WIND TURBINE TEST STATION, KAYATHAR.

INDIA

As per estimates, India has a wind potential of more than 695.50 GW at a hub height of 120 metres, and the country currently has the fourth-highest wind installed capacity in the world with total installed capacity of 38.62 GW as on 31 December, 2020 and 60.42 billion units were generated from wind power during the year 2020.

DR. K. BALARAMAN, DIRECTOR GENERAL
National Institute of Wind Energy, India

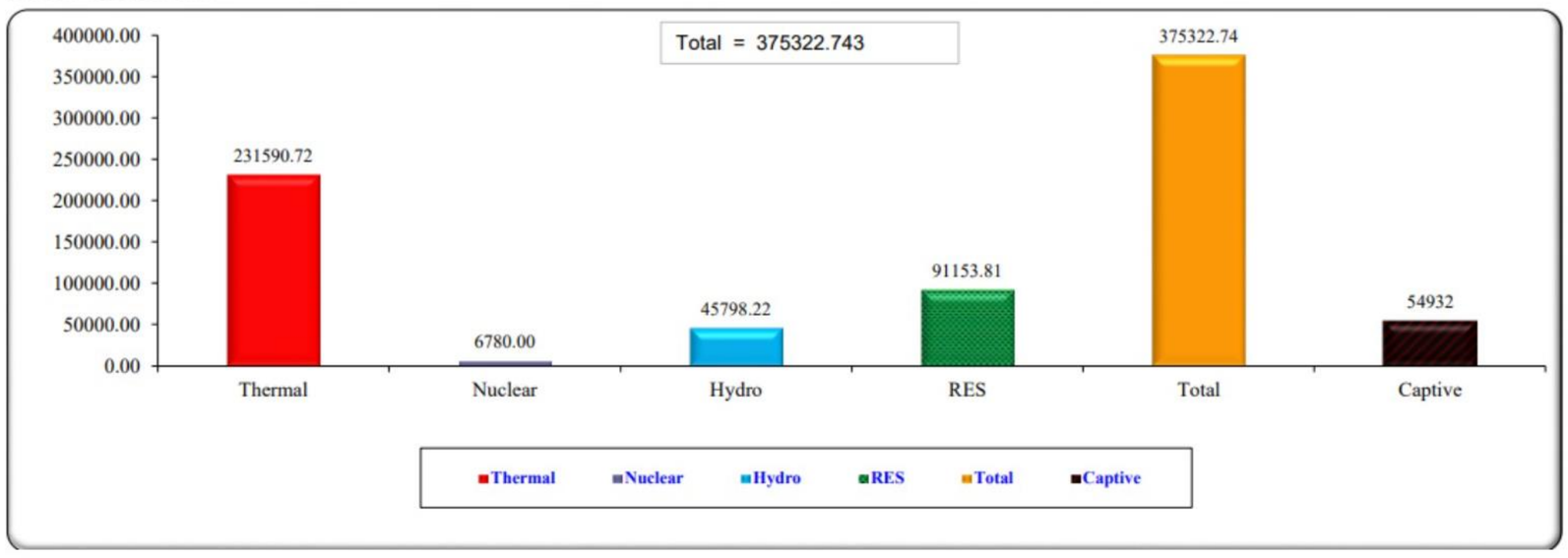
India's Nationally Determined Contributions (NDC) under the Paris Agreement for the Period 2021 - 2030 include:

- To reduce the emissions intensity of its GDP by 33 to 35% by 2030 from 2005 levels; and
- To achieve approximately 40% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance.

TABLE 1. KEY NATIONAL STATISTICS 2020: [COUNTRY NAME]

Region	Coal	Lignite	Gas	Diesel	Total				
Northern	53437.79	1580.00	5781.26	0.00	60799.05	1620.00	20143.77	17581.99	100144.81
Western	73735.12	1540.00	10806.49	0.00	86081.61	1840.00	7555.00	27933.96	123410.57
Southern	44634.52	3140.00	6491.80	433.66	54699.99	3320.00	11774.83	43665.36	113460.18
Eastern	27287.05	0.00	100.00	0.00	27387.05	0.00	4639.12	1568.11	33594.28
North-East	770.02	0.00	1776.96	36.00	2582.98	0.00	1685.50	369.17	4637.64
Islands	0.00	0.00	0.00	40.05	40.05	0.00	0.00	35.22	75.27
ALL INDIA	199864.50	6260.00	24956.51	509.71	231590.72	6780.00	45798.22	91153.81	375322.74

