Indian Wind Power

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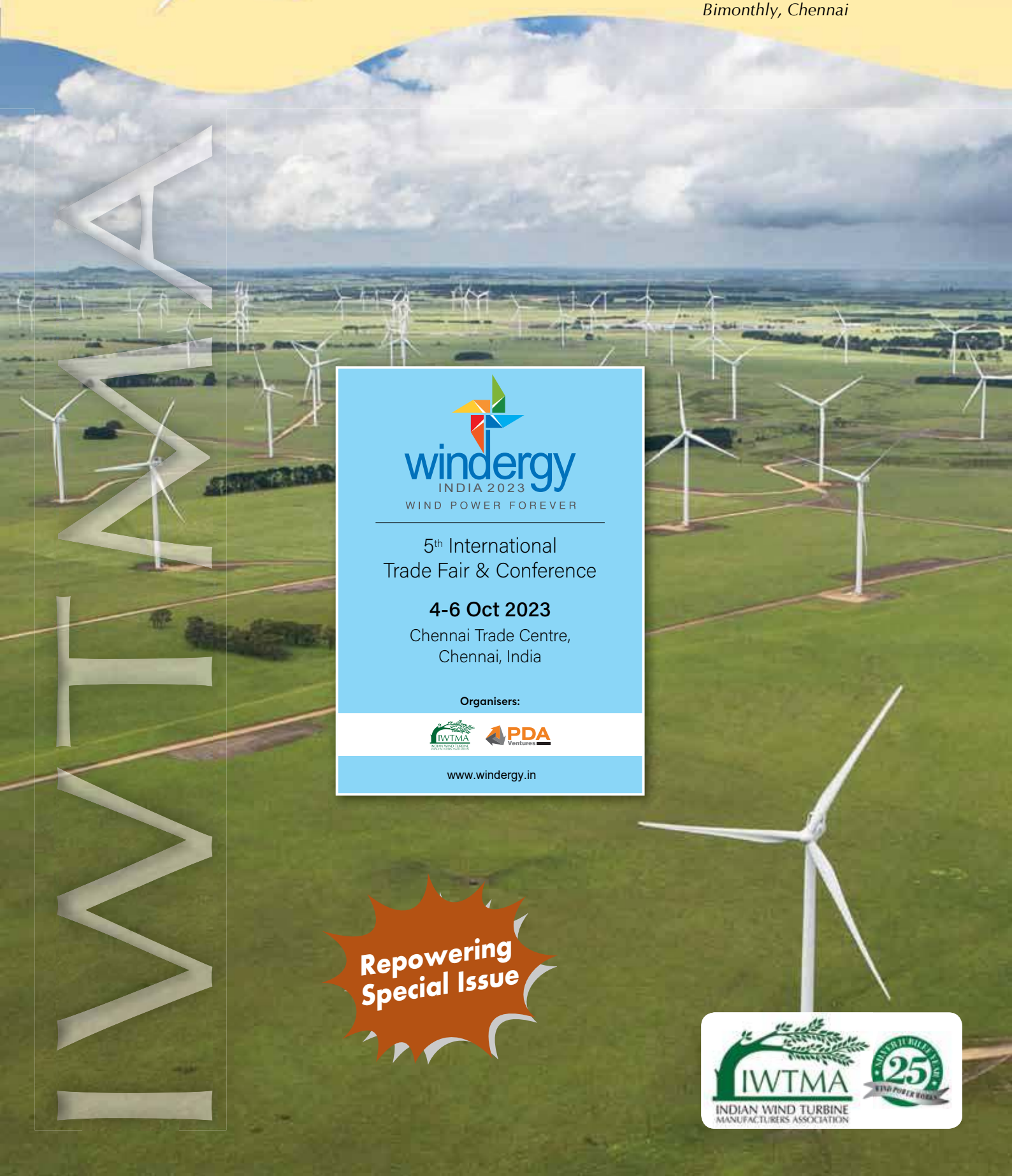

Repowering Special Issue

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION
25 WIND POWER BOOM

NATIONAL INSTITUTE OF WIND ENERGY

Under Ministry of New and Renewable Energy, Government of India

India's Wind Potential Atlas

at 150m agl (Above Ground Level)

June 2023

State-wise Detailed Wind Potential at 150m agl

% CUF	25-30%	30-32%	32-35%	35-38%	38-40%	>40%	Total
State	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)	(MW)
Andhra Pradesh	65409	19143	19184	12297	4670	2632	123336
Arunachal Pradesh	121	57	57	12	0	0	246
Assam	451	7	0	0	0	0	459
Bihar	4023	0	0	0	0	0	4023
Chhattisgarh	2670	79	0	0	0	0	2749
Goa*	9	4	1	0	0	0	14
Gujarat	59392	16800	32275	34629	16589	21104	180790
Haryana	593	0	0	0	0	0	593
Himachal Pradesh	239	0	0	0	0	0	239
J&K*	0	0	0	0	0	0	0
Jharkhand*	16	0	0	0	0	0	16
Karnataka	65638	32200	40194	21696	5686	3836	169251
Kerala	663	247	277	323	144	968	2621
Madhya Pradesh	47861	5452	2016	94	0	0	55423
Maharashtra	104551	25650	25168	14258	3273	968	173868
Manipur*	0	0	0	0	0	0	0
Meghalaya*	55	0	0	0	0	0	55
Mizoram*	0	0	0	0	0	0	0
Nagaland*	0	0	0	0	0	0	0
Odisha	11072	945	112	0	0	0	12129
Punjab	428	0	0	0	0	0	428
Rajasthan	230414	44852	8958	27	0	0	284250
Sikkim*	0	0	0	0	0	0	0
Tamil Nadu	38859	17876	18207	8182	4266	7717	95107
Telangana	38279	10160	5617	609	52	0	54717
Tripura*	0	0	0	0	0	0	0
Uttar Pradesh	510	0	0	0	0	0	510
Uttarakhand*	30	12	6	2	0	0	49
West Bengal	1281	0	0	0	0	0	1281
A&N Islands	229	343	491	167	13	2	1245
Chandigarh*	0	0	0	0	0	0	0
DNH*	17	0	0	0	0	0	17
Daman and Diu*	0	0	0	0	0	0	0
Delhi*	0	0	0	0	0	0	0
Ladakh*	0	0	0	0	0	1	1
Lakshadweep	7	16	8	0	0	0	31
Puducherry	76	116	57	160	0	0	408
Total in MW	**672893**	**173958**	**152628**	**92455**	**34694**	**37228**	**1163856**

Total Wind Power Potential at 150M agl	1164 GW
• For Waste Land	544 GW
• For Cultivable Land	607 GW
• For Forest Land	12 GW

* In these states, even though the wind potential is indicated as negligible based on the applied methodology and land suitability analysis, there can be scattered potential pockets available for wind farm development due to the localized wind flows and such pockets can only be identified through in-situ measurements.

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Indian Wind Power

A Bi-monthly Magazine of Indian Wind Turbine Manufacturers Association

Volume: 9 Issue: 2 June - July 2023

Contents

Indian Wind Turbine Manufacturers Association

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From the Desk of the Secretary General – IWTMA

Dear Readers,

Greetings from IWTMA!

The delay in monsoon, unseasonal downpour in a few states, recording of the highest temperature in the world on 3rd July 2023 are clear indicators of climate change and perhaps the El Nino effect. Where does this lead us? The major nations on planet earth have to come together and reinforce the commitment to arrest climate change and global warming and achieve the targets set in COP. Reports of increase in ocean level and recent report on receding of seawater in the state of Tamil Nadu are dangerous signals to human beings. Non-fossil fuel is the answer and we at IWTMA are committed to Wind Energy, combination of Wind Solar Hybrid with Storage for supply of firm power to DISCOMs and Industry.

India is taking a major step in promotion of Green Hydrogen with a just concluded three-day international conference in Delhi. The Green Hydrogen industry will see promotion of electrolyser and Green Hydrogen and Green Ammonia. It is very promising that India has recently announced the Green Hydrogen Mission to build capacity to produce at least 5 million Tons of Green Hydrogen per year by 2030. Ministry of New and Renewable Energy has also issued guidelines to provide funds of Rs.70,490 Crores for the manufacture of electrolysers. Wind energy from onshore and offshore will be a major input in production of Green Hydrogen, which will play a pivotal role in steel, fertilizer, and other allied industries. Steel industry for example is looking at Green Economy to reduce carbon footprint for the organizations that are looking to cut down overall carbon emissions.

This issue of Indian Wind Power focuses on Repowering, a subject pending for long but it is of high importance to maximize land resource with the state-of-the-art megawatt size turbines in place of turbines of sub-megawatt turbines. It is interesting to add that some of the sub-megawatt turbines which have completed 30 years, are still functional – an example of a combination of safety and performance time tested over three decades.

The flagship event of Windergy India 2023 is just three months away and perhaps will be the largest show in our 5th edition. We invite all stakeholders to join us as visitors/delegates/exhibitors/sponsors in our march towards a "Clean Green India and Net Zero."

With regards,

D.V. Giri
Secretary General

Global Wind Day Celebrations

by the Ministry of New and Renewable Energy, Government of India (GoI), New Delhi - 15th June 2023

Theme: 'Pawan Urja: Powering the Future of India'

at Hotel Le Meridien, New Delhi

The Ministry of New and Renewable Energy (MNRE), GoI joined the worldwide celebrations of 15th June as Global Wind Day, through the organization of a day-long event in New Delhi. The event was held with an intent to celebrate the success so far and discuss the potential ways forward for accelerating wind energy adoption in India with the central theme of "Pawan Urja: Powering the Future of India".

The celebration was organized by the by the Ministry of New and Renewable Energy, GoI, New Delhi in collaboration with the National Institute of Wind Energy (NIWE), Shakti Sustainable Energy Foundation, Indian Wind Turbine Manufacturers Association (IWTMA), Indian Wind Power Association (IWPA) and Wind Independent Power Producers Association (WIPPA).

Shri Bhupinder Singh Bhalla, Secretary, MNRE delivered a motivating and aspiring address by congratulating Rajasthan, Tamil Nadu and Gujarat for their remarkable contribution in the wind energy sector. He expressed his gratitude for all the participants of Global Wind Day Run and Quiz Competition. He further laid the vision of MNRE towards the 2030 agenda and emphasized that the Government of india is fully committed to achieve the target of 500 GW of renewable energy capacity by 2030 and urged all stakeholders to actively work towards achieving the set target.

During the event, the states of Rajasthan, Gujarat and Tamil Nadu were lauded for their performance in financial year 2022-23. Rajasthan was felicitated for achieving the highest wind capacity addition, Gujarat for achieving the highest wind capacity addition through open access and Tamil Nadu for initiating repowering of wind turbines.

The event had the active participation of the key stakeholders from central and state government authorities, DISCOMs, CPSUs, wind industry, academia, think-tanks, etc.

The event also witnessed the launch of Wind Atlas at 150 meter above ground level, prepared by National Institute of Wind Energy (NIWE). The onshore wind potential of the country is now estimated at 1,164 GW at 150 meter above ground level.

The event also included Quiz Competition, Global Wind Day Run and Wind Exhibition Gallery for raising awareness among the masses about the role of wind energy in India's energy transition and its contribution to a broader vision of achieving our clean energy goals.

The Global Wind Day was celebrated with in-depth discussions on wind energy progress in India, offshore wind development, strengthening wind energy manufacturing ecosystem in India and green finance for wind energy in 4 sessions moderated and participated by the experts.

Lighting of the Lamp by the Dignatries

Shri Bhupinder Singh Bhalla, Secretary, MNRE delivering the Inaugural Address

Felicitation to the State of Rajasthan

Felicitation to the State of Tamil Nadu

Felicitating the State of Gujarat

Mr. Madhusudan Khemka, the wind veteran was given Special Recognition

A view of the audience at the event

Launching of New Wind Atlas by National Institute of Wind Energy (NIWE)

The Global Wind Day 2023 Run 'Run With The Wind' event organized on 11th June 2023 at Jawahar Lal Nehru Stadium, New Delhi

Award for winning the quiz was given to Mr. Praveen Thakre by the Secretary, MNRE Sri Bhupinder Singh Bhalla

Session 1: Wind Energy Progress in India: Learnings from the Success Stories

Session 2: Offshore Wind Development in India: Bolstering India's Energy Security

Session 3: Strengthening Wind Energy Manufacturing Ecosystem in India: Steps towards Aatma Nirbhar Bharat

Participants at the Event

Session 4: Unpacking Green Finance for Wind

Vote of thanks was given by Shri Dinesh Jagdale, Joint Secretary, MNRE

A view of the Audience

Pre-Event Celebration to Global Wind Day

Jaipur, 31st May 2023

Ministry of New & Renewable Energy (MNRE) and National Institute of Wind Energy (NIWE) celebrated the **Global Wind Day – 'Pawan-Urja: Powering the Future of India' on 15th June 2023 in New Delhi.**

In a run up of the Global Wind Day, Indian Wind Turbine Manufacturers Association (IWTMA), along with Indian Wind Power association (IWPA) and Wind Independent Power Producers Association (WIPPA) conducted a Pre-event Celebration to Global Wind Day as a Seminar titled "Wind Solar Hybrid & Repowering" at Amber Hall, Hotel Hilton, Jaipur on 31st May 2023. The brief report of the event is given below.

Government Dignitaries at the Inaugural Function

Shri Anil Dhaka, IRS, Managing Director, Rajasthan Renewable Energy Corporation Limited (RRECL) delivered Special Address.

Dr. Rahul Rawat, Scientist, Ministry of New and Renewable Energy (MNRE), New Delhi gave the opening remarks at the event.

Mr. Bhaskar A Sawant, Principal Secretary-Energy, Government of Rajasthan delivered Special Address

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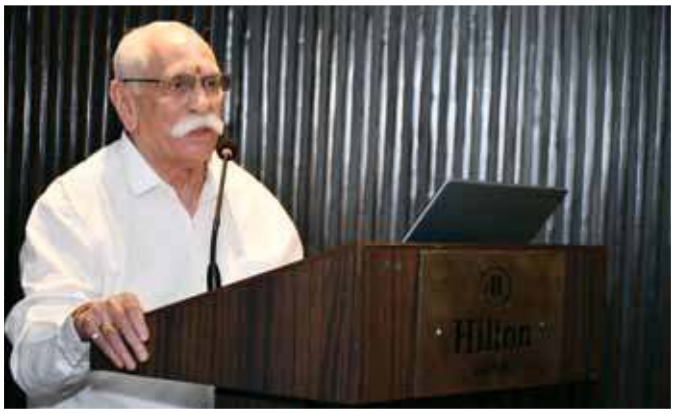
*Data till 31st December 2021

Dr. B.N. Sharma, Chairman, RERC as Chief Guest delivered the Keynote Address. Dr. Sharma mentioned that they took the initiative to provide annual banking for the wind power projects. He further mentioned that the full support from Rajasthan Government would be provided for the Wind Solar Hybrid and Repowering projects.



