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## **LONG TERM OFFSHORE WIND ENERGY PROSPECTS IN BANGLADESH: A LITERATURE REVIEW**



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# INTRODUCTION: Motivation for this paper.

- The world is moving faster and faster towards goals like **zero carbon emission goals** and **complete fossil fuel independence**.
- The “**Sustainable Development Goals 2030**” declared by **UN** in 2015 underpin every major trend in scientific and business effort today.
- Countries are spending billions behind research on diversifying their energy generation portfolio with a strong emphasis on renewables.
- Bangladesh has set a 3.17 GW of renewable energy goals for 2021, or about **12.5%** of total domestic power production.
- However, with renewables making up about **3%** of Bangladesh’s total power generation in 2018, the country is not remotely set to achieve these goals.

# Aim and Scope of this paper

- To examine the technological feasibility of large-scale offshore wind power generation within the sovereign maritime boundary of Bangladesh.
- To find out whether the unique topography of the seabed of Bay of Bengal can be used to our advantage.
- To map out an area of the Bay of Bengal which will be best suited for such an undertaking in terms of total wind energy generation per annum.
- The cost analysis of such a project is strictly NOT within the scope of this paper.

# History of Wind Power



Wind Mills : The Past



Onshore Wind Farms: The Present



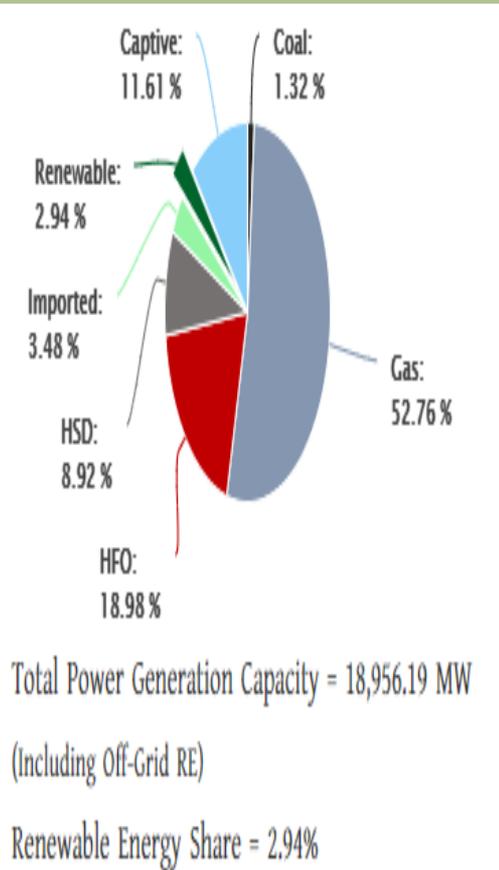
Offshore Wind Farms: The Future

# Hypothesis

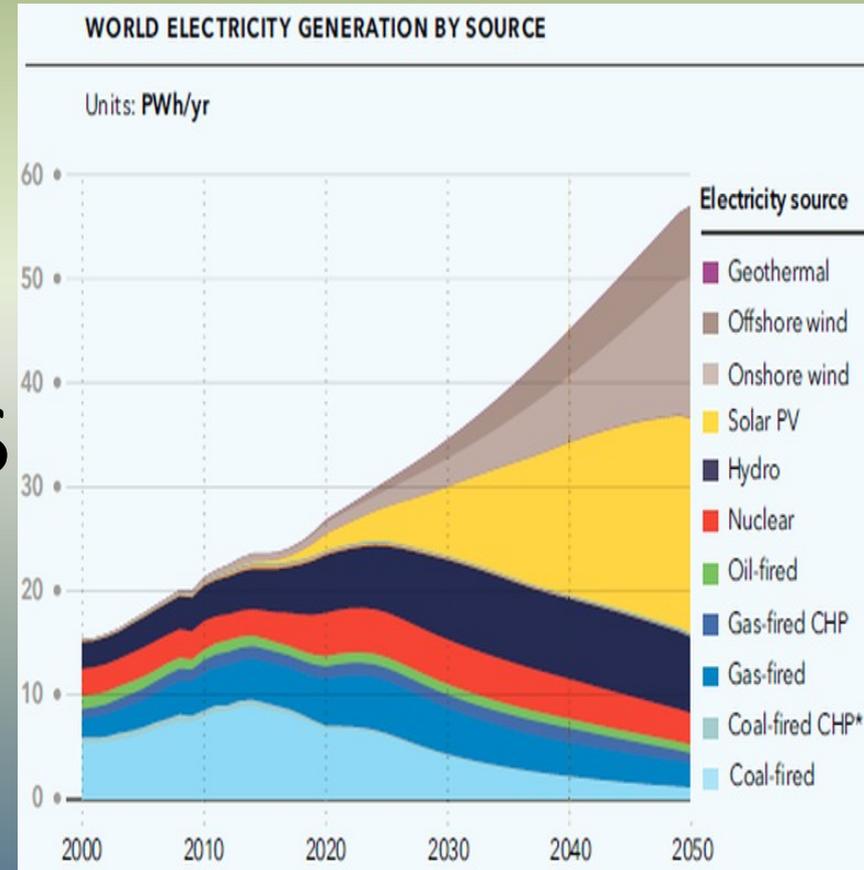
