Indian Wind Power

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In this issue...

Offshore Wind Energy Special

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

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IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Indian Wind Power

A Bi-monthly Magazine of Indian Wind Turbine Manufacturers Association

Volume: 8 Issue: 5 December 2022 - January 2023

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Indian Wind Turbine Manufacturers Association

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(For Internal Circulation only)

From the Desk of the Secretary General – IWTMA

Dear Readers,

Year 2023 has begun with a positive note and good news for the Wind Sector. IWTMA would like to place on record its thanks and appreciation to Hon'ble Minister, Shri R.K. Singh and MNRE on the recent two path-breaking policies viz~

1. Gazette Notification on Implementation of RE Tariff through central pool
2. Competitive Bidding thro' Closed Bidding process instead of e-Reverse Auction

The pooled tariff will consist of all RE sources and will be uniform to all the DISCOMs. This will help the DISCOMs to plan their purchase for their state requirement. It is heartening to note that that Closed Bidding from the year 2023 to 2030 will be 8 GW per annum covering all the 8 Wind States. This is a welcome move as it will result in investment, job opportunity across the Wind States and lead to an all-inclusive growth. Naturally, tertiary business in these wind states will also get benefited.

Time and again, we have reiterated and have lauded the targets of the Government to reach 500 GW of RE by 2030 of which 140 GW will be from Wind. The industry is in dialogue with the Government on implementation of a National RPO across the 29 states as a national movement. Renewable Energy is not, yet another power source but needs to be seen as an instrument to combat climate change and our commitment to the world in reduction of temperature and save the planet earth.

The industry is equally excited on the development of offshore for which a tender of 1 GW is expected to be announced soon. This will set the tone and the learning process to exploit nearly 90 to 100 GW of offshore mainly in the states of Gujarat and Tamil Nadu. Development of offshore requires a sophisticated robust supply chain and infrastructure development and the industry is ready with offshore technology. The association plans to take up with the Government the requirement and promotion of PLI for development of critical offshore components. The theme of this issue of the magazine is "Offshore Wind" with 5 articles on the subject.

There is an excitable buzz on Green Hydrogen and Green Ammonia as the fuel of the future both for industrial and transport applications. Lot of interest is evinced in manufacturer of Electrolysers.

Finally, India with its stewardship of G20 is in consultative process on various aspects which includes development of non-fossil fuels to meet the targets and goals.

Happy Reading!

With regards,
D.V. Giri
Secretary General

Ministry of New and Renewable Energy, Government of India
Joint Monthly Meeting with Wind Sector Stakeholders

Ministry of New and Renewable Energy, Government of India Joint Monthly Meeting with Wind Sector Stakeholders held on 19th January 2023 at Atal Akshay Urja Bhawan, New Delhi chaired by Mr. Bhupinder Singh Bhalla, IAS, Secretary, MNRE

SnipPets

UPERC Orders SECI to Refund Performance Bank Guarantee to Solar Developers

Uttar Pradesh Electricity Regulatory Commission (UPERC) identified the COVID-19 epidemic, delays in tariff approval, and issues with electricity procurement procedures as contributing factors in project delayed completion, thus, ordering Solar Energy Corporation of India (SECI) to refund the performance bank guarantee to ReNew Power's subsidiaries. Because of delays in finishing 150 MW grid-connected floating solar power projects, SECI has called for the encashment of the performance bank guarantee (PBG). The developers had provided PBG of Rs. 1.13 million/ MW. Earlier, after winning an auction to build 150 MW of floating solar projects on Rihand Dam, ReNew Solar Power and Auxo Sunlight encountered delays because of lockdowns across the nation and supply chain concerns. They asked SECI for an extension of the project's financial closure and commissioning, which was approved. However, the solar developers claimed that SECI had postponed submitting the petition for the approval of the tariff to the relevant body. As a result, the Commission rejected the developers' request for a deadline extension.

In order to seek an extension, SECI then required the developers to sign an agreement waiving a number of contractual rights, which the developers later discovered to be against the power purchase agreement (PPA) and the COVID-19 relief recommendations of the Ministry of New and Renewable Energy (MNRE). The developers, thereafter, asked SECI for an extension of the project schedules, but they were turned down. The agency informed the developers that they had not reached financial closure, leading to the encashment of the PPA. Therefore, in response, the developers petitioned the Allahabad High Court for an extension of the project deadlines as well as for the PBG to not be cashed in. The court granted an interim injunction stopping the encashment of the PBG and directed the parties to approach the Uttar Pradesh regulator.

The Commission noted that SECI should return the PBG to the developers because the delay was the result of a force majeure incident and not the developers' fault. The Commission determined that factors such as COVID-19, the monsoons, delayed fulfilment of 100 MW of floaters, and other purchase orders, including delays in the signature of water and land leasing agreements, all contributed to the project's implementation delay. In addition, UPERC reasoned that the developer was not to blame for the delays in commissioning caused by the signing of the PPA and PSA, submitting a petition for tariff determination, or procuring electricity. Thus, the petitioners were ordered to be freed from the PPA and PSA.

Source: Solar Quarter.com, 3 January 2023

Interview

Indo-Danish Cooperation in Offshore Wind in India

IWTMA Interview with
Mr. Alp Günsever, Head of Secretariat
Centre of Excellence for Offshore Wind and Renewable Energy,
New Delhi, India

Mr. Alp Günsever
Head of Secretariat
Centre of Excellence for Offshore
Wind and Renewable Energy, New Delhi, India

India has currently the second largest population, almost one-sixth of humanity, and the fifth largest economy in the world. Consequently, it has significant energy needs for its development with its growth momentum being an integral part of global development. This means that any step taken for electricity generation will influence the world climate and population. In that sense, offshore wind can play an important part in the energy mix also having the potential to contribute to long-term development and climate goals.

With a long coastline of about 7600 km, India is blessed with having good prospects of harnessing offshore wind energy. MNRE with support from other stakeholders including Center of Excellence for Offshore Wind and Renewable Energy (CoE), which is a joint initiative between India and Denmark, has set up an ambitious goal of developing 37GW of offshore wind in India and has initially identified coast of Tamil Nadu and Gujarat as the feasible options for offshore wind development.

Previously there has been feasibility studies carried out in these regions, but more recent development has been initiated by the release of the strategy paper from NIWE and the release of draft tender documents by MNRE in 2022. In the strategy paper, three different models have been defined for developing offshore wind in India. The draft tender documents are released for Model-3, where demarcated offshore wind zones are going to be leased out to developers fulfilling the techno-commercial and financial criteria. CoE has contributed to these developments by launching three different reports with two of them on Maritime Spatial Planning of the coast of Tamil Nadu and Gujarat and one of them on Port Infrastructure and Development in these regions. The goal of CoE by releasing these reports was to compile the publicly available information in a systematic context in order to reduce the risk for the developer while assessing the feasibility of the sites. Another aim was to contribute to a stakeholder consultation period, where questions and comments from various market players are gathered and assessed. It is now expected that MNRE will finalize the stakeholder consultation period and invite the interested developers to a final round of information sharing session before releasing the final tender documents.

The current momentum with recent developments brings a lot of opportunity as well as uncertainty and risk along especially when a new market is being developed. The cost of offshore wind in comparison to other renewable energy sources will be extremely significant in addressing the amount of this uncertainty. One of the most important aspects of offshore wind projects in this regard is the scale.

Talking purely from Indian context, the upcoming offshore wind tender will not have a maximum cap for installed capacity per site. This means that the developers will be able to develop the maximum capacity they find feasible and thus reducing their cost per produced unit of electricity. A financial tool called FIMOI (Financial Modelling of Offshore Wind in India) has been developed under CoE to assess the cost of offshore wind in India for different capacities. A report has been published using this tool with the findings indicating that offshore wind can be competitive in the long run with other initiatives being introduced by MNRE.

India's long-term Low-Carbon Development Strategy foresees offshore wind to be one of the most important enablers. A future development of a carbon market structure will make offshore wind very significant. Same can be said for the National Green Hydrogen Mission, which aims to make India the Global Hub for production, usage and export of Green Hydrogen and its derivatives. The Mission is foreseen to lead to significant decarbonization of the economy, reduced dependence on fossil fuel imports, and enable India to assume technology and market leadership in Green Hydrogen.

Offshore wind has the potential to be one of the main energy sources for this mission again considering the scale of the individual projects as well as the set pipeline of 37 GW. Finally, the development of Power Exchange Market will reduce the uptake price risk on the developers and contribute to more stable pricing for the future. To fulfill this purpose, there is ongoing collaboration between India and Denmark on system flexibility and integration of renewable energy in the power system exchanging knowledge on how to promote the integration of renewable energy in the grid by optimizing flexibility, forecasting, consolidated grid codes, efficient design of the power market and other measures.

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The collaboration also covers cooperation on advanced grid planning to underpin renewable energy markets, experience sharing and capacity building for Grid Integration of increased renewable energy in the power system in terms of system flexibility and stability, flexibility assessment and optimization of flexibility need with appropriate regulatory framework and market design, and market design for capacity market and resources adequacy measures along with ancillary service and other relevant measures.

There is also another ongoing cooperation with the Indian Central Electricity Authority exchanging knowledge on energy planning tools, including a technology catalogue, which is planned to be updated regularly. This includes aiming at producing a power outlook report for India.

The Centre of Excellence for Offshore Wind and Renewable Energy (CoE)

Together, India and Denmark has launched a knowledge hub called the Centre of Excellence for Offshore Wind and Renewable Energy (CoE). This is formalised as a joint initiative between the Indian Ministry of New and Renewable Energy (MNRE) as the host of the CoE and the Danish Energy Agency (DEA) as support. The initiative is starting up as a government-to-government initiative under the Indo-Danish Energy Partnership (INDEP). By bringing together industry, public authorities and civil society, the CoE will play a crucial role in facilitating and accelerating the implementation of the Indian offshore wind strategy.

In order for India to achieve its ambitious RE targets, a series of enabling initiatives are set in motion under the CoE. Through collaboration across various stakeholders, the CoE aims to create a transparent, facilitating and enabling environment for offshore wind in India. It shall develop and disseminate best available practices, methods and tools in order to minimize risk and reduce the overall cost of offshore projects. India can benefit from more than 30 years of Danish experiences and skills in areas such as marine spatial planning and the one-stop-shop concept for permitting and clearances in offshore wind, which streamlines crucial processes in the development of offshore wind projects. Furthermore, tools such as investor dialogue, auctioning and de-risking will facilitate investments. The CoE will play a crucial role in facilitating and implementing the actions needed to build a concrete pipeline of projects.

- The CoE´s operational work will be organized in four thematic areas, namely Spatial Planning and Permitting Process
- Financial Framework and Auction Design
- Grid and Supply Chain Infrastructure
- Technical Standards and Rules for Innovation.

Various activities and studies are carried out within these four thematic areas. The final objective is to increase the amount of precise and relevant information, create a transparent process, and finally reduce overall risk and uncertainties for developers and industry. By reducing risk, there is a direct positive impact on advancing offshore wind projects and lowering the cost.

The vision for the CoE is to become a nationally and internationally recognized, respected and leading non-profit knowledge hub working for the rapid development of offshore wind energy in India. In the medium to long-term, the vision is that the CoE will broaden to include a wider group of international governments and stakeholders, accumulating experience and best practices on offshore wind and become a regional knowledge hub.

India and Denmark have a long history of cooperating within the wind sector, including the development of the first onshore wind atlas for India and establishing the Wind Turbine Test Station at Kayathar. Today, India is world's fourth-largest onshore wind market by cumulative installation capacity. Therefore, it is only natural that Denmark and India embark on the journey of developing the offshore wind sector together. Denmark is a front-runner in the global green transition and a first mover and at the forefront of the offshore wind sector since early 1990s.

RBI Launches First-Ever Sovereign Green Bonds Auction Worth $1.93 Billion

As announced in the Union Budget 2022-23, Government of India, as part of its overall market borrowings, will be issuing Sovereign Green Bonds (SGrBs), for mobilizing resources for green infrastructure. The proceeds will be deployed in public sector projects which help in reducing the carbon intensity of the economy. Accordingly, it was notified in the Half-yearly issuance calendar for marketable dated securities for the second half of the fiscal year 2022-23 on September 29, 2022 that SGrBs for an aggregate amount of Rs. 16,000 crore would be issued. Government of India has since issued the Sovereign Green Bond Framework on November 09, 2022.

RE Agencies Association Signs MoU with CMAI for Knowledge Sharing on Carbon Trading

Carbon Markets Association of India (CMAI) and Association of Renewable Energy Agencies of States (AREAS) announced they have signed an MOU to provide exchange of information in carbon trading and assist in the development of Indian carbon market.

Source: ET Energy World, 19 January 2023

Norway's Climate Investment Fund Invests Rs. 900 Million in Transmission Project in Karnataka

The new Norwegian Climate Investment Fund managed by Norfund and KLP, made its first investment of Rs. 900 million into an Indian transmission project in Karnataka developed by ReNew Power. This investment will connect 2.5 GW of renewable capacity connected to the national grid.

Source: Solar Quarter.com, 4 January 2023

Offshore Wind India: *Looking into the Crystal Ball*

Sidharth Jain
Director
Mec Intelligence, Gurgaon

Indian Offshore Wind Reaches a Critical Milestone in 2022

Offshore wind activity in India started in 2010 when MNRE designated NIWE to conduct feasibility studies. The first offshore wind policy was released in 2015, following years of studies and multi-ministerial engagements. In 2018, MNRE announced an offshore wind target of 5 GW by 2022 and 10 GW by 2030 along with an expression of Interest and RfS for 1GW in Gujarat. NIWE released a map of wind resources and identified offshore wind-relevant areas in Gujarat and Tamil Nadu to guide further studies and surveys. In the following year, offshore wind lease rules were released to enable private players to conduct surveys in these identified areas. During this year, multiple consultations were undertaken to lead to the identification of the support the industry needs to kick-start. All required approvals were sought to achieve the target.

However, In July 2022, MNRE released a tender trajectory for the next 10 years, increasing the interest in the Indian offshore wind.

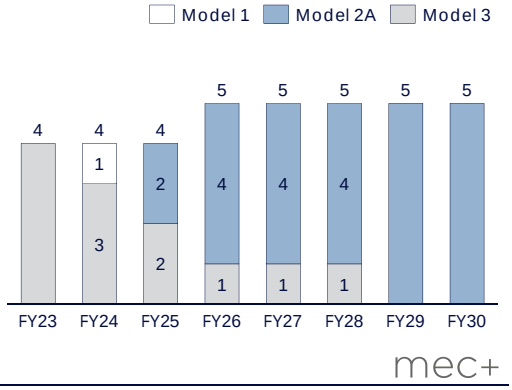
37 GW Opportunity in the Next 10 Years at the Cusp of Unlocking

The strategy paper and the offshore wind tender trajectory released by the government introduce three different auction models for tendering 37GW of offshore wind capacity in India in the next 10 years.

The tender trajectory will start with those sites where the exclusive seabed rights are provided initially, followed by a separate PPA award. Thereafter, the sites applicable for non-exclusive leases will be awarded on a first come first serve basis. The award of PPAs is likely to start in 2025.

India OW bidding models

Model 1	1 GW	PPA award along with exclusive lease award based on quoted tariff / VGF requirement bid
Model 2 – 2A	24 GW	Non-exclusive lease award on 'first-come-first-serve' basis, for consequent procurement under model 1
Model 2 – 2B		Non-exclusive lease award rights on 'first-come-first-serve' basis, for captive/ open-access sales
Model 3	12 GW	Exclusive lease award based on lease fee bid for captive/ open access sales



Note: VGF- Viability Gap Funding
Source: Press Release- MNRE OW; Strategy paper on OW development; mec+ analysis

- Model 1, applicable to the site in Gujarat in Zone B, has a certain opportunity since the detailed site studies have been done by the government. This site will be awarded a direct PPA for power offtake.
- Models 2 and 3 are relevant to all the other sites. The resource at these sites is not studied in detail, leaving a lot of work for the developers. At these sites, seabed leases and PPA will be done separately. These two models differ in terms of site exclusivity right to the winning player.