The Vote of Thanks for the Inaugural Session was delivered by Sri D. V. Giri, Secretary General, Indian Wind Turbine Manufacturers Association, New Delhi.

In the Technical Session, Mr. Manoj Kumar Gupta, ReNew Power and Mr. Sunil Kundu, Sembcorp made presentations on 'Wind Solar Hybrid'

The presentation on 'Draft- National Repowering Policy' was made by Mr. K.R. Nair, Emergya Wind Technologies. The presentation on 'Repowering – An Approach to Pilot Project in Rajasthan' was made by Sri O. P. Taneja, Advisor.

Delegates at the Seminar

The Seminar had a participation of 65 persons. *The event was well covered by the Media.*

Mr. Sumit Kumar of Envision gave the concluding remarks to the discussions at the event

Pre-Event Celebration to Global Wind Day

Chennai - 2nd June 2023

Indian Wind Turbine Manufacturers Association (IWTMA) conducted a Pre-Event Celebration to Global Wind Day supported by Ministry of New and Renewable Energy (MNRE), National Institute of Wind Energy (NIWE), Indian Wind Power Association (IWPA) and Wind Independent Power Producers Association (WIPPA) as a seminar titled "Offshore Wind Development" on 2nd June 2023 at National Institute of Wind Energy (NIWE), Chennai.

Dignitaries on the Dais at the Inaugural Session

Mr. D. V. Giri, Secretary General, Indian Wind Turbine Manufacturers Association (IWTMA) gave a snapshot on wind power in India

Welcome address for the event was given by Dr. Rajesh Katyal, Director General, National Institute of Wind Energy (NIWE), Chennai. He also made a presentation on "Indian Offshore Wind and Overview" in Technical Session

Dr. P. K. Dash, Scientist, Ministry of New and Renewable Energy (MNRE) gave the opening Remarks for the seminar.

Mr Oliver Ballhatchet MNE, British Deputy High Commissioner, delivered the Special address

Mr. Srijith Menon, Senior Trade and Investment Adviser - Energy, Lead-Offshore Wind India, Department of Business and Trade, British Deputy High Commission, Chennai made a presentation on "Offshore Wind Experiences in UK."

Keynote address was delivered by Chief Guest Mr. S. Krishnan, IAS, Additional Chief Secretary - Industries, Investment Promotion and Commerce Department, Government of Tamil Nadu. Mr. Krishnan detailed the need for a balanced approach to offshore wind Power development to ensure that the interests of both the central & state governments are served. He emphasized that offshore bids with power off-take mechanisms both through open access and state discoms, addressing environmental concerns, engagement with the local community and offshore wind-linked hydrogen storage options would ease the process of implementation of the technology in India. He also enumerated as a case of success of the competitiveness of the textile industry in Tamil Nadu through wind turbine installations.

The presentation on "Design of Ports and Offshore Wind Turbine Foundation" was made by Ms. Sherly Jenifer Dhanraj, Project Manager-Marine and Mr. G. Balamurugan of COWI Consultants.

This was followed by the Open Discussion steered by Dr. Rajesh Katyal, DG, NIWE.

There was the participation of around 90 persons at the event.

Vote of Thanks for the inaugural session was proposed by Dr. P. Kanagavel, Director & Divisional Head, Skill Development and Training, Infrastructure Management, NIWE. Director & Divisional Head, Skill Development and Training, Infrastructure Management, NIWE.

Childhood Story of Wind Energy Programme in India

M.K. Deb
Chairman, Consolidated Energy Consultants Limited, Bhopal

Indian Wind Turbine Manufacturers Association (IWTMA) was established in 1998 and is celebrating its silver jubilee this year. We wish to bring interesting anecdotes from the experienced persons of Indian Wind Power Industry about the journey of wind power in India.

Shri M. K. Deb, Chairman, Consolidated Energy Consultants Limited, Bhopal is pioneer in wind energy in India with 60 years of experience in the field of engineering out of which 40 years is in the field of wind power. Shri Deb has been a Member of the Board of Governor of Indian Institute of Management (IIM), Kolkata for 5 years and also a Member of the Board of Directors of Indian Institute of Forest Management (IIFM), Bhopal for 2 years term. Shri Deb has also been a Member of the Advisory Committee of M.P. Electricity Regulatory Commission for 5 years. – Editor

Our journey in wind energy sector started at the very initial stage in 1984 through installation of a 50 kW Wind Turbine at Kukru village in Madhya Pradesh.

Kukru was not a known destination in Madhya Pradesh for Wind Power Project. It was a tiny scenic village on the Maharashtra–Madhya Pradesh border, with a population of about 250, in Betul District. It is located in the Satpura Range, about 90 km from the district headquarters, at an altitude of about 1100 meters. Livelihood was agriculture and collection of non-timber forest products such as mango, amla, Jamun and harra. Thirty five years ago, this tiny tribal village stood forgotten by development.

The core idea of wind power conversion came from Mr. Ranjit Dutta – an eminent Professional Manager - who had experienced the fascinating new technology of producing electricity from flowing wind in the USA. At the same time, Mr. M.S. Choudhary, Ex-Chief Secretary and Chairman of Madhya Pradesh Dairy Development Corporation, had visited Kukru to source milk collection and observed the strong wind flow and wondered if electricity could be produced to chill the milk for safe transportation to Betul. He relayed the information to Mr. C.S. Chaddha, the first Managing Director of M.P. Urja Vikas Nigam, to crystallize a plan to implement the concept.

Lifting the blade for First 50 kW Enertech Wind Turbine installed in 1986 in Kukru village

A visit to the site led to an initial short term wind-data collection and a decision was taken to install an experimental 50 kW wind turbine. A location at a slightly higher elevation was selected near a lone tree.

Harvesting the Invisible

It was quite an adventure – knowledge was inadequate, technical and commercial aspects were totally unknown, there was no experience, road connections were poor, and there was no infrastructure.

Strategic decision was taken to –

- Import the "Enertech" 50 kW WEG from USA and fabricate the tower locally.

  The WEG supplier, however did not appreciate the idea and refused to provide warranty cover – if tower is not purchased from them.

  We took the calculated risk, though not having any idea about the consequences.
- India had experience of manufacturing transmission line towers– which however does not have any dynamic load of nacelle on top of tower.

Figure 1: Lifting of Nacelle on 80 ft High Tower

We identified a transmission line ttower fabricator at Nagpur.

The next challenge was to identify an agency who would erect the tower as also lift the nacelle and blades.

Luckily we came in contact with the Regional Manager of SAE Power (most reputed Transmission Tower Manufacturer and Line Contractor) Mr. L. Rangarajan - who assured us availability of one of their sub-contractor – Mr. Subhaya – an extremely polite, highly competent and co-operative person.

In the small remote village Kukru, we could not provide any accommodation, not even a roof to Subhaya and his team members. They had no complaints and in fact they were highly enthusiastic to venture in a unique experimental project.

After having identified the agency to erect the tower, the next challenge was how to lift the nacelle and blades at a height of 80 ft.

We designed a cantilever superstructure to be assembled at tower top for lifting of nacelle and blades.

Figure 2: 50 kW Enertech Wind Turbine installed in 1984

Mr. Rangarajan once again came to our help and provided a 5 tonne chain-pulley block for lifting the nacelle and blades.

Incidentally, the Nacelle of the Enertech machine imported by us weighed only 2 tonnes as against weight of 5 Tonnes of Danish Machine – selected by the Ministry, GoI for four Demonstration Projects (each having 10 No. of 55 kW Danish Machine).

The Central Government/State Agencies at 4 demonstration sites spent Lakhs of Rupees to transport and avail the services of high boom cranes which were not readily available in those days.

However it took few months to lay a 30 Km long 11 kV overhead line by Kukru mostly through Forest Area, in spite of good cooperation of M.P. Electricity Board officers and staff.

Finally the wind turbine was commissioned on 4th July 1986, just one day after Commissioning of Demonstration Wind Farms financed by Government of India.

The Toddler Started Walking

We gained initial experience to install and operate wind turbine but there were virtually no further activities to sustain business.

Government of India installed few more demonstration projects in few states – with turbine ratings increasing from 50, 55, 90, 100 to 110 kW. Unfortunately none of these demonstration projects performed satisfactorily due to poor grid availability, inexperience of operation and maintenance and more significantly due to inadequate financial provision for after-sales service and performance monitoring.

Government of India also installed few small capacity Stand Alone System for battery charging but none of them operated satisfactorily due to lack of after sales service.

We provided consultancy services for design and installation of most of these demonstration projects.

At Ministry level in Government of India, a highly dedicated team headed by Dr. J. Gururaja and duly assisted by Shri Ajit K. Gupta took several major steps to ensure techno-commercial viability of wind power projects as also motivate-otherwise least interested - electricity board officials.

Then came the turning point – when DANIDA in 1989-90 funded 20 MW Projects – 10 MW at Lamba in Gujarat and 10 MW (6 MW at Kayathar and 4 MW at Muppandal) in Tamil Nadu. DANIDA ensured most reasonable budgetary provision for after sales services and rigorous monitoring.

COWI Consult of Denmark was the prime turnkey consultant and we "Consolidated Energy Consultants Ltd. (CECL)" were their associates.

Highly successful operation of these DANIDA aided windfarms and particularly very high generation at Muppundal site immediately attracted the attention of industries and even state electricity board officials got interested.

Based on the success of DANIDA Project – World Bank offered a line of credit. COWI Consult, Denmark and CECL were the mission members to formulate the project. Subsequently CECL was retained to prepare the procurement document.

At this stage – two most attractive incentives in the form of (i) Tax saving through Accelerated Depreciation Benefit on Investment in windfarms and (ii) Provision of Captive

Consumption by Wheeling the Wind Power through Electricity Board network played the major role to attract private sector investment in wind power projects.

Mass scale participation of private sector industry was however not happening due to several constraints in project implementation and routine O&M of project. Manufacturers only provided the WEG and the investors had to procure land, ensure grid connectivity and also arrange operation and maintenance of windfarm. Due to virtual non-availability of skilled manpower, not many industries could set up the project.

CECL mooted the idea of a Joint Sector Company, M.P. Windfarms Limited (MPWL) to develop Wind Power Estate – to avoid duplication of investment in infrastructure and also provide life time O&M service. On successful establishment of 15 MW Windfarm by MPWL in the year 1995-96 – all WEG manufacturers were rather forced to offer similar turnkey facility and services for establishing large capacity wind power estates and also take responsibility of life time O&M.

Once this happened – there was no looking back and the annual capacity addition rate of 100/200 MW per year in 1994-95 increased exponentially to 500, 1000, 2000 & 5000 MW per year after 1997.

Today Kukru has installed Wind Farm projects of total 127.50 MW consisting of 72 numbers of WEGs of different capacity and this is by far the best generating project in M.P., which has further potential to install 500 MW.

On introduction of Electricity Act 2004 – Maharashtra Electricity Regulatory Commission (MERC) was the first to declare a feed-in-tariff for sale of Wind energy. CECL was assigned to prepare the base document. In fact this initiative accelerated investment in Wind Energy Sector.

As the market demand increased, Asian Development Bank (ADB) offered a line of credit and CECL was engaged to prepare the investment plan.

Over the years – the country – through Private Sector participation – has developed a strong manufacturing base to meet the ever increasing demand of WEGs.

Since 2000 – CECL has been compiling and publishing annually an unique "Directory – Indian Windpower" for past 23 years which is a comprehensive ready-reckoner for Policy Makers, Planners, Investors, Manufacturers and Service Providers in Wind Energy Sector.

Wind Energy Programme in India has now reached the adult-hood.

Pre-Event Celebration to Global Wind Day - Pune - 8th June 2023

In a run up to the Global Wind Day, Wind Independent Power Producers Association (WIPPA) along with Ministry of New and Renewable Energy (MNRE), Indian Wind Turbine Manufacturers Association (IWTMA) and Indian Wind Power association (IWPA) conducted a Pre-event Celebration to Global Wind Day as a Conference on "Scaling Up Wind Energy: Leveraging Policy, Capital Transition and Business Innovation for Achieving 2030 Targets" at O Hotel, Koregaon Park, Pune on Thursday, 8th June 2023.

Experts at the Panel Discussion at the Conference

Snippets

Kerala can save Rs 9,000 Cr in 5 years by switching to 100% RE

Kerala can save Rs 9,000 crore over a five-year period if they replace coal power purchases with renewable energy contracts by 2040, according to a new study. If the state replaces its scheduled purchases of coal power from central sector plants with new renewable energy at an average tariff of Rs 3/kWh, the state would save approximately Rs 969 crore per annum. The report also suggests a transition pathway that sees the most expensive central sector power contracts phased out first, saving the state Rs 4,505 crore through the phase-out of 1560 MW of coal power by 2026-27.

Source: PTI, 9 June 2023

Renewable Energy Boom stares at Talent Blackout

A lack of trained manpower is proving to be a major bottleneck for Indian renewable energy companies which are struggling for new hires as they expand capacities. Companies say they are either forced to send executives overseas to be trained, hire expats or poach employees from other players. "The scale of the opportunity is something that is very exciting but there is a lack of talent and it is one of the challenges," said Mr. Sumant Sinha, chairman and chief executive of ReNew. In the next seven years, India will have to add 60 GW of renewable energy capacity every year to meet its aspirations across power and green green hydrogen, and trained manpower is needed for this, he added.

Source: ET Energy World, 31 May 2023

Old Wind Turbines and Need for Repowering


Dr. Karunamoorthy Neethimani
Managing Director


C.R. Viswanathan
Advisor – Regulatory & Policy


Ms. Maheswari Manoharan
Executive - Business Development

Windplus Private Limited, Coimbatore, India

Introduction

The wind power industry in India witnessed significant growth and development in the 1990s, driven by favourable government policies. These policies attracted businesses to invest in wind power and resulted in various benefits. Tamil Nadu emerged as the leading state in wind mill installations, with specific locations like Muppandal, Kayathar, and Udumalpet identified as favourable for wind energy generation due to their geographical location and availability of high wind speed.

…repowering projects attract investments and expertise in the renewable energy sector, fostering innovation and establishing India as a global leader in clean energy production, which will pave the path for a cleaner and brighter tomorrow.

