



OFFSHORE WIND ENERGY IN INDIA

In this article, **Prabir Kumar Dash** discusses India's efforts towards offshore wind through a robust programme based on sound resource assessment.



Wind energy stands tall amongst all the renewable energy sources in terms of installation capacity and energy generation in India. Out of the total renewable energy installation capacity of 78 GW, wind energy contributes to more than 35 GW as on March 2019 and the national target is to achieve 60 GW of wind energy installations by 2022. The onshore wind energy potential estimated by the National Institute of Wind Energy (NIWE) stands at 300 GW at 100 m hub height. However, it has been observed in recent past that, many onshore wind energy projects are adversely affected due to land acquisition issues. Further, the tariff discovered through e-auction started moving upwards on account of exhaustion of best wind sites.

In this scenario, offshore wind can be seen as a viable option in order to protect the precious land resources. India is blessed with a coastline of nearly 7,600 km with relatively shallow waters

(within 12 nautical miles of the coast) near to shore in most parts showing good prospects of harnessing offshore wind energy. With this objective, the national offshore wind energy policy has been notified on October 2015 to provide a legal framework for development of the offshore wind sector in India. Policy authorises, the Ministry of New and Renewable Energy to work in close coordination with other government entities for development of offshore wind energy within the entire exclusive economic zone (EEZ) of the country and NIWE has been designated as the nodal agency to carry out or facilitate necessary resource assessment activity for offshore wind development and demarcate blocks and facilitate developers for setting up offshore wind energy farms.

■ GLOBAL SCENARIO

Globally, offshore wind is nearly three decades old history with total installation

capacity of 23.35 GW as on December 2018 in 17 different countries of which important ones are—the UK (6,836 MW), Germany (6,410 MW), China (4,558 MW), Denmark (1,358 MW), The Netherlands (1,118 MW), Belgium (1,178 MW), and Sweden (206 MW). Annual capacity additions of more than 4 GW have been observed in the last couple of years. As per the 'Wind Europe Outlook' offshore wind installation capacity may reach up to 70 GW in Europe by 2030. IRENA estimates that roughly 400 GW offshore wind installations may be possible by 2045 globally. The price of offshore wind energy has been reducing owing to technological innovation and emerging of new markets. The lowest tariff discovered in November 2016 was \$49.9/MWh in Denmark. Further, in many European countries, the offshore wind energy tariff has already become competitive vis-à-vis onshore wind tariff.

■ OFFSHORE WIND STATUS IN INDIA

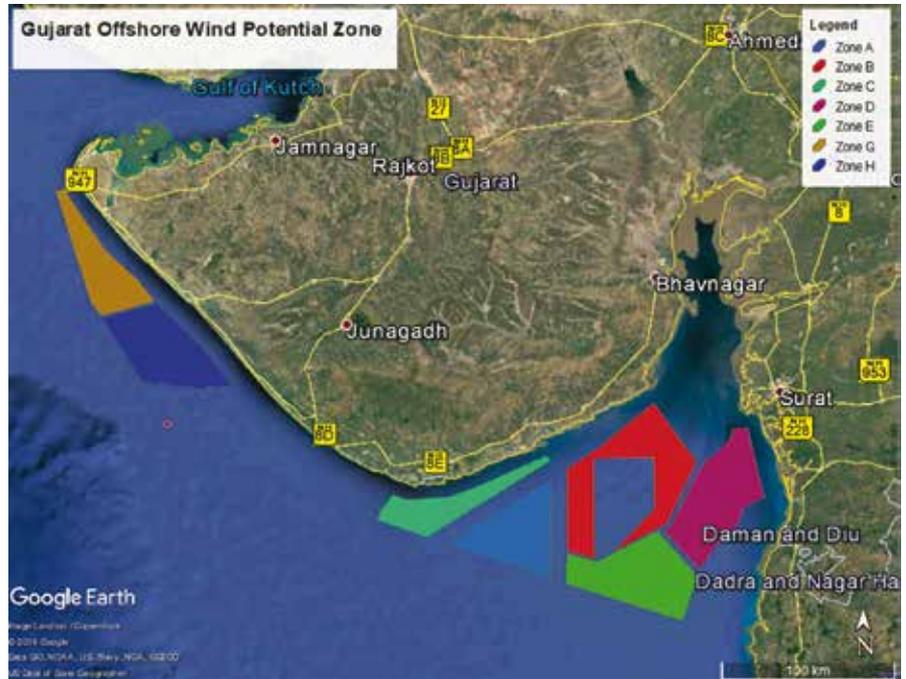
NIWE assisted by various multilateral agencies carries out estimation of offshore wind energy potential in India. A preliminary estimate suggests good potential exists off the coast of Gujarat and Tamil Nadu. Under the FOWND project supported by the European Union, eight zones each in Gujarat and Tamil Nadu were identified as potential zones for development of offshore wind energy projects, through techno-commercial analysis and preliminary resource assessment based on satellite data and data available from other sources. Further, assessment by NIWE excluding the