Early Developers Need to Balance Risks and Benefits to Secure the Opportunity

Each auction model has its own benefits and risks and therefore returns. Therefore, each model is attractive to different types of developers anchored around their risk vs. return expectations. Below is an overview of the risks and rights for the three(four) models

- **Model 1** – The capacity will be awarded based on a bidding process with a clear offtake agreement by the government. While the VGF is available for this model, but value and volume are unclear. Also, there is uncertainty about the award of sea-bed rights if all approvals are not secured.
- **Model 2** – The sites will be awarded on a First come first serve basis, with no fees but no exclusivity right either. PPA for these sites may be awarded by the government, however, it will be subject to VGF. If the funding isn't available, then the developers can sell the power under a corporate PPA. However, the resource at these sites is relatively weak.
- **Model 3** – The sites will undergo a two-stage tender process where initially the site lease will be awarded for a period of 7 years. During this period, the developer will pay a lease fee for exclusive access to these sites. However, the government will not off-take the power and neither will provide VGF. Data collected on the site during the exclusivity period will have to be shared with the government after the expiry of seven years.

Opportunity Seems Certain, But Timelines Do Not

An offshore wind project must undergo four stages of development before it can begin on-site construction. Each stage is marked by a few milestones which are critical for progressing to the next stage and building bankability of the project.

At the pre-licensing stage, the milestones are regarding policy and site feasibility analysis which are done. At the licensing stage, zone-wise technical studies are done, and rules are framed to initiate commercial activity. Thereafter, clarity is needed to start the bidding process before the actual project development can begin.

However, given the recent activity, we believe that lease rules, bid guidelines, award guidelines, and waivers are likely to arrive soon.

At the consenting stage, there are several activities e.g., DPR framework, EIA approval process, port permits, permitting of design and construction, and grid permitting with very little documentation as of now and advocacy is needed to move it forward. The clarity in the above-listed activities will set the ground for development under model 3.

Risks and Rights in the three auction models

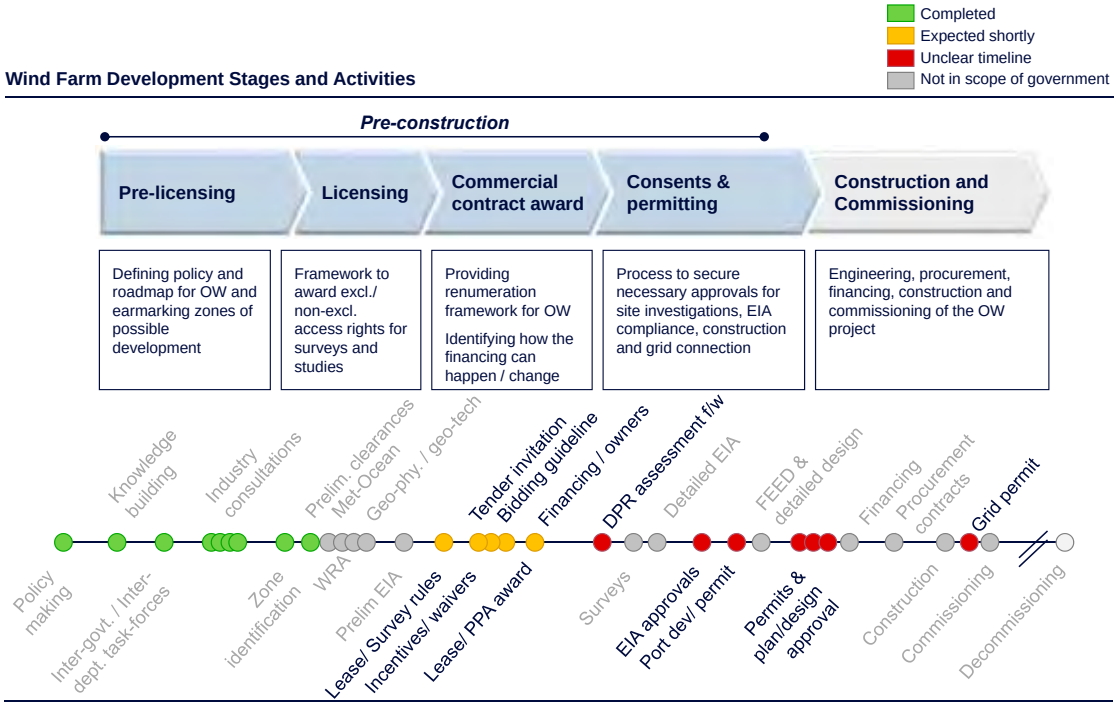
Increasing risk →

Characteristics	Model 1	Model 2A	Model 2B	Model 3
Eligibility and award criteria	Two stage and bidding – technical criteria not defined for eligibility	First come first serve basis / no fee until CoD / technical qualification criteria unclear		Two stage – tendering – technical criteria not defined for eligibility
Site exclusivity	Exclusive rights to sea-bed, timeline unclear	No sea-bed exclusivity, requirement limited to maintaining a minimum gap of one km between the mast location/ LIDAR site & bore holes of one developer and another developer		Exclusive rights to sea-bed until 7 years from letter of consent
Upfront costs/ investments	No upfront cost, all outflow post securing SECI PPA	Cost of studies and survey		Lease fee + cost of studies and surveys
Off-taker is government	Yes	May be (subject to validation)	No guarantee	No guarantee
Grid development scope	Grid development in scope of central transmission utility or PGCIL			
VGF availability	VGF available, if bidding based of VGF discovery		No VGF available	No VGF available
Other incentives	Unclear		Transmission charge waiver; RECs with multiplier, carbon credit benefits	
Data rights	Unclear if unable to secure Stage-II clearances or commission in 5 years	All data to be disclosed if failed to secured PPA under SECI auction or OA sales in 6 years		All data to be disclosed post 7 year expiry of exclusivity

Source: MNRE Strategy Paper on OW; mec+ analysis

mec+

Wind Farm Development Stages and Activities



Note: Govt.- Government; Dept- Departmental; WRA- Wind Resource Assessments; Geo-phy- Geophysical; Geo-tech- Geotechnical; Invt.- Investigation; EIA- Environmental Impact Assessment; FEED- Front End Engineering and Design; excl.- Exclusive
Source: MEC+ analysis

mec+

Supply chain and developers will need to work with the government to operationalise the strategy and realise timelines

MEC Perspective - Based on the current status of the milestones and risks with the auctioning models, two forecasts emerge for the project commissioning timeline.

- **Optimistic Scenario** - Project commissioning is likely to start from 2029 while reaching peak installations in 2032.
- **Conservative Scenario** - The project commissioning is delayed by a year i.e., from 2030, reaching annual peak installation in 2035. Key driver or the peak shift is the capacity auctioned under model 3.

However, the Cost of Offshore Wind Energy is High

The cost of energy is the measure of the total cost incurred per unit of generation during the lifetime of the project.

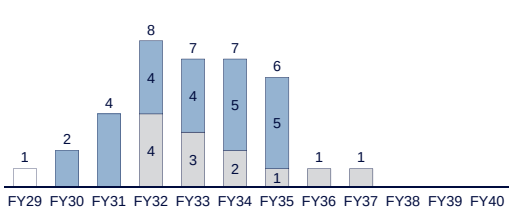
Levelized cost of energy = Total Lifetime Costs ÷ (Total Lifetime production – Losses)

For offshore wind, 40% of the lifetime costs are incurred on the CAPEX. This includes:

- Turbine – nacelle, blades, towers
- Support structures- foundations, cables, electricals
- Services-contract management, project design and development, project management and the overall offshore construction of the farm

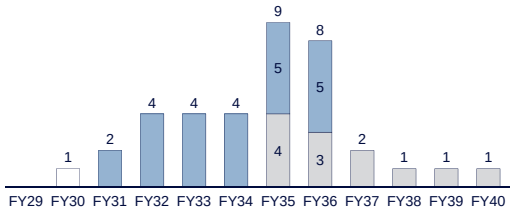
Model 1 Model 2A Model 3

India OW commissioning trajectory- *optimistic case*



Assuming that projects secure consenting in one year and complete commissioning without delays/ extensions

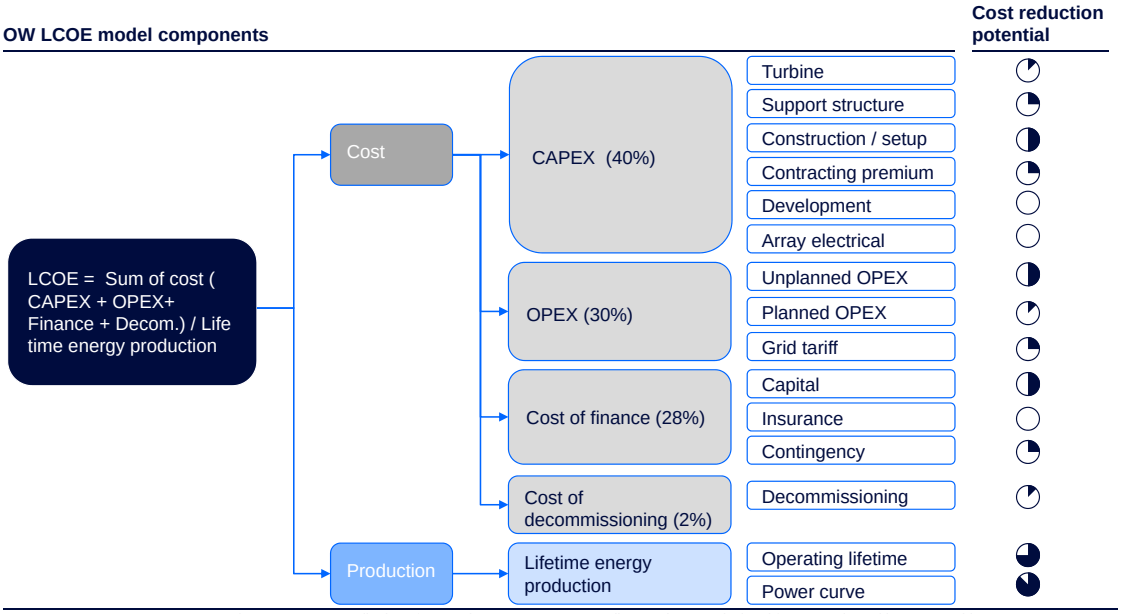
India OW commissioning trajectory- *Conservative case*



Assuming delay in consenting and need for extensions in commissioning. Major delay in model 3 projects in securing offtake arrangements

Note: Assuming projects in model 1 & 2 secure stage 2 clearance in 1 year bid award and commissioned in stipulated time of 5 years. Assuming model 3 will secure DPR approval & C&I PPA in 7 years and commission in 5 years
Source: NIWE; mec+ OW Summit; mec+ analysis

mec+



Note: Percentages represent the percentage contribution of respective component to overall cost. Figures calculated for 1 GW plant with 15 MW turbines undergoing FID in 2030
Source: mec+ analysis

mec+

The CAPEX is dependent on the size of the farm, number of generating units, site characteristics and sourcing location (i.e., transportation, customs, taxes, etc.)

OPEX constitutes 30% of the lifetime cost, including:

- planned inspection, services, and repairs
- unplanned component faults, breakages, and replacements
- Grid charges for power offtake and integration into the onshore grid

The OPEX is dependent on the project size, number of generating units, generating technology, components robustness and policies on offtake.

The cost of financing is a whopping 28-30% of the lifetime cost considering the high cost of capital in India, insurance to cover the risks, and contingency margins. At the end of the project lifetime, the decommissioning cost is around ~2% accommodating for the terminal project value.

All these cost components are dependent on the supply chain presence and willingness to take the risks in the market. For a nascent market, the margins and premiums are an added cost to cover all the risks.

In effect, while globally the current cost of offshore wind energy is almost twice that of its onshore counterpart, in India, it is 2.5-3 times that of onshore wind.

An LCOE of 50-60 USD/MWH can be Expected for Indian Offshore Wind Farms Coming Online by 2032

Global cost reductions are highly relevant for Indian OW projects. Almost all the projects have similar site location characteristics, except the slightly slower wind speeds. Efficiencies in the supply chain, project management and technology are transferable from advanced OW markets and highly relevant for India.

Building upon the global LCOE estimates, MEC+ modelled the LCOE for the Indian OW projects which are expected to come online by 2032 and later. Three scenarios are considered based on technology, supply chain costs and efficiencies throughout the project's lifetime.

Project assumptions

Location : Class 4 site
Wind speeds range : 7.94 - 9m/s; Average: 8.85 m/s

Case	CAPEX (m USD/ MW)	OPEX (k USD/MW)	CUF (%)	WTG (MW)
Advanced	1.6	52	52	18
Base	1.8	55	50	15
Conservative	2.3	60	46	12

Significant Cost Reduction Potential Exists in CAPEX, OPEX and Cost of Financing

Technology is expected to be the largest driver behind cost reduction. The turbine size is expected to go up from the current global average of 10 MW to 15-18 MW by 2030 and later. An increase in the WTG size will significantly reduce the quantities of the balance of plant components, i.e., fewer foundations, cable and electrical connections, fewer offshore construction days, fewer chartering days for heavy lift vessels, etc.

At the same time, volume clarity in the industry will bring economies of scale in the capital investments made in the supply chain for localization and industrialization.

Therefore, each of the work packages is expected to reduce by at least 40% in respective CAPEX amounts. At the same time, increasing the size of WTG and projects will reduce the OPEX costs, especially because of fewer offshore activities and shared infrastructure for O&M. The two figures below explain the cost of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its components in India since 1996
With 14 manufacturing units and wind farms across 8 states, Suzlon creates local jobs at the grass-root level, energizes micro-economies, supports a local supply chain and reduces imports by making India more 'Aatmanirbhar' in the manufacturing of Wind Turbine Generators and its components. Suzlon is also a flag bearer of the ambitious 'Make in India' program for Wind Energy and a key partner in the nation's Renewable Energy mission. We are committed to energy security and low-carbon economy for the country by providing sustainable and affordable energy to power a greener tomorrow, today.
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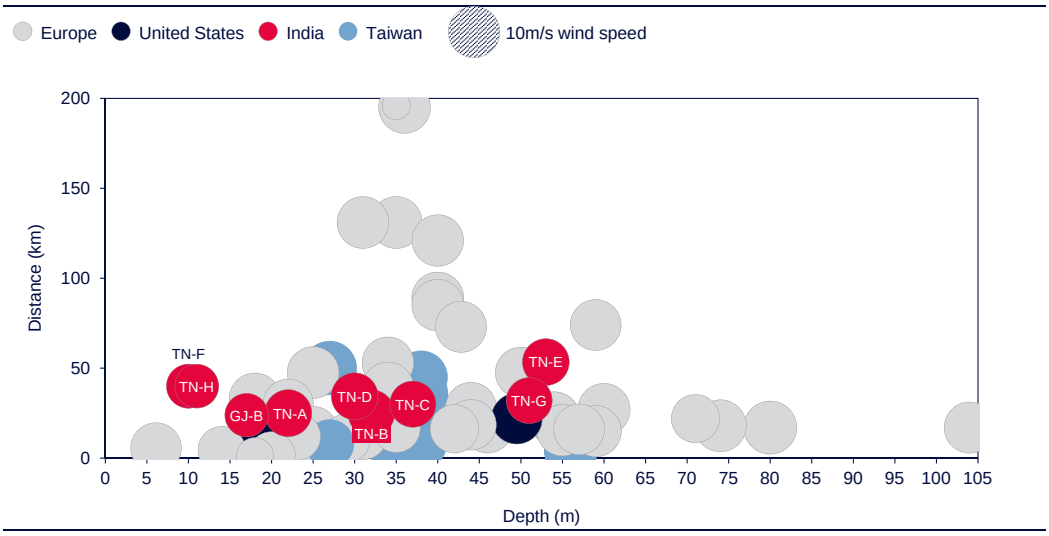
More than 18.8 GW of installations I Footprint across 18 countries I Largest product portfolio I R&D across The Netherlands, India, Germany and Denmark
Leading global renewable energy player offering end-to-end solutions. To know more visit us at: www.suzlon.com I Join us on

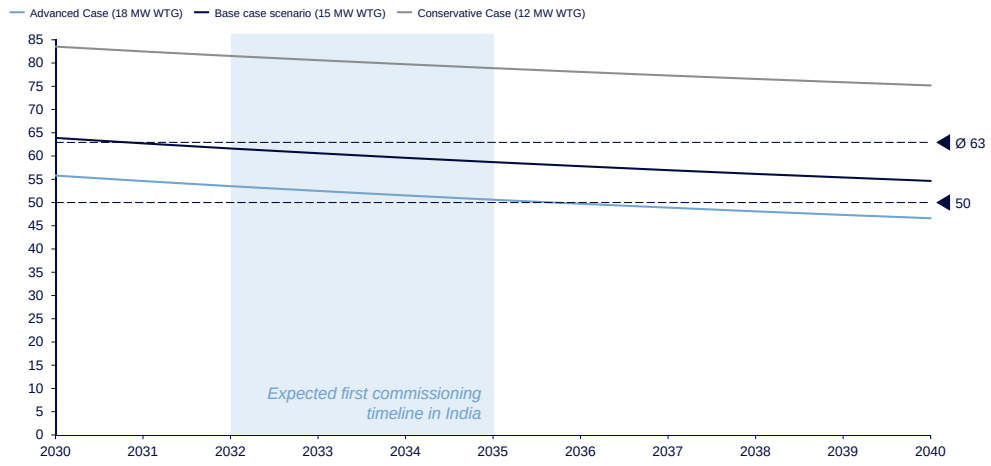
Depth vs Distance comparison for OW sites



Note: Wind farms not commissioned but under development; sample sites (illustrative in nature)
Source: mec+ OW database; 4C offshore website. mec+ analysis

mec+

India projection of OW LCoE by CoD – average for class 4 site
(USD/ MWh)



Note: Modelled for class 4 resource min speed- **7.94m/s; max speed 8.85m/s;** average 9m/s
Source: mec+ analysis

mec+

energy breakup today, with the reduction potential expected in the next 8-10 years.