Figure 1: Nedwind 500/550 kW Two Bladed Upwind Turbines

The introduction of wheeling and banking of power became common practice, allowing businesses with factories or spinning mills to install wind turbines and use wind power internally. This led to lower electricity bills paid to the Electricity Board. Long-term Power Purchase Agreements (PPAs) with State Electricity Boards, ranging from 10 to 20 years, provided investors with confidence in their returns on investment.

To attract investors, various incentives and subsidies were offered, including accelerated depreciation benefits, Generation Based Incentives (GBI) for those not utilizing accelerated depreciation and tax holidays. Additionally, states like Gujarat, Maharashtra, Andhra Pradesh, and Karnataka provided waste land, Concessional rates For Wheeling and Banking of power, and infrastructure support for wind farm development.

The wind energy boom attracted numerous manufacturers, including prominent companies such as NEPC Micon (later NEPC India), Vestas RRB India Ltd, BHEL and BHEL Nordex, Nedwind (known for their 2-blades and 3-blades turbines), Carter (known for 2 blades), AMTL, Das Lagerway, and TTG, who played a crucial role in shaping India's wind power industry.

Today, India has become the fourth-largest wind power market in the world, with an installed capacity of 42,633 MW in the first quarter of 2023, compared to just 100 MW in 1993. Wind power now accounts for approximately 10% of India's electricity generation, making a significant contribution to the country's energy mix.

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Figure 2: DAS lagerway 250 kW Down Wind Turbine

As the wind power industry matures and wind turbine generator (WTG) sizes increase, the need for repowering arises. Repowering involves replacing older, less efficient turbines with newer and more advanced ones, maximizing the potential of wind energy and ensuring the continued growth and sustainability of the sector.

In this article, we will explore the major wind turbine manufacturers that have played a crucial role in shaping India's wind power industry. Additionally, we will discuss the emerging trend of repowering and its importance in meeting the rising energy demands, reducing carbon emissions, and driving the transition towards a greener and more sustainable future.

Glimpses on Manufacturers of WTGs

Turbine capacities up to 2 MW are listed below, showcasing a substantial amount of installed capacity. The list encompasses various wind turbine manufacturers who have installed the turbines in India since beginning of the wind power installation. The list does not cover the complete data.

Serial No.	Turbine Make	Installation
1	Aban	94.71 MW
2	Acciona	60 MW
3	BHEL	4.28 MW
4	BHEL Nordex	61.8 MW
5	Chettinad	2.4 MW
6	AMTL (Later CWEL)	71.2 MW
7	Das Lagerway	71.2 MW
8	Danish Wind Power	1.8 MW
9	Elecon	28.1 MW
10	Garuda	2.4 MW
11	Ghodawat	4.95 MW
12	Global Wind Power	125.975 MW
13	GWL	1.125 MW
14	Himalaya	5.36 MW
15	India Wind Power	3.25 MW
16	JMP EcoTechnica	2.25 MW
17	Kenersys	218.9 MW
18	Kirloskar	3.2 MW
19	Lietner Shriram	262 MW
20	Micon Pearl	8.91 MW
21	Mitsubishi	1.89 MW
22	NAL	0.5 MW
23	Nedwind	30.25 MW
24	NEPC India	233.75 MW
25	NEPC Micon	325.115 MW
26	NuPower	30.75 MW
27	Patel Alloys	8.5 MW
28	Pegasus	2.25 MW
29	Pioneer Asia	44.20 MW
30	Regen	2302.6 MW
31	Real	20.51 MW
32	RES AWT	20 MW
33	RRB	1174.095 MW
34	Sangeeth Carter	7.5 MW
35	Shriram EPC	161 MW
36	Sinowel	15 MW
37	Siva	5 MW
38	Southern Wind Farms	140.625 MW
39	Tacke	14.35 MW
40	Textool Nordtank	22.25 MW
41	Wind Master	0.2 MW
42	Wind Power	9.57 MW
43	Wind Matic	1.65 MW
44	Win Wind w	93 MW
45	Wind World	4996 MW
46	Xyron	1 MW

Additionally, it's worth highlighting the remarkable contributions made by other esteemed manufacturers like Suzlon, Gamesa, and NEG Micon (Vestas) to India's wind power industry. These companies have played a significant role in shaping the landscape of renewable energy in the country. Their expertise, innovation and dedication have helped propel India's wind power sector forward, fostering sustainable development and driving the transition to cleaner and greener energy sources. Their impact cannot be overlooked, and their continued efforts will undoubtedly contribute to a brighter and more sustainable future for India's renewable energy sector.

As the size of the WTGs increases, the necessity of repowering becomes more pronounced. Larger turbines often offer several advantages over smaller ones, such as increased energy production, improved efficiency and reduced costs per unit of energy generated. However, as older and smaller turbines become out-dated, repowering becomes necessary to harness the full potential of wind resources and maximize the benefits of modern turbine technology.

Wind Repowering

Wind repowering is a process that entails the replacement of aging wind turbines with newer and more advanced models, resulting in increased efficiency. This practice is executed through two primary methods: Full Repowering and Partial Repowering.

Full Repowering

Full repowering involves the complete dismantling of old turbines and the installation of new ones. It is commonly employed when the existing turbines have reached the end of their operational lifespan or when significant advancements in wind turbine design and efficiency have emerged.

Partial Repowering

On the other hand, partial repowering focuses on upgrading specific components of the existing turbines, such as blades or generators, to enhance performance and extend their operational life. This approach is typically chosen when the current turbines still possess some usable lifespan and can benefit from efficiency improvements or technological upgrades.

Both full repowering and partial repowering are strategies aimed at optimizing energy output and overall efficiency within wind farms by harnessing the potential of modern turbine technology. These repowering initiatives play a vital role in fostering a more sustainable and productive wind energy sector.

Need for Repowering in India

Increasing Energy Production: Many older wind turbines have a low plant load factor (PLF) of 10-15%, indicating their underperformance. By repowering with newer and more efficient turbines, India can significantly increase its energy production and utilize its wind resources more effectively.

Cost-effective utilization of existing infrastructure: Repowering allows the utilization of existing land and infrastructure, resulting in cost savings compared to developing entirely new wind farms. India has limited land availability, especially in areas with high wind potential. Repowering enables the installation of larger and more efficient turbines on the same land, maximizing energy output without the need for additional land acquisition.

Integration with the modern power grid: Older turbines lack advanced features such as Low Voltage Ride Through (LVRT) and Supervisory Control And Data Acquisition (SCADA) systems, which are crucial for efficient grid integration and stability. Repowering with newer turbines that incorporate these features ensures better alignment with the modern power grid, improving grid compatibility and reducing the risk of power outages.

Safety concerns and improved aesthetics: Over time, wind farms in India have been surrounded by populated areas and infrastructure, increasing the potential safety risks associated with older turbines. Repowering eliminates these safety concerns by replacing worn-out turbines with modern, safer models. Additionally, repowered wind farms often feature a reduced number of turbines, enhancing the aesthetics of the landscape and minimizing visual impact.

Environmental benefits: Repowering helps mitigate the risk of bird collisions by reducing the number of turbines. It also contributes to the reduction of carbon dioxide emissions per unit of electricity produced, supporting India's efforts to combat climate change. By generating clean and sustainable energy, repowering plays a vital role in preserving biodiversity and protecting the environment.

Given these factors, repowering is essential in India to optimize wind energy generation, increase energy production, utilize existing infrastructure cost-effectively, enhance grid integration, address safety concerns, improve aesthetics, and contribute to environmental sustainability. Implementing repowering policies and supporting the transition to modern and more efficient turbines will unlock the full potential of India's wind energy sector and contribute to the country's renewable energy targets.

Challenges Associated with the Repowering Process

- Limited availability of suitable sites: As WTG sizes become bigger; finding suitable sites with proper evacuation infrastructure becomes more challenging. In some cases, land and evacuation routes may already be occupied by owners or investors with smaller capacity turbines. This can hinder the development of new wind farms with larger turbines, as the necessary space and infrastructure may have been already blocked.
- Out-dated smaller turbines: Some of the existing smaller capacity turbines may have surpassed their intended technical life of around 20 years. Despite their out-dated status, these turbines may still be running and wheeling power, as per the order by the Appellate Tribunal for Electricity (APTEL) in the case of TNEB vs. TASMA. This situation delays the implementation of repowering projects, as the focus remains on the existing functioning turbines.
- Grid capacity limitations: Repowering involves replacing smaller turbines with larger ones, resulting in increased power output. However, the grid capacity may not be able to accommodate the higher output from repowered wind projects. In the given example, the grid capacity is limited to 2 MW, which becomes a constraint in installing larger capacity turbines even if the land area allows for it.
- Challenges with approach roads: Repowering may require the transportation of larger turbines, cranes and materials to the site. However, inadequate or inaccessible approach roads can pose logistical challenges and hinder the repowering process.

These challenges highlight the complex nature of repowering projects, which involve considerations such as land availability, existing infrastructure, grid capacity and logistical requirements.

Overcoming these obstacles requires careful planning, coordination between stakeholders, and potentially addressing regulatory and infrastructural limitations to facilitate the transition to larger and more efficient turbines.

Repowering Policy

The Policy for Repowering of Wind Power Projects was notified by the Ministry of New and Renewable Energy (MNRE), Government of India on 5th August 2016. The objective of the policy is to promote optimum utilization of wind energy resources by creating facilitative framework for repowering.

This policy has been followed by various states like Gujarat, Karnataka, Rajasthan and Tamil Nadu. The key points of the policy are as follows:

Ministry of New and Renewable Energy (MNRE)

- Wind turbines with a capacity of 1MW and below are eligible for repowering.
- An extra rebate of 0.25% will be provided by the Indian Renewable Energy Development Agency (IREDA) in addition to the existing rebates.
- All fiscal benefits will be available, and repowering will be done through State Nodal Agencies.
- Transmission network augmentation will be carried out by the State Transmission Utility (STU).
- Additional footprint will be allocated by the state.
- If power is sold to the State Electricity Board under a Fixed PPA or Feed-In Tariff, the power generated corresponding to the average of the last 3 years' generation prior to repowering will be purchased by the board according to the terms of the PPA. Excess power can be sold at the Feed-In Tariff or to third parties.
- The 7DX5D criteria for micrositing will be relaxed.
- The terms of the existing PPA does not need to be honoured while undergoing repowering.

Draft MNRE National Repowering Policy for Wind Power Projects- 2022 (17.10.2022)

- Wind turbines identified in accordance with the quality control order issued by this ministry under the relevant BIS Act.
- Rated capacity is below 2 MW.
- Wind turbines which have completed their design life
- A set of existing wind turbines over an area shall also be eligible for Repowering provided:
  - Project area is a geographically contiguous land area.
  - All turbines considered for repowering are connected to a single Polling Sub Station (PSS)

Gujarat

Gujarat Wind Power Policy 2016 (02.08.2016)

Above policy was with operative period up to 30.06.2021, amended on 21.06.2017 and 21.05.2018. The period was extended up to March 2023 or till a new policy is announced.

Gujarat Repowering of the Wind Projects Policy – 2018 (21.05.2018)

Repowering is applicable to projects below 1 MW.

- The repowered project's life will be 25 years or the actual life, whichever is earlier.
- Fiscal incentives will be provided as per the MNRE guidelines.
- The Gujarat Energy Development Agency (GEDA) will be the nodal agency.
- Network augmentation will be done by the Gujarat Energy Transmission Corporation Limited (GETCO), and developers will undertake augmentation up to GETCO Substation.
- Additional power will be procured by distribution companies (DISCOMS) considering Renewable Purchase Obligation (RPO) and through a competitive bidding process.
- The terms of the PPA will be relaxed for a period of 4 months.

Karnataka

Karnataka Renewable Energy Policy 2022-27 dated 16.04.2022 has the provision for Repowering of older wind turbines. Karnataka Electricity Regulatory Commission vide their order dated 15 November 2022 has also given the following points in the matter of Repowering of Wind Turbines.

- Repowering is allowed for existing wind turbine generators that have completed at least 10 years as of the policy date, after informing the Electricity Supply Companies (ESCOMS).
- The MNRE guidelines mentioned above apply to existing power PPA holders.
- Additional power generated through repowering can be used for captive/group captive/third-party sale.
- The developer must ensure evacuation readiness in consultation with the Central Transmission Utility (CTU) and State Transmission Utility (STU).
- During the period of repowering, the PPA holder is not obligated to honour the terms of the PPA for non-availability of generation.

Rajasthan

Wind and Hybrid Energy Policy-2019

- Wind turbines that have completed at least 10 years in operation.
- Other provisions as per the guidelines/policies issued by MNRE from time to time.
- If power being procured by State DI5COMs through existing PPA, the power generated corresponding to average of last three year's generation prior to repowering would continue to be procured on the terms of PPA in-force and remaining additional generation may be purchased by DISCOMs at a tariff discovered through competitive bidding in the State at the time of commissioning of the repowering project.
- The Wind Power Producer shall also be allowed to use the additional generated power for captive use/third party sale.
- The lease period of land beyond normal period will be extended on recommendation of RREC for the useful life of the project.

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HEXAGON

- The power evacuation facility for new pooling station or augmentation of existing substation will be provided by RVPN/DISCOMs based on load flow studies.

Tamil Nadu

A detailed policy note is yet to be prepared and approved for repowering.

These policies and guidelines aim to facilitate the repowering of existing wind turbine generators, promote clean energy generation, and address various aspects such as incentives, network augmentation, power purchase agreements, and evacuation readiness.

Conclusion

As discussed earlier, by revitalizing these old assets, India can unlock their untapped potential and maximize renewable energy generation. Repowering old wind turbines with modern technology not only addresses the challenges posed by out-dated technology but also presents a unique opportunity to enhance efficiency, increase capacity, and reduce operational costs. Moreover, it cuts emissions, creates jobs, and promotes tech progress while being eco-friendly and economically feasible. On top of all that, repowering projects attracts investments and expertise in the renewable energy sector, fostering innovation and establishing India as a global leader in clean energy production, which will pave the path for a cleaner and brighter tomorrow.

