangladesh will need technical help with the whole mapping process and modeling. Mast can be manufactured locally. Best on business case, a combination of Anemometer on mast, Sodar, Lidar, Scanning LiDAR can be used. Cost of scanning LiDARs can be shared with weather department and airports.

Energy crises in Bangladesh: Installed capacity of electricity in Bangladesh is 12725 MW (Including 600 MW of import) as on July 25, 2016. [6] But, available capacity is considered about ¾ th of installed capacity. About 62% people have access to electricity (Jan 2014). Both industrial and household demand for electricity is growing. Bangladesh is now investing on coal base power plants and nuclear power plant. With growing demand, renewable energy like wind farming has bright prospect. Bangladesh government established wind turbines in Kutubdia island (2007-2008), Maheshkhali and Muhuri Dam area (2005, 4X225kW, Vesta turbine, diameter 27 m, estimated annual production 2 GWh, 28% time full load/year). [8, 9] Some small turbines are also installed by BRAC and Grameen Shakti in different coastal areas. [9] In 2015, Bangladesh Government signed a Memorandum of Understanding with Vesta Wind System to conduct wind resources in Patuakhali area within a year and establish 100 MW project. [10].

Investment in wind farming can come from both local and international entrepreneurs and businesses.

Site development: From wind farm to national grid, electrical line & substation need to be developed. For onshore project access roads may need to build. For offshore farms under sea electrical grid needs to be developed with some marking to avoid damage from anchorage of ships.

For highly populated country like Bangladesh, purchasing land is very difficult. Law needs to be developed to buy air right and long term lease contract even when ownership changes. Legal dispute-arbitration process needs to be developed as any litigation in Bangladesh can take long time to end.

Using ship yards to manufacture parts for wind farms: Local ship builders can be used to build Wind turbine's tower, blades, Nacelle etc. Built to design concept can be used. This can reduce manufacturing cost of these parts. Also, this will add additional capacity to support developing countries. Once local engineers and technicians are trained to install the wind turbine, the installation cost may also reduce. Big brand wind turbine OEMs can use the partnership with Bangladeshi ship yards to serve other developing countries with lower cost model. This can also help big turbine to get out their capacity constraints. Also, it may help them to marketing the developing countries better.

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