** RES as on 31.12.2020



*Break up of RES all India as on 31.12.2020 is given below (in MW) :

Small Hydro Power	Wind Power	Bio-Power		Solar Power	Total Capacity
		BM Power/Cogen.	Waste to Energy		
4750.46	38624.15	10145.92	168.64	37464.64	91153.81

(*) AS AT 31 MAY 2021, THE INSTALLED WIND CAPACITY IS 39.44 GW. SOURCE: WWW.CEA.NIC.IN

India is well on its way to achieving these targets. The country has large renewable energy potential from sources such as wind, solar, biomass, small hydro, among others. As per estimates, India has a wind potential of more than 695 GW at a hub height of 120 metres, solar potential of ~750 GW, assuming 3% wasteland is made available, small hydro potential of~20 GW, and bio-energy potential of 25 GW.

India's wind energy sector is led by an indigenous wind power industry and has shown consistent progress. The expansion of the wind industry has resulted in a strong ecosystem, project operation capabilities, and a manufacturing base of about 10,000 MW per annum.

The country currently has the fourth-highest wind installed capacity in the world with total installed capacity of 38.62 GW * (as at 31 December 2020) and 60.42 billion units were generated from wind power in 2020.

India has one of the highest rates of growth for renewable energy in the world. According to a 2020 Global Trends in Renewable Energy Investment report, during the period 2014-2019, renewable energy programmes and projects in India attracted investments of USD 64.2 billion (Rs. 4.7 lakh crore).

Wind resource

Extensive wind resource assessments are pre-requisites for the selection of potential sites. Over a period of time, the Ministry of New and Renewable Energy (MNRE), through the National Institute of Wind Energy (NIWE), has installed 890 wind-monitoring stations all over the country and published wind potential maps at 50 m, 80 m, 100 m, and 120 m above ground level. There are over 1,000 wind monitoring stations installed by the private developers with quality checking carried out by NIWE. The wind atlas is available on NIWE's website https://niwe.res.in/ and the wind potential map at 100 m and 120 m above ground level is shown below:

Market development

State-of-the-art technologies are available in the country for the manufacture of wind turbines. For some of the wind turbine models, more than 75% localization has been achieved with strong domestic manufacturing capacity and supply chain industry for wind energy turbines and its components in the country.

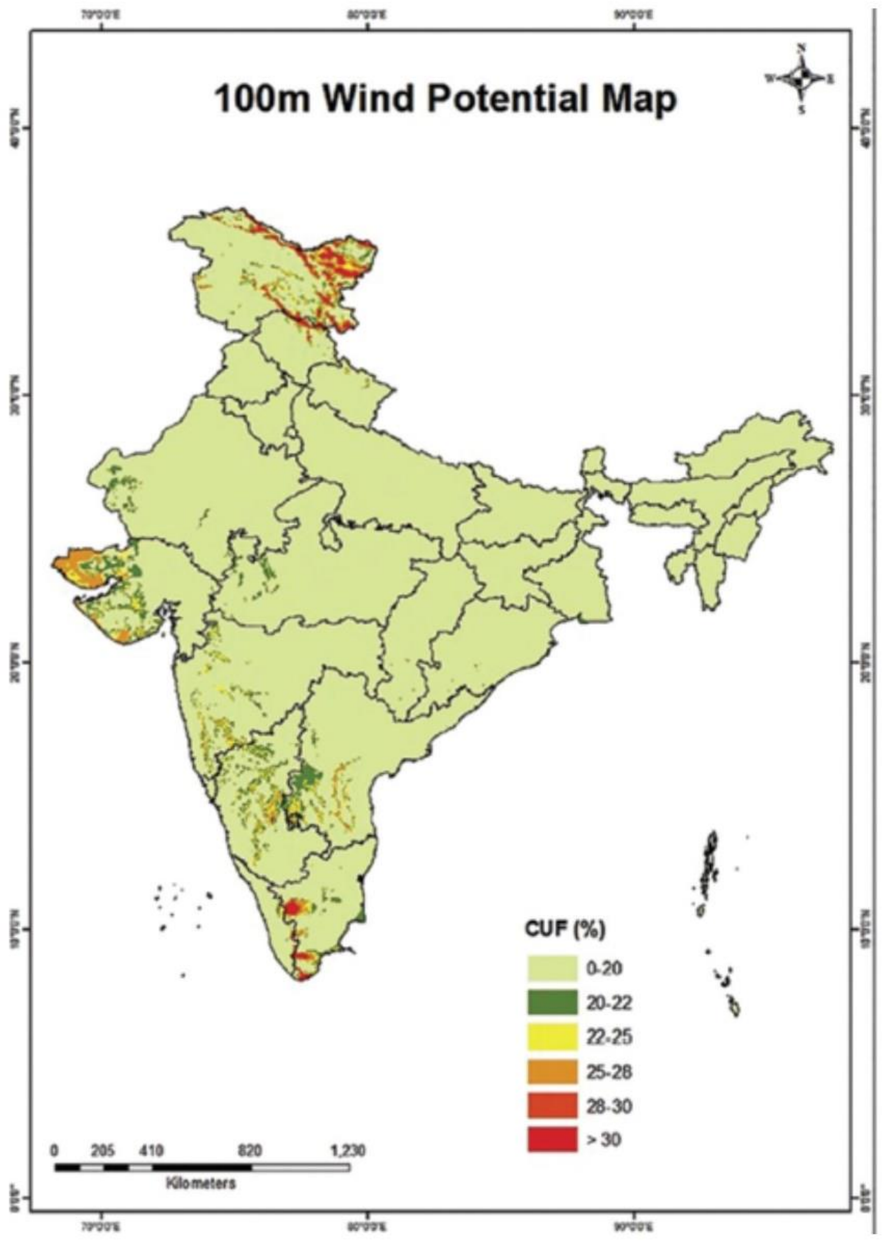
All the major global players in this field have a presence in India, and over 31 different wind turbine models are being manufactured by more than 13 different companies through