Acronyms used

NEPC	:	Natural Energy Processing Company
BHEL	:	Bharat Heavy Electricals Limited
AMTL	:	Arul Mariamman Textiles Limited
CWEL	:	Chiranjeevi Wind Energy Limited
WTG	:	Wind Turbine Generator
PLF	:	Plant Load Factor
LVRT	:	Low Voltage Ride Through
SCADA	:	Supervisory Control and Data Acquisition
APTEL	:	Appellate Tribunal for Electricity
TNEB	:	Tamil Nadu Electricity Board
TASMA	:	Tamil Nadu Spinning Mill Association
MNRE	:	Ministry of New and Renewable Energy
IREDA	:	Indian Renewable Energy Development Agency
STU	:	State Transmission Utility
CTU	:	Central Transmission Utility
PPA	:	Power Purchase Agreement
GEDA	:	Gujarat Energy Development Agency
GETCO	:	Gujarat Energy Transmission Corporation Limited
DISCOMS	:	Distribution Companies
ESCOMS	:	Electricity Supply Companies

References

1. Indian Wind Power Directory 2021/22
2. Gujarat Re Powering Policy dated 21.5.2018
3. Karnataka Repowering Policy dated 15th November 2022
4. TN repowering Policy dated 2.2.21
5. Rajasthan Wind and Hydrid Energy Policy 2019

Snippets

Tata Power RE Arm Receives LoA to Set up 966-MW RTC Hybrid Project for Tata Steel

Tata Power Renewable Energy (TPREL) has said that it has received Letter of Award, through its subsidiary TP Vardhaman Surya, to set up 966 MW round-the-clock hybrid renewable power for Tata Steel. It said that this was one of the biggest industrial RTC power power purchase agreement in the country. The project has the hybrid renewable capacity of 379 MW solar and 587 MW wind power.

Source: ET Energy World, 9 June 2023

Just Climate Raises $1.5 Billion with Help From Microsoft Fund

Asset manager, 'Just Climate' has said that it had raised $1.5 billion for its inaugural fund after strong demand from institutional clients including Microsoft's Climate Innovation Fund helped it beat the original target of $1 billion.

Source: Reuters, 8 June 2023

Approval of Pumped Storage Projects Fast-Tracked

The Central Electricity Authority (CEA) has accorded concurrence to Upper Sileru Pumped Storage Project (PSP) of 1350 MW being developed at Sileru, Alluri Sitharama Raju district of Andhra Pradesh by APGENCO in record time of 70 days against the stipulated timeline of 90 days. The CEA has established a single window clearance cell for this purpose.

Source: ET Energy World, 9 June 2023

EU, COP28 Host UAE Pledge to Rally Support for Renewable Goals

The European Commission and the United Arab Emirates' presidency of this year's COP28 climate summit pledged to seek support for global goals to expand renewable energy, which they said would help countries to shift from unabated fossil fuels. The two sides will work to "ensure maximum support on global 2030 targets for the tripling of renewable energy and doubling of energy efficiency," a statement agreed after a meeting of officials in Brussels said.

Source: Reuters, 8 June 2023

Suzlon Reaches 20-GW Installed Wind Energy Capacity Globally

Suzlon Group has said that it has crossed the 20 GW wind energy installations milestone through 12,647 wind turbines installed across 17 countries. With 5.9 GW of Indian wind turbines installed across the globe, Suzlon's 20 GW is a story of taking India to the world," said Mr. Girish Tanti, vice-chairman, Suzlon Group.

Source: ET Energy World, 9 June 2023

Repowering
An Approach to Pilot Project in Rajasthan

Om Prakash Taneja
Renewable Energy Consultant

Applicable Repowering Policies
Rajasthan Wind and Hybrid Energy Policy-2019

The Policy has a Provision of Repowering and the same can be termed as Investor Friendly.

The Extract of repowering details from the Policy

- The State will promote Repowering of existing wind turbines that have completed at least 10 years in operation. Other provisions will be as per the guidelines/policies issued by MNRE from time to time.
- In case of power being procured by State DI5COMs through existing PPA, the power generated corresponding to average of last three year's generation prior to repowering would continue to be procured on the terms of PPA in-force and remaining additional generation may be purchased by DISCOMs at a tariff discovered through competitive bidding in the State at the time of commissioning of the repowering project.
- The Wind Power Producer shall also be allowed to use the additional generated power for captive use/third party sale.
- In case of Repowering of the projects, lease period of land beyond normal period will be extended on recommendation of RREC for the useful life of the project.
- In case of Repowering, the power evacuation facility for new pooling station or augmentation of existing substation will be provided by RVPN/DISCOMs based on load flow studies.

Note:

Suitable amendment will be made in Land Revenue Rules, 2007 for repowering of the projects.

Draft National Repowering Policy for Wind Power Projects- 2022

The relevant Details from the Policy are as follows:

Repowering Project

- A Repowering Project is a project which satisfies one or more of the eligibility conditions mentioned at clause 5 of the National Policy. The capacity of the Repowered Wind turbines is enhanced by at least 1.5 times of its aggregate capacity of old turbines.
- The Repowering Projects would be implemented through respective State Nodal Agency/Organization involved in promotion of Wind energy in the State or the Central Nodal Agency, appointed by the Central Government.

Eligibility

The following Wind turbines are eligible for Repowering under the policy:

- All Wind turbines as identified in accordance with the quality control order issued by this ministry under the relevant BIS Act.
- The Wind turbines of rated capacity below 2 MW.
- Wind turbines which have completed their design life.
- A set of existing wind turbines over an area shall also be eligible for Repowering provided:
  - Project area is a geographically contiguous land area.
  - All turbines considered for repowering are connected to a single Polling Sub Station (PSS).

Wind Repowering Project Aggregators (WRPA) (Major Responsibilities)

Preparation of a Detailed Project Report (DPR) for land acquisition and development of the site is needed.

Acquisition/leasing/purchase of additional land, if required.

Acquisition of all assets at the site including wind turbine and associated equipment, infrastructure, land and power evacuation rights,

WRPA shall also be responsible for decommissioning of the existing assets, removal and lawful disposal of all scrap from the site, including disposal of the wind turbine blades. The turbine blades to be disposed as per the applicable norms of MoEFCC and CPCB/ SPCB and a certificate from appropriate authority.

Benefits of Repowering in Rajasthan

Technical

- Efficient utilisation of potential wind sites producing higher quantum of energy.
- Improved CUF at given wind farm site. The increase can be between 12 to 16% higher efficiency.

Operational

- Reduced operation and maintenance (O&M) costs
- Modern wind turbines/farms offer better integration with grid.
- Better management of grid parameters and provision of higher operational flexibility for the system operators.

Environmental

- Reduced impact on movement of birds
- Reduced noise pollution

Financial

- Achieve better wind power economics. (Additional Benefits if the land & infrastructure is used for Wind Solar Hybrid).
- With repowering, there is reduction in land area per MW of wind farm. Additional energy generation can yield higher profits including more Renewable Energy Certificate (REC) offerings and
- Clean Development Mechanism (CDM) benefits.

Repowering in Rajasthan

The wind power installed capacity of Rajasthan is 5193 MW as on 30.04.2023. There is a capacity of about 1300 MW which can be taken up for repowering in the state. The CUF of these farms can be increased from 15 to 18 % at present to 28 to 32% depending upon the proper selections of Turbines.

Rajasthan has state owned assets which are older than 15 years or so. Some of the Machines are non-operational also. The assets are eligible for repowering as per criteria of both Rajasthan Policy & National Policy for Repowering. There is an indication that Bay availability for increased capacity can be managed.

Assets of Rajasthan State Mines and Minerals Limited (RSMML)

Rajasthan State Mines and Minerals Limited (RSMML) has entered into wind power generation business in 2001. Now it owns wind power plants having total installed capacity of 106.9 MW. These were commissioned in phases at different locations in the District Jaisalmer of Rajasthan state as follows:

Phase	Capacity (MW)	Wind Turbine Used	Location	Commissioned on
1	4.9	14 x 350 KW	Badabagh	10-Aug-01
2	4.9	14 x 350 KW	Badabagh	27-May-02
3	5.0	4 X 1250 KW	Pohra	22-Mar-04
4	7.5	6 x 1250 KW	Pohra	25-Mar-06
5	15	25 X 600 KW	Bramsar & Pohra	14-Oct-06
6	15	12 X 1250 KW	Hansuwa, Gorera & Satta	29-Sep-07
7	7.5	6 x 1250 KW	Gorera, Pithla	28-Mar-08
8	15	12 x 1250 KW	Satta, Mondri	25-Sep-08
9	31.5	15 x 2100 KW	Mokal	31-Mar-10

Assets of Rajasthan Renewable Energy Corporation Limited (Earlier RSPCL)

Rajasthan Renewable Energy Corporation Limited also owns wind power plants having installed capacity as below. These Wind farms were commissioned at different locations in the District Jaisalmer.

Location	District	No. Of WTGs	Rating (KW)	Capacity (MW)	Year of Commissioning
Jaisalmer	Jaisalmer	2	600	1.200	Mar-07
Jaisalmer	Jaisalmer	17	600	10.200	Mar-10
Soda Mada	Jaisalmer	8	1250	10.000	Mar-04
Soda Mada	Jaisalmer	12	1250	15.000	Mar-05
Soda Mada	Jaisalmer	1	1250	1.250	Sep-05
Jaisalmer	Jaisalmer	9	600	5.400	Mar-06
Jaisalmer	Jaisalmer	8	600	4.800	Sep-06

Repowering of State Assets

Two State entities have installed wind assets.

1. Rajasthan State Mines and Minerals Ltd. (RSMML)

RSMML has wind capacity of about 106 MW consisting of wind turbine capacity of 350 KW, 600 KW ,1250 KW & 2100 KW Installed between 2001 to 2010.

Out of the 106 MW capacity, initially following can be considered for Repowering.

- 1250 KW x 10 Turbines : 12.5 MW
- 600KW x 25 Turbines : 15.0 MW

Both the Wind Farms are in the proximity of each other.

However a proper Survey & Feasibility study is essential before the start of the work.

2. Rajasthan Renewable Energy Corporation Limited (RREC) (Earlier RSPCL)

In both the companies, as per available records only 600 KW and 1250 KW Wind Turbines have been installed. The Following can be considered for Repowering.

- 17 x 600 KW Turbines : 10.2 MW attached to Akal
- 17 x 600 KW Turbines : 10.2 MW attached to Pohora
- 21 x 1250 KW Turbines : 26.25 MW attached to Soda Mada

These Turbines were installed between 2004 and 2010.

However a proper survey and feasibility study is essential before awarding the work.

Rajasthan to Lead in Repowering

Implement Pilot Project(s)

- Rajasthan State Mines and Minerals Ltd. (RSMML) can initiate the Repowering of 25 turbines of 600 KW and totaling 15 MW to above 22 MW with fewer turbines and saving in land, which can also be utilized for solar project at the same location.

Simultaneously/alternatively and in addition to RSMML.

- Rajasthan Renewable Energy Corporation Limited (RRECL) can plan repowering of 2 projects of 10.2 MW each (17 x 600 KW) projects connected with Bramsar and Pohra.

The Way Forward

- Rajasthan Renewable Energy Corporation Limited (RRECL) can take a lead and as a Model Project can initiate repowering of the installations under its own control or with the other companies of the state.
- The concept of Wind Repowering Project Aggregators (WRPA) may be adopted for survey, estimation, availability of grid etc. WRPA can submit Detailed Feasibility and Project Report
- PPP model with Bidding from concept to commissioning will be a good option.

Rajasthan should take a lead and demonstrate initiate repowering pilot project for other states to follow.

Wind Turbine Blades: Technological Advancements and Cost Reduction

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Wind turbines, one of the most popular alternative energy sources, utilize the wind to push a set of propellers and generate electricity[1]. There has been a push towards "net-zero emission" recently as countries strive to improve on technologies and wind energy has been at the forefront of the market for upwards of a decade[2] due to its reputation as the most cost-effective renewable energy source, relative to other methods[3]. While wind turbines can vary in design based on the surrounding environment, the fundamental concept behind the mechanism remains the same: use the wind to turn a set of blades, which will spin an attached rotor and generate power kinetically[1].

Since the propeller-like blades are the driving factor behind power generation, blades are the most important feature of a turbine. When improvements are made towards a turbine's efficiency or reliability, the blades are often the subject of change, as a turbine's power generation is more or less reliant on how well its blades can withstand and repurpose the harsh energies of wind. Over the past three years, wind turbine blades have undergone remarkable innovations, driven by the desire to produce more efficient and less wasteful blades. In this article, we will explore these developments in wind turbine blades, noting their significance and positive implications for further research and development of wind turbines.

It is imperative to remember that the development of wind turbine blades is typically motivated by the desire to either reduce the financial or ecological cost of blade production or increase the efficiency or reliability of the blades themselves. The goals could be either one or the other, but the result typically holds positive implications for the other goal, as well. For structural purposes, this article will observe advancements made towards each goal separately, focusing first on developments that aim to reduce cost and then pivoting to address improvements on the efficiency or reliability of resulting blades.

Reducing the Cost of Manufacturing Wind Turbine Blades

Firstly, this article will tackle developments that aim to reduce the cost of manufacturing wind turbine blades or improve the sustainability of creating said blades. According to a 2017 study on the cost of wind energy, wind turbine blades represent almost a quarter of the cost of energy in the entire turbine[4]. This cost results from several factors, owing primarily to the large size of the blades in question. As of 2022, a typical wind turbine blade is roughly 70-80 meters or more, though the size of the blades varies depending on the area and tends to increase in size rather than decrease in windy and offshore farms. The cost of constructing such a long blade paired with transportation

Figure 1: A wind turbine blade undergoing transportation
Source: https://www.windsystemsmag.com/nrel-determines-how-to-transport-wind-turbine-blades

fees can result in tens or hundreds of thousands of dollars to transport just one blade[5]. While the price of construction and transport is already off-putting, it is worsened by the average lifespan of a wind turbine blade, which will last for around 20-25 years[6] before needing to be replaced and having to construct and transport another blade. To offset the high cost, researchers at the National Renewable Energy Laboratory (NREL) began experimenting with methods to reduce the cost of transportation and maintenance.

Thermoplastic Resin Composite

This research culminated in a 2020 study performed by researchers at the National Renewable Energy Laboratory in the US, which detailed the practicality and structural integrity of a wind turbine blade composed of a thermoplastic resin composite rather than the standard composition[7]. Unlike standard thermoset blades, the thermoplastic blades could be fashioned on-site[8], drastically reducing transportation costs. The study then compared a standard turbine blade to an identically shaped thermoplastic blade, showing that the two performed very similarly, albeit with the thermoplastic blade experiencing slightly higher damping than the standard blade. Figure 2 illustrates the testing process of the thermoplastic blade, generating roughly 20 years of wear.

The study also highlights that thermoplastics can be polymerized and formed at room temperature, unlike thermoset composite blades that require heated tooling and ovens for further curing. Because of this, the cost and time spent manufacturing blades will be lower due to the removal of the heating step. Furthermore, thermoplastic blades can be reformed through heating, making them much easier to repair. By the article's projections, this would make thermoplastic blades roughly five percent cheaper to produce and far more sustainable and manageable to maintain and recycle through the turbine's lifespan. Thus, if thermoplastic turbine blades were standardized, wind turbine blades would be significantly cheaper to build and maintain.