Offshore Wind has a Critical Role to Play in the Indian Energy Mix.

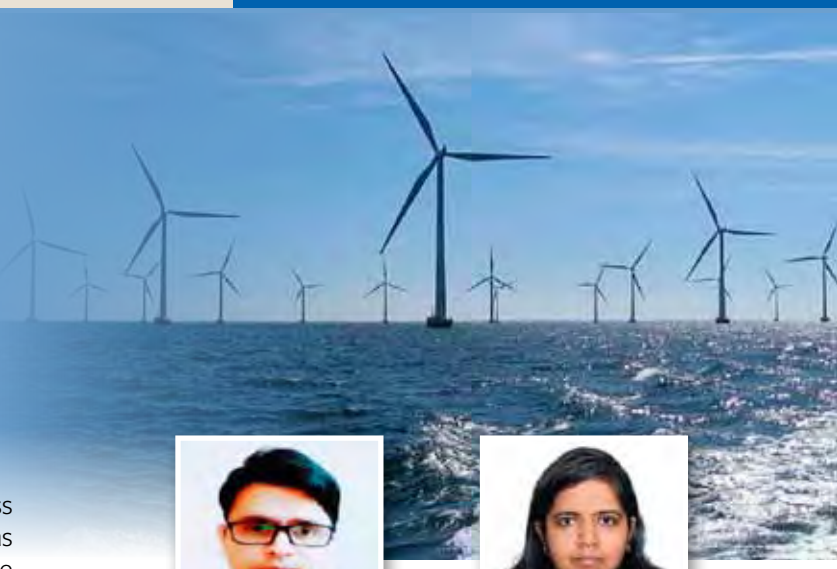
The cost of offshore wind today is higher than the other renewable sources abundantly available in India. Despite the significant cost reduction expected in the future, the cost will remain higher than solar and onshore wind. However, its generation profile is less intermittent and delivers a higher CUF. Therefore, offshore wind projects are best suited for creating high-value – renewable – power products for energy supply and grid balancing services.

Therefore for the developers and investors, it is of prime importance to build the right business model and revenue mechanism with the right customer.

Please Note: *All images and graphs are copyrighted by MEC+.*

About MEC: *MEC+, also known as MEC Intelligence, is a specialist consulting firm focused on the wind and renewables sector for 10+ years. It is based out of India and Denmark. Our clients include some of the largest global wind OEMs, European utilities, Global Supply chain players, Equity funds and Independent Service Providers. Please visit www.mecintelligencec.com or reach out at info@mecintelligence.com for more details.*

COP27 and Offshore Wind



Manoj Kumar Singh
Founder & CEO

Dr. Kruthika Eswaran
Lead ESG Consultant

Net Zero Think Private Limited

The recently concluded COP27 resulted in outcomes across the spectrum. On one hand, there was a positive note as the "loss and damage" fund was established to help vulnerable countries affected by the adverse effects of climate change along with $3.1 billion set aside by the UN to ensure global coverage of early-warning systems in the next 5 years. While many developed countries are in the right direction and have made financial commitments with respect to the aforementioned fund, the promise of $100 billion annually has still not been met. On the other hand, measures taken for adaptation and mitigation have been slow and not been on scale and the topic on energy transition are still unclear and continue to be under discussion for the next COP event. However, COP27 made positive strides in establishing global initiatives for the acceleration of deploying renewables and green hydrogen necessary for moving towards cleaner energy. These initiatives include the Planning for Climate Commission, Global Renewables Alliance and the Global Offshore Wind Alliance (GOWA) expansion.

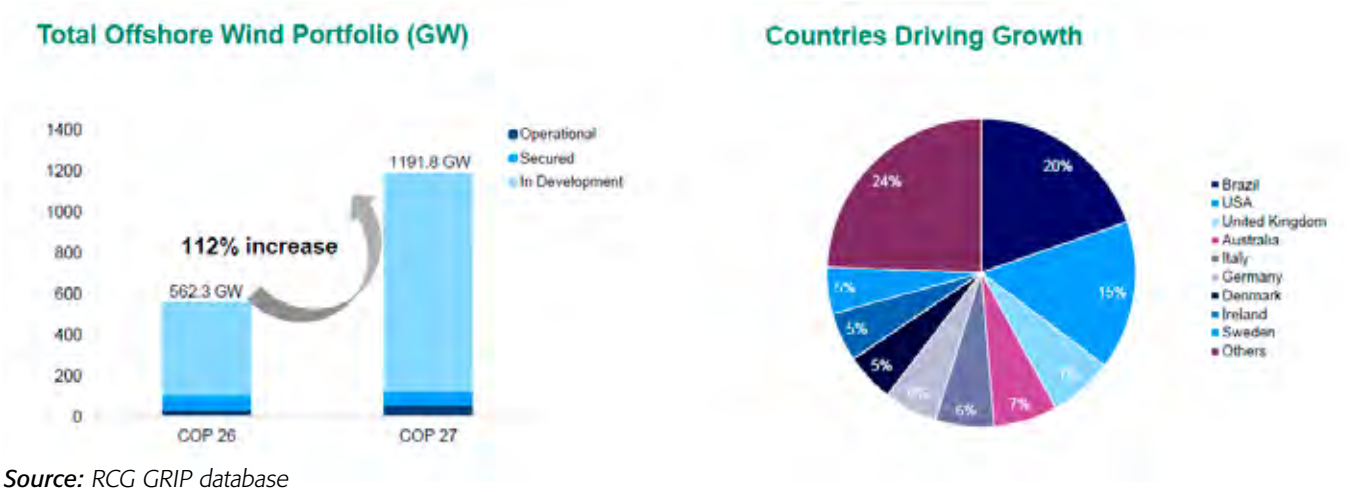
Global Offshore Wind Alliance (GOWA)

Global Offshore Wind Alliance (GOWA) was established at COP26 by Denmark, the International Renewable Energy Agency (IRENA) and the Global Wind Energy Council (GWEC) with an aim to bring together governments, private sector, international organizations and other stakeholders to accelerate the deployment of offshore wind power. At the COP27 nine

Country wise and Year wise Offshore Wind Power Installation

Rank	Country	2016	2017	2018	2019	2020	2021	2022 (June)
1	China	1,627	2,788	4,588	6,838	9,996	19,747	24,851
2	United Kingdom	5,156	6,651	7,963	9,723	10,428	12,281	13,601
3	Germany	4,108	5,411	6,380	7,493	7,689	7,701	7,701
4	Netherlands	1,118	1,118	1,118	1,118	2,611	3,010	3,010
5	Denmark	1,271	1,268	1,329	1,703	1,703	2,343	2,343
6	Belgium	712	877	1,186	1,556	2,261	2,263	2,263
7	Vietnam	99	99	99	99	99	99	396
8	Taiwan	0	8	8	128	128	237	237
9	Sweden	202	202	192	191	192	191	191
10	South Korea	35	38	73	73	136	104	112
11	Japan	60	65	65	85	85	85	84
12	Finland	32	92	87	71	71	71	71
13	United States	30	30	30	30	42	42	42
14	Italy							30
15	Ireland	25	25	25	25	25	25	25
16	Portugal					25	25	25
17	Norway	2	2	2	2	2	6	6
18	Spain	5	5	5	5	5	5	5
19	France	0	2	2	2	2	2	2
	World Total (MW)	**14,482**	**18,658**	**23,140**	**29,142**	**35,500**	**48,176**	**54,935**

Source: https://en.wikipedia.org/wiki/Offshore_wind_power



Source: *RCG GRIP database*

Notes:

OSW = offshore wind, Operational projects require all turbines to be commissioned and connected to the grid, Secured projects have reached financial investment decision (FID) but are not fully operational and in Development is anything pre-FID

new countries including Belgium, Colombia, Germany, Ireland, Japan, the Netherlands, Norway, the UK, the US joined the Global Offshore Wind Alliance (GOWA). Both IRENA and the International Energy Agency (IEA) expect that offshore wind capacity will need to exceed 2000 GW in 2050, from just over 60 GW today, to limit the rise in global temperatures to 1.5 degree Celsius and achieve net zero. To reach this target, GOWA will aim to contribute to accelerating growth to reach a total of at least 380 GW installed capacity by the end of 2030.

Global offshore wind installation since 2016 onwards have increased in many parts of globe. As on June 2022 China, UK and Germany have more than 80% of global offshore wind installation.

The Renewables Consulting Group (RCG) recently released a report, "Global Offshore Wind: Annual Market Report" for the COP27 which examined progress made in the global offshore wind sector since COP26 and challenges faced by the industry, while outlining how government should help, and how to accelerate the offshore wind industry in emerging markets. According to the report, the global offshore wind project portfolio has increased by 112% since COP26 with the maximum growth by Brazil and the US.

However, few countries need to accelerate their development to reach their respective 2030 targets including India.

How do offshore wind systems help India?

Offshore wind systems (OWS) refers to the deployment of wind farms inside the water bodies. They utilize the sea winds to generate electricity. These wind farms either use fixed-foundation turbines or floating wind turbines. Average modern offshore wind farms distance varies between 10 to 40 km from seacoast and located 10 to 50 meter deep in the ocean. Electricity generated by offshore wind turbines is sent back to land via cables sunk in the ocean floor.

India with a coastline of about 7600 km surrounded by water on three sides has good prospects of harnessing offshore wind energy. There is also a growing need for focusing on offshore wind energy in India for reasons as follows:

- ***Less availability of area on land:*** In India, where land is limited and the population is increasing, large wind farms positioned over water bodies will be vital.
- ***High efficiency:*** Offshore wind turbines are more efficient compared to onshore turbines. Wind speed over water bodies is high and is consistent in direction. As a result, offshore wind farms generate more electricity per installed capacity. Also, fewer turbines are required to produce the same capacity of energy as compared to onshore ones.
- ***High reliability:*** As offshore wind farms have a higher capacity utilization factor (CUF), they allow for longer operating hours. Transmission losses are minimized since these wind farms are located near cities and load centres.
- ***Lesser disputes:*** Offshore wind farms prevent social conflicts which arise due to competitive land uses.
- ***Environmental benefits:*** As any other renewable energy source, offshore wind farms do not require the consumption of water to operate properly, and also do not emit any environmental pollutants or greenhouse gas emissions during its operation thereby helping us in fighting climate change and will pave way for the sustainable development.
- ***To meet Nationally Determined Contributions (NDCs):*** It will help in achieving India's target of 500 GW from non-fossil fuel by 2030 as part of Paris agreement which includes 30GW of OWS.
- ***Energy security:*** Domestic offshore wind energy production will reduce the need for energy imports and consequently reduce our dependence on exporter countries.

Key Developments in India's Offshore Wind Power

The Key developments in India's offshore wind power are listed below:

- Offshore wind energy potential: about 70 GW within 2 identified zones on Gujarat and Tamil Nadu coasts
- Strategy for offshore wind development issued in July 2022. Three models of development of offshore wind projects
- Gujarat and Tamil Nadu have consented to buy power from offshore wind projects.
- Planning of transmission infrastructure for 10 GW capacity completed
- Assistance sought for 3GW offshore projects- Rs 14300 crore

A wind RPO was created and went into effect for all electricity produced from wind energy projects after March 31, 2022, in recognition of the potential wind energy may bring to India's energy mix and energy transformation journey. In terms of wind RPO, the Ministry of Power has set forth a roadmap for wind energy that extends through 2021–2022. The trend requires state to meet 0.81% wind RPO for 2022–2023 and anticipates a 6.94% RPO by 2029–2030.

Key Initiatives Taken by Government of India to Promote Offshore Wind

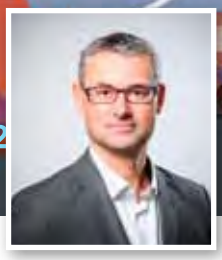
1. **National Offshore Wind Energy Policy (2015)**
   - Allowed Offshore Wind (OSW) development within territorial waters (12 nautical miles (nm) up to the Exclusive Economic Zone (EEZ) (200 nm).
   - MNRE is the nodal ministry and NIWE designated as nodal agency.
   - Encourages indigenization, R&D and skill development.
   - Set 30 GW installation target by 2030.
2. **Seabed Lease Rules - Draft (2019)**
   - Draft lease rules-2019 provided guidance on sea-bed leasing methodology.
   - Provided conditions and rights of lease for exploration, installation, operation of offshore wind farms.
   - Final lease rules planned to be released.
3. **Strategy Paper For Offshore Wind Development in India (2022)**
   - Provided bidding trajectory till 2030 for 37 GW.
   - 3 GW capacity planned with Viability Gap Funding (VGF) mechanism, rest in the market mode.
   - 3 different project development models with total 4 variants on basis of VGF, primary studies status, and sale of power envisaged.
   - 12 GW capacity to be auctioned by 2024-25.
4. **Offshore Wind Development in Tamil Nadu**
   - 4 GW tendered in Tamil Nadu for seabed leasing released (November 2022).
   - OSW projects planned under model-3, phase-1.
   - Power sale provision in Open Access-captive/third party or merchant, power exchange sale.
5. **For Offshore Wind Research, Test Centre Development**
   - Total 4 offshore wind turbines to be set up. 2 beds for 8 MW OSW turbines for greening of Rameshwaram project.
   - 2 Turbine beds for Offshore/Onshore turbine test set up.
   - INR 350 Crore projects announced by MNRE

Way Forward to Achieve India's Offshore Wind Systems (OWS) Targets

1. Climate Change impact Assessment (Long term scenario-based analysis) to be carried out during site selection process to understand the associated physical risk w.r.t. extreme weather events and wind pattern changes.
2. Carbon foot-printing (GHG accounting, scope, 1, 2 & 3) and emission reduction plan needs to be developed in-line with Net Zero Goals.
3. Financing offshore wind is complex, risks need to be reduced and bankability should be ensured. Low-cost financing and greater volume transparency can help reduce tariffs (unit cost). Governments, developers and supply chain companies need to work together regionally to plan offshore wind portfolios, supply chain capacities and localisation policies to determine the most achievable targets.
4. Grid and offshore wind planning should be done in unison involving power system stakeholders.
5. Establishment of local industry depends on the volumes that can be supported by the domestic and export market. Environmental protection and community trust-building efforts are also necessary.
6. To attract widespread interest in project investment, manufacturing and supply chain development in India, sufficiently ambitious and realistic long-term targets are needed. Potential locations identified by MNRE for Offshore wind systems (OWS) projects are along the coasts of Gujarat and Tamil Nadu with a potential to harness 70 GW. Further feasibility studies on these locations have to be performed in detail taking into consideration socio-economic and environmental impacts.

India is in the right direction in the offshore wind scenario but the progress has not been quick. However, taking into above actions including practices from other countries to further expand the sector. Regional cooperation across the entire supply chain and operations is key in achieving this goal.

The Future of Hydrogen Storage and Transport with Advanced HyCS Technology



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Introduction

The potential for Hydrogen as a form of energy is unparalleled by any other source and is set to revolutionise many sectors in the coming years including steel, cement, fertilizers, transportation, on-grid and off-grid energy storage, refining, chemical feedstock etc. Production of Green Hydrogen through electrolysis of water from renewable energy sources such as wind and solar energy is the Holy Grail for solving many of the carbon emission challenges in a number of sectors and can reduce our dependence on fossil fuels.