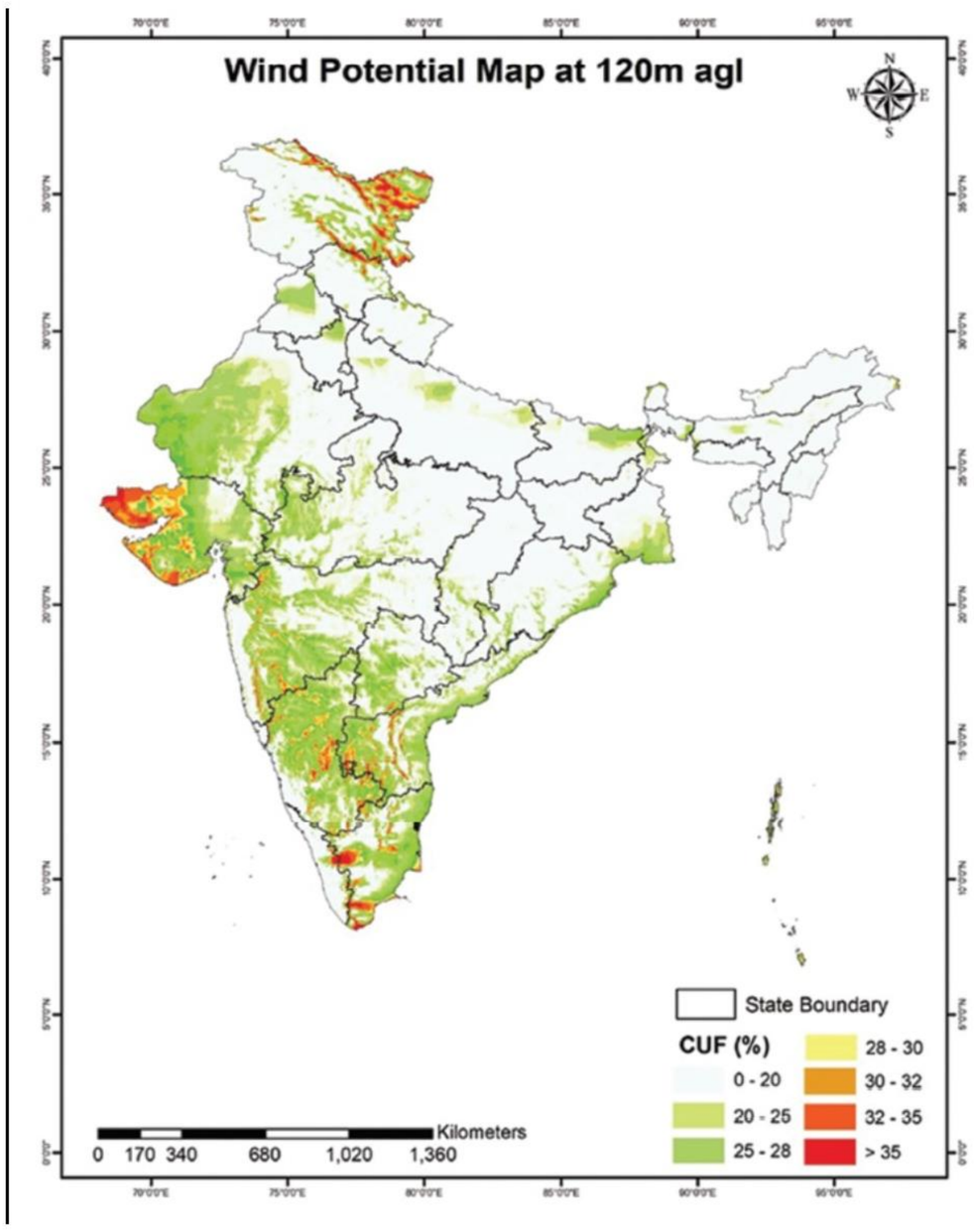
(i) joint ventures under licensed production