Finally, while the direct efficiency of the thermoplastic blade was not the focus of the study, the thermoplastic blade behaved similarly to the standard blade while also exhibiting higher structural damping, meaning that it takes a shorter amount of time to return to its original displacement compared to that of the traditional blade, which took almost five times as long to return. While this property requires further testing, this could result in a greater malleability for thermoplastic blades, allowing them to withstand harsher winds for longer periods while being more reliable and reparable than traditional thermoset blades.

Not to be outdone, a research team in Berlin then explored different manufacturing approaches to wind turbine blades, experimenting with fully 3D-printed wind turbine blades[9] whereas the team at NREL only partially fabricated their blades with 3D-printed materials[10]. The published study details the team's construction and examination of three fully 3D-printed blades in a three-blade rotor. The blades were constructed using fused filament fabrication (FFF), rapidly printing the structure layer by layer to process a wide array of thermoplastics within the structure, such as ABS (Acrylonitrile Butadiene Styrene), PTAG (Polyethylene Terephthalate), and PLA (Polylactic Acid). The resulting blades are a conglomerate of plastics, far stronger than a single-compound structure. After the turbine was assembled and tested in a wind tunnel, the constructed turbine held up remarkably well while performing relatively smoothly and efficiently. The study concludes that the future for 3D printing wind turbines could become feasible very soon and that the blades were precise in shape, but required further polish after printing to perform more efficiently.

In parallel to this study, the initial group at NREL attempted to design an entirely new structural core for the blades, with a long network of cores of varying densities and shapes inside the blade and with the shell of the blade being infused with thermoplastic resin[11]. If successful, the team will reduce turbine blade weight and cost by ten percent and reduce the manufacturing time by as much as fifteen percent. If the results are positive, this could reduce production costs and time for wind turbine blades.

Wooden Blades

Aside from that study, two European companies have announced a collaboration on the construction of a set of wind turbine blades

Figure 2: A thermoplastic blade undergoing a simulation of 20 years of use.

Source: https://www.nrel.gov/manufacturing/comet-wind-blade-resin.html

Figure 3: A Wind Turbine with Wooden Blades

Source: https://www.compositestoday.com/2016/10/researchers-develop-lightweight-composite-wind-turbine-blades/

composed entirely of wood[12]. From laminated veneer lumber, a 20-meter-long blade will be installed on a preexisting wind turbine for a test run, with an 80-meter blade in the works for a second phase. By substituting composite materials and fiberglass with wood, the resulting blades will be much lighter and allow for a much easier load for transportation and installation. This should not be seen as a replacement for conventional wind turbine blades but as a lighter alternative. Thus, smaller wind farms that cannot afford large-scale wind turbines can opt for a weaker turbine fitted with wooden blades like the one depicted in Figure 3. Hopefully, these turbines can act as a sustainable alternative energy source for those who cannot afford current alternative energy sources.

Technology and Material is the Key for Improvements in Blades

While numerous efforts have been taken towards reducing production costs, more developments explore the prospect of improving the blades, employing either new materials or new techniques to better maintain turbine blades or increase their energy efficiency. As mentioned previously, wind turbines and their corresponding blades are large, as larger turbines are proven to generate more energy due to stronger winds at higher altitudes[13]. However, this ballooning trend in size also results in increasingly heavier blades, which inevitably weigh down the rotor and reduce its efficiency.

To tackle this issue, UK-based company ACT Blade began drafting plans to develop large turbine blades that remain light despite an increased size[14]. The result of those plans is both revolutionary and familiar to aeronautics engineers[15]. The blade is a standard spar with attached ribs spanning the length of the spar, as illustrated in Figure 4. However, wrapped tightly around the spar and ribs is a textile fabric, known as a "sock," which will effectively catch the wind while keeping the blade lighter than its contemporaries. With the skeleton of a wing for the fabric to work around, the company expects the blade to hold its shape without deforming while also remaining aerodynamic due to the

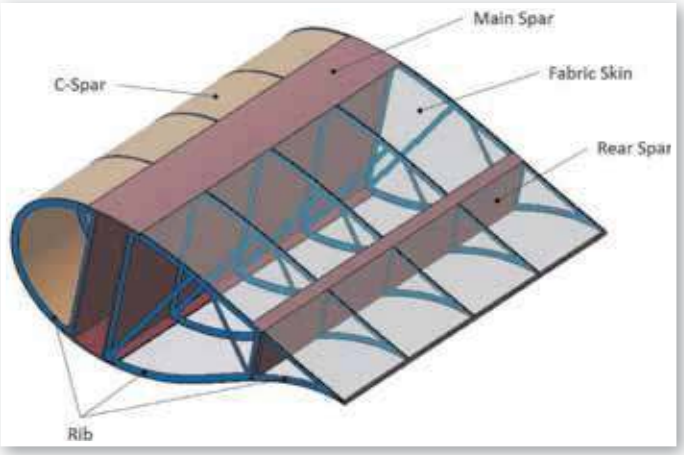

Figure 4: A diagram of a "spar and rib" design, though not the exact diagram provided by ACT Blade.

Source: https://www.mdpi.com/1996-1073/13/12/3276

Figure 5: A prototype of the fabric blade undergoing testing.

Source: https://www.researchgate.net/figure/Illustration-of-a-fabric-blade-prototype-tested-in-the-Offshore-Renewable-Energy-Catapult_fig9_334638710

fabric's ability to bend and flow around the design of the blade, rather than having a rigid structure that clashes with the flow of the wind. On top of the proposed aerodynamic benefits, the resulting wing would be far lighter than traditional wings. Acting on this, ACT Blade lengthened the blade until its weight matched its peers. The increased length allows the blade to catch greater volumes of wind and thus collect power more efficiently. This design is groundbreaking and bodes quite well for the future of textiles in wind turbine blades.

In a similar vein, a group of scientists in Turkey has attempted to stabilize wind turbine blades and improve overall output by applying a flexible membrane over localized patches rather than over the blade as a whole[16]. In wind turbines, energy efficiency can be harmed by disruptions in airflow, such as laminar separation bubbles which can push against airflow, or other conditions which can otherwise disrupt the standard flow and push against the blades. Like the ACT Blade technology above, these researchers utilized a flexible membrane material as a safeguard. But rather than draping the membrane over the entire blade, the membrane only extended to the surfaces where the disruptions in airflow were most common. In doing so, the group found that the separation bubble was diminished, and with it the fluctuations of aerodynamic force. As a result, the blades were less subject to instabilities, which reduced the hindrances in efficiency and allowed greater control over energy output. If this research develops further, localized flexible membranes could act as an alternative to ACT Blade technologies, allowing specific patches of hindrances to be isolated and mitigated rather than pivoting to entirely new blades.

Additionally, a team of Romanian researchers has independently begun experimenting with turbine blades, attaching several winglets similar to those found in planes to the blades to reduce drag and improve performance[17]. The study details the implementation and analysis of two different types of winglets, and the analysis of those winglets at many angles to determine an optimal placement angle. The lift and drag coefficients for each configuration were calculated and analyzed to determine the angle that could maximize the lift coefficient and minimize the drag coefficient.

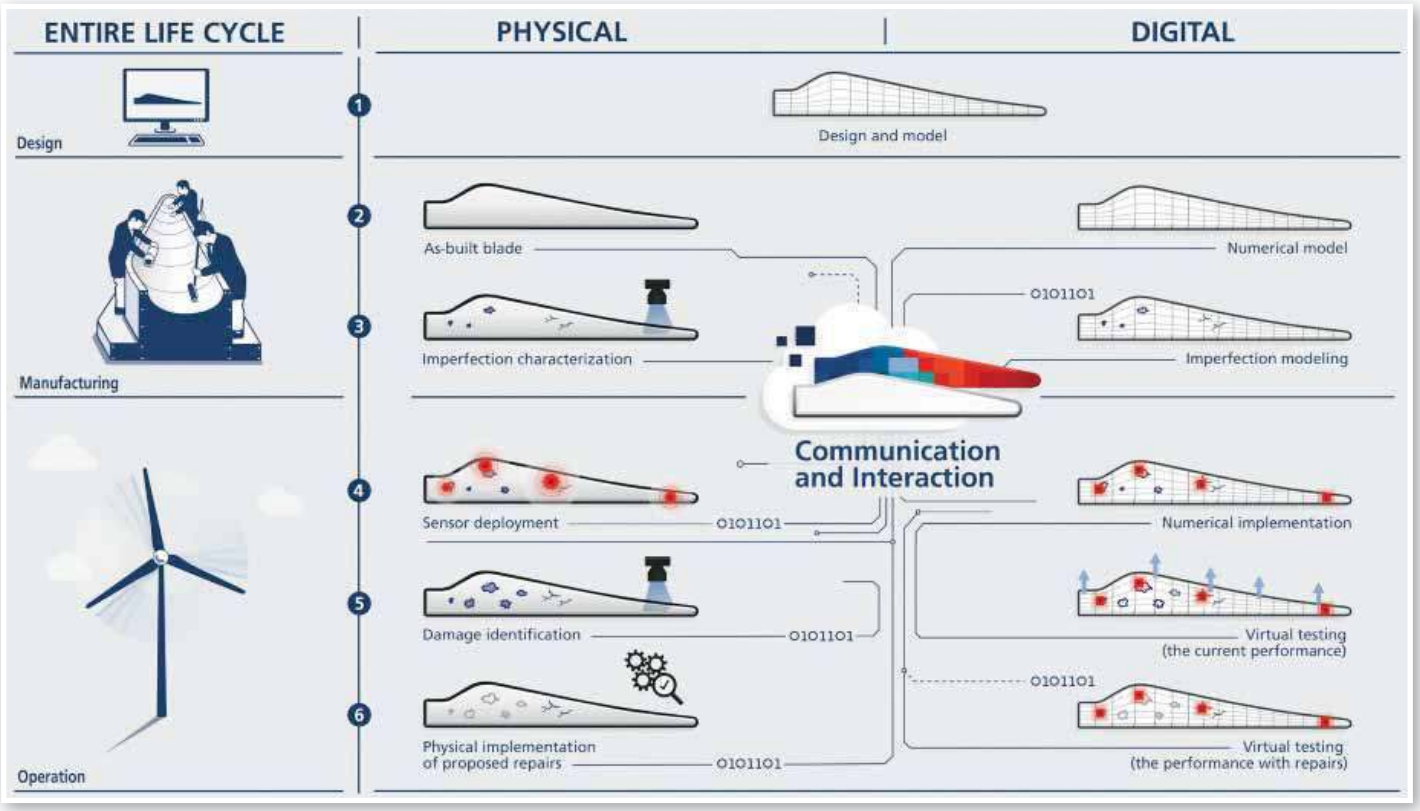

Figure 6: An illustration of the mechanism within the ReliaBlade project. Source: https://iopscience-iop-org.proxy.library.stonybrook.edu/article/10.1088/1757-899X/942/1/012006/pdf

Afterwards, the team concluded that the implementation of winglets improved the ratio of lift coefficient to drag coefficient by 15%, but no set configuration optimized the coefficients at all tested angles, so further testing is required. While further testing has been cleared, the study indicated the potential use of an adaptive winglet system. If adaptive winglets were affixed to a turbine in an environment with volatile winds, it could be possible for the winglets to detect the strength of the winds and the optimal angle of configuration and adjust automatically to match it. While this is mere speculation, the increase in lift coefficient and reduction in drag coefficient presented by the implementation of winglets in any position bodes well for the future of the technology in certain wind turbine blades.

Reliability of Turbine Blades

Finally, significant progress has been made to improve the reliability of turbine blades, allowing designers to more easily maintain turbine blades while simultaneously reinforcing them against future stressors. In 2020, a research paper released documenting an experiment on the viability of the digitalization of wind turbine blades[18], examining the results of the "ReliaBlade Project," which purports to create a reliable virtual model of wind turbine blades, as seen in Figure 6, to model its imperfections and predict how the blade could be damaged in the future[19]. The study concludes by affirming the viability of digitalization for wind turbine blades and indicating that the project requires further tweaking and validation for practical use. Regardless, this study proves that modeling the state of wind turbine blades is possible. With this knowledge, engineers will be far more capable of diagnosing at-risk wind turbine blades and far more able to repair imperfections in them before they worsen. If given more testing, the ReliaBlade Project can result in far greater efficiency in repairing and maintaining wind turbines, reducing wasteful repairs, and optimizing the efficiency of wind farms as a whole.

Conclusion

Therefore, many improvements have been made to wind turbine blades over the past three years alone. In making blades more efficient and less wasteful, scientists experimented with new materials, techniques, and membranes to advance blade construction and design to staggering new heights. To this day, researchers are still working hard finding new methods of making turbine blades more sustainable, with one of the most recent innovations coming from a Danish company report claiming that they found a new method of recycling all blades, including those already discarded in landfills[20]. Indeed, whether the intent is to reduce waste or to improve output, wind turbine blade development is always moving forward towards a greener future and a cleaner sky.