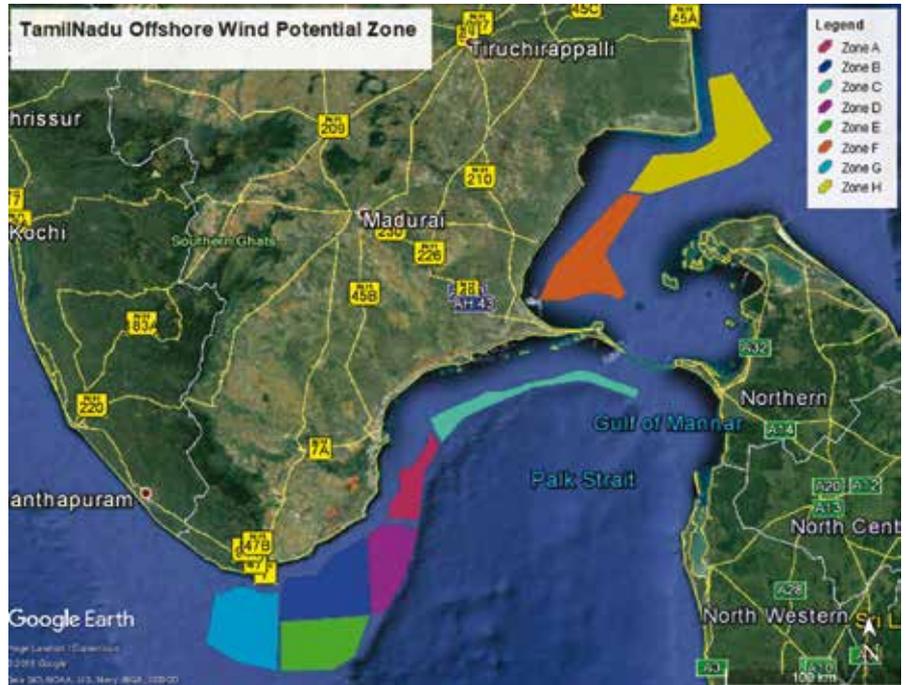
areas in consultation with various line ministries/organizations suggests 36 GW of offshore wind energy potential exists off the coast of Gujarat and 35 GW off the Tamil Nadu coast only. In order to exploit the potential and keeping the falling global tariff trend in view, the government has announced its intention of installing 5 GW of offshore wind installations by 2022 and 30 GW by 2030. This announcement may give confidence to the Indian and global project developers along with financing institutions in India market.

■ OFFSHORE WIND RECOURSE ASSESSMENT THROUGH LIDAR

In order to enhance the confidence of project developers and financing institutions on the estimated potential of a site, more precise measurement campaigns are required. Wind resource measurement campaign deploying light detection and ranging (LiDARs) along with geophysical, geotechnical, and oceanographic studies in selected zones off the coast of Gujarat and Tamil Nadu needs to be carried out. One LiDAR commissioned in November 2017 (in identified zone-B off the coast of Gujarat which is nearly 23 km away from the port of Pipavav) by NIWE has completed more than one year of data collection. One year analysed data published by NIWE along with the raw data suggest annual average wind speed of about 7.52 m/s at 104 m hub height, which seems to be more than the earlier estimation based on satellite data (Vortex data). The month wise measured wind speed is given in Table 1. The LiDAR measured data indicates that, the Vortex data under-predicts the average wind speed by 12.5% at 100 m above sea level (ASL). Based on this, the long-term average wind speed may increase from earlier estimation of 7.1 m/s–8.0 m/s, at 100 m ASL. This increase in the wind speed may result in 21%–25% increase in the capacity utilization factor



» Identified zones off Gujarat coast



» Identified zones off Tamil Nadu coast

(CUF) in comparison to the earlier prediction reported (which is 30%) under FOWPI project. It is worthwhile to mention here that, the reported capacity

utilization factor from onshore wind energy projects in India varies from 22%–30% depending on the site of installation. Further, sometimes nearly 35% of CUF

Month	Nov,17	Dec, 17	Jan, 18	Feb, 18	Mar, 18	Apr, 18	May 18	Jun, 18	Jul, 18	Aug, 18	Sep, 18	Oct, 18
WS in (m/s)	6.06	7.44	5.63	6.39	7.11	6.90	8.71	9.82	10.58	9.81	6.94	4.85



» Offshore LiDAR structure and LiDAR off Gujarat coast (23 km from Pipavav)

is also being claimed by some of the manufacturers and developers. The best onshore windy sites in India have average wind speed of 6 m/s–7 m/s. Accordingly, it can be expected that the offshore wind projects in the identified location may operate at a CUF of about 45%. Reportedly, the government is planning to deploy five more LiDARs (two off Gujarat coast and three off Tamil Nadu coast) for carrying out the offshore wind measurements to validate the estimated offshore wind energy potential and gather precise bankable data. Further, interested private players can also carry out the required studies/surveys for establishment of offshore wind projects within the EEZ of India under the 'Guidelines for Offshore Wind Power Assessment Studies and Surveys' issued by NIWE.

■ THE PROPOSED FIRST OFFSHORE WIND ENERGY PROJECT IN INDIA

Looking at the global success of offshore wind energy technology and tariff trend in the last couple of years, the government

has planned to develop the first offshore wind energy project of 1 GW capacity in the identified zone-B off the coast of Gujarat in a commercial scale. This may be due to the fact that the logistics and ecosystem development cost for offshore wind energy projects are quite high. Accordingly, a small capacity demonstration project will be too costly and only solve the purpose of technology feasibility. The project size of 1 GW may realize the economy of scale and bring down the tariff in the first project itself. The Expression of Interest (EoI) for this project was floated in April 2018 and 35 international/Indian developers/OEMs had participated and consulted for preparing the final bidding document. Being the first of its kind, all the perceived risks associated with the project needs to be identified and taken care of by the government in order to keep the tariff at a lower level. Although, substantial information on execution of offshore wind energy projects is available globally, specific customizations in Indian context will be a key challenge.

■ CONCLUSION

Owing to the vast potential in the entire coastline, offshore wind energy in India can provide the desired results to realize the climate commitment and energy security, the country is thriving for. Although, it will be very challenging to achieve a cost competitive tariff for the proposed first offshore wind project, it will open up a complete new sector for India to contribute to its overall economy and India may emerge as a global leader in this sector similar to onshore wind due to its experience in providing quality systems at a lower cost. ■

Disclaimer: The views expressed in this article are personal views of author and not endorsed by the Government.

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