



Report 2021

India

Photo: Milin John / Unsplash

Author National Institute of Wind Energy (NIWE), India

The Government of India has announced an achievable Renewable Energy target of 500 GW of clean energy sources by year 2030, out of which 140 GW will be coming from wind power. The wind energy potential in India is very high, estimated at 695.5GW at 120m in height.

Renewable Energy Sources (excluding large Hydro) currently account for 27.5% (109,885 MW) of India's overall installed power capacity of 399,496 MW (31.03.2022). Wind Energy holds the major portion of 36.7% of total RE installed capacity. The country currently has the fourth-highest wind installed capacity in the world, with total installed capacity of 40,358 GW as of March 2022.

India is blessed with a coastline of about 7600 km and has good pros-

pects of harnessing offshore wind energy. Gujarat and the Tamil Nadu States have identified a high potential for an offshore generation. Ministry of New and Renewable Energy, Govt. of India (MNRE) has set a target of 30 GW offshore installations by 2030.

In India, most of the leading wind turbine manufacturers have established their facilities. India has a strong supply chain of wind turbine component manufacturers, and Indian wind turbine manufactures have already

Table 1. Key National Statistics 2021: India

Total (net) installed wind power capacity	40.4 GW
Total offshore capacity	0 MW
New wind power capacity installed	1.11 GW (Period from April 21 to March 2022)
Decommissioned capacity (in 2020)	GW
Total electrical energy output from wind	68.64 TWh
Wind-generated electricity as percent of national electricity demand	4.60% (Source: CEA)
Average national capacity factor	%
Target (2050)	140 GW from Wind by 2029-30 (Source: CEA-Report on Optimal Generation Capacity Mix for 2029-30)
National renewable energy R&D budget	Rs. 228/- crore for Renewable Energy Research and Technology Development (RE-RTD) during the period 2021-22 to 2025-26 (Source: MNRE)

started focusing on the export market demand, apart from meeting the domestic market demand.

Highlight(s)

- A new target of 30 GW offshore installations by 2030 was set in 2021.
- 1.11 GW of new wind capacity was installed in 2021 to surpass 40 GW of total wind capacity.

Market Development

Targets and Policy

The Government of India has announced a laudable Renewable Energy target of 500 GW of lean energy sources by 2030, out of which 140 GW will be coming from wind power. The wind energy potential in India is very high. The National Institute of Wind Energy (NIWE) initially estimated the wind potential in India

as 49 GW at 50m height. However, according to the new study conducted by NIWE, the wind potential has been estimated as **695.5GW** at 120m height. At present, the assessment of wind potential at 150m is underway.

Offshore strategy document

- Ministry of New and Renewable Energy (MNRE) has prepared the "Strategy Paper on the Establishment of Offshore Wind Energy Projects to achieve a target of 30 GW by 2030" after consultation with various stakeholders.
- MNRE has proposed the following three models:
 - Model 1 approach will be followed for demarcated offshore wind zones for which MNRE/NIWE has carried out detailed studies/surveys. Presently, identified as Zone B3 (365 Sq.km) off the coast of Gujarat.