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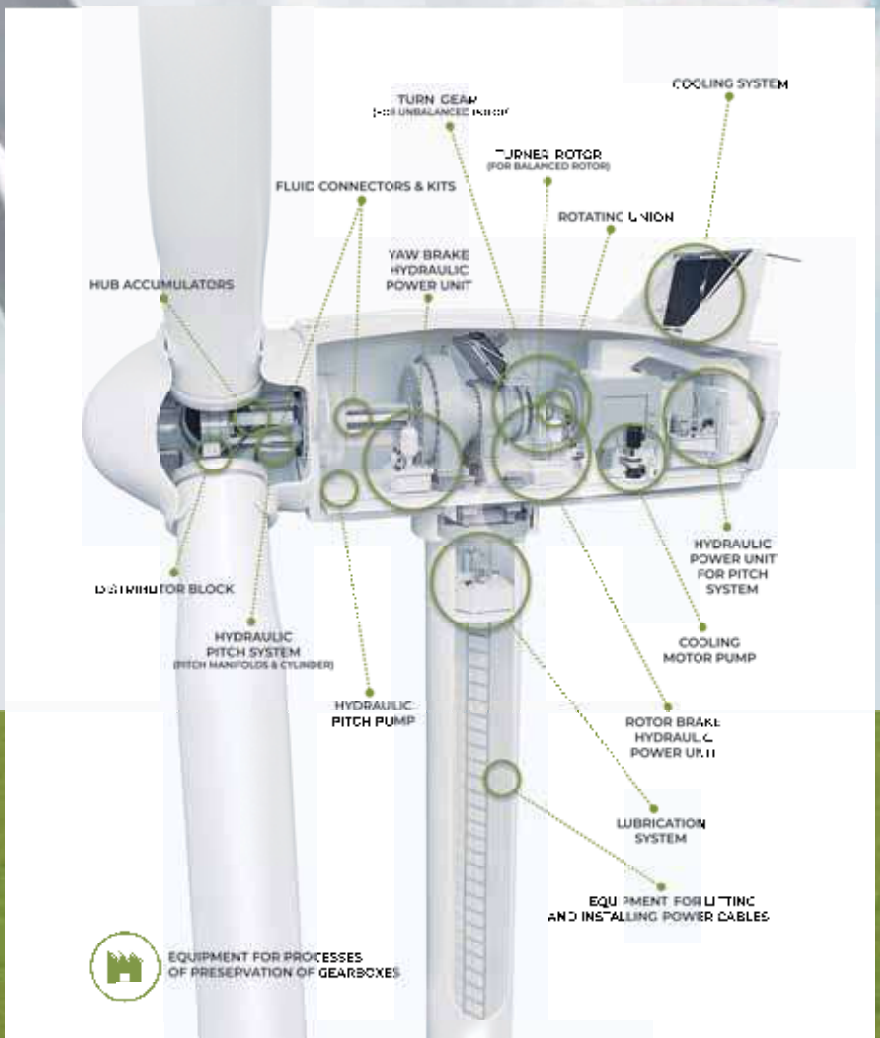

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Snippets

India's green goal offers companies $500 billion opportunity, ReNew CEO says

India's energy transition plans offer a $500 billion investment opportunity for companies through the end of the decade, as the nation seeks a record expansion in clean power, Mr. Sumant Sinha, Chief Executive Officer at ReNew Energy Global Plc. said. The nation, the world's third largest emitter of greenhouse gases, has set a target to nearly triple its generation capacity from non-fossil sources by 2030.

Source: Bloomberg, 8 June 2023

India Vulnerable to Climate Change due to Heavy Population: UNEP Executive Director Erik Solheim

United Nations Environment Programme (UNEP) Executive Director Mr. Erik Solheim has said that India is particularly vulnerable to climate change because of its heavy population. "You see the effects of climate change everywhere in the world. But of course, India is particularly vulnerable to climate change because it has a heavy population and the kind of nature of India makes it more vulnerable than most other places," Mr. Solheim said during Y20 talk on climate action.

Source: ANI, 12 June 2023

675 Million People Worldwide Without Electricity: Report

A full 675 million people worldwide still lack access to electricity, mainly in sub-Saharan Africa, according to a report published by the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division, the World Bank and the World Health Organization. Despite significant efforts and some progress, the world continues to face a dramatic energy access gap. The report cautioned that the world remained off track to ensure clean and affordable energy access for all by 2030 -- one of the so-called Sustainable Development Goals set by all UN countries in 2015.

Source: AFP, 7 June 2023

Wind Turbine Developments and Repowering

Dr Sanjiv Kawishwar
Director, CORE (Center of Renewable Energy), India

In India the development of wind power projects started in mid-1990's and these wind power projects are located at the best wind sites. That time the capacity of the turbines was 225 to 600 kW and with a hub height of not more than 25 to 30 Meters. 1 MW turbines were installed from 2001-02 and 2 MW turbines installation started in 2009-10. The average capacity utilisation factor (CUF) of those projects at present is about 10% to 15% despite having very good wind resource. With advanced wind turbines installed, the operational CUF would have been above 30%.

Latest Developments in Wind Turbine Technology

1. **Increasing Turbine Size:** Wind turbines continue to grow in size to capture more wind energy and has reached to above 5 MW for onshore wind turbines with hub height of 160 meters and rotor diameter more than 150 meters..
2. **Advanced Blade Designs:** Researchers and manufacturers are exploring new blade designs to improve turbine efficiency. These include curved blades, serrated edges, and bio-mimicry-inspired designs that mimic the efficiency of natural elements like bird wings or whale fins.
3. **Improved Aerodynamics:** Wind turbine manufacturers are incorporating advanced aerodynamic technologies to maximize energy capture and reduce turbulence. This includes the use of smart sensors, advanced control systems, and blade pitch adjustments for optimal performance.
4. **Wind Energy Storage:** Energy storage technologies, such as advanced batteries and grid-scale solutions, are being integrated with wind farms to store excess energy and provide a more stable and reliable power supply.
5. **Digitalization and Data Analytics:** The wind industry is leveraging digitalization and data analytics to optimize operations, enhance maintenance practices, and improve overall efficiency. Real-time monitoring, predictive maintenance, and advanced analytics help optimize turbine performance and minimize downtime.

Repowering

Repowering refers to the process of replacing older wind turbines with newer, more efficient ones at an existing wind farm. It involves upgrading the existing infrastructure to increase the overall capacity, energy production, and performance of the wind farm. Repowering is often undertaken to take advantage of advancements in wind turbine technology and to maximize the potential of a wind site. Here are some key aspects of wind turbine repowering:

1. **Technology Upgrade:** Repowering involves replacing older wind turbines with modern, more advanced models. Newer turbines typically have larger rotor diameters, taller towers, and more efficient designs, allowing them to capture more wind energy and generate higher electricity output.
2. **Increased Capacity:** Repowering can significantly increase the capacity of a wind farm by replacing older turbines with larger and more powerful ones. This leads to higher energy production and increased overall capacity, allowing for a more efficient utilization of the available wind resources.
3. **Performance Enhancement:** Repowering can improve the overall performance of a wind farm by utilizing the latest turbine technology. Modern turbines have improved reliability, better control systems, and enhanced operational capabilities, resulting in increased efficiency and reduced downtime.
4. **Cost Reduction:** Repowering can offer economic benefits by optimizing the energy output of a wind farm. Newer turbines have higher capacity factors, meaning they generate more electricity over time, leading to improved project economics and potentially lower levelized cost of energy (LCOE).
5. **Environmental Impact:** Repowering can contribute to reducing greenhouse gas emissions and reliance on fossil fuels by replacing older, less efficient turbines with modern ones that generate more clean energy. It allows for the utilization of wind resources in a more sustainable and efficient manner.
6. **Permissions and Grid Connection:** Repowering projects typically require the necessary permits and approvals from relevant authorities. Upgrading the turbines may also involve modifications to grid connection infrastructure to accommodate the increased capacity and energy output.

It is worth noting that repowering is a complex process that involves careful planning, feasibility studies and coordination with stakeholders. Factors such as site assessment, turbine selection, project financing, and community engagement play crucial roles in successful wind turbine repowering projects.

Repowering can breathe new life into existing wind farms, extending their operational lifespan and maximizing their energy production potential. It presents an opportunity to enhance renewable energy generation and contribute to the transition towards a more sustainable future.

Repowering in India

Wind turbine repowering in India has gained significant momentum in recent years as the country aims to increase its renewable energy capacity and optimize the performance of existing wind farms.

The Government of India has recognized the importance of repowering and has introduced policies and initiatives to promote it. The Ministry of New and Renewable Energy (MNRE) has issued guidelines to encourage wind turbine repowering projects. The ministry had issued the earlier policy in 2016 to create a facilitative framework for repowering.

The Draft National Repowering Policy for Wind Power Projects- 2022 makes the wind turbines of rated capacity below 2 MW and the wind turbines which have completed their design life eligible for repowering. By this the capacity of the repowered wind turbines can is enhanced by at least 1.5 times of its aggregate capacity of old turbines. Further turbine repowering is eligible provided the project area is a geographically contiguous land area, all turbines are connected to a single polling substation, and over 90 per cent of total capacity of the project has completed its design life.

Repowering Potential in India

The National Institute of Wind Energy (NIWE) has estimated the repowering potential of the country to be 25.406 GW considering wind turbines below capacity 2 MW. There will be additions in repowering potential as old turbines will complete their design life. NIWE will issue a repowering potential map of the country considering below 2 MW capacity wind turbines.

Wind turbine repowering in India is expected to play a crucial role in achieving the country's renewable energy targets. It not only enhances the performance and capacity of existing wind farms but also supports the growth of the wind energy sector, contributing to India's sustainable development goals.

Chennai Airport Turns Green, Runs Fully On Renewable Energy

The entire power requirement of the city airport, which handles around 20 million passengers per year, is now met by renewable energy. It uses a combination of power generated from rooftop solar plants, solar energy purchased from firms and also by procuring power under green tariff from Tangedco. This was achieved last month when the use of renewable energy was scaled up from 50%. Solar power is used for runway and taxiway lights too.

Source: TNN, 11 June, 2023

BlackRock Eyes $7 bln for New Global Renewable Power Fund

The world's biggest asset manager BlackRock said that it hopes to raise up to $7 billion for its fourth Global Renewable Power Fund as clients ramp up climate-friendly investments. The fund, focused on projects in Organisation for Economic Cooperation and Development countries, could invest across wind and solar as well as other clean technologies such as batteries and grid infrastructure.

Source: Reuters, 8 June 2023

Power Ministry Plans Rs. 40,000 Cr Transmission Infrastructure to Evacuate RE Power from Gujarat, Rajasthan

The Ministry of Power has chalked out Rs. 40,000-crore capital investment for building transmission infrastructure to evacuate renewable power from Gujarat and Rajasthan. The government plans to spend Rs. 18,598 crore for Khavda hybrid renewable energy park in Gujarat and Rs. 19,483 crore for the Jaisalmer-Barmer region of Rajasthan. The Khavda hybrid renewable energy park in Gujarat is expected to be the home for 30 GW of wind and solar energy. Since wind and solar plants come up faster than the associated transmission infrastructure, the government is keen on planning for evacuation of power in advance.

Source: The Hindu BusinessLine, 9 June 2023

MoP Asks CERC to Start Process for Implementation of Market Coupling

Ministry of Power (MoP) has decided to go ahead with the process of market coupling. Towards this end, the MoP has requested the Central Electricity Regulatory Commission (CERC) to initiate process of consultation and finalisation of the construct for the implementation of market coupling process. This is in the context of multiple power exchanges, and will result in uniform prices for power across multiple exchanges.

Source: Powerline, 7 June 2023

Wind Returns to Top of List of German Power Sources

Just under a third of electricity generated in Germany came from wind power in the first quarter of 2023, as wind turbines edged past coal as the nation's top power provider. Some 32.2% of German electricity was produced by wind in the first three months of the year, versus 30 per cent from coal. Germany aims to generate at least 80 per cent of its electricity from renewable sources by 2030

Source: Reuters, 7 June 2023

Higher RE Generation to Cut Coal Reliance this Summer, Says EIA

The Energy Information Administration (EIA) expects the largest increases in the US electricity generation this summer to come from renewable energy sources and natural gas, which will lower the coal-powered demand by 15 per cent from the year earlier.

Source: Reuters, 9 June 2023

Repowering/Restructuring of Wind Farms

Manish Kumar Singh
Secretary General, Indian Wind Energy Association, New Delhi

Repowering of wind farm refers to the process of refurbishing, repowering or upgrading the existing wind turbines with more efficient components of existing low capacity – not necessarily inefficient WTGs or replacing older wind turbines with larger and efficient models wind turbines leading to more generation of power. We generally refer repowering as replacing older wind turbines with larger and efficient models of wind turbines, with changes in the present lay out of the wind farm as per micro-siting. Wind repowering plays a crucial role in reducing greenhouse gas emissions and combating climate change. By replacing older turbines with more efficient models, wind farms can generate more electricity using fewer turbines. This leads to a smaller physical footprint and less impact on the environment, including reduced land use, noise, and visual pollution.

Wind repowering can benefit various stakeholders. Here are some of the main beneficiaries of wind repowering – wind farm developers and operators who are running the farms with older turbines and with more advanced ones. They can increase the capacity and efficiency of the facility. The grid operators also benefit as newer turbines are equipped with advanced technology and control systems, allowing for better integration and management of the electricity generated. Equipment manufacturers also secure orders for supplying high powered MW turbines. Service providers also get to secure O&M contracts for a longer time. Investors gravitate towards investing in the repowered wind farms due to their improved performance and profitability. Wind repowering generally brings economic, environmental and social benefits to multiple parties involved in the renewable energy sector.

Need of Repowering in India

Around 35 years back, in 1986, India started its first wind farms with turbines of 55kW capacity at low hub heights. The wind farms started in the coastal areas of Maharashtra (Ratnagiri), Gujarat (Okha), and Tamil Nadu (Tirunelveli). Majority of the wind turbines installed in the Class – 1 sites (which is high windy areas) are of old generation with very low CUF. These turbines are not only unable to utilize wind resource efficiently, but it is hazardous too. However, the Indian wind energy sector has undergone a transformative technological change from 55 kW to 3.6 MW (latest being 4.2 MW prototype wind turbine installed by Brazilian manufacturer WEG in Tirunelveli district, Tamil Nadu and 5.2 MW prototype in Mundra by Mundra Windtech Limited a company of Adani New Industries Limited) capacity wind turbines having more efficiency to generate electricity and make optimum utilization of natural resources. The new state-of-art wind turbines are designed to achieve better CUF even in Class 3 sites. During this period, there have been several regulatory and policy changes announced by Union and State governments to support and facilitate the growth of wind energy sector. Unfortunately, even after various studies on repowering in the last decade, we do not have suitable policy and regulatory mechanism for repowering of old wind turbines or repowering of the wind farms for the optimum utilization of wind resources. We have not even fixed the operational life of the wind turbines; therefore, the older wind turbines are still running at very low CUF i.e. 10 – 15 % which cause a low utilization of a natural resource. Wind turbines are normally designed for a lifespan of about 20 to 25 years. There are several old wind turbines which have completed their design life, are still running.

…therefore, the older wind turbines are still running at very low CUF of about 10 – 15 %, which is causing a loss of natural resource and may become a threat to life.

Repowering of Existing WTGs

Right now, a few companies are undertaking a phenomenal work in the field of repowering of existing turbines. The concept of repowering of existing wind turbine can be a game-changer in the country, in which one can retain the foundation, the balance of plant, the tower, and others, but can put up a longer rotor for higher yield as well as increase in hub heights, where feasible technically. Through this initiative, the life of the machine is extended. Subsequently, the WTG can operate for another 20 years with higher energy output. During the recent past, the repowering of WTG in some countries has seen 20% average increase in Annual Energy Production (AEP). In some cases, AEP will be increased by 5-30% depending on the site. Repowering of WTG provides a reliability and guarantee for 20 years post repowering FSA (Field Service Agreements) for the entire lifecycle. Even if scrap and re-build is not feasible at certain places, 1-2 MW partial repowering could be a viable option as recommended by OCM which is doing repowering projects

in other parts of the world. We can implement repowering of WTG at the site where replacement of old wind turbines are not possible because of limitation of geography or infrastructure.