(ii) subsidiaries of foreign companies, and

(iii) Indian companies with their own technology.

The unit size of the largest machine has gone up to 3.46 MW. Wind turbines and components manufactured in India are also being exported to various countries.





The current annual production capacity of wind turbines in the country is about 10,000 MW.

Bidding process for procurement of power from grid-connected wind power

The government issued Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Wind Power Projects, was notified on 8 December, 2017. This was done with an objective to provide a framework for procurement of wind power through a transparent process of bidding including standardization of the process and defining of roles and responsibilities of various stakeholders. The guidelines aim to enable the distribution licensees to procure wind power at competitive rates in a cost-effective manner.

Based on past bidding experience and after consultation with stakeholders, the standard bidding guidelines for wind power projects were amended on 16 July 2019 to reduce the investment risks related to the land acquisition and Capacity Utilisation Factor (CUF). The subjectivity in penalty provisions was removed and the penalty rate was fixed. The risk of wind power developers in case of delay in signing a Power Sale Agreement (PSA) has been mitigated by starting the timeline of execution of project from the date of the signing of a Power Purchase Agreement (PPA) or PSA, whichever comes later.

Incentives available for the wind sector

The Indian government has promoted wind power projects throughout the country through private sector investment by providing various fiscal and financial incentives like accelerated depreciation benefits, concessional custom duty exemption on certain components of wind electric generators. Besides, the Generation Based Incentive (GBI) Scheme was available for wind projects commissioned up to 31 March 2017. In addition to fiscal and other incentives as stated above. The inter-state transmission charges and losses have been waived off for solar and wind projects to be commissioned up to 30th June 2025 to facilitate energy sales between the utilities. The Policy for Repowering of the Wind Power Projects (for wind turbine generators of capacity 1 MW and below) has been released on 5th August, 2016 to promote optimum utilization of wind energy resources by creating facilitative framework for

Table 4.4: Minimum Tariffs discovered from Tenders Auctioned for Wind Power

Sl. No.	Bid	Capacity Awarded (MW)	Type	Min. Tariff (Rs./kwh)
1.	SECI-I	1049.9	Central	3.46
2.	SECI-II	1000	Central	2.64
3.	SECI-III	2000	Central	2.44
4.	SECI-IV	2000	Central	2.51
5.	Tamil Nadu	450	State	3.42
6.	Gujarat (GUVNL)	500	State	2.43
7.	Maharashtra (MSEDCL)	500	State	2.85
8.	SECI-V	1190	Central	2.76
9.	NTPC	850	Central	2.77
10.	SECI-VI	1200	Central	2.82
11.	SECI-VII	480	Central	2.79
12.	SECI-VIII	440	Central	2.83
13.	Gujarat (GUVNL)	202.6	State	2.80
14	SECI-IX	970	Central	2.99
	Sub Total	**12832.5**		

SOURCE: MNRE ANNUAL REPORT 2020-21

repowering. The Policy provides additional interest rate rebate (0.25 %) and also all fiscal and financial benefits available to the new wind projects will also be available to the repowering projects.