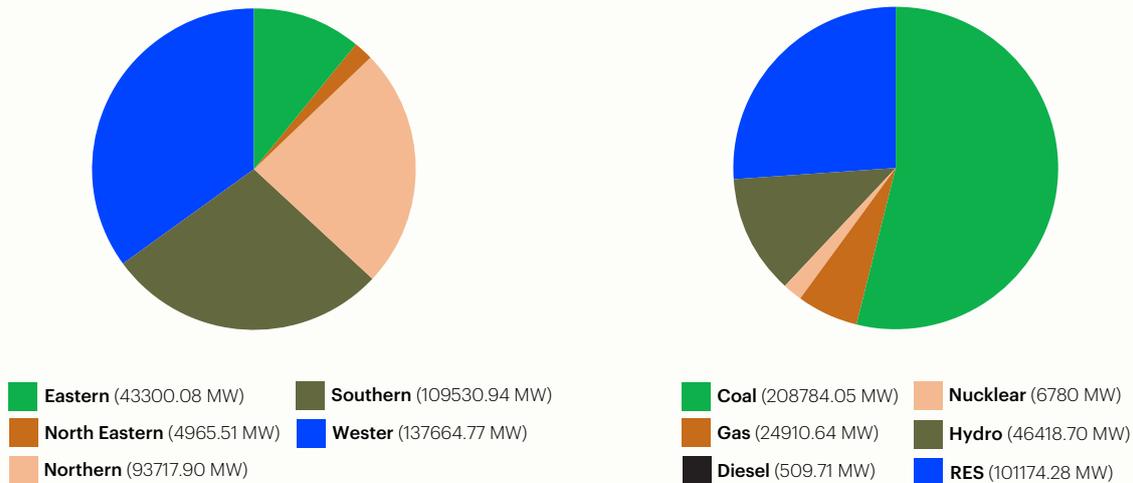
- Model 2 approach has two stages, i.e., Model 2A and Model 2B. These approaches will be followed for wind sites for which detailed studies/surveys have not been carried out off the coast of Tamil Nadu.

- In the Model 2A approach, MNRE through its implementing agencies, will come up with bids for procurement of 2 GW of offshore wind power capacities tentatively in the FY 2024-25. Those developers who have carried out the studies and survey will be allowed to participate in the bidding for the development of such projects.
- In Model 2B, developers who have carried out studies and surveys may also decide to develop offshore wind power projects by themselves for the sale of power on a merchant basis or under bilateral agreements with

Wind power installations from April 2021 to March 2022 (MW)

S.No	State	Total installations during FY 20-21	Total Operations al in March 2021	April-May 2021	Jun 2021	Jul 2021	Aug 2021	Sep 2021	Oct 2021	Nov 2021	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Total during FY 21-22	Total Operations al in March 2022
1	Andhra Pradesh	4.20	4096.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4096.65
2	Gujaret	1020.30	8561.82	164.20	32.40	23.70	69.80	65.70	35.30	16.20	38.60	8.00	28.10	165.40	647.40	9209.22
3	Karnataka	148.00	4938.60	0.00	0.00	0.00	0.00	63.00	37.80	27.30	10.50	0.00	0.00	53.70	192.30	5130.90
4	Kerala	0.00	62.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.50
5	Madhya Pradesh	0.00	2519.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2519.89
6	Maharashtra	0.00	5000.33	10.50	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	5012.83
7	Rajasthan	27.10	4326.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4326.82
8	Tamil Nadu	303.70	9608.04	20.50	12.00	76.50	32.50	50.60	46.55	0.00	0.00	10.22	0.75	8.70	258.32	9866.36
9	Telangana	0.00	128.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	128.10
10	Other	0.00	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30
	Total	1503.30	39247.05	195.20	44.40	102.20	102.30	179.30	119.65	43.50	49.10	18.22	28.85	227.80	1110.52	40357.57

Source: www.indianwindpower.com



Data Source: www.cea.nic.in

consumers under the open access mechanism or for captive consumption.