Restructuring of Existing Wind Farms

The complete repowering or restructuring of wind farm is not a straightforward task, but a tough job to execute. Early installations mostly occurred in the states like Tamil Nadu, Gujarat, and Karnataka. In Tamil Nadu, such developments happened in Muppandal, Kayathar, Coimbatore, etc., which are class I sites having high wind speeds. The complete repowering or restructuring of wind farms can be started from Muppandal in Tamil Nadu. At present, there is an installed capacity of about 1800 MW at Muppandal. The actual generation in the last three years is about 2400 million units a year. In wind power density (WPD) study, the WPD distribution is 250-300 watts per sq. meter at 50 m hub height which rise to 400-500 watts per sq. meter at 130 m hub height. If micro-siting is done using a larger turbine with large rotor diameter, there will be a huge jump in energy generation. For micro-siting, the government policy mentions spacing of 5D X 7D in a wind farm; therefore, after repowering, the installed capacity may not increase much, but the energy yield would be 2.5 – 3 times the present actual generation. This is true for most of the sites in Tamil Nadu.

There are other problems associated with repowering in the country. In the wind farm, there are many turbines of 250 – 750 kW owned by multiple owners. The project ownership is very fragmented. It would be quite a challenge to get them together on the same page to take up repowering. In Muppandal, the engineering aspects of wind farms were not properly followed; there was no concept of micro-siting or safe distances. There are multiple sub stations present, but upgradation in terms of protection and re-alignment of evacuation infrastructure is needed. The entire low voltage lines should be upgraded to 33 kV instead of 11 kV. With the help of TANGEDCO and MNRE, the grid augmentation can be easily achieved. For these class I sites, the OEMs would have to optimise the RPM and manage the tip speed ratios to improve the mechanical stability and the life of the turbine. Presently, the turbines are listed under the RLMM as Class III or Class S type, but wind regimes at class I sites are different.

In Karnataka, the repowering of old turbines is slightly more difficult given the prevailing scenario there. The wind farms are situated on the complex hilly terrain and forested areas. The turbines are in the range of 500 – 800 kW size. For repowering in the forest areas, an existing policy needs to be overhauled to provide favourable conditions. To transport the larger turbines with a rotor diameter of 60–70 m in the hills, it would be a difficult task considering the terrain of these sites.

Barriers of Repowering

1. Operational Life of Wind Turbine

The design life of wind turbine is 20 to 25 years but its operational life is not fixed that is causing the turbines to run beyond 25 years of designed life. Owners of the turbine get financial benefits to operate these turbines. In the context of forego the existing cash flows in the hope of future benefits, they are reluctant to opt for repowering.

2. Multi-ownership of Turbines in Wind Farm

Ownerships are fragmented; there are many owners of turbines in a wind farm. It is very challenging to bring all stakeholders on the same platform to get agreed to the same vision. There are cases where land ownership is based on foot-print of the turbine in a wind farm. Aggregation of land parcels belonging to different owners and getting them together to cooperate is also a difficult task.

3. Captive Users' Status

In the case of a captive user, a consumer must own at least 26 per cent equity stake in the generating company and it shall consume at least 51 per cent of the aggregate generation. If a captive power generator seeks to opt for repowering, the aggregate generation may increase up to three times. In case captive user is not in condition to consume 51 per cent of the aggregate generation, then he will lose the captive status. The condition of minimum consumption on a captive basis needs to be relaxed at least for repowering projects. There are several captive users who are interested in repowering; but, due to two issues – grid infrastructure and micro siting, it has not happened. This is the issue faced by several wind farms, because of two major issues augmentation of the grid and micro-siting, they are not able to do repowering.

4. Limitation of Evacuation Infrastructure

Most of the old wind projects are connected to 11KV lines, which is a major hurdle for repowering initiative. After repowering, power generation my increase by two to three fold. Therefore, the evacuation infrastructure is required to be upgraded and its capacity is needed to be increased.

5. Financial Loss Due to Decommissioning

a. The decommissioning of old wind turbine requires movement of heavy machinery, removal of decommissioned materials from site to recycling plant, loss of power generation during the period of decommissioning and re-installation of turbines.
b. Termination of old PPA for the remaining period is also a concern for the turbine owners. Old PPAs have higher FiTs and the new PPA may be signed at lower rates causing loss of revenue.
c. After micro-siting, there is high possibility of the reduction in the number of turbines. In this, owners of small turbine may lose the ownership of that individual turbine.
d. Salvage value of the old wind turbine is also a cause of concern.

Suggestions to Implement Repowering

There is an urgent need to have a long term policy on repowering of wind turbines, especially in those states that have a huge population of low capacity turbines and have almost spent their useful life. This policy needs to be evolved in consultation with the states.

1. Eligibility
    a. Since there is a target to increase CUF of the wind turbine/farm through repowering, it should also include lower CUF as one of the eligibility criteria.
    b. Fixing the operational life of old wind turbines to get retired to optimally utilize the natural resources and getting a higher yield per unit of land area.
2. Another way to implement repowering is intercropping in which the larger turbines are placed in between smaller turbines. At places where it is not possible to replace small wind turbines, then new turbines with a height of 120 or

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130 m hub height could be positioned to generate more power.

3. At the repowered sites, wind and solar hybrid plants can be installed to generate more power. In fact, storage facilities can also be arranged at these sites which will mitigate the intermittency nature.
4. Grid augmentation is the need of the hour where repowering has occurred so that the extra power generated by the plant, can be fed into the grid. The upgradation in the evacuation infrastructure and increase in the capacity has to be implemented; otherwise the issue of curtailment will crop up.
5. Financial Support
   a. The government should incentivise the owners of old turbines to repower their sites with the new and efficient WTG.
   b. They should be provided with over and above the old FiT rates for their new installations.
   c. SPV should be encouraged by the MNRE to support repowering activities.
   d. IREDA and other financial institutions should provide a rebate of at least 1% on the interest rates of loans.
   e. Yearly banking facility should be provided to the repowered projects to provide a thrust for repowering projects.
6. To empower a developer to take up repowering wind projects, developer should have complete liberty to sell additional wind power capacity/generation without any restriction either to sell the power to third parties or on power exchanges. In addition to this to stimulate repowering, the excess power after repowering will be sold to the DISCOM at the fixed tariff determined by the SERC's.
7. For placing the wind-turbines, the criteria need to be relaxed for micrositing.
8. In addition to this, for revenue/forest lease land, the tenure of lease to be extended further for 30 years. Single window clearance should be provided for additional required land and it should be allotted with minimal process and charges.

Policies alone are not enough. There should be regulations in tune with the policies. Even if policies and regulations are in tandem, the stakeholders will have to act in tune with the spirit of these prescriptions. The basic requirement is one of getting all the stakeholders together on the same page and act in unison.

National Electricity Plan (NEP)

The Central Electricity Authority, India, after much deliberation over the draft National Electricity Plan (NEP), notified the latest NEP (Vol-I-Generation). The NEP represents a detailed plan for 2022-27 and a perspective plan for 2027-32. Based on generation planning studies carried out for the period of 2027-32, the likely installed capacity for 2031-32 is calculated to be 900.4 GW. Conventional power capacity comprising coal, gas, and nuclear would total up to 304 Gw while renewable energy capacity (including large hydro) is expected to touch 596 GW. Additionally, the CEA expects several new energy sources, such as small hydro (5.4 GW), biomass (15 GW), pumped storage (26 GW), and battery storage (47 GW) to also come up by 2032. The latest NEP claimed that the peak electricity demand in India would rise from 203 GW in 2021-22 to 277.2 GW in 2026-27 and ultimately to 366 GW in 2031-32. It also estimated that the projected all-India electricity requirement would rise to 1907.8 BU in 2026-27 and go up to 2473.8 BU in 2031-32.

NEP_Vol-I (generation): https://lnkd.in/dWEU5gWe

India Ranked 67th on Energy Transition Index, Makes Significant Improvement: WEF Report

The World Economic Forum has ranked India at 67th place globally on its Energy Transition Index and said that it is the only major economy with energy transition momentum accelerating across all dimensions. Sweden topped the list and was followed by Denmark, Norway, Finland and Switzerland in the top five on the list of 120 countries.

Releasing the report published in collaboration with Accenture, the WEF said "India is the only major economy with energy transition momentum accelerating across the Energy Transition Index's equitable, secure and sustainable dimensions. "For example, despite continued economic growth, India has successfully reduced the energy intensity of its economy and the carbon intensity of its energy mix, while achieving universal energy access and effectively managing affordability of electricity," the WEF added.

Source: PTI, 28th June 2023

UAE Emerges as 4th Largest Investor in India in FY23; Infra, Renewable Energy in Focus

The United Arab Emirates (UAE), with which India implemented a comprehensive free trade agreement in May last year, has emerged as the fourth largest investor during 2022-23. In the last fiscal, foreign direct investment (FDI) from the UAE to India jumped over three-fold to USD 3.35 billion from USD 1.03 billion in 2021-22. UAE was the fourth largest investor in India in 2022-23 compared to the seventh in 2021-22. Singapore was the largest investor in India with USD 17.2 billion investment in FY23, followed by Mauritius (USD 6.1 billion) and the US (USD 6 billion.

Source: PTI, 12 June 2023

Torrent Power to invest Rs 27,000 cr to build Pumped Storage Hydro projects in Maharashtra

Torrent Power has inked an initial pact with the Maharashtra government for the development of three pumped storage hydro projects of 5,700 MW capacity, entailing an investment of about Rs 27,000 crore. These projects are likely to generate 13,500 jobs. Projects would be executed at three sites identified by Torrent – Karjat (3,000 MW) in the Raigarh district, Maval (1,200 MW) and Junnar (1,500 MW) in the Pune district, a company statement said. All the sites are off-stream and the projects are planned to provide a minimum of six hours of energy storage on a daily basis.

Source: PTI, 6 June 2023

Regulatory Update on Wind Power

Government Waives ISTS Charges on Offshore Wind, Hydrogen, Ammonia Projects

The Ministry of Power, Government of India has decided to grant waiver of ISTS charges to off-shore wind Projects and extend the waiver to green hydrogen/green ammonia. As per the notification issued by Ministry of Power, a complete waiver of ISTS charges (Inter-State Transmission Charges) has been given for off-shore wind power projects commissioned on or before 31st December, 2032 for a period of 25 years from the date of commissioning of the Project. The off-shore projects commissioned from 1st January, 2033 would be given graded ISTS charges. Earlier, all wind energy projects were provided waiver upto 30.06.2025. Now, offshore wind would be treated separately, and waiver to these would be granted up to 31st Dec, 2032 with graded transmission charges thereafter as follows:

No.	Period of Commissioning of Offshore Wind Power Projects	Applicable ISTS Charges
1	01.01.2033 to 31.12.2033	25% of the applicable ISTS charges
2	01.01.2034 to 31.12.2034	50% of the applicable ISTS charges
3	01.01.2035 to 31.12.2035	75% of the applicable ISTS charges
4	From 01.01.2036	100% of the applicable ISTS charges

The ISTS waiver of Green Hydrogen and Green Ammonia projects extended from 30 June 2025 to 31 December 2030 with graded transmission charges thereafter.

CERC Proposes Amendment to Inter-State Transmission Charges and Losses Regulations

The Central Electricity Regulatory Commission (CERC) in New Delhi has issued a draft notification to amend the Central Electricity Regulatory Commission (Sharing of Inter-State Transmission Charges and Losses) Regulations, 2020. The proposed amendment aims to introduce changes to the calculation of transmission charges and losses for inter-state power transmission in India. The amendment will come into effect upon notification by the Commission.

The draft amendment includes two key provisions. Firstly, a proviso will be inserted in sub-clause (d) of Clause (3) of Regulation 5 of the Principal Regulations, stating that a minimum of 30% of the yearly transmission charges should be applicable as per sub-clause (a) of Clause (1) of Regulation 6 of these regulations. Secondly, a new provision will be added in sub-clause (a) of Clause (1) of Regulation 6.

Central Government Amends Electricity (Rights of Consumers) Rules, 2020 by Introducing Time of Day (ToD) Tariff and Simplification of Smart Metering Rules

The Ministry of Power, Government of India has introduced two changes to the prevailing power tariff system, through an amendment to the Electricity (Rights of Consumers) Rules, 2020. The changes are the introduction of the Time of Day (ToD) Tariff and the rationalization of smart metering provisions.

Introduction of Time of Day (ToD) Tariff

Under the ToD Tariff system, the Tariff during solar hours (duration of eight hours in a day as specified by the State Electricity Regulatory Commission) of the day shall be 10%-20% less than the normal tariff, while the tariff during peak hours will be 10 to 20 per cent higher. ToD tariff would be applicable for Commercial and Industrial consumers having Maximum demand of 10 KW and above, from 1st April 2024 and for all other consumers except agricultural consumers, latest from 1st April 2025. Time of Day tariff shall be made effective immediately after installation of smart meters, for the consumers with smart meters.

Time of Day (TOD) tariff, is recognized globally across electricity industries, as an important Demand Side Management (DSM) measure which is used as a means of incentivizing consumers to shift a portion of their loads from peak times to off-peak times, thereby improving the system load factor by reducing the demand on the system during peak period.

The Electricity (Rights of Consumers) Rules, 2020 were notified by the government on December 31, 2020, based on the conviction that power systems exist to serve consumers and that consumers have the right to get reliable services and quality electricity. The Rules seek to ensure that new electricity connections, refunds and other services are given in a time-bound manner and that wilful disregard for consumer rights results in the levying of penalties on service providers and payment of compensation to consumers.

The current amendment to the Rules is a continuation of the measures taken by the government, to empower power consumers, to ensure a 24X7 reliable electricity supply at affordable cost, and to maintain a conducive ecosystem for investment in the power sector.

Rajasthan Electricity Regulatory Commission Issues RPO

The Rajasthan Electricity Regulatory Commission prepared the following Renewable Purchase Obligation Regulations by order dated 13.06.2023.

These regulations shall come into force from 01.04.2024 after their publication in the Official Gazette. (ii) For the period prior to 01.04.2024, the Renewable Energy Obligation as specified in RERC (Renewable Energy Obligation) Regulation, 2007 & other relevant Regulations as amended from time to time, shall remain applicable. These Regulations will be applicable to the following -

i. Distribution licensee including deemed licensee; ii. Open Access (OA) consumer;
iii. Captive Power Plant (CPP) of installed capacity 1 MW and above.