The Government of India has projected a production capacity of at least 5 MMT per annum Green Hydrogen by 2030 and this can be further scaled up to 10 MMT per annum with the growth of export markets and international partnerships (Source: National Green Hydrogen Mission 2023).

Storage and transportation of hydrogen remains one of the biggest challenges in the H_2 value chain due to its low volumetric density in comparison to fossil based energy sources such as coal, oil and natural gas. Green Hydrogen production today is possible through electrolysis using current electrolyzer technologies such as PEM (Polymer Exchange Membrane), Alkaline based, Solid Oxide or AEM (Anion Exchange Membrane) or through carbon based Hydrogen production via pyrolysis of biomass, biogas or natural gas.

Storage and transportation of hydrogen remains one of the biggest challenges in the H_2 value chain due to its low volumetric density...

Conventional storage systems such as compressed H_2 gas (300 bar, 700 bar), Liquefied H_2, Liquid Organic Hydrogen Carriers (LOHC), Ammonia (NH_3) require specialised tankers and vessels which are more expensive due to high material cost, low storage volume, high energy demand and low storage efficiency. Also safety is a big concern due to the highly flammable nature of hydrogen and needs to be stored in a controlled environment. Additionally, storage of hydrogen for longer periods of time is not practical with the available storage technologies in the market.

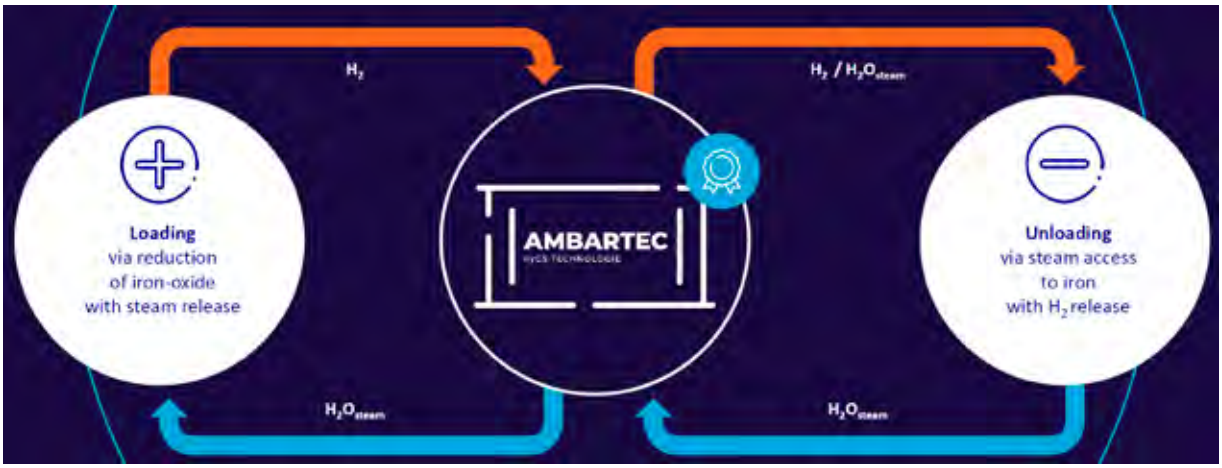

Figure 1: Process: Reduction and Oxidation of Iron (Fe) (H_2 + FeO <-> Fe + H_2O)

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NGC is a global leader in wind gearbox development and production with high performance product which provides complete main gearboxes, yaw and pitch drive product for wind turbine. NGC high reliability products are adapted to various working conditions, low/high temperature, low wind speed, high altitude, offshore and others. By far, over 90,000 NGC main gearboxes have been operating globally with excellence performance, contributing to the continuous power supply for green energy.

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NGC

AMBARtec HyCS® Technology: Simple and Effective

At the core, AMBARtec HyCS® technology relies on the principle of reduction and oxidation of Iron (Fe). When loading the device, the Fe is reduced by the supplied H_2. Steam (H_2O) is released and can be used again in electrolysis. The Fe can be stored for long periods of time or transported to the point of H_2 consumption for unloading. During discharge, steam is fed at the point of use, which can also come from the exhaust gas of a regeneration unit. This oxidizes the Fe and H_2 is released. The reaction at discharge is exothermic and heat produced during release of H_2 while unloading can be used to produce more steam (H_2O) thus reducing the overall requirement of heat during the unloading process and increasing efficiency. Also, HyCS® technology is safer in comparison to conventional storage technologies as the energy is stored via Iron (Fe) and not via Hydrogen and the system has a higher cycle life with the possibility of storing the energy for a longer duration of time.

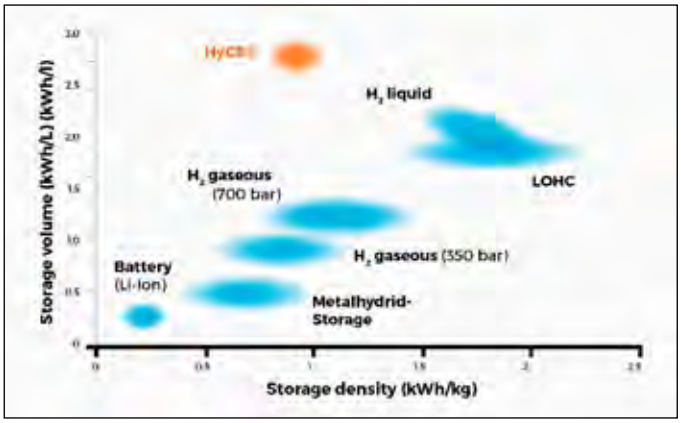

Figure 2: Comparison between Gravimetric vs Volumetric Storage density for different technologies

Benefits of HyCS® Compact Hydrogen Storage Technology

1. Proven Commercial Applications

The HyCS® Compact Hydrogen Storage technology has been demonstrated and proven since early 2022. The HyCS® solution is available in a standard 20-feet containerized format. First commercial units will be available by 2023 and the 20-feet standard containers by 2024. The 20-feet standard containerized solution is capable of delivering 20MWh of energy equivalent to 600kg of H_2. The container can be loaded or unloaded within 15 minutes which is very quick when compared to conventional storage systems. Also the containers can be transported using the standard transport infrastructure readily available through trailers, trucks, trains or container shipping vessels and is very safe due to the absence of H_2 in the storage vessel. Solutions for large-scale applications can also be designed.

HyCS® technology is safer in comparison to conventional storage technologies as the energy is stored via Iron (Fe) and not via Hydrogen and the system has a higher cycle life with the possibility of storing the energy for a longer duration of time.

2. Highest Storage Density

The HyCS® process principle offers numerous advantages compared to conventional H_2 storage. The graph shows: More than 2 kWh of H_2 can be stored in one litre of HyCS® storage. This is about 2.5 to 5 times as much as in a pressure vessel (700/350 bar). And twice as much as can be stored with liquid hydrogen, in metal hydrides or similar approaches Liquid Organic Hydrogen Carrier (LOHC). This makes the HyCS® storage system the most compact of all energy storage systems – of course also significantly more compact than Li-ion batteries (factor 10).

3. Best Efficiency

Smart integration, especially with steam driven electrolysis Solid Oxide Electrolyzer Cell (SOEC) and Solid Oxide Fuel Cell (SOFC), results in long-term power storage efficiencies of up to 100% higher than with alternative systems (Power to Power efficiency). *(See Figure - 3)* HyCS® technology thus reduces H_2 generation and storage costs.

4. Reduced Transport Costs

HyCS® technology results in:

- Halving the space requirement for H_2 storage
- Double the amount of H_2 per truck when compared to bundles of bottles
- Reduction of H_2 generation and storage costs *(See Figure - 4)*

Figure 3: Comparison of Power to Power Efficiency of H_2 storage systems (Electrolyzer - Storage - Re-electrification)

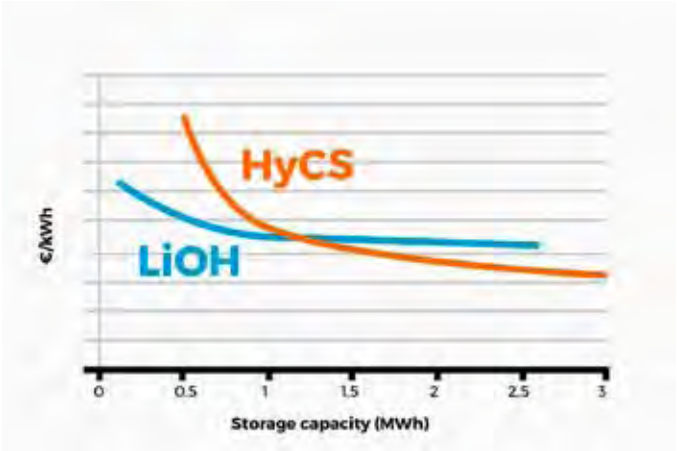

Figure 5: Comparison between Storage Capacity vs Price for HyCS and LiOH technology

5. Lower CAPEX

For larger storage systems, HyCS® already offers cost advantages. Due to the currently high costs of the reversible SOFC, HyCS® storage units are currently more expensive than electric batteries with a storage capacity of <1 MWhel. HyCS® storage systems will be competitive by the help of investment subsidies, in the medium term they will be by raising cost-cutting potentials *(See Figure - 5).*

Applications for HyCS® Technology

H_2 Transport – Economically Viable and Over Long Distances

i) Decentralised Transportation

With HyCS® technology, energy can be supplied from wind farms and solar plants to, for example, a H_2-filling station. The transport of H_2 from decentralised producers to decentralised users represents the next level of scaling up of the technology. The modular transport units (100 litres/250 kWh), can be scaled up without major technical adjustments to the connected systems.

The HyCS® solution enables transportation companies or fuel suppliers to transport at least twice as much H_2 on a truck as with conventional pressure vessels. This leads to a significant reduction in transport costs. Although the market for

Figure 4: Comparison of Transport costs for different H_2 storage technologies

decentralised H_2 transport is currently limited, it is projected to grow significantly over the coming years with the adoption of H_2 Fuel Cell Vehicles (FCV) and the Indian Government's vision to make India a leading producer and consumer of Hydrogen.

ii) Long Distance Transportation

Additionally, the HyCS® technology is very well suited for long distance transportation of H_2 using ships due to the compact containerized storage solution and can make India a leading exporter of Hydrogen.

This technology is far superior to conventional methods. Compared to today's liquid hydrogen transporters, the HyCS® technology can transport about four times as much H_2 in a ship of the same size.

In addition, the water required for H_2 production can remain at the production site and be reused. This is an enormous advantage, especially for H_2 generation from solar energy in sunny and mostly dry locations.

Storage of H_2 from Renewable Energy Sources

The HyCS® technology is suitable for short-term and long-term storage of H_2 produced from electrolyzers using renewable energy sources such as wind and solar energy. Due to the intermittent nature of these energy sources, the H_2 produced from the electrolyzers can be stored during the peak hours and utilised during off-peak hours with periods of high demand e.g. in evenings when there is no availability of solar power. Also it can be used for intermediate storage of H_2 during the production of hydrogen based fuels such as ammonia, methanol or any other PtX application based on the requirement.

Decentralised Energy Storage – Long and Safe

The 100-litre unit also offers interesting applications for decentralised energy storage. To store a comparable amount of energy in an electric Li-ion battery, five to ten times the volume is required i.e. up to 1,000 litres. HyCS® technology is of interest for medium-sized applications, e.g. customers with PV systems >500 kW or wind turbines >250 kW and power consumption >500 MWh/a.

SG 3.4-145, our next -generation turbine

Delivering India's positive energy with SG 3.4-145, our next -generation turbine. India's journey to become a sustainable nation is powered by a billion aspirations. We're proud to play a part in empowering India with clean and renewable energy, at affordable costs. Standing tall on a new 3MW platform, the SG 3.4-145 is a key milestone in India's clean energy story. This turbine delivers a remarkable 48% more

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annual generation than its predecessor, in Indian low-wind conditions. Backed by smart monitoring system and optimized for all-weather conditions, the SG 3.4-145 is the right fit for the Indian market, delivering high profitability and reduced LCoE. The perfect turbine made for India, made in India. The SG 3.4-145 is indeed geared up to deliver India's positive energy.

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RENEWABLE ENERGY

Operating Heavy Duty Vehicles, Ships and Trains with H_2

The HyCS® technology is characterised by its compactness. This property is particularly advantageous for use in mobility, where the moved volume is primarily required for the payload. Fields of application are seen here in road transport in the field of heavy duty transport and in commercial vehicles in the inner city area (by sweepers, waste disposal) as well as in buses.

Competitive advantages also arise in ship and train operations, in particular when switching from diesel engines to alternative power trains. The special advantage of the HyCS® technology is that using combustion engines leads to high efficiency. Engines are currently far more robust and technically approved than fuel cells, and they are well known to all actors in the value chain including service and maintenance.

Key Advantages of HyCS® Storage technology

- Compact storage solution
- High process efficiency and overall high system efficiency
- Long term storage solution with high cycle life
- High safety and reliability
- Quick Loading and Unloading rates
- Use of sustainable and widely available materials (Iron)
- Standard 20-feet container solution can be transported using available methods.
- Can be used for small to large scale applications.
- Suitable for use in multiple sectors such as industry, mobility, heating or chemical feedstock
- Production of water/steam during loading especially useful for areas with low availability of water (dry regions) for electrolysis
- Robust design with limited tolerance to impurities, trace elements and water content during Loading process
- Loading at standard pressure and temperature increases overall system efficiency

The India Focus: AMBARtec was founded by Mr. Matthias Rudloff (CEO and Founder) together with the CTO Mr. Uwe Pahl and a business angel in Dresden, Germany with a vision to solve the storage and transportation challenges in the Hydrogen eco-system. The company has a partnership with VoltAsset Ventures Private Limited, a leading renewable energy company in India with a focus on Hydrogen. The products will be manufactured in India to promote Government of India's (GoI) vision of Make-in-India and offer local support to customers for their project requirements.

Government Revamps Auction Norms, Bans Reverse Bidding For Wind Energy Projects

The Government of India has revised the auction process for wind energy projects and set a target to invite bids for 8 GW of projects each year till 2030. The new norms will put in place a clear path for companies to bid for wind energy projects in India, the ministry said. The Centre has also disallowed reverse bidding for such projects in the future. A formal procedure has been put in place to pool all the bids to ensure that capacity addition is done across all eight windy states in the country, instead of just two. The move comes at a time when wind energy installations have slowed down in the country, even though the government has a target of setting up wind energy projects totalling 140 GW by 2030. Against this target, India has an installed capacity of about 40 GW of wind projects, data from the ministry of new and renewable energy showed.

"Bids for a cumulative capacity of about 8 GW will be issued each year from January 1, 2023 to 2030. In order to ensure that wind energy capacity comes up in all eight windy states, every bid will be a composite bid-comprising state-specific sub-bids for each state. The power generated from the capacity established in each of the state sub-bids will be pooled and offered at pooled tariff to all procurers. The pooling of tariff will be as per the notified Electricity (Amendment) Rules, 2022," the MNRE said in a statement. A detailed breakup of this capacity shall be issued the by Solar Energy Corporation of India (SECI). Also, necessary amendments in the 'Guidelines for Tariff Based Competitive Bidding Process for Procurement of power from grid connected wind power projects' for this purpose will be notified separately by ministry.

"The bids will specify the capacity to be installed. One sub-bid will be specific to one state. The cumulative size cap in any one of the eight states in one year will not be more than 2 GW every year. SECI / implementing agency may determine the minimum and maximum bid size based on the wind purchase obligation targets of states," it said.

In July 2022, the power ministry released its long-term growth trajectory of renewable purchase obligation (RPO) and energy storage obligation till financial year 2029-30. For 2022-23, the government has mandated that 24.61 percent of the total energy consumed in a discom's area will have to be from renewable sources. The RPO, for the first time, includes a mix of 0.81 percent wind power, making it mandatory for discoms to purchase wind energy. Earlier, wind power used to be included in the 'others' category, which made it optional for discoms to buy it. Other RPOs include 0.35 percent from hydropower and the remaining 23.44 percent from other renewable sources.

Source: Money Control.com, 12 January 2023

Pre-feasibility Assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi

Alp Günsever
Head of Secretariat,
Centre of Excellence for Offshore Wind and Renewable Energy, New Delhi

This report was jointly prepared by the Danish Energy Agency (DEA) and the Technical University of Denmark (DTU) and the National Institute Wind Energy (NIWE). The report is part of the Centre of Excellence for Offshore Wind and Renewable Energy under the India-Denmark Energy Partnership and the Green Strategic Partnership between India and Denmark. This report summarizes the main activities and findings related to the support provided for the pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi.