National Wind-Solar Hybrid Policy:

On 14 May 2018, the Ministry of New and Renewable Energy issued the National Wind-Solar Hybrid Policy. The main objective of the policy is to provide a framework for promotion of large-scale grid-connected wind-solar PV hybrid systems for optimal and efficient utilization of wind and solar resources, transmission infrastructure, and land. The wind-solar PV hybrid systems will help in reducing the variability in renewable power generation and achieving better grid stability. The policy also aims to encourage new technologies, methods and way-outs involving combined operation of wind and solar PV plants. The major highlights of the policy are:

- A wind-solar plant will be recognized as a hybrid plant if the rated power capacity of one resource is at least 25% of the rated power capacity of other resource.
- Both AC and DC integration of wind-solar hybrid project are allowed
- Existing wind or solar power projects, willing to install solar PV plant or Wind Turbine Generators (WTGs) respectively, to avail benefit of hybrid project, may be allowed.
- All fiscal and financial incentives available to wind and solar power projects will also be made available to hybrid projects.
- Storage may be added to the hybrid project to ensure availability of firm power for a particular period.

In order to implement the National Wind-Solar Hybrid Policy, a scheme for setting up of 2500 MW Inter State Transmission System (ISTS) connected wind-solar hybrid projects was sanctioned on 25.05.2018. The Solar Energy Corporation of India (SECI) was the nodal agency for implementation of the scheme through tariff based transparent competitive bidding process. SECI has awarded 2550 MW capacity of wind-solar hybrid projects after e- reverse auction, as shown below:

Sl. No.	Bid	Capacity Awarded (MW)	Min. Tariff (Rs./kwh)
1.	SECI Hybrid – I	840	2.67
2.	SECI Hybrid -II	600	2.69
3.	SECI Hybrid -III	1110	2.41
	Total	**2550**	

Greening of islands

The government intends to power Andaman and Nicobar, Lakshadweep islands, through green energy where energy needs will be met using RE sources. The Greening of Islands programme aims to deploy 52 MW of distributed grid-connected solar PV power projects by March 2021. The Ministry provides 40% capital subsidy for projects under the scheme. Projects of 20 MW SPV with 16 MW/8 MWH BESS in Port Blair, South Andaman; and a project of 1.95 MW with 2.15 MWH BESS in four Lakshadweep islands, are expected to be commissioned by January 2022.

Ensuring Round-the-Clock-Power (RTC) from the RE power projects

In order to overcome the issues of intermittency and low-capacity utilization of transmission infrastructure, the mechanism of 'bundling' has been brought out by the Ministry. To ensure uninterrupted firm power round-the-clock, RE is bundled with power from other sources or combined storage. Such bundled power is supplied to the distribution company (DISCOM) thereby obviating the need for DISCOMs to balance power.

Geo-tagging of wind turbines installed across the country:

At present, the installed capacity of wind generation in India stands at about 38,600 MW with equivalent number of wind turbines. However, there is no centralized system for maintaining this vast database. Considering the requirements of the centralized system, under the directions of MNRE, NIWE has developed a geo-tagged data base and online registry web portal with the support of agencies of the central and state governments. The web portal will maintain a data base of wind turbines already installed and proposed to be installed across the country. Wind turbine details to the tune of 34 GW has been collated.

Certification scheme:

Type certification and type testing of wind turbines played a critical role for healthy and orderly growth of wind turbines in the Country for Onshore Wind Turbines. As per MNRE guidelines dated 22.10.2016 for Onshore Wind Turbine models, "No wind turbine model shall be allowed for installation in the country until it has obtained type and quality certification". A Revised List of Models and Manufacturers of Wind Turbines (RLMM) ensues that all the wind turbine models listed possess valid type certificates issued by an internationally accredited type certification body.

Considering the need to formulate a holistic certification mechanism covering entire life cycle of wind turbine, the Indian Wind Turbine Certification Scheme has been formulated. The comprehensive certification scheme, Indian Wind Turbine Certification Scheme (IWTCS), which is the first of its kind covering various aspects of certification until the disposal of wind turbines. The scheme covers Prototype

Certification & Type Certification for wind turbines; Project certification, failure reporting of installed wind turbines, safety and performance assessment and de-commissioning. The draft document is under discussion.

Wind and solar forecasting:

Grid integration of wind and solar power requires forecasting and research focus has been made in this direction with development in-house data management system, monitoring system, web portal, forecast simulation tools and security system. NIWE has created an operational forecast system with simulation tools, to predict the wind power up to seven days ahead.