1. Offshore winds off the coast of Bay of Bengal holds the best source of wind energy we can tap into to ensure a diversified portfolio of renewable energy sources.
2. The unique seabed structure of the Bay of Bengal can be used to our advantage for anchoring offshore wind farms.
3. The technology is mature enough to be deployable with minimum risk in Bangladesh.

# Renewable energy portfolio of Bangladesh vs Global Trends

Technology	Off-Grid	On-Grid	Total
Solar	285.51	38.69	324.21
Wind	2	0.90	2.90
Hydro	-	230	230
Biogas to Electricity	0.68	-	0.68
Biomass to Electricity	0.40	-	0.40
<b>Total</b>	<b>288.59</b>	<b>269.59</b>	<b>558.19</b>



VS



# Offshore vs Onshore Wind Farms: Advantages

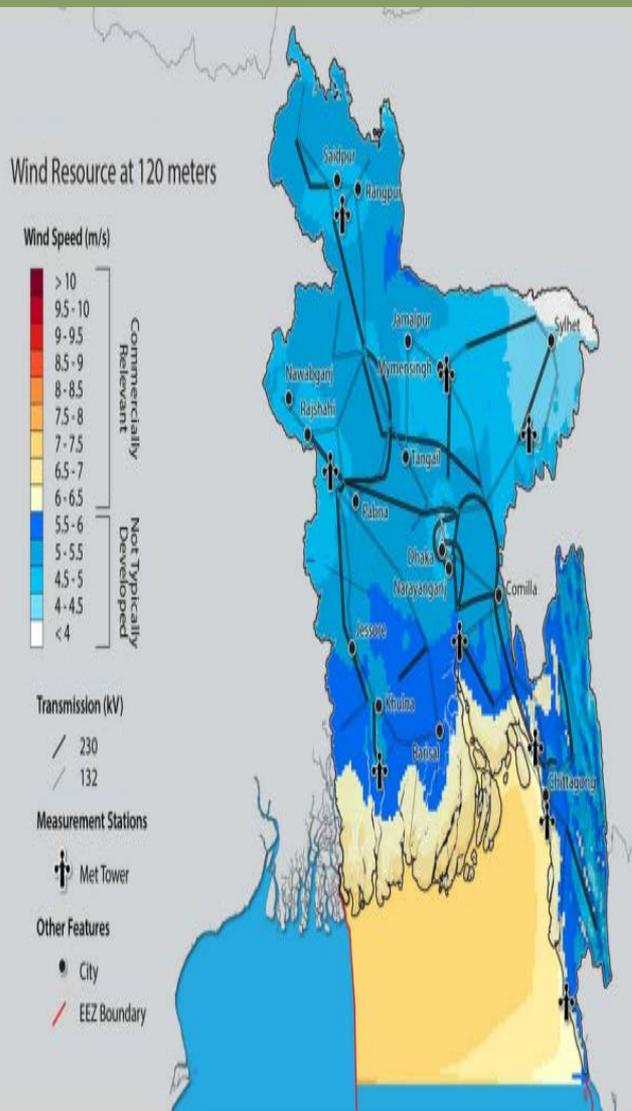
OFFSHORE WIND FARMS	ONSHORE WIND FARMS
✓ Offshore wind speeds tend to be faster than on land. Small increases in wind speed yield large increases in energy production.	❖ Lower wind speed yields significantly lesser power.
✓ There are no barriers to wind flow at sea as compared to hills and mountains on land.	❖ Land barriers makes for uneven supply of wind power.
✓ Tower frame can be lower on the sea and greater wind speed can be gained in the lower height.	❖ Tower frames need to be very tall.
✓ Does not occupy valuable land area, does not involve issues such as land acquisition and environmental impact is far smaller.	❖ Take up valuable land area which is a luxury for a high population density country like Bangladesh.
✓ The fatigue loads of wind turbine are small, which will enable the unit to extend its lifetime.	❖ Fatigue load is significantly higher and thus require lots of maintenance.