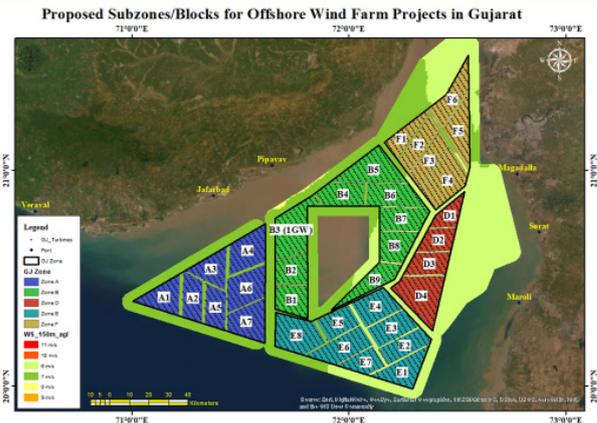
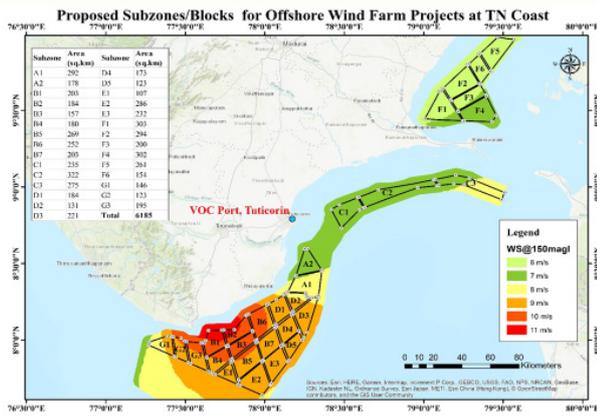
- Model 3 approach is applied for the coast of Tamil Nadu. In this model, NIWE shall identify from time to time large offshore wind zones within the EEZ but not covered either under Model 1 or Model 2.

Progress and Operational Details

Renewable Energy Sources (excluding large Hydro) currently account for 27.5% (109,885 MW) of India's overall installed power capacity of 399,496 MW (31.03.2022). Wind Energy holds the major portion of 36.7% of total RE installed capacity. The country currently has the fourth-highest wind installed capacity in the world, with

total installed capacity of 40,358 GW as of March 2022, as shown above.

Central Electricity Authority projections for 2029-30 suggest that when India installed capacity becomes 817 GW in 2030, non-fossil resources would meet 525 GW. In such a scenario, wind energy would have a higher share of the renewable energy contribution.



Matters Affecting Growth and Work to Remove Barriers

The Indian public sector undertakings (PSUs) have been encouraged by the government to scale up their renewable energy portfolio. This has opened a door for win-win partnerships between international offshore wind players and PSUs. In recent years, oil and gas company ONGC and the National Thermal Power Corporation (and largest power generator utility NTPC) have entered into a Memorandum of Understanding (MoU) to explore offshore wind opportunities.

Offshore wind

With India having a coastline of nearly 7,600 km, and the preliminary assessments in Tamil Nadu and Gujarat Coast have shown 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.

Eight zones each off these coasts have been identified as potential offshore zones. Measurement of wind resources through LiDAR in the Gulf of Khambhat off the Gujarat coasts, a survey of subsea surface and soil profile, a geophysical survey of 365 sq. km of area (required for a 1.0 GW project), and geotechnical 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. Presently, Geotechnical investigations (up to 60m into soil penetration) for the proposed Lidar locations (Zone C, Zone B, & Zone A) have been completed. With regard to Met-ocean measurement, a tender document is under preparation for the locations (sub zones C3, B3 & E1 – Refer TN map).

Type certification and quality control

Type certification and type testing of wind turbines played a critical role in the 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) issued by MNRE ensures that all the wind turbine models listed possess valid type certificates issued by an internationally accredited type certification body and also their manufacturing facilities (Nacelle and Hub assembly) in India possess the quality certification as per ISO 9001 standard.

Considering the need to formulate a holistic quality control mechanism covering the entire life cycle of a wind

turbine, the Indian Wind Turbine Quality Control Order is proposed. The comprehensive quality control order, Indian Wind Turbine Quality Control Order (IWQCO), which is the first of its kind, covers the entire life cycle of wind turbines, including their disposal. The IWQCO covers ITAM (presently known as RLMM), Prototype Certification & Type Certification for wind turbines, failure reporting & failure evaluation of installed wind turbines, safety and performance assessment, and de-commissioning. The draft document is under finalisation.

One-Stop Collection of data on Wind Power Sector of India

IWTMA’s Data Repository was launched on 6th April 2022 as a compilation of a one-stop collection of data related to the wind power sector in India.

Repository endeavours to provide data related to the wind industry in India with the aim to benefit various stakeholders.

The Target Group of Repository

- The investors who wish to create the manufacturing facilities of wind turbines and or their components.
- Independent power producers, individuals, corporates, government institutions, etc. who would like to invest in wind farms for wind power generation.



