Indian Wind Power

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August - September 2021 &
October - November 2021

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Bimonthly, Chennai

IWTMA
INDIAN WIND TURBINE
MANUFACTURERS ASSOCIATION

Expertise and Research & Development for Wind and Solar Energy Stakeholders

Resource Assessment

Wind Energy

- Carry out Nationwide Wind Resource Assessment
- Estimation of Wind Potential in the country through Wind Atlas preparation
- Design and implement the comprehensive Resource Assessment Programme
- Analysis of wind data to identify Wind Farmable locations
- Verification and vetting of wind data generated by private entrepreneurs
- Consultancy services for Feasibility Studies, Technical Due Diligence, Micro-siting and preparing DPR for Wind Farming and Repowering assessment

Offshore Wind Energy

- Nodal Agency for Offshore Wind Energy development in India
- Met-Ocean Measurement
- Demarcation of Offshore Wind Energy Blocks
- Geophysical and Geotechnical Studies

Solar Energy

- Solar Radiation Resource Assessment
- Investor & bankable grade Solar / Meteorological data
- GIS enabled Indian Solar Atlas
- Calibration of solar sensors as per International Standards
- Consultancy on Solar Energy Projects

Forecasting

- Wind Power Forecasting Services
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- Power Performance measurements
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- Safety and function tests
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- User defined measurements
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The services are as per internationally accepted procedures & stipulations and certified as per the requirements of ISO 9001 & NABL accredited as per the requirements of ISO/ IEC 17025 : 2005

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- Preparation of Indian standards on wind turbines
- Accord Type Certification to Wind Turbines. Type Certification Services are certified as per ISO 9001
- Issue the recommendation for grid synchronization to facilitate installation of prototype wind turbines
- Technical Due Diligence for Wind Farm Projects

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- Wind and Solar Energy Technology
- Testing and Certification of Wind Turbines
- Installation, Commissioning and Operation & Maintenance of Wind Turbines
- Grid Integration of Renewable Energy System
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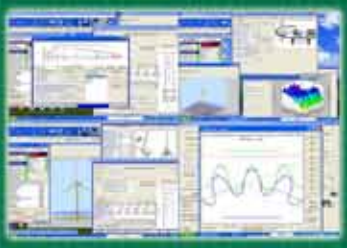
- Seminar / Workshops on Wind and Solar Energy



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Indian Wind Power

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Contents

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From the Desk of the Chairman – IWTMA

Dear Readers,

Greetings from IWTMA!

I wish you and your families a very Happy New Year.

The world is going through another wave of uncertainty with wide-spread confusion around the Omicron variant which is spreading fast and posing fresh challenges. Additionally, there is climate change crisis looming large. Global cost of climate impact is estimated to be $140-300 billion/year by 2030 & $280-500 billion/year by 2050. A warming world could reduce agricultural yields up to 30% by 2050, affecting ~500 million small farms worldwide and resulting in large scale adverse impact on lives and livelihoods.

Today, as never before, people are looking at Renewable Energy as a solution to both stimulating economies as well as climate change. With immediate and strong actions, CO_2 emissions can be reduced by ~70% by 2050 and 75% of this reduction can be attributed to renewable power. Wind energy can produce highly affordable green hydrogen and green ammonia which are future fuels. Wind integrated with solar energy and battery storage solutions will accelerate energy transition. Thus total renewable energy required is 4-5x of what is available today which makes me very excited about the opportunity ahead of us.

With this the stage is set for global commitment to the sustainable energy transition. The drivers facilitating this transition would be government initiatives, corporate initiatives, people's personal commitments, technology and green funds/ESG funds.

This commitment towards renewable energy was also encapsulated in the recently held COP26. This was a critical COP and despite a lot of discussion on whether or not it was successful enough, it has set new benchmarks as never before.

This COP has been particularly important for India. As you know, India modified it's Nationally Determined Contribution (NDCs) for 2030 and committed to achieve net-zero emissions by 2070. We welcome this and are extremely happy that a date for net zero has been set. Notably, several powerful and ambitious targets for the near term, by 2030, were also adopted like-

1) India will take its non-fossil energy capacity to 500GW by 2030.
2) By 2030 half of India's energy consumption will come from renewables.
3) India will strive to reduce its total projected carbon emission by 1 Billion till 2030.
4) India will reduce it carbon intensity (CO2/GDP) by 45%.
5) By 2070 India will achieve net zero status.

Many initiatives leading to these targets are already underway in India and the country as the 4th largest renewable energy hub is well on track to achieve these aspirational targets.