NIWE and DTU prepared and conducted a stakeholder analysis for the Dhanuskodi Test Centre and reached out to the users and beneficiaries of the test centre (the wind industry), but so far not to the local communities whose interests may be affected by the establishment of the test centre.

Therefore, the stakeholders of the Offshore Wind Test cum Research Centre are so far limited to the following customers, to whom the centre adds value:

- Wind turbine manufacturers (OEMs) that need to test prototypes at an Indian test site according to international test standards – domestic as well as international.
- Developers that want to test their preferred/acquired wind turbine at an Indian test site before installation.
- Wind turbine component manufacturers that want to test a specific component (e.g. blades) on a wind turbine.

Inputs and Recommendations

Based on background information and discussions between NIWE, DEA and DTU, impressions from DTU and DEA from the site visit to Dhanuskodi and stakeholder interaction can be summarized to the following:

- NIWE had developed a detailed Project Report for a commercial 20 MW wind farm at the Dhanuskodi site, called the "Greening of Rameswaram" project. It will consist of two commercial wind turbines (each 8MW+) and a solar plant (1MW). The aim is to kick start the national test center by installing the 20MW wind farm and parallel to that start preparing the test center with two test pads with the capacity of 20MW each.
- Contrary to Østerild Test Centre, the Dhanuskodi test centre foresees to use monopiles as foundation for the test pads due to land constraints.
- A power evacuation analysis was made by NIWE in 2022 for a 20MW wind farm at Dhanuskodi. The project is planned in two phases: Phase 1 consisting of the two commercial wind turbines (each 8MW+) and 1MW solar plant, and Phase 2 consisting of two test pads (each 20MW).
- NIWE will conduct a HTL/LTL (high tide level / low tide level) demarcation study for the Dhanuskodi site according to the Coastal Regulation Zone (CRZ). The project lay out will be superimposed on the CRZ Map (1km x 1km) on the 1:4000 scale and CRZ Map (7km x 7km) on the 1:25000 scale indicating HTL and LTL with ecological features.
- The centre is expected to have multiple uses. It will be a demonstration site, which will allow NIWE to gain the necessary competences to be used also for the test centre. It will also be an educational and learning centre where the next generation of engineers can be trained. It will visible to the general public and people visiting the pilgrimage site at the end of the peninsula and may influence the public acceptance of wind power.
- The Detailed Project Report for the proposed 20MW wind farm at Dhanuskodi site will be finalized before the end of fourth quarter of Financial Year 2022-23 and used in the further process to attract funding to the project, e.g. the

storage part from agencies like the World Bank's Energy Storage Programme.

Based on these impressions and inputs, the DEA and DTU recommendations can be summarized to the following:

- **It is challenging to envision the size of the future wind turbines and thereby also the dimension of the test site. Therefore, it is important to design the test site for the future:**
  - Design for scalability and adaption to be made for the future. The technology development is fast and the test centre should be designed in a way so that it can be upgraded or adapted to accommodate new wind turbine proto-types.
  - Take the necessary precautions regarding access to the test site, both in terms of commercial confidentiality and requests for restrictions, safety issues espe-cially during installation and radar control of overflying air-planes.
  - Consider carefully the implications of the co-location with the pilgrimage site, both during installation time but also in operation. There may be both pros and cons. Pros as being highly visible to the general public and cons in terms of disturbing a holy site.

- **Develop a sound business model**
  - Build on the good momentum of the stakeholder interactions and workshop to deepen the value proposition to the different customer groups, including further stakeholder interviews and consultations.
  - Create a business model where the roles and responsibilities allows NIWE to provide test services to the industry while also create the societal benefit of providing large wind turbines to the Indian market.
  - Plan a robust economic model for the test services to the industry, including stable and secured cash out- and inflows.
  - From the very beginning, make a robust and convincing plan for data management that takes notice of IPR and the request for academic publishing, all of which are important to gain the necessary trust from industry.
  - In case of an accident at the test centre, explore carefully what the insurance company cover and what not.

- **Prepare a detailed project description document for the design and construction of the test centre, making use of the synergies and learnings from the demonstration project. It should include:**
  - Detailed technical description and lay out plan
  - A solid Environmental, Social and Governance (ESG) assessment of the centre, making sure that the centre safeguards the environment, meets social criteria regarding relationships with employees, suppliers, customers and the communities where it operates, and that the Governance structure deals with the leader-ship, audits, internal controls and shareholder rights.
  - Detailed activity plan and timeline, including a set of measurable KPIs
  - A detailed budget for preparation and construction of the test centre.
  - An accountable, market-oriented governance model, which accommodates the viewpoints of the industry (group of the most influential industrial stakeholders) while meeting governmental obligations.

Next Steps in the Project Development for Dhanuskodi (NIWE)

1. Formulation of a detailed project description plan that includes a detailed time line, activity list, and KPIs
2. Formulation of the detailed layout plan for the Offshore Wind Test cum Research Centre at Dhanuskodi
3. Finding out efficacy of Test Centre at Dhanuskodi based on Wind resources available at the site.
4. Micro siting of the Offshore Wind Test cum Research Centre at Dhanuskodi.
5. Development of a Public-Private Partnership and business model for the Offshore Wind Test cum Research Centre at Dhanuskodi.

Following the completion of the support to the pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi, it has been agreed between NIWE, DEA and DTU that further support will be provided with a specific focus on inputs for the drafting of a detailed project description for the Dhanuskodi Test Centre. This will have three main focus areas:

1. To support NIWE's development of a detailed project description plan for the development of the Offshore Wind Test cum Research Centre at Dhanuskodi.
2. Support NIWE in the development of a Public-Private Partnership and business model for the Offshore Wind Test cum Research Centre at Dhanuskodi.
3. To share experiences from the layout plan of Østerild Test Centre and assist NIWE in the micro siting of the Dhanuskodi site based on Danish experiences.

The support and joint work will be continued under the framework of the joint Centre of Excellence for Offshore Wind and Renewable Energy between India and Denmark.

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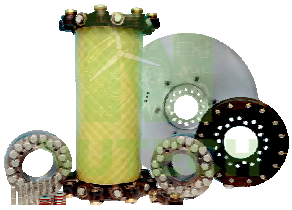

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Electricity (Amendment) Rules, 2022

Under section 176 of the Electricity Act, 2003 (36 of 2003), the Central Government notified the rules, further to amend the Electricity Rules, 2005. These rules may be called the Electricity (Amendment) Rules, 2022.
https://powermin.gov.in/sites/default/files/webform/notices/Electricity_Amendment_Rules_2022.pdf

Highlights

1. Renewable Energy Projects in Central Pool to Have Uniform Tariff for DISCOMs. There shall be a different central pool for each of the sectors of the renewable energy sources.
2. The Implementing Agency shall compute the uniform renewable energy tariff for selling of electricity to end procurer by intermediary procurer, on a monthly basis, as per the methodology specified in the Schedule I annexed to these Rules.
3. All the contractual obligations between power generators and intermediary procurer and intermediary procurer and end procurer including but not limited to liquidated damages, penalties, extension charges, dispute resolutions shall be governed by respective bidding document including Power Purchase Agreements, Power Sale Agreements and shall have no bearing on uniform renewable energy tariff.
4. The uniform renewable energy Tariff shall be applicable only to power procured by the end procurers and shall not in any manner have any implication on the renewable energy tariff discovered under the respective tariff based competitive bidding process and payable to renewable energy generators by the intermediary procurer as per the Power Purchase Agreement.
5. Provided that intermediary procurer may sell any power not purchased by distribution licensees, to open access consumers in a transparent manner at a price not less than uniform renewable energy tariff and any gain from such a sale over and above uniform renewable energy tariff shall be adjusted in the uniform renewable energy tariff for distribution licensees. Procurers under section 63 of the Act and as per provisions of bidding guidelines notified by the Government from time to time and adopted tariff of one category of renewable energy power shall be part of the respective category of the central pool.
6. The uniform renewable energy tariff under these rules shall be applicable only to the renewable energy generators for their contracted capacity which forms part of central pool under these rules.
7. The Energy Storage Systems shall be considered as a part of the powersystem, as defined under clause (50) of section 2 of the Act.

   The Energy Storage System shall be utilised either as independent energy storage system or network asset or in complementary with generation, transmission and distribution.

   The Energy Storage System shall be accorded status based on its application area i.e. generation, transmission and distribution.

Wind industry, which is slowing down as a result of low tariffs discovered in reverse auctions, may also benefit from the uniform tariff's catalytic effects.

CERC Notifies REC Regulations 2022 Effective Dates

Central Electricity Regulatory Commission (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation), 2022 were published in Part-III, Section 4, No. 272 of the Gazette of India Extraordinary on 24.05.2022. Whereas, the Clause (2) of Regulations 1 of the said regulations provides that the Regulations shall come into force from the such date as may be notified by the Commission in the Official Gazette. And, now, therefore, it is notified that the Central Electricity Regulatory Commission (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations, 2022 shall come into force with effect from 05.12.2022.

Time-Extension to Solar PV/Solar, PV-Wind Hybrid Power Projects Bid Out on or After 10.04.2021

MNRE's Renewable Energy Implementing Agencies (SECI/NTPC/NHPC) may extend the Scheduled Commissioning Date (SCD) till 31.03.2024 (and commensurately extend other associated intermediate milestones) of such Solar PV/Solar, PV-wind hybrid power projects wherein the last date of bid submission was on or after 10.04.2021 and whose SCD (including time-extensions already granted, if any) is before 31.03.2024, and who wish to avail such time-extension. This extension would not be available to those projects where the PPA has not been signed before 1st October 2022 as such projects would most likely be having their SCD beyond 31st March 2024.

Ministry of Law & Justice issues the Energy Conservation (Amendment) Act, 2022

The Energy Conservation Act, 2001 provides a framework for regulating energy consumption and promoting energy efficiency and energy conservation. The Act has set up the Bureau of Energy Efficiency to recommend regulations and standards for energy consumption.

1. The Bill amends the Energy Conservation Act, 2001 to empower the central government to specify a carbon credit trading scheme.
2. Designated consumers may be required to meet a proportion of their energy needs from non-fossil sources.
3. The Energy Conservation Code for buildings will also apply to office and residential buildings with a connected load of 100 kilowatt or above.
4. Energy consumption standards may be specified for vehicles and ships.

(Link) https://egazette.nic.in/WriteReadData/2022/241246.pdf

CERC Puts Cap of Rs 12/kWh on Normal Rate of Charges for Grid Deviations

CERC has declared that, up till further orders, the regular rate of charges for deviations for a time block as stipulated under the DSM Regulations, 2022, shall be subject to a maximum of Rs 12 per kWh. Central Electricity Regulatory Commission (Deviation Settlement Mechanism (DSM) and Related Matters) Regulations, 2022 were issued on 31.10.2022. These DSM Regulations said No Settlement For Wind and Solar Power Over Injection. These regulations seek to ensure, through a commercial mechanism that users of the grid do not deviate from and adhere to their schedule of drawl and injection of electricity in the interest of security and stability of the grid. Now CERC has declared that "Deviation Settlement Mechanism and Related Matters Regulations, 2022 shall come into force with effect from 05.12.2022".

Tamil Nadu Government Issues Micro Siting Notification for WTGs

Tamil Nadu Government has issued notification for micro siting on 2nd January 2023 as follows:

The minimum distance to be maintained between the Wind Electricity Generators (WEG) and public roads/railway tracks/highways/ High Voltage electric lines/building/Public Institutions shall be the height of the tower/hub height (in metre) + half the diameter of the blade/rotor (in metre) + 5 meters. WEG shall not be erected within 500 metre from any dwelling unit. The plan showing the micro siting of WEG within a site and their specifications regarding development, installation, erection and operation shall be certified by Tamil Nadu Generation and Distribution Corporation Limited.

This is in line with the Guidelines issued by MNRE.

Amendment to the Green Open Access Rules

Ministry of Power has issued an amendment to the Green Open Access Rules (GOAR) released last year in June 2022. The amendments provide further clarity to some points which were not explicitly discussed in the initial release and also add a few more inclusions. The overall summary of the changes includes:

1. Banking credit period linked to banking cycles rather than being defined as one month
2. Excess energy not utilized in the banking cycle to be compensated in form of Renewable Energy Certificate to the generator.
3. The OA charges now mentions banking charges and also includes other charges like SLDC fees, etc.
4. Waiver of CSS and AS is made applicable only for Waste to Energy produced from non-fossil fuel sources.
5. Waiver on additional subsidy extended to offshore wind projects commissioned before Dec 2025.
6. Standby charges information window is now linked to DAM closure timing
7. Standby charges upward ceiling increased from 10% to 25% on applicable tariff openaccess.

CERC Issues Draft Notification for GNA to ISTC

Central Electricity Regulatory Commission has issued Draft Notification No. L-1/261/2021/CERC Dated: 27 January 2023 to amend the Central Electricity Regulatory Commission (Connectivity and General Network Access to the inter-State Transmission System) Regulations, 2022.

KERC Issued Draft Discussion Paper for Determination of Generic Tariff for Wind Power Projects

Karnataka Electricity Regulatory Commission has issued the discussion paper for Determination of Generic Tariff for Wind Power projects for the period from FY 2023-24 to 2025-26 giving various parameters for fixation of the tariff.

CERC Adopts Peak and Off Peak Tariff for 1200 MW ISTS Connected RE Project with Assured Peak Power Supply

CERC has adopted peak and off peak tariff for 1200 MW ISTS connected RE Project with assured peak power supply as follows:

S.No.	Bidder	Project Company	Off Peak Power Tariff (INR/kWh)	Peak Power Tariff (INR/kWh)	Awarded Capacity (MW)
1	Greenko Energies Private Limited	Greenko AP01 IREP Private Limited	2.88	6.12	900
2	ReNew Solar Power Private Limited	Renew Surya Ojas Private Limited	2.88	6.85	300
	Total				**1200**

*Contributed by: **O.P. Taneja**, Renewable Energy Consultant*

Parliament Passes Energy Conservation (Amendment) Bill

The Rajya Sabha passed the Energy Conservation (Amendment) Bill on 12th December 2022 with the aim to mandate non-fossil sources of energy and establish a domestic carbon market in India. The Minister of Power and New & Renewable Energy has said that we are relentlessly marching ahead towards our target of reducing India's carbon intensity by 45% by 2030.

Renewable Energy Jobs on the Rise

The number of jobs in renewable energy grew by around 700,000 globally between 2020 and 2021. In 2021, global renewable energy jobs reached 12.7 million in a trend that's set to continue. Solar power currently provides around a third of the total jobs, the highest number of renewable energy jobs, at 4.3 million. The majority of green energy jobs come from China, around 42 percent, while the EU and Brazil both hold 10 percent of the world's renewable energy jobs, and the USA and India each hold 7 percent. A significant proportion of renewable energy jobs were in construction, installation and operations and maintenance (O&M).

Source: Oilprice.com, 2 January 2023

MSEDCL invites RFS for 300MW of wind Power

The Maharashtra State Electricity Distribution Company Limited (MSEDCL) has invited RFS (request for selection) for procurement of 300 MW of wind power on a long-term basis through a competitive bidding process from inter-state wind power projects. The last date for submitting the (online) bid is January 06, 2023, till 4 pm and the bid will be opened on the same day. The successful bidder and MSEDCL will enter into a power purchase agreement (PPA) for 12 years beginning on the PPA execution date.

India Plans $2 Billion Incentive for Green Hydrogen Industry

Indian Government plans to invest US$ 96 billion (Rs. 8 trillion) in green hydrogen and its derivative green ammonia by 2030. Moreover, the government is planning a US$ 2.2 billion (Rs 180 billion) incentive in the upcoming budget that aims to reduce the production cost of green hydrogen by a fifth, over the next five years. The current cost of green hydrogen in India is Rs. 300 to TRs. 400 per kg. The incentive provided by the government is expected to be US$ 0.60 (Rs 50) per kg for 3 years.

