

# OFFSHORE WIND ENERGY

## A Potential Energy Source of Bangladesh



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## Background

Bangladesh is an upcoming development country which has experienced rapidly rising energy consumption over the past two decades. Rapid decrease in Fossil fuel generation and GHG emission from renewable energy sources creates the need for green energy. Among many renewable energy options, wind energy is much feasible for long term usage. Many developed countries try to adopt renewable energy as their main energy source. BD is not indifferent, Bd already have wind farm at Muhuri Dam, Feni and Kutubdia Island which generates 2 MW energy altogether. But still we are lagged of our energy goal. So offshore wind energy becomes a potential source to mitigate the energy shortage.



The wind turbine in costal areas

## Methodology

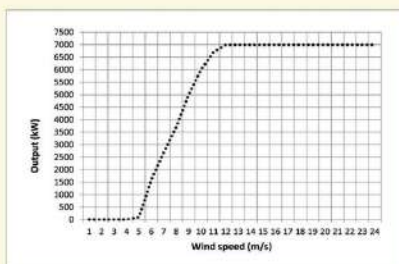
The differential heating of the sun on earth causes the wind to blow. A wind turbine obtains its power input by converting the force of the wind into torque acting on the rotor blade which follows the equation of

$$P = \frac{1}{2} \eta \rho A v^3$$

The energy which the wind transfer to the rotor depends on

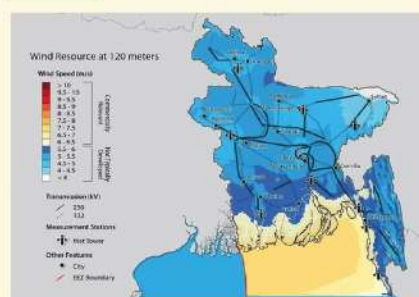
- 1-hub height,
- 2-rotor diameter,
- 3-wind speed.

Higher wind speeds are available in off-shore compared to on land, which means greater energy generation in off-shore.



Power generation vs wind speed

## Wind Map of BD



### QUICK FACTS

- Energy generation increases with height.
- Installation cost regained in 4 to 6 years.
- 85% drop in wind energy costs in the last 20 years.
- Lasts 25 years or more.
- Offshore turbine is 17% more efficient than land turbine.
- One average-sized wind turbine can power 442 homes in Texas

## Observation

The power can be defined as

$$P = \frac{1}{2} \eta \rho A v^3$$

$\eta$ =efficiency factor\*generator loss \* transmission loss.

$$\eta = 0.45 * 0.85 * 0.90$$

$$\eta = 0.344$$

$$\rho = 1.2 \text{ kg/m}^3$$

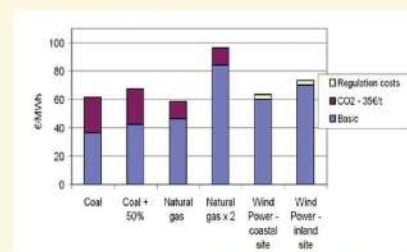
$$A = \text{swept area } [D=90\text{m}]$$

$$v = \text{wind velocity.}$$

At wind speed 7m/s [120m height]

The obtained extractable power will be.

$$P = \frac{1}{2} * 0.344 * 1.2 * \pi * (45)^2 * (7)^3$$

$$= 450 \text{ KW (approx.)}$$


Comparative cost & CO2 emission analysis

## Results

Consider an offshore wind farm with 4 rows of HAWT. BD has a 580 km coastal area. If we take 35% of its near-shore and set the turbine spaced 7D apart between the row, and 3D apart in the wind direction. We can set at least 6016 wind turbine and capable of generated total power of 2707 MW. This is 13.5% of today's energy generation and also fulfill the GOB's plan to produce 10% of their energy from a renewable source. [D=diameter]

## Conclusion

Wind speed increases when it enters V shape regions over BD. The depth of the sea bed of this area is 20m which is commercially feasible for constructing a wind firm. As land is a scarce commodity as well as a flood-prone area, having an offshore wind farm will be a great choice. There is no fuel cost as well as no carbon emission. and it's environmentally friendly.



Bathymetry of Bangladesh

## References

1. AZA Saifullah, Karim, MR Karim. (2016). Wind Energy Potential in Bangladesh. AJER.
2. Roddier, D., Cermelli, C., Aubault, A., & Weinstein, A. (2010). WindFloat: A floating foundation for offshore wind turbines. Journal of Renewable and Sustainable Energy.
3. Maarten Jaspers Fajier, Eric Arends. (2017). Baseline Study Wind Energy Bangladesh
4. Abdelhady, S., Borello, D., & Shaban, A. (2017). Assessment of leveled cost of electricity of offshore wind energy in Egypt. Wind Engineering, 41(3), 160-173. doi:10.1177/0309524x17706846

# CERTIFICATE

## OF ACHIEVEMENT

THIS CERTIFICATE IS PROUDLY PRESENTED TO

*Md. Abu Mogira, Md. Towfiq Elahi, Mohammad Saeiduj jaman Chowdhury*

*For achieving silver award with project entitled*

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DATE



Dr. Abu Yousuf  
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