As we close the year there is definitely something to cheer on the recent Government order on ISTS waiver for captive, sale to exchange and for bilateral trade i.e., to C&I customers. The waiver is available up to 2025 and gradually increases from 25% and upwards. IWTMA has been leading the initiative to champion for this policy and has submitted multiple requests and proposals to the Government for the same. As our efforts bear fruit we are thankful to Ministry of New & Renewable Energy and our Hon'ble Minister in releasing this policy which will open new markets and give long term benefits to the industry.

I see a lot of potential and hope in the coming year 2022. The industry is hopeful of the Government releasing the scheme on Wind Energy Parks. This scheme would help mitigate the time and cost risk while establishing a meaningful tariff.

The industry is also looking forward to the release of Indian Wind Turbine Certification Scheme (IWTCS) which will strengthen and position India as a Global Leader in Certification. While this will lead to higher standards of safety and performance, this scheme also dwells on the end-of-life programme for wind turbines which will open up the much-awaited 'Wind Turbine Repowering Programme'. Wind energy installations are site specific and defined by finite land resources. Maximum utilization of land with best performing megawatt size turbines will further help reduce the Levelized Cost of Energy (LCOE).

The Indian MSME sector has played a vital role in wind energy development on the demand side to build the first 20 GW of wind power in the country and on the supply side to bring about a robust supply chain with localization of over 80%. This has been critical in contributing to "Make in India or Atmanirbhar Bharat". Our Association is taking up the importance of the MSME Sector to strengthen its role both on the supply side and demand side towards further localization. This will allow an equal opportunity for investment in wind turbines for captive use and will future proof the cost of power for the MSMEs.

With this, I must emphasize that wind sector in India continues to be plagued by several challenges which impact its very viability. In the coming year, we must continue with our relentless push for policies and reforms which ensure that the sector not only survives but thrives and grows.

Windergy India 2022, our flagship International Conference and Exhibition will be hosted by the association in April 2022. This event is supported by the Ministry of New and Renewable Energy and endorsed by international and national stakeholders. The two-day conference and three-day exhibition will bring all stakeholders on a single platform to strengthen our commitment to the national targets of 500 GW of renewable energy by 2030 as announced by the Hon'ble Prime Minister of India at the recent COP26.

We invite all members to participate in this event to take the **'Green Power Revolution'** through wind energy to the next level.

As we close the year 2021 we pray and hope that the sufferings of 2020 and 2021 end, and that we can look forward to health, progress and economic growth powered by sustainable energy across the world.

With regards,
Tulsi Tanti
Chairman

Structural Aspects for Offshore Observation Platforms at Gulf of Mannar off Tamil Nadu Coast

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India has set itself an ambitious target of achieving 450 GW of renewable energy by 2030. The two weather driven renewables wind and solar energy will play a major contributing role towards achieving the said target. The Government of India aspires to meet 30 GW of its renewable energy from offshore wind by 2030. The southern tip of the country, off Tamil Nadu coast has good wind potential in terms of exploring offshore wind energy as per mesoscale data sets available in the public domain. But this needs to be validated by fresh long-term wind measurements to take better and informed decisions to mitigate the risk of underperformance for a 25 years' design life of an offshore wind farm by using observatory platforms. The said article deals with designing of an observation platform for the in-situ soil and environmental conditions at Gulf of Mannar off Tamil Nadu coast. Based on the data, it has been observed that both mono-pile and tripile as shown in Figure 1(a) & 1(b) is feasible for the said location. However, the tripile performs better, is economical and is also easy to install when compared to the mono-pile. The tripile is designed to have bracings to form guiding jackets with the pile and piles are driven through these jackets. The structural behaviour of the two, therefore are completely different.

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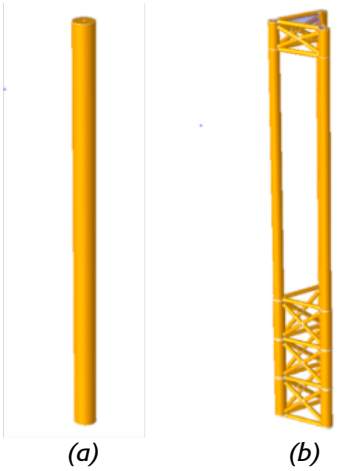