Source: Solar Quarter.com, 2nd January 2023

SC to examine if Tariff Determined under PPA can be revised

The Supreme Court has sought the response of Tata Power to an appeal filed against the Andhra Pradesh High Court order which held that tariff determined under long-term Power Purchase Agreement (PPA) cannot be revised by a State Electricity Regulatory Commission. A bench has issued notice to Tata Power Renewable Energy Limited on the appeal filed by Andhra Pradesh Southern Power Distribution Company Limited returnable on February 10, 2023. The power distribution company has in its plea filed has said that the finding of the high court is ex facie (on the face of it) contrary to the specific provisions of the Electricity Act. "The High Court has erred in not appreciating that a PPA is not a contract simpliciter as envisaged under the Indian Contract Act, 1872 but is a regulated contract under the Electricity Act," it said. The high court in its order dated March 15, 2022 held that under no circumstances can the tariff mentioned in a PPA be amended/ revised subsequently by the Commission.

Source: PTI, 14 December 2022

India Needs a Doubling of Installs to Deliver on PM Modi's 450 GW By 2030 Ambition

India installed a record 15 GW of new renewable energy capacity in 2021/22, giving visibility to Prime Minister Shri Narendra Modi's ambitious vision of 450GW by 2030. This would require a new investment in firmed renewables and grid transmission capacity of US$500bn. It would also dramatically improve India's domestic energy security, delivering a near doubling of capacity whilst also reducing reliance on expensive fossil fuel imports. While new renewable energy proposals have lifted in recent months, a lot more effort is required. If it is to deliver on PM Modi's ambition, SECI needs to revert to the hugely successful tendering drive it was delivering before Covid-19 struck.

Source: ET Energy World, 15 December 2022.

Senvion India Wins 102.6 MW Firm Order from Tata Power

Senvion has been awarded a 102.6 MW project to deliver its high-quality Wind Turbines for Tata Power Saurya Limited (TPSL), a subsidiary of Tata Power Renewable Energy Limited. TPSL has recently won a 300 MW Wind Solar Hybrid project to supply power to Maharashtra State Electricity Distribution Company Ltd. (MSEDCL). The project comprising of 38 numbers of Senvion's State-of-the-art 2.7 MW turbines will be developed in Koral, Maharashtra.

Source: Wind Insider, December 23, 2022

GWEC releases TN Wind Energy Roadmap

Global Wind Energy Council (GWEC) has released Tamil Nadu Wind Energy Roadmap on 9th December 2022. Tamil Nadu's renewable energy resources can deliver both clean energy and clean industry to the state and give it a pivotal role in Asia's clean energy transition, according to a new roadmap released by GWEC.

Powergrid to Invest Rs 330.61 Crore to Evacuate 20 GW Renewable Energy

Power Grid Corporation of India has approved a proposal worth Rs.330.61 Crores to construct a transmission system to evacuate power from Rajasthan's REZ (20GW) under Phase III Part J.

Source: Business Standard, 19th December 2022

India to Build New Transmission Lines with Rs 2.4 Lakh Crore for Upcoming 2030 Target of 500 GW Renewable Energy Capacity

Union Minister for Power and New and Renewable Energy Shri R.K. Singh has launched the plan 'Transmission System for Integration of over 500 GW of renewable energy Capacity by 2030.' This plan was prepared by a high-level committee constituted by the Ministry of Power. The planned additional transmission systems will be built at an estimated cost of Rs 2.44 lakh crore. The plan also includes installation of Battery Energy Storage Capacity of 51,500 M. It also plans for transmission system required for evacuation of 10,000 MW off-shore wind projects in Gujarat and Tamil Nadu.

Source: Swarajyamag.com, 8 December 2022

Recent Advances in Blade Design for Offshore Wind Turbines

Dr. Raj Shah
Director, Koehler Instrument Company, NY, Adjunct Full Professor, Department of Material science and Chemical Engineering, State University of New York, Stony Brook, New York

Prof. Marjaneh Issapour
CEO National Wind Services Company and Professor of Electrical and Computer Engineering Technology at Farmingdale State College

Yunfan Lu
Chemical Engineering Student, Stony Brook University

Abstract

Wind power generation is a growing technology of generating electricity from renewable energy sources. With the progress of technology, the technology of wind power generation has tended to be mature and has been put into large-scale application. Onshore wind energy generation capacity is limited. Considering the economic benefits, they must be built in those areas which are wide and have satisfactory wind conditions. With the tremendous development speed of wind power generation, the places where onshore wind farms can be built become fewer and fewer. Therefore, developing offshore wind power generation is the main direction. However, compared with the onshore wind farm, offshore windfarm has more challenges that need to overcome a worse working environment, higher blades fatigue load, and more difficulty to assemble and repair. Focus on designing and using advanced blades is undoubtedly an entry point to overcome such problems. The study on how to improve blade design has kept going for decades and many achievements have been done. Researchers provide several effective ways to analyze new designs' performance and the development in materials and dynamic study also show us the study on wind blades is still open. This paper will provide a brief summary of the recent research in blade design. Including how mathematical methods help engineers build blade models in more effective ways[4,5,6]; how improvement in automatic control systems that connect to blades protect offshore monopile wind turbines[7]; and the potentiality of advanced material science8 and Aerodynamics[9] in offshore wind blades design field.

...oceans have much better wind conditions and will not influence the living environment. However, ...blades used in offshore wind turbine faces a higher fatigue load and need to take care of more serious corrosion problems.

The Study

Reducing greenhouse gas emissions and creating an environmentally friendly society is undoubtedly an important direction of global development in recent years. Among the sources of greenhouse gases, coal-fired power generation generates the largest share of emissions. Globally, carbon dioxide emissions from power generation and heating account for 31 percent of all greenhouse gas emissions. At the same time, sulfur dioxide produced by burning fossil fuels also causes a serious problem for the environment. At the end of the last century, developed countries realized the harm of environmental pollution and the shortage of fossil energy and started to develop renewable energy. How to use renewable sources such as solar energy, wind energy, water potential energy, and other natural and convenient energy to generate electricity has become a popular topic of research. Among these new power generation methods, wind power generation has the greatest potential for large-scale deployment. In addition, it has

the advantages of low cost, low impact on the environment, and many economic development benefits. Since 2016, wind power generation has been the fifth-largest source of electricity and the second-largest renewable source after hydropower. In 2021, about 6% of electricity is generated from wind energy[2].

Wind Blowing Towards Offshore

However, the locations which can be utilized for onshore wind energy generation are limited. Generally speaking, only those places where the annual average wind speed is at least 9 mph are good to build wind farms3. Meanwhile, the land price, wild animals, and wind power stability should also be considered. This means that onshore wind farms can only be built in certain places and it restricts wind power generation development. Because of this, more and more countries focus more on offshore wind farms which have much larger developing spaces. Compared to the land, oceans have much better wind conditions and will not influence the living environment. However, building offshore wind farms is also more challenging. The blades used in offshore wind turbine faces a higher fatigue load and need to take care of more serious corrosion problems. For the further development of wind power generation and make more progress in offshore wind farms.

Offshore Wind Blades: Challenges

Since the maintenance of offshore wind blades is difficult and may cost a lot to repair, simulation models must be introduced into the design process. M. Tarfaoui[4] and his group indicated that the direction of improving wind turbines should be focused on aerodynamic design and structural design in their article. In this paper, they also point out that the design of blades should base on the proper use of mathematical and modeling tools - the optimal configuration of blade structures shall be determined by parametric studies using finite element methods. By the blade models built by ABAQUS, an implicit solver software, designers can acknowledge the mechanical behavior of the structures and localize the susceptible sections to reinforcement. (Figure 1) Compared with the traditional physical model, the virtual model which is based on finite element analysis can simulate offshore wind turbines' working environment in more detail and provide a more meticulous solution with high precision. M. Tarfaoui and his group's work explain the contribution mathematics methods can make in wind turbine design and it shall be also a cornerstone of design.

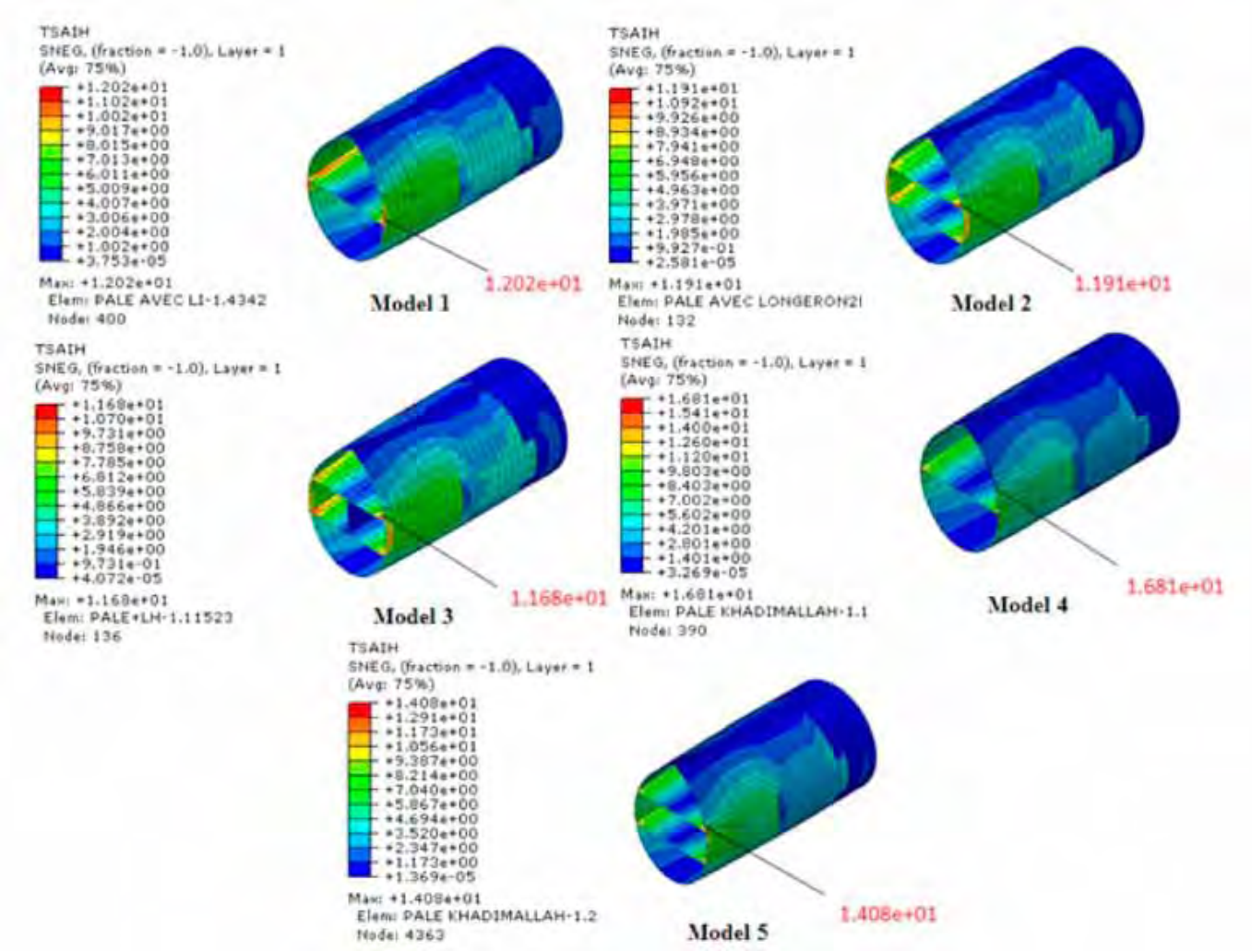

Figure 1: The Damage Analysis of Wind Turbine by Finite Element Method[5]

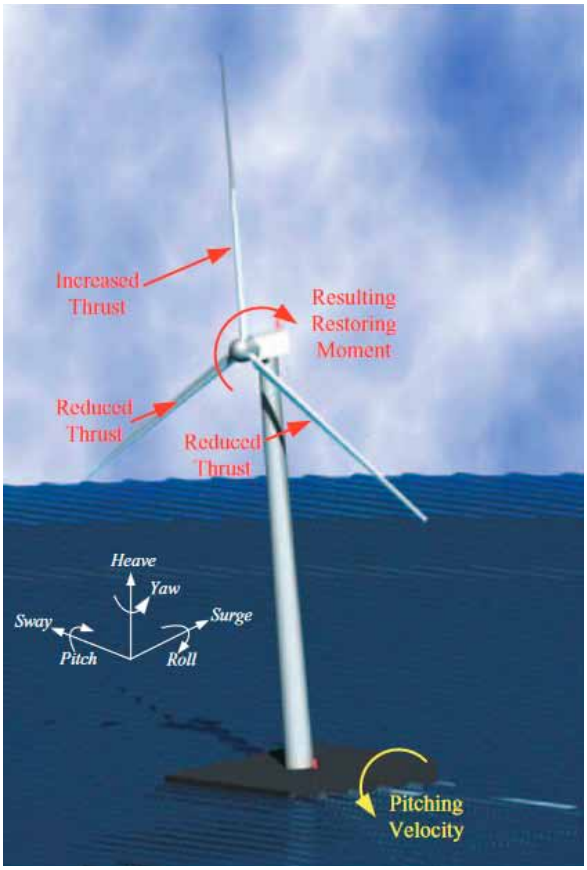

Figure 2: The Floating Wind Turbines with Individual Blades Control[7]

Blade Design and Performance

Besides using the virtual model to improve designs step by step, using formulas to determine the best theoretical model is also a method to design blades. Jing Li6 and his group pay attention to how different rotating speeds and blades length influence the centrifugal stiffening effect and improve offshore wind turbine efficiency. They used the Rayleigh Energy Method (REM) to derive a fundamental frequency correction formula based on the rotating speed and the blade lengths. The error between the formula calculation result and the theoretical result is only 0.5%. This formula provides the possibility to find out the best blade length to the corresponding rotate speed before building models. Designers can also use the formula to decide the length of the blades that can fit the wind conditions best to reach a higher efficiency.

After discussing the recent methods that can help designers optimize their blades in wind turbine structures, an introduction of researchers' methods of improving offshore wind turbines' performance with advanced blades in micro view is in order. Floating offshore wind turbines is another important technology that is becoming more mainstream. It allows us to build wind farms at larger distances from the coast compared to monopile traditional technology. However, floating type of wind turbine has very low stability since they are held by ocean buoyancy. The sway caused by waves and extremely strong wind will significantly influence their performance and efficiency and even may cause equipment damage. H. Namik7 and his fellows pointed out that this problem can be mitigated by using the individual blade pitch control. As figure 2 shows, this kind of floating wind turbine can adjust each of its blades at different angles to resist the pitching in all directions. Compared with the single symmetric loads created by collective blades, the additional asymmetric aerodynamic loads which are created by individual blade pitching can increase the platform restoring moments more effectively. According to this article, the test in high-fidelity non-linear turbine mode shows that the individual blade pitch controller can reduce power fluctuations, platform rolling rate, and platform pitching rate by 44%, 39%, and 43%, and the tower side-side fatigue loads were reduced by 39%, relative to a traditional baseline controller. This will effectively extend the turbine and platform service life.

The development of material science also energizes offshore wind turbines' improvement, especially in blades. Nanomaterials have the advantages of outstanding mechanical properties, high corrosion resistance, and various characterizations; this leads it to be an ideal material that can apply for advanced offshore wind turbine design. Y. El Assami and his fellows focus on one common defect of existing offshore wind blades – sudden separation and try to prevent it by using nanomaterials in wind blade design. They focus on the joint part and suggest a two-step strategy concept: first strengthening the bond joints with carbon nanotubes (CNTs), which is followed by stitching of the two

Figure 3: Comparison of spiroid wing-leg (a) and baseline (b)[9]

bonded joints with a composite cord8. In this way, they expect the CNTs will increase the joints' stiffness and delamination strength for composites by numerical study.

Stand out from the traditional dynamic models to design is also a very powerful way to improve the wind blades. Using spiroid wing legs instead of the traditional blade tip, the baseline is a popular new design method that is talked about a lot in recent years. (Figure 3) The use of spiroid wing-leg has been proven effective to improve turbine efficiency generally by several articles[9].

B Fathi9 did research to discuss how spiroid wing-leg tip design influences NREL 5 offshore wind turbine performance by using OPEN-FOAM. In his research, he found out the spiroid winglet can increase distributed axial force, section torque, and vorticity in the lateral direction, especially after rated power. This leads to a significant improvement in power and blade performance. However, he also noted that the spiroid wing leg

makes no contribution to increasing the vorticity in the radial direction which means it is not very helpful to control the tip effect. He also pointed out the research on spiroid winglets can be further developed and it will give a positive influence on the improvement of wind turbines.