For the development of wind and solar power forecasting using High Resolution Numerical Model, NIWE gets NWP data from four service providers. Currently, NIWE has developed the indigenous Intra-day forecasting model and also carrying out various activities to improve/fine-tune the day ahead model from the inputs received during the delivery of pilot operational forecasts to RE SLDCs.

Test facilities

For successful completion of type tests within short period of time, a good wind potential site without much interference from already existing wind turbines & compliance with IEC Standards with respect to terrain and topographical conditions are essential. Hence, a dedicated site allotted as a Wind Turbine Test Station (which has good flat terrain with abundant wind and without neighbouring wind turbines) is normally preferred.

NIWE has been established by MNRE with a dedicated wind turbine test station at Kayathar, Tamil Nadu for type testing of onshore wind turbines, and has tested several wind turbine models. The testing facilities are certified under ISO 9001:2015 and accredited in accordance with ISO / IEC 17025:2017.

Offshore wind turbine research and test centre at Dhanushkodi, Tamil Nadu:

In order to strengthen the domestic capacity for design and development of new offshore wind energy turbines, a test research facility was necessary, and NIWE has already identified a suitable site at Dhanushkodi, Tamil Nadu for the establishment of the test research centre. The required land for the purpose has been allotted by the government of Tamil Nadu. NIWE is in the process of preparing a detailed project report for the centre.

Offshore wind

With India having a coastline of nearly 7,600 km, and preliminary assessments in Tamil Nadu and Gujarat

DHANUSKODI (PLANNED FOR OFFSHORE TEST FACILITY).

Coast showing reasonable wind potential to replicate the success of onshore wind in the offshore wind power development, the MNRE announced the National Offshore Wind Energy Policy in the Official Gazette in October 2015.

The policy serves as a decision-making document for offshore wind energy development, including, setting up offshore wind power projects and research and development activities in waters in or adjacent to the country up to the seaward distance of 200 nautical miles (EEZ of the country) from the base line. There are two main maritime areas in which structures such as offshore wind farms can be built:

- Indian territorial waters, which generally extend up to 12 nautical miles (nm) from the baseline;
- Exclusive Economic Zone (EEZ) beyond the 12 nm limit and up to 200 nm, where under international law, India has right to construct structures such as wind farmss.

Offshore wind in India has a potential of approximately 70 GW, mainly off the Tamil Nadu and Gujarat coasts. Eight zones each off these coasts have been identified as potential offshore zones. Measurement of wind resources through LiDAR in the Gulf of Khambat off the Gujarat coasts, survey of subsea surface and soil profile,

geo-physical survey of 365 sq km of area (required for a 1.0 GW project) and geo technical studies at five locations have been carried out off Gujarat Coast. Similar studies and surveys are planned for areas off the coast of Tamil Nadu.

Rapid Environmental Impact Assessment (EIA) for 1 GW off shore wind farm project at Gulf of Khambhat off Gujarat coast:

The Rapid EIA work has been completed by the National Institute of Oceanography (NIO) and the report has been finalized after carrying out stakeholders' consultation and based on the inputs received from MoD the report has been published in NIWE website.

Offshore wind energy lease rules:

In order to formulate the required framework for regulating the lease of offshore areas within the Exclusive Economic Zone (EEZ) of India for offshore wind energy development, MNRE is framing Lease Rules under the 'Territorial Waters, Continental Shelf, EEZ and Other Maritime Zones Act, 1976'. Stakeholders' consultation with various ministries and departments, including private players, have been completed. The Ministry is consulting with MEA, the administrative ministry for the Act, with a view to having it notified.

Measures taken by MNRE to address COVID-19 pandemic:

To mitigate the economic and financial impact of the COVID-19 Pandemic, MNRE took several proactive measures during 2020-21 to support the RE Sector and businesses. These include:

- MNRE requested States and UTs to ensure uninterrupted essential operation of Renewable Energy Generating Stations (REGS) and permit and facilitate movement of equipment and machinery needed during the nation-wide lockdown due to COVID-19 outbreak.

- Blanket Time-Extension of five months due to lock-down.

The Ministry issued clarifications that Renewable Energy (RE) Generating Stations have been granted 'Must-Run' status. This status remains unchanged during the lockdown period. The Ministry also directed DISCOMs for the payments to RE generators be done on a regular basis as was being done prior to the lockdown as per established procedures.

References:

1. MNRE Annual Report 2020-21

2. Statistics from CEA Website (Central Electricity Authority) – www.cea.nic.in

3. Offshore Wind Policy dated October 2015.