Photo: Dhruvin Pandya / Unsplash

- Various countries of the world interested in renewable energy, global institutions, associations and industry, leaders/ international organisations, banks and financial institutions, consultants, clean-tech specialists, lawyers, surveyors, content writers, researchers, students, and host of other interested professionals.

Coverage by the Repository

The repository covers most of the aspects of the wind industry. The following topics (not limited to) will be reviewed and updated from time to time.

- Notifications, guidelines, regulations, schemes of central government and wind rich states of India
- Policies of centre and states
- Wind potentials of the Indian states at various hub heights of the turbines.
- Entities catering to wind and renewable sector like the Ministry of New and Renewable Energy (MNRE), Ministry of Power (MOP), Ministry of Defence (MOD), Central Electricity

Regulatory Commission (CERC), State Electricity Regulatory Commissions (SERCs), Central Electricity Authority (CEA), Energy Exchanges, Power System Operation Corporation (POSOCO), etc.

- Prevalent and other topics important to the development of wind energy.
- Skill development in wind energy.
- Nodal Agencies involved in the Renewable Sector.

Original/base documents, amendments, etc. are compiled from recent to the past in a compendium Book form. Each document has the Index of contents and page numbers for easy use. The data are in PDF format (downloadable) and will be updated regularly.

In most the cases, the details will be available in one or several volumes depending upon the size of the documents. The Data Repository can be accessed on the website of the Indian Wind Turbine Manufacturers Association (www.indianwindpower.com).