Conclusion

Developing wind power generation is an indispensable part of building an environmentally friendly society that preserves the nation's energy security. Developing offshore wind power is also the only way to expand the scale of using wind power. However, compared with onshore wind generation, the development of offshore wind farms also faces many difficulties. Research on wind blades, one of the most important parts of a wind turbine, has also never stopped. In recent years, based on various mathematical methods, the design ideas of wind blades of offshore generators are becoming mature. The development of material technology also provides more possibilities for wind blade design. A variety of novel design ideas have also proved that there is still a lot of room for growth in wind blades. Predictably, research into wind blades will also further boost offshore wind power in the future.

References

1. United States Environmental Protection Agency, Wind Turbines - Renewable Energy Fact Sheet
2. Victoria Masterson (2022), 'Wind and solar generated 10% of global electricity in 2021 – a world first' climate champions
3. U.S. Energy Information Administration. 'Wind explained where wind power is harnessed'
4, 5. Tarfaoui, M., Shah, O. R., and Nachtane, M. (January 18, 2019). "Design and Optimization of Composite Offshore Wind Turbine Blades." ASME. J. Energy Resour. Technol. May 2019; 141(5): 051204. https://doi.org/10.1115/1.4042414
6. Li, Jing, Jianyun Chen, and Xiaobo Chen. "Dynamic characteristics analysis of the offshore wind turbine blades." Journal of Marine Science and Application 10.1 (2011): 82-87.
7. S. Sarkar, B. Fitzgerald, and B. Basu, "Individual Blade Pitch Control of Floating Offshore Wind Turbines for Load Mitigation and Power Regulation," in IEEE Transactions on Control Systems Technology, vol. 29, no. 1, pp. 305-315, Jan. 2021, doi: 10.1109/TCST.2020.2975148.
8. Y. El Assami, M. Drissi Habti & V. Raman (2020) Stiffening offshore composite wind-blades bonding joints by carbon nanotubes reinforced resin – a new concept, Journal of Structural Integrity and Maintenance, 5:2, 87-103, DOI: 10.1080/24705314.2020.1729519
9. Fathi B. Applying Spiroid Winglet on The Tip of NREL 5 MW Offshore Wind Turbine's Blade to Investigate Vortex Effects. E3S web of conferences. 2020; 197:8004-. doi:10.1051/e3sconf/202019708004

SnipPets

RE Sector to Boom with Likely Investments of Over US$ 25 Billion in 2023

Mr. R K Singh, Union Minister for Power has told that in 2023, investments in the renewable energy sector could total around USD 25 billion. He added that India needs to add 25 GW of renewable energy capacity annually for the next eight years, which would cost an investment of Rs. 1,25,000 crore, or USD 15 to 16 billion, taking into account the requirement of Rs. 5 crore per MW of capacity addition.

Source: PTI, 22 December 2022

Power Ministry Seeks Comments from State Discoms, CEA On Draft National Electricity Policy

The Union power ministry has sought comments from state discoms and Central Electricity Authority (CEA) on the draft National Electricity Policy (NEP). The The NEP seeks to create a financially viable and environmentally sustainable power sector furthering energy security and providing reliable 24x7 power at a reasonable price. The new policy seeks to fulfil four objectives -- decarbonization and energy, transition, resilient and flexible grid, financial viability of the power sector and evolving a consumer-centric approach.

Source: ET Energy World, 27 January 2023

India Ranks in Top 7 Nations with Prospective Renewable Power

India ranks among the top seven countries in the world with the most prospective renewable power, according to a new analysis by San Francisco-based NGO Global Energy Monitor. The country also plans to add 76 GW of utility-scale solar and wind power by 2025, leading to savings of up to $19.5 billion a year. This build out can avoid the use of almost 78 million tonnes of coal annually, or roughly 32 GW in coal power plant capacity. Annual savings in India can skyrocket if the coal-to-clean switch matches the country's ambitions.

Source: TNN, 25 January 2023

Amazon Announces 300 MW Wind-Solar Hybrid Projects in India

Amazon India has announced its first wind-solar hybrid projects in India. The two projects with a capacity of 300 MW will be based in Madhya Pradesh and Karnataka, and once operational, will produce 1163 GW hours of clean power.

Source: Swarajyamag.com, 2 December 2022

MNRE Grants Time Extension up to March 2024 for Completion of Solar, Hybrid Projects

In a bid to provide relief to renewable energy players, the government has allowed the implementing agencies to extend the commissioning date of solar PV and solar PV-wind hybrid power projects till March 31, 2024, for which the bids were finalised before 9th March 2021.

Source: MNRE, 25 January 2023

Hexagon puts data to work to overcome challenges in renewable energy technology manufacturing, such as cost, durability and efficiency.

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Hexagon offers an unrivalled portfolio of end-to-end solutions, each focused on automating processes for more efficient manufacturing and more reliable, high-performance systems. Our technology accelerates progress towards a sustainable future for all. Find out more at **https://hexagon.com/industries/energy-power-generation**

Or write to naveen.chakradhar@hexagon.com

HEXAGON

Driving End to End Change -
Working on the Life Cycle of Wind Turbine Blades

Paul Spencer
Head of Materials: Technology & Innovation
Gurit (Asia Pacific) Limited, New Zealand

Working on the Life Cycle of Wind Turbine Blades

Truly addressing end-of-life concerns of composite structures requires the integration of many factors within the lifecycle of a component. The development of recyclable resin systems in isolation is not enough to provide an industry solution. To develop effective End of Life solutions, the material suppliers, blade producers, farm operators, maintenance contractors and decommissioning entities all need to work together. It's not something that one company or one part of the blade lifecycle can address alone.

Addressing end-of-life concerns is one of the key challenges facing the wind energy industry. Many solutions proposed to date repurpose the original component (for example, turning old wind turbine blades into bridge parts) or recycle the component to create low value materials that have limited reuse.

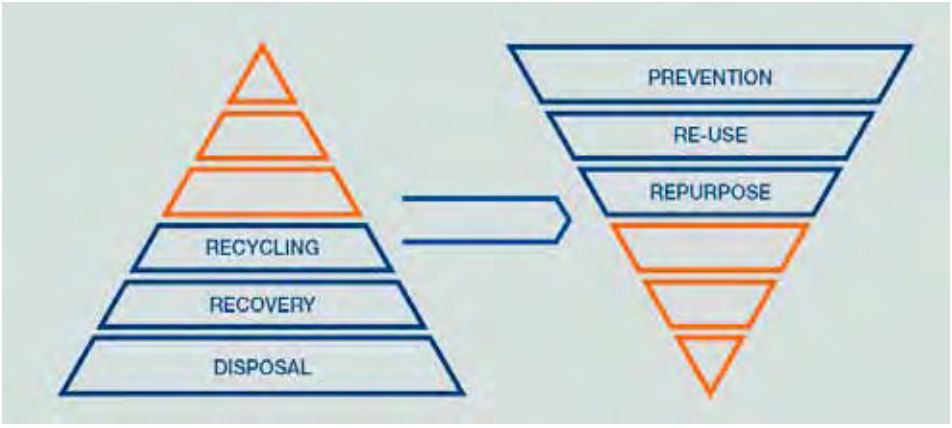
To address this issue comprehensively, a circular approach is required. This means not only looking at the finished product – for example, the blade or other component – at the end of its life but considering the end of life already early on at the design stage of both the materials and the blade. This relies on strong industry collaboration, data-driven decisions, and the development of standardised approaches to measuring the economic and environmental footprint of different solutions. From there, industry can adopt credible solutions that are truly sustainable for the future with two approaches; one, to address the end of life of current blades in service, and two, to adopt circularity for blades of the future.

Recyclable Turbines

Around 85% of a wind turbine is currently recyclable, specifically the foundation, tower and nacelle parts. The blades, however, are typically made from fibreglass reinforced plastic, for which there isn't yet an established recycling solution. The composites used in blade production need to be particularly durable to withstand harsh weather conditions over decades of use. But because of this, it is incredibly challenging to break the material down for recycling.

One solution is mechanical recycling: blades are broken down into smaller fragments using mechanical "shredders". However, the shredded material is of lower value and a suitable end-user stream for the material needs to be found to avoid committing to landfill.

Some research is being done into the use of thermoplastics in wind blades so that the materials could be reformed at end of life, or at least separated and reused in other applications.



But this approach is still only theoretical, as for fibre-reinforced materials, the energy required to reclaim the materials is very high.

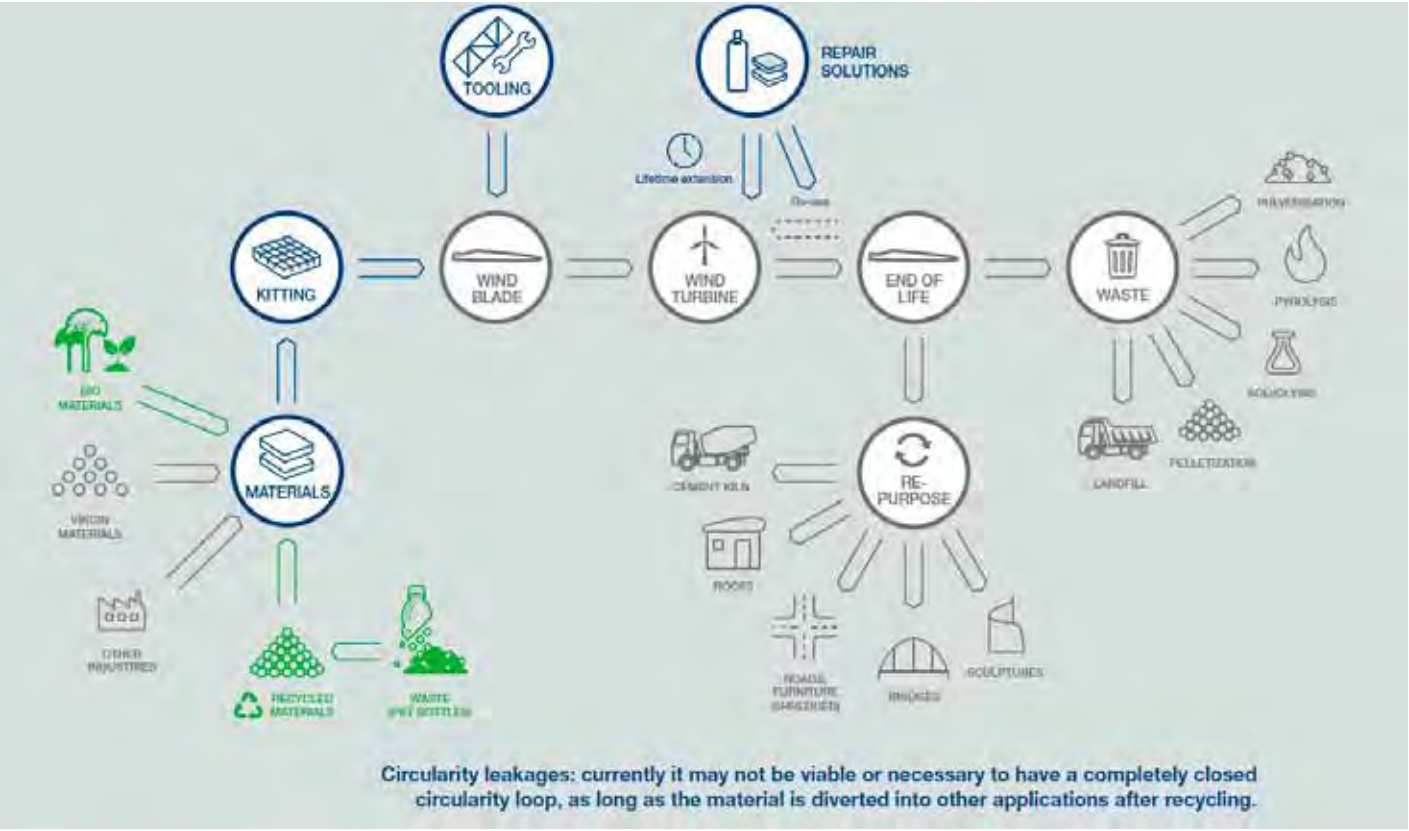
Approximately 2.5 million tonnes of composite materials are used annually in the global wind industry, and around 14,000 blades are reaching their end of life, which is currently around 50,000 tonnes of composite waste per year.

Designing smart materials which allow for easy separation and segregation of blade components into individual waste streams, and most importantly, only at the point of end of life, is integral into any blade recycling technology. It is of little benefit for example, to have an in-principle, recyclable glass fibre blade skin if the coating and adhesives it is connected to are either not recyclable themselves or require a different recycling process. This has been identified this as a key part of the problem to addressing end-of-life concerns.

- Second life: repurposing materials for shelters, bridges, coastal protection, noise barriers…
- Landfills

So what are the current options?

1. ***Reuse of the whole blade*** – they can be refurbished and transported to another farm, but this becomes logistically challenging as the blades increase in length.
2. ***Incineration*** – difficult due to the amount of fibreglass, which is not combustible.
3. ***Recycling*** – mechanically turning the composite materials into pellets or boards to be used in walls and flooring (companies like Global Fiberglass Solutions have made great headway with this).
4. ***Co-processing in the cement industry*** – this option reduces the consumption of some raw materials that would otherwise be needed to make the cement.
5. ***Chemical or thermal processing*** – various processes are being researched and trialled to separate the fibres and the resin so that one or both can be reused. Current drawbacks are economic and environmental cost.
6. ***Enzyme recycling*** – use of enzymes to convert plastics (mainly polyesters such as PET) back into base chemicals (low technological readiness however).
7. ***Fermentation*** of plastics into biofuels (low technological readiness).
8. ***Reuse sections*** of the blade in playgrounds, as outdoor seats or repurposing in civil engineering projects for structures such as pedestrian bridges, beams, towers co-processing to produce cement is currently the most viable commercial option.



End-of-Life Perspectives for Wind Turbine Blades

Limitations or Concerns with Present End-of-Life Methods

- Difficult to de-compose composites that have to last and perform for decades under very challenging climatic conditions
- Lack of proven and robust methods
- Energy-intensive processes
- What is the most sustainable solution?

Wind Turbines could help Capture Carbon Dioxide while Providing Power!

Wind turbines like these near a power plant can pull CO_2 into their wakes in order to send it to machines that capture the greenhouse gas in the battle against climate change, simulations and a scaled-down wind tunnel test suggest.

Wind turbines could offer a double whammy in the fight against climate change. Besides harnessing wind to generate clean energy, turbines may help to funnel carbon dioxide to systems that pull the greenhouse gas out of the air (SN: 8/10/21). Researchers say their simulations show that wind turbines can drag dirty air from above a city or a smokestack into the turbines' wakes. That boosts the amount of CO_2 that makes it to machines that can remove it from the atmosphere. The researchers plan to describe their simulations and a wind tunnel test of a scaled-down system at a meeting of the American Physical Society's Division of Fluid Dynamics in Indianapolis.

Most human-produced CO_2 is high in the air. Turbines could funnel it to the ground for removal

Addressing climate change will require dramatic reductions in the amount of carbon dioxide that humans put into the air — but that alone won't be enough (SN: 3/10/22). One part of the solution could be direct air capture systems that remove some CO_2 from the atmosphere (SN: 9/9/22).

But the large amounts of CO_2 produced by factories, power plants and cities are often concentrated at heights that put it out of reach of machinery on the ground that can remove it. "We're looking into the fluid dynamics benefits of utilizing the wake of the wind turbine to redirect higher concentrations" down to carbon capture systems, says mechanical engineer Clarice Nelson of Purdue University in West Lafayette, Ind.

As large, power-generating wind turbines rotate, they cause turbulence that pulls air down into the wakes behind them, says mechanical engineer Luciano Castillo, also of Purdue. It's an effect that can concentrate carbon dioxide enough to make capture feasible, particularly near large cities like Chicago.

"The beauty is that [around Chicago], you have one of the best wind resources in the region, so you can use the wind turbine to take some of the dirty air in the city and capture it," Castillo says. Wind turbines don't require the cooling that nuclear and fossil fuel plants need. "So not only are you producing clean energy," he says, "you are not using water."

Running the capture systems from energy produced by the wind turbines can also address the financial burden that often goes along with removing CO_2 from the air. "Even with tax credits and potentially selling the CO_2, there's a huge gap between the value that you can get from capturing it and the actual cost" that comes with powering capture with energy that comes from other sources, Nelson says. "Our method would be a no-cost added benefit" to wind turbine farms.

There are probably lots of factors that will impact CO_2 transport by real-world turbines, including the interactions the turbine wakes have with water, plants and the ground, says Nicholas Hamilton, a mechanical engineer at the National Renewable Energy Laboratory in Golden, Colo., who was not involved with the new studies. "I'm interested to see how this group scaled their experiment for wind tunnel investigation."