The minimum Renewable Purchase Obligations for the obligated entities shall be as under:
Distribution Licensee including deemed licensee:

S.No.	Year	Wind RPO	HPO	Other RPO	Total RPO
1	2024-25	2.46%	1.08%	26.37%	29.91%
2	2025-26	3.36%	1.48%	28.17%	33.01%
3	2026-27	4.29%	1.80%	29.86%	35.95%
4	2027-28	5.23%	2.15%	31.43%	38.81%
5	2028-29	6.16%	2.51%	32.69%	41.36%
6	2029-30	6.94%	2.82%	33.57%	43.33%

Provided that Wind RPO shall be met by energy produced from Wind Power Projects (WPPs) commissioned after 31.03.2022 and the wind energy consumed over and above 7% from WPPs commissioned till 31.03.2022.

MoP Amends SBDs for Procurement of ISTS through TBCB Process

The Ministry of Power (MoP), Government of India has issued an amendment in the standard bidding documents (SBDs) for procurement of Inter-state transmission service (ISTS) through tariff based competitive bidding (TBCB) process to include provisions of aggregate capital cost for high voltage direct current (HVDC) systems vide F. No. 1 51412021-Trans-Part(2) dated 21st June 2023.

The new provision asks the bidders to specify experience of developing projects in the infrastructure sector in the last five years with aggregate capital expenditure and the capital expenditure of each project. It also specifies costs for high voltage alternate current and HVDC systems.

Amendment in Scheme for Flexibility in Generation and Scheduling of Thermal/Hydro Power Stations through Bundling with Renewable Energy and Storage Power (RE Bundling Scheme)

Ministry of Power on 21.06.2023 has amended the provisions of notification dated 12.04.2022 of Scheme for Flexibility in Generation and Scheduling of Thermal/ Hydro Power Stations through bundling with Renewable Energy and Storage Power (RE Bundling Scheme).

1. Criteria of establishing RE power plants by Central/State Gencos under the Scheme have been relaxed.
2. Provisions made for allowing setting up of RE plant under the Scheme through JV.

It will help the thermal Gencos to meet their RE bundling targets under the Scheme and supply low carbon energy to beneficiaries under existing PPAs.

Andhra Pradesh Green Hydrogen & Green Ammonia Policy – 2023

Andhra Pradesh State Government has notified the Andhra Pradesh Green Hydrogen & Green Ammonia Policy – 2023 for promotion of Green Hydrogen and Green Ammonia production on 20.06.2023. This is in line with Five targets under "Panchamrit" set up by Government of India for dealing with climate change and global warming.

The Green Credit Program Implementation Rules, 2023

Ministry of Environment, Forest and Climate Change Notification of 26th June, 2023 has isued the Green Credit Program Implementation Rules, 2023.

These are a set of regulations that have been released by the Government of India to promote environmentally sustainable and responsive actions by companies, individuals, and local bodies.

The rules notified under the Environmental Protection Act, 1986 and will create a mechanism for issuing and trading green credits for various activities that support the vision of Lifestyle for Environment (LiFE) or Panchamrit, the five nectar elements of India's climate action.

The rules are designed to help mitigate climate change, build adaptive capacity, and improve the overall state of the environment by increasing energy and resource use efficiency and encouraging environmental conservation.

The rules define a green credit as a "credit that is generated by an entity for undertaking activities that are environmentally sustainable and responsive."

The rules also establish a Green Credit Registry, which will be maintained by the Ministry of Environment, Forests & Climate Change, Government of India. The registry will track the issuance and trading of green credits and will provide a platform for buyers and sellers of green credits to connect. The Green Credit Programme Implementation Rules, 2023 are expected to come into force on 1st July 2023. (Readers are advised to refer to the main documents for detailed information on various regulations.)

Compiled by: ***Om Taneja****, Renewable Energy Consultant along with inputs from*
Alla V Srikanth*, Divisional Head, AP Urban Infrastructure Asset Management limited, Vijayawvada*

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Snippets

Mission MAHIR on the latest and emerging technologies in energy sector

The Ministry of Power (MoP) and the Ministry of New and Renewable Energy (MNRE) have jointly launched a national mission titled "Mission on Advanced and High-Impact Research (MAHIR)" to facilitate indigenous research, development and demonstration of the latest and emerging technologies in the power sector. Planned for an initial period of five years from 2023-24 to 2027-28, the mission will follow the technology life cycle approach of idea to product. To begin with, eight areas have been identified for research. The mission seeks to make India a manufacturing hub of the world.

Source: Ministry of Power, GoI, 7 June 2023

India has raised $43 billion in the hidden universe of Green Bonds since 2014: Report

India has raised $43 billion since 2014 through green bonds which have played an important role in funding the growth of renewable energy in the country, according to a new report by Blooomberg New Energy Finance (BNEF). "Power producers are leading the issuance of these green debt instruments and are also bringing innovation in their structuring. The emergence of sovereign Indian green bonds has spurred regulatory reforms and catalyzed new market products, which may broaden the investor base and bring in even more capital," the report said.

Source: ET Energy World, 6 June 2023

CERC to Initiate 'Market Coupling' of Power Exchange, Decision Receives Mixed Response

Ministry of Power has directed the Central Electricity Regulatory Commission (CERC) to initiate the process of "market coupling" of power exchanges, in order to have uniform prices across multiple exchanges. Market coupling refers to aggregation of all buy and sell bids from all power exchanges in the country under a single power trading entity, matching them and discovering a uniform market clearing price.

While the decision has been hailed by some analysts saying it could improve price discovery, Indian Energy Exchange (IEX), the largest platform handling more than 90% of power deals in India, said it will "kill innovation." Citing many stakeholders want market coupling of multiple power exchanges, the ministry, in a letter dated June 2, directed the regulator to initiate the process of implementation of market coupling.

Source: Financial Express, 10 June 2023

China's Installed Non-Fossil Fuel Electricity Capacity Exceeds 50% of Total

China's non-fossil fuel energy sources now exceed 50% of its total installed electricity generation capacity as per State planner the National Reform and Development Commission official. Non-fossil fuel power sources, such as wind and solar power, account for 50.9% of the country's total installed capacity, marking the early completion of a government target proposed in 2021, under which renewable capacity was planned to exceed fossil fuel capacity by 2025. By the end of 2022, China's installed power generation capacity was 2,564 GW.

Source: Reuters, 11 June 2023

India will be Epicentre for Green H_2 Development: Mr. Hardeep Singh Puri

Minister of Petroleum and Natural Gas, Sri Hardeep Singh Puri has said that India will be the place for green hydrogen development because there is a demand here. The private sector has shown great interest in the green hydrogen segment in India and acquired large manufacturing facilities and contracted to supply green ammonia, Mr. Puri said, speaking at a conference on India's Role in the Future of Energy." Many electrolyser manufacturers in the world today have got a tie up or production here", He added.

Source: ET Energy World, 15 June 2023

NLC India Forms Subsidiary NLC India Renewables Ltd to Strengthen RE Projects

State-owned NLC India Ltd has announced the establishment of its wholly-owned subsidiary, NLC India Renewables Ltd (NIRL) on June 14, 2023 to oversee its existing renewable energy projects. The newly formed company will assume responsibility for NLC India's current renewable energy projects and assets. NIRL's primary objective is to promote renewable energy ventures both in India and internationally. Additionally, the company aims to develop power generation systems utilizing various non-conventional and renewable energy sources, including wind, hydro, solar, tidal, geothermal, biomass, steam, wave, waste, hybrid, and other forms.

Source: Solar Quarter, 17 June 2023

windergy INDIA 2023
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The next Issue of Indian Wind Power will be WINDERGY 2023 SPECIAL ISSUE It will be distributed in the Trade Fair and Conference - 4 - 6 October, 2023.

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IWTMA New Member

Durga Prasad Amudalapalli
Managing Director, Gurit India

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With a head office in Wattwil, Switzerland, Gurit operates on a global scale, with production sites and offices spanning across the continent in 17 countries. The company's global reach enables Gurit to provide localized support and tailored solutions to its diverse customer base in Wind energy and light-weighting.

Manufacturing Excellence in India

In 2021, Gurit further expanded its reach by establishing an integrated manufacturing facility in India. Located in Oragadam, Chennai, the state-of-the-art facility covers an impressive 16-acre area within the Hiranandani Greenbase Industrial & Logistics Park, with over 40,000 square meters of factory space. And it also established a kitting facility at Ahmedabad to cater wind blade customer in north part of India.

Commitment to Quality and Innovation

Gurit is establishing a state-of-the-art Technology and Innovation Center inside of Gurit Chennai Business Park. The center will foster the development of cutting-edge solutions and promote collaboration with industry experts and researchers, further reinforcing Gurit's commitment to quality, innovation and growth.

Successful Together

At Gurit Wind Private Limited, Chennai Business Park and at Ahmedabad site there are dedicated employees of strength of nearly 450 highly skilled professionals. At the helm of Gurit Wind Private Limited in India is Mr. Durga Prasad Amudalapalli, with a rich academic background of MTech from IIT-Varanasi, MBA from the National University of Singapore (NUS), and a CMA from the Institute of Management Accountants in New Jersey, USA and over 25 years of national and international experience including a decade-long tenure in leadership roles in automotive, heavy engineering and wind energy industries, who brings a wealth of knowledge and expertise for Gurit's success in India. His invaluable contributions were particularly evident in establishing Gurit's integrated manufacturing facility, solidifying the company's presence in the region.

With a company value of "successful together', Mr Durga Prasad Amudalapalli is giving importance for the talent management and collaboration to inspire the growth and learning as well as create more employment opportunities in India as part of its future expansion plans. Durga will continue to guide the India team with his dedication, strategic vision and drive Gurit to new horizons in India.

Passion for a Sustainable Future

As the wind energy industry continues to evolve, Gurit remains at the forefront of technological advancements for wind energy generation, driving a greener future and more sustainable world.

Gurit Wind Private Limited is proud to be member of the IWTMA and contributing to the growing share of renewable energy, reducing CO_2 emissions. For more information please visit https://www.gurit.com or contact Mr. Durga Prasad Amudalapalli at durga.amudalapalli@gurit.com.

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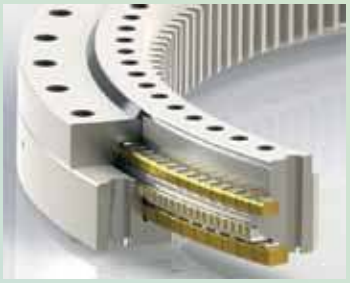

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4-6 October 2023
Chennai Trade Centre, Chennai, India

Windergy India 2023 Sets New Heights: Exhibition Space is Fully Sold Out Three Months in Advance!

Indian Wind Turbine Manufacturers Association (IWTMA) in collaboration with PDA Ventures Private Limited, a Bangalore-based Trade Fair Organiser is organising the 5th edition of Windergy India which is India's sole comprehensive International Trade Fair and Conference for the Wind Power Sector, is set to take place from 4 – 6 October 2023, at the Chennai Trade Centre, Chennai, India. Supported by the Ministry of Power, Ministry of New and Renewable Energy, Government of India and Niti Aayog, Windergy India is truly an event "for the industry, by the industry". Indian Wind Power Association, Wind Independent Power Producers Association (WIPPA), Asia Wind Energy Association and various other government bodies and industry associations are supporting it.

Windergy India is happy to announce that it has achieved a remarkable feat by booking all available exhibition spaces three months ahead of its scheduled dates. The overwhelming response from the industry and the support of key stakeholders have propelled Windergy India to become the most sought-after event in the renewable energy calendar. "The overwhelming response from our exhibitors, sponsors and attendees highlights the immense interest and confidence in the wind energy sector," said Mr. D. V. Giri, Secretary General of Indian Wind Turbine Manufacturers Association. "We are excited to welcome industry leaders, innovators, and policymakers to this dynamic platform, where they can explore the future of wind energy and drive the sustainable transformation of our energy landscape." He further said.

Windergy India serves as a global platform for industry leaders, policymakers, investors and innovators to come together and explore the latest trends, technologies, and business opportunities in the wind energy domain. With an exhibition area spanning over 10000 square meters and an anticipated attendance of over 6000 participants, Windergy India promises to be an unparalleled gathering of thought leaders and game-changers driving the sustainable energy revolution.

This exclusive wind sector event will include Original Equipment Manufacturers (OEMs), Component Manufacturers, Industrial Equipment, Lubricants, Gear boxes and others such as Suzlon Energy Limited, Envision Energy, INOX Wind, LM Wind Power, NGC Transmission, Flender Drives, ZF Wind Power, TPI Composites, Hine Hydraulics, Mtandt Group, Jindal Steel & Power, Larsen & Toubro, NexHS Renewables Pvt Ltd, Onyx Insight, HINE Hydraulics, Everrenew Renewable and many more..

Supported by the Government of Tamil Nadu through its investment promotion arm, Tamil Nadu Guidance Bureau as the Investment partner, Windergy India will have representations from all the wind rich states such as Karnataka, Andhra Pradesh, Telangana, Maharashtra, Gujarat and Rajasthan with a delegation.

UK is joining Windergy India as a Partner Country and Denmark is the Green Strategic Partner Country of Windergy India and will also feature country pavilions from Germany, and Spain, adding a global perspective to the event.

Alongside the trade fair, a two-day conference themed on "Power of Wind 2.0 - Energizing the Future of India" will be organised. The conference will host special addresses, keynote speeches, panel discussions, and technology presentations revolving around key topics, including accelerating decarbonization through wind energy, the business and financial economics of wind power, hybrid and storage solutions, technology and innovation, the Inflation Reduction Act (IRA) and Net-Zero initiatives, manufacturing and supply chain/export aspects, grid-planning integration with regulatory frameworks, the southern region's specific considerations, offshore development in India, and Tamil Nadu's unique context.

In addition to the extensive trade fair and conference, Windergy India 2023 will also host round table discussions involving key stakeholders from Spain, UK, Denmark and the Tamil Nadu Guidance Bureau. These round tables will provide an opportunity for vital discussions and collaboration among the most important players in the wind energy sector.

Windergy India 2023 aims to serve as a platform for knowledge exchange, business networking, and showcasing the latest advancements in the wind power industry. The event will bring industry leaders, policymakers, experts, and technology innovators together to explore strategies, trends, and opportunities in the wind energy sector.

We invite all stakeholders, professionals, and enthusiasts from the wind power industry to join us at Windergy India 2023 and be a part of the renewable energy revolution.

For more information, please visit www.windergy.in
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