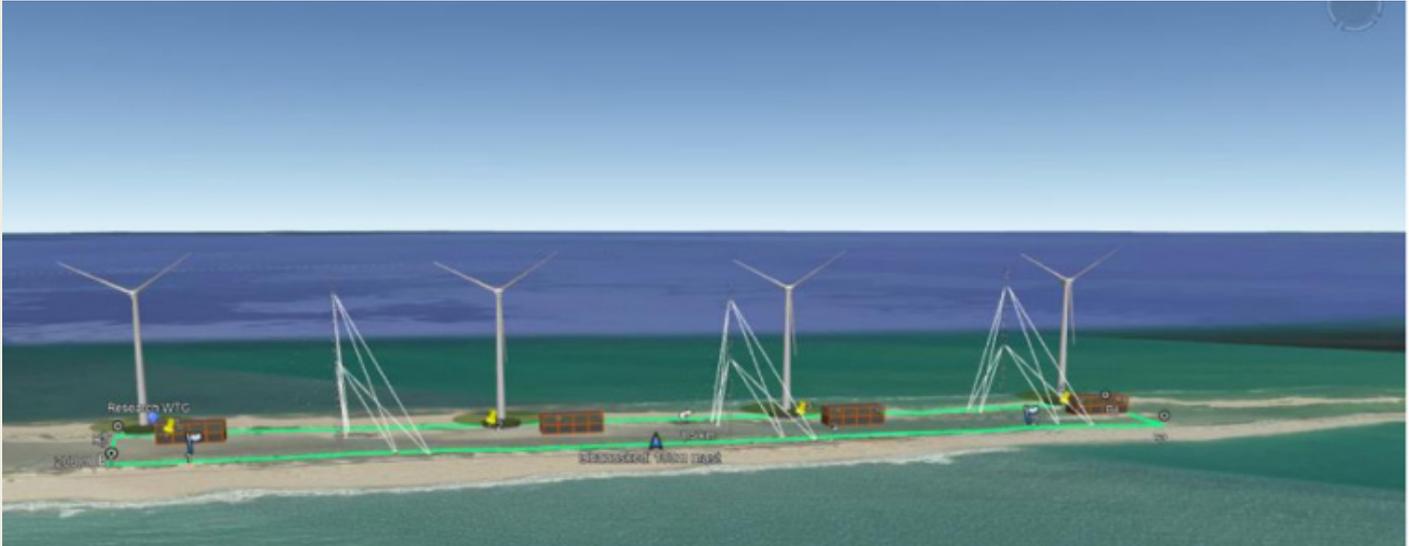
RD&D Activities

National RD&D Priorities and Budget

The Ministry of New and Renewable Energy (MNRE) programme on implementation of “Renewable Energy Research and Technology Development (RE-RTD)” during the period 2021-22 to 2025-26 at a total cost of Rs. 228/- crore. The scheme aims at scaling up R&D effort for “Renewable Energy Research and Technology Development” during the said period for promoting indigenous technology development and manufacture for wide spread applications of new and renewable energy in efficient and cost effective manner across the country. The programme will strengthen research and innovation capacity of the country and will be implemented in accordance with the policy and guidelines issued from time to time and thrust areas identified by MNRE.

National Research Initiatives and Results

The following are the planned National Research Initiatives during the period 2021-22 to 2025-26:



Source: Proposed Offshore Test Research Facility.



Source: Dhanuskodi (Planned for Offshore Test Facility)

- Cost reduction and indigenization of wind turbine components and sub-systems;
- Development of materials, techniques and technologies for offshore wind energy deployment;
- Modelling and simulation including high-performance computing (HPC) to improve generation forecasting, and performance analysis.
- LiDAR installations and Horizontal/ Vertical Axis turbine.
- Off-shore wind installation to power Indian islands as well as drinking water by desalination.

Test Facilities and Demonstration Projects

On-Shore Test Facility at Kayathar:

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

neighboring 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 facility is certified under ISO 9001:2015 and accredited in accordance with ISO / IEC 17025:2017.

Off- Shore Test Facility planned at Dhanuskodi

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.

Dhanushkodi (meaning tip of an arrow) is located, around 20 km away from Rameshwaram, Tamil Nadu, India. It's the nearest land point from India to Srilanka, approximately 30 Km away. Before 1964, it had a jetty service to transport travellers to Talaimannar in Srilanka.

Offshore Wind Turbine models can

be tested at the facility. Wind blows throughout the year in Dhanuskodi (since Land in India & Srilanka creates a natural wind tunnel here) and the yearly average wind speed is around 8.5 m/sec. And Wind is available only in two directions (North East & South West) and hence positioning of Wind Turbine becomes easier.

Dhanuskodi site with steady winds throughout the year and having characteristics like flat terrain -without any significant obstacles will expedite successful completion of Type Tests & faster turnaround of commercial models for the market. Hence, Wind Turbine Test Station at Dhanuskodi will be beneficial for the following reasons:

Representative site for moderate & high wind conditions.

- To promote new wind turbine variants designed for moderate wind conditions in India.
- Skill development for O&M engineers on offshore WT erected in test site.
- Testing & Validation of Remote Sensing Device.

Collaborative Research

India is involved in the following IEA Wind TCP Tasks:

- Task 25 Design and Operation of Energy systems with Large amounts of variable generation
- Task 41 Distributed Wind
- Task 43 Wind Energy Digitalization

Impact of Wind Energy

Environmental Impact

National Institute of Wind Energy (NIWE) has released the Rapid EIA report for 1GW of Gulf of Khambhat, Off Gujarat coast for understanding the study outcome. The report has been finalised after carrying out stakeholders' consultation and based on the approval from Ministry of Defence (MoD), the report has been published

in NIWE website. This report will provide confidence to the prospective stakeholders those who are willing to participate under the Model-1 (As per Offshore discussion paper).

Economic Benefits and Industry Development

In India, most of the leading wind turbine manufacturers like Vestas, GE, Siemens Gamesa, Suzlon, Nordex, etc., have established their manufacturing facilities. Further, India has a strong supply chain of wind turbine component manufacturers, which supports the manufacturing of wind turbines in India. Further, Indian wind turbine manufacturers have already started focusing on the export market demand, apart from meeting the domestic market demand.

References

[1] Website of MNRE
Ministry of New & Renewable Energy
- Government of India)
mnre.gov.in

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

[3] Website of IWTMA
www.indianwindpower.com

[4] GWEC Global Offshore Wind
Report 2022