Citations

- C. Nelson. On carbon entrainment in the wind turbine wake. American Physical Society Division of Fluid Dynamics meeting, Indianapolis, November 21, 2022.
- A.E. Moser. Experimental study of CO_2 capture in a model wind turbine array. American Physical Society Division of Fluid Dynamics meeting, Indianapolis, November 21, 2022.

Courtesy: ***James R. Riordon****, Science News, 31 October 2022*

SnipPets

Cabinet Approves National Green Hydrogen Mission; to bring Rs 8 lakh Cr investments by 2030

The Union Cabinet, chaired by the Hon'ble Prime Minister Shri Narendra Modi, has approved National Green Hydrogen Mission. The initial outlay for the Mission will be Rs.19,744 crore, including an outlay of Rs.17,490 crore for the SIGHT programme, Rs.1,466 crore for pilot projects, Rs.400 crore for R&D, and Rs. 388 crore towards other Mission components. MNRE will formulate the scheme guidelines for implementation of the respective components. The Mission will result in the following likely outcomes by 2030: Development of green hydrogen production capacity of at least 5 MMT (Million Metric Tonne) per annum with an associated renewable energy capacity addition of about 125 GW in the country, Over Rs. Eight lakh crore in total investments, Creation of over Six lakh jobs, Cumulative reduction in fossil fuel imports over Rs. One lakh Crore, Abatement of nearly 50 MMT of annual greenhouse gas emissions.

Source: PIB Delhi, 04 January 2023

TN Power Utility to do away with Subsidies for Consumers

The Tamil Nadu Generation and Distribution Company (Tangedco) is to formulate a plan for consumers to give up the 100 free units and other power subsidies. This will come into effect after the Aadhaar linking of the consumers is completed. Streamlining of power subsidies, Aadhaar linking of consumers and feeder segregation are three major parameters to be executed by a power utility to get the Central government funding.

Source: IANS January 24, 2023

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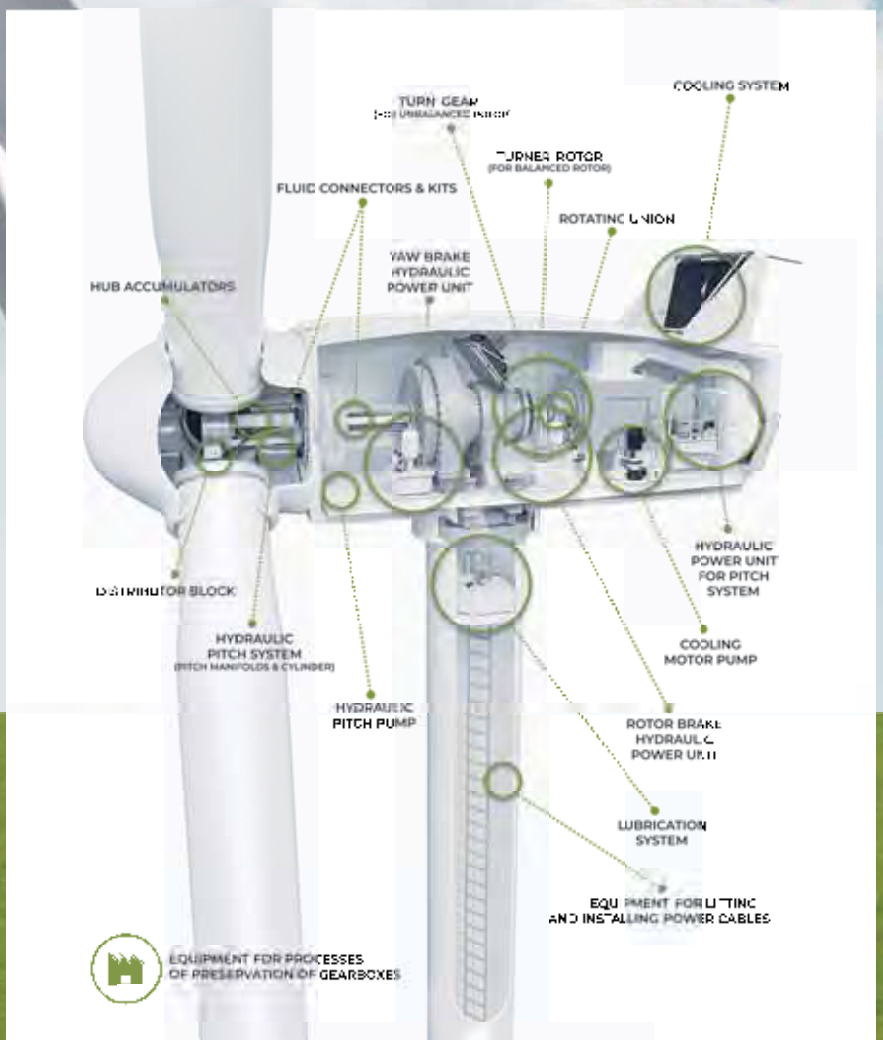

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Eye on Wind
Next Level Core Kit Design Platform

Morten Jacobsen
Head of Digitalization Technology and Innovation, Gurit Services AG, Zurich, Switzerland

Core kit design is limited by human cognitive abilities, which restrict the number of product design parameters that can be considered simultaneously. Gurit, together with project partners DTU and the Energy Cluster Denmark, has received funding from the Danish Energy Technology Development and Demonstration Program to develop a new parametric core material design platform to help reduce blade production costs and shorten the time to market.

Many parameters impact the design of a single core panel, such as geometrical fit, blade weight, resin uptake cost, manufacturing costs, panel weight, panel permeability and infused mechanical properties. With the new design platform, multiple optimisations can be run simultaneously, with many more variations being considered in a much shorter time.

Our experts have decades of experience designing core kits for wind turbine blades. The new Opticore design platform opens new opportunities to explore the entire design space defined by the customers' blade designs and specifications. Ultimately, this will enable to identify solutions that were previously unconceivable and ensure that customers can reduce blade weight and cost without comprising the blade quality.

Figure 1: *Large Scale Testing in Gurit Innovation Centre*

Figure 2: *Resin Uptake Test on Optimized Gurit Kit*

SnipPets

MNRE Secretary Urges IREDA to Develop Action Plan for Project Financing

Secretary to the Ministry of New and Renewable Energy (MNRE), has urged Indian Renewable Energy Development Agency (IREDA) to develop an action plan for financing renewable energy projects. The challenges being faced by the company to meet the huge demand for funding for the RE sector were also discussed, for which the secretary has assured full support and guidance by MNRE.

Source: ANI, 23 January 2023

USTDA Working on 200 projects worth $ 37 billion in India

US Trade and Development Agency (USTDA) is working on around 200 projects that will unlock investments worth $ 37 billion in India across clean energy transportation, digital infrastructure, and health care, according to the Director of the agency Ms. Enoh T Ebong. She said the focus of this visit has been on renewable energy, and spreading broadband connectivity in 16 states.

Source: ET Bureau, January 19, 2023

India's G20 Presidency to Play Key Role in Renewable Energy Push: IEA Chief Fatih Birol

International Energy Agency chief Mr. Fatih Birol has mentioned that India's G20 presidency will play an essential role, particularly because it takes over from one other creating nation Indonesia and can hand over in late 2023 to Brazil. "It is good opportunities for India to show case its recent successes," mentioned Birol. "We are entering a new and extraordinary growth phase of renewables," mentioned Mr. Birol. Driving this acceleration are considerations about energy safety, economic system, in addition to local weather change. The elevated tempo of renewable energy deployment would require funding to stream, significantly to rising markets and creating economies.

Source: Pehal News.in, 12 December 2022

Green Energy, Data Centres & Edutech, Areas of Future: L&T

Green energy, data centres, edutech, and SuFin (L&T's e-commerce platform) are areas of future that engineering, procurement and construction major L&T needs to be sharp and smart about, said Mr. S. N. Subrahmanyan, CEO, Larsen & Toubro in his new year message to 50,000 employees.

Source: ET Bureau, 3 January 2023

Tamil Nadu Sets up Rs. 1,000-Crore Green Climate Fund

Tamil Nadu government has issued orders to set up Tamil Nadu Green Climate Fund (TNGCF) with Rs.1,000 crore. The fund will support various climate change initiatives, mitigation and greening projects.

It will mobilise necessary resources from the government, development finance institutions and international climate fund. The fund will be managed by the Tamil Nadu Infrastructure Fund Management Corporation with fund size of Rs. 1,000 crore with a greenshoe option for another Rs. 1,000 crore.

Source: The Hindu Businessline, January 02, 2023

NTPC to allot 5 GW Capacity for Green Hydrogen and Ammonia Business

NTPC Limited has announced its plans to allot 5 GW capacity, out of its 60 GW green portfolio target, towards green hydrogen and ammonia business by 2032. Notably, NTPC does not seek to use hydrogen for generation purposes. NTPC presently has three on-going pilot projects in the hydrogen business. One in Leh, the other at its Kawas plant in Gujarat and the third at its Vindhyachal plant in Madhya Pradesh. NTPC aims to create and expand renewable capacity to nearly as large as its present coal-based capacity in the next 10 years.

Source: PowerLine.com, 14 December 2022

Green Energy Investment in India to Be $10 Billion in 2023: Bank of America

According to Bank of America Corp.'s top executives, India could attract investments of close to $10 billion in renewable energy by 2023. Ms. Kaku Nakhate (the lender's president and India country head) stated in an interview that deals and investments would continue to flow into areas such as electric vehicles and green hydrogen as investors seek to reflect the energy transition within their portfolios. Nakhate stated that if you have a strong ESG story and are interested in energy, you could do large parts of work in India. While rising interest rates and market volatility are affecting deal making around the world, India's geopolitical stability allows it to attract greater inflows.

Source: Solar Quarter.com, 14 December 2022

Taking Steps to Make India Market for Carbon Credits: MNRE Minister Mr. R K Singh

Union Minister for New and Renewable Energy Mr. R K Singh has said that the government is taking measures to make India a market for carbon credit which will be utilised to meet the country's NDC goals.

Source: PTI, 6 October 2022

A Turbine Prototype Just Broke a 24-Hour Wind Power World Record

Siemens Gamesa's 14-222 DD offshore wind turbine prototype has set a world record for the most power output by a single wind turbine in a 24-hour period: 359 megawatt-hours. The SG 14-222 DD is a 14 MW offshore wind turbine with a capacity of up to 15 MW with Power Boost. It features a 222-meter diameter rotor, 108-meter-long B108 blades that are cast in a single piece and can now be recycled, and a swept area of 39,000 square meters.

Source: Electrek, 10 October 2022

Suzlon Bags 144.9 MW Order from Aditya Birla Group

Suzlon Group has announced that it had won an order to develop 144.9 MW wind power projects for Aditya Birla Group to install 69 wind turbines with a Hybrid Lattice Tubular tower and a rated power of 2.1 MW each. The project is located in Madhya Pradesh and Gujarat and is expected to be completed in 2023.

Source: Wind Insider, 12th October 2022

US and India Launch Task Force on Energy Storage Technologies

The US Department of Energy (DOE) and India's Ministry of Power (MoP) launched the Energy Storage Task Force to facilitate on going and meaningful dialogue among government officials, industry representatives, and other stakeholders from both countries to help scale up and accelerate deployment of energy storage technologies to facilitate clean energy transition.

Source: Chemindigest, 10 October 2022

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ENERCON WINDENERGY is the largest privately owned wind turbine makers in the world, head quartered in Germany and having operations in many countries in the world. ENERCON is the pioneer and world leader in gearless technology wind turbines.

The Company has started operations in India, in 2019 with a Corporate Office in Bangalore, and currently having a large R&D set up and also established a unique business model as part of the Atmanirbhar Bharat (Self-Reliant India) program established 3 manufacturing plants for generator, tower and blades. All these are contract-manufacturing establishments under ENERCON's strict international quality guidelines. The generator plant is based in Erode, Tamil Nadu that has commenced full swing operations in June 2022. Tower plant is based in Trichy, which will commence commercial production in January 2023 and the blade plant is located in Nellore, Andhra Pradesh which also will be on stream from January 2023. India will be the global export hub for ENERCON Group.

Dr. PKC Bose
Vice Chairman & Managing Director

Currently, ENERCON has a work force of close to 200 employees and ramping up on fast track basis, as India is the strategic location for the group. Currently these plants are manufacturing components for 4.2 MW and 5MW wind turbines. ENERCON has an ambitious plan for India for the coming years and India will be a full-fledged development center for ENERCON Group for new turbines.

Dr. PKC Bose is the Vice Chairman & Managing Director of ENERCON WINDENERGY, in India. He was instrumental to start the operation of ENERCON in India. Dr. Bose has been closely involved in the wind industry since last 18 years and leading ENERCON's strategy and growth plans in India.

IWTMA DATA REPOSITORY

IWTMA Data Repository has been UPDATED & some New Topics have been added.

Please visit www.indianwindpower.com

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Windergy India 2023
5th Edition to be held in Chennai

5th International Trade Fair & Conference
4-6 October 2023
Chennai Trade Centre, Chennai, India

India is one of the fastest growing wind energy markets in the world with an installed capacity of over 41 GW. With a rapidly growing population and increasing demand for cleaner sources of energy, India's wind energy market is set to continue its strong growth trajectory.

It may be recalled that in order to reduce dependence on fossil fuel and achieve the target of net-zero emission by 2070, Prime Minister Shri Narendra Modi at COP26 (November 2021) pledged five key targets towards fulfilment of this objective. These include: (i) Increasing country's non-fossil energy capacity to 500 GW by 2030 (ii) 50 percent of country's energy requirements to come from renewable energy by 2030 (iii) Reduction of total projected carbon emissions by one billion tons from now till 2030 (iv) By 2030, India will reduce the carbon intensity of its economy by more than 45 percent (v) By the year 2070, India will achieve the target of Net-Zero.

Wind energy will play a pivotal role in achieving the above objectives and has already made impressive progress in terms of capacity addition, manufacturing capabilities and other areas. Currently, 27% of the total installed power capacity in the country comes from renewable energy, of which 37.73% is contributed by wind energy (40.13 GW). The target for wind energy is 140 GW by 2030 ~ an annual capacity addition of around 10 GW year on year.

As India's only comprehensive International Trade fair and Conference for the Wind Energy Sector, Windergy India aims to once again bring together wind industry professionals from India and overseas to reiterate the pivotal role of wind energy in achieving the target of net-zero emission objectives and to accelerate progress in terms of capacity addition, manufacturing capabilities and other areas through its annual Trade fair and conference. Indian Wind Turbine Manufacturers Association (IWTMA) and PDA Ventures have just announced the fifth edition of Windergy India 2023 to be held from 4-6 October 2023 at Chennai Trade Centre, Chennai. Tamil Nadu is in the forefront of the entire Eco Value Chain.

The last edition which took place from April 27–29, 2022, at Pragati Maidan in New Delhi, was a success in bringing together the top OEMs, component makers and service providers from countries including China, Malaysia, Denmark, the UK, Italy, Germany, France and India. Over 3000 wind industry professionals from India and overseas comprising of Academicians, Associations, Industry Leaders, International Organisations, Banks and Financial Institutions, Clean-Tech Specialists, Consultants, Corporates, DISCOMS, Environmental Groups, State/Central Governments, Green Power Providers, Independent Power Producers, Investors, Landscape architects, Energy Consultants, Lawyers, Surveyors & appraisers, Media and trade press, Municipalities, Non-Governmental Organisations, Non-profit Organisations, Think Tanks, PSUs, Power Consultants, R&D Institutions, Technology Developers, Trading Company/ Distributing Agent, Utility Providers and Venture Capitalists participated at the event in a span of three days.

The parallel conference themed 'Power of the Wind: India's Drive to Net-Zero" had deliberations by industry leaders and professionals with the presence of 300 plus delegates analysed and reflected on policies and regulatory challenges in India. Future electricity demands, efficient grid integration and offshore were all examined in-depth, in addition to technology and green finance methods.

The upcoming 5th edition will yet again be an exclusive blend of a 3-day Trade fair alongside a 2-day power packed conference with key note speeches, thought-provoking panel discussions, special addresses and technology presentations by senior bureaucrats, industry leaders, academics and other subject matter experts, providing an exclusive platform to meet, interact and engage with policymakers, regulatory authorities, international/domestic technology, solutions and service providers from the Wind Energy Sector.

For more details: https://windergy.in/
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