# Offshore vs Onshore Wind Farms: Disadvantages

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OFFSHORE WIND FARMS	ONSHORE WIND FARMS
<ul style="list-style-type: none"><li>❖ Offshore wind farms can be expensive and difficult to build and maintain. In particular: It is very hard to build robust and secure wind farms in water deeper than around 200 feet (~60 m).</li></ul>	<ul style="list-style-type: none"><li>✓ Relatively cheaper technology and easier to build and maintain via inland roads.</li></ul>
<ul style="list-style-type: none"><li>❖ Wave action, and even very high winds, particularly during heavy storms or hurricanes, can damage wind turbines</li></ul>	<ul style="list-style-type: none"><li>✓ Less prone to natural disasters but more prone to everyday decay.</li></ul>
<ul style="list-style-type: none"><li>❖ The production and installation of power cables under the seafloor to transmit electricity back to land can be very expensive.</li></ul>	<ul style="list-style-type: none"><li>✓ Power cables can be directly fed via local grid to surrounding neighborhood or to the grid.</li></ul>
<ul style="list-style-type: none"><li>❖ Effects of offshore wind farms on marine animals and birds are not fully understood.</li></ul>	<ul style="list-style-type: none"><li>✓ Good amount of research has been conducted on its environmental impact.</li></ul>

# Offshore Wind farm potential of Bangladesh



- “**Low Wind Resources**”: The ‘Solar and Wind Energy Resources Assessment’ initiative calculated the annual wind speeds in Bangladesh at a height of 50 meters to be not more than 5 meters per second and 6 meters per second for offshore wind, but well over **35** meters per second in typhoon season.
- USAID Bangladesh and the U.S. Department of Energy’s National Renewable Energy Laboratory published their National Wind Resource Assessment, where they have identified key offshore locations, especially at the sea closer to the south-west of the country as “**high-value sites**” for developing wind farms in Bangladesh.

# Key Findings



1. Wind speeds are in fact much higher offshore and can produce much more energy than existing onshore farms.
2. The shallow coast line of Bangladesh mainly consists of mud and loose sand, which is not at all suitable for offshore wind farm foundations and cannot be used to our advantage.
3. Offshore from the Chittagong division, the seabed is solid and the harbor of the City of Chittagong is also nearby, which can be an ideal candidate for offshore contractors.
4. The technology has come a long way and is being deployed worldwide, but can still be considered lacking maturity compared to onshore wind farm technology. Further research recommended.

Figure: Seabed depth graph of the Bay of Bengal