(a) *(b)*

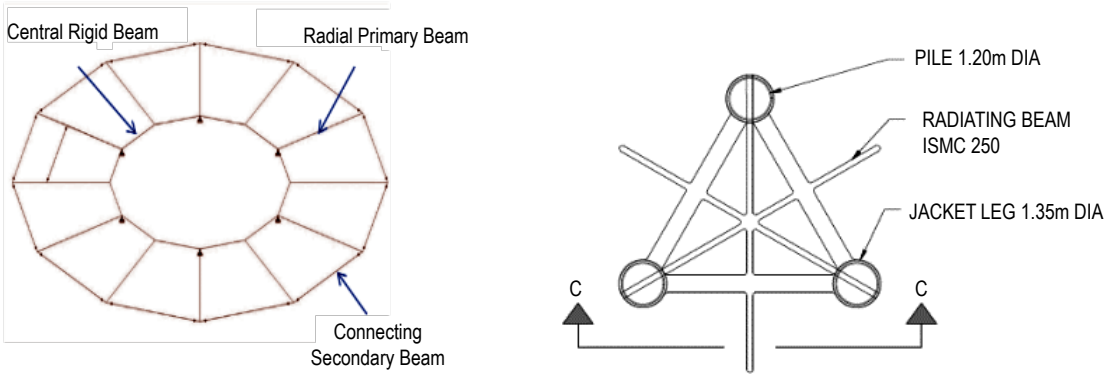
Figure 1: *Structural Configurations of (a) Monopile and (b) Tripile*

Structural Configuration

In the present study, two types of support structures are analysed, namely, monopile and tripile for the static loads, pile-soil interaction, seismic and fatigue loads using a Finite Element Software (SACS) together with its installation methodology. The observation platform that houses the equipment and instruments is kept constant for both the structures and slight modifications are made in the way of connection to the support structures.

Observation Platform

The observation platforms for that of the monopile and the tripile are shown in Figure 2. The platform is positioned at +7.5m with respect to Charted Datum (CD). The level is fixed based on the tidal variation, storm surge, wave run up and air gap to be provided for the given location. It has a manhole for access to the platform from the support structure for installation, maintenance, data collection and dismantling of the instruments. A handrail is placed at the periphery of the plate for safety. A jib crane is also



(a) *(b)*

Figure 2: *Configuration of platforms for (a) Monopile and (b) Tripile*

provided on the platform for ease of handling of instruments during installation and dismantling.

The platform has a circular plate at the base with a thickness of 25mm. All the components are of structural steel with a yield strength of 250kPa. The same is supported by ISMB 150 as radial beams and central beam and ISMC 75 as peripheral beams is the case of monopile while the radial beam consists of ISMB 250 placed on bracing frame in the case of tripile. All the joints are welded together and fabricated onshore and fixed to the support structure on site.

Support Structure

Monopile

Monopile is a pipe structure of 2.5m diameter and thickness of 65mm, which is considered as substructure for observation platform. The thickness satisfies the minimum thickness necessary as per American Petroleum Institute (API) standards. It is embedded to a depth of 30m below seabed, in a water depth of 40m. The total length of the monopile from the bottom of the observation platform to that of the embedded length is 30m. The monopile is to be cast as a single member with provision for attaching the observation platform onsite. The configuration of the monopole is shown in Figure 3.

Tripile

The data collection platform is mounted on a tripile system. Piles of 1.2m diameter and thickness of 32mm are embedded to a depth of 20m below seabed. A bracing of 5m height is placed at the top to connect it to the observation platform. The piles will be placed in position by making use of a 15m Jacket structure positioned at sea bed level. This jacket will provide additional

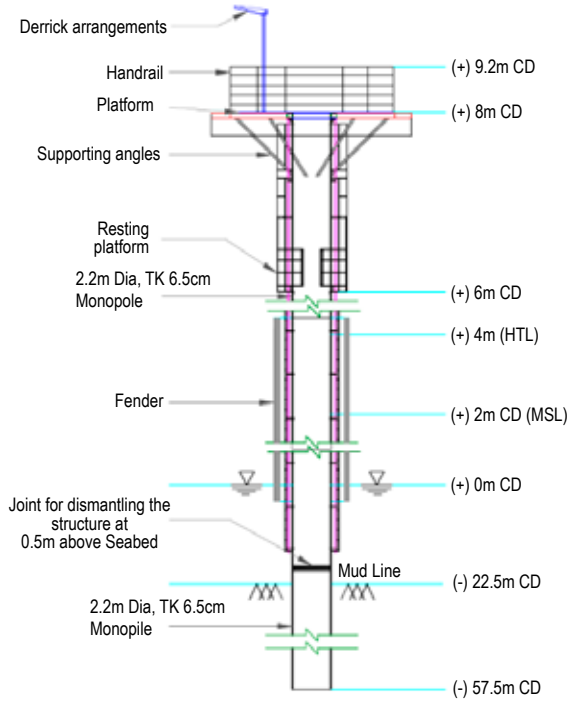


Figure 3: *Monopile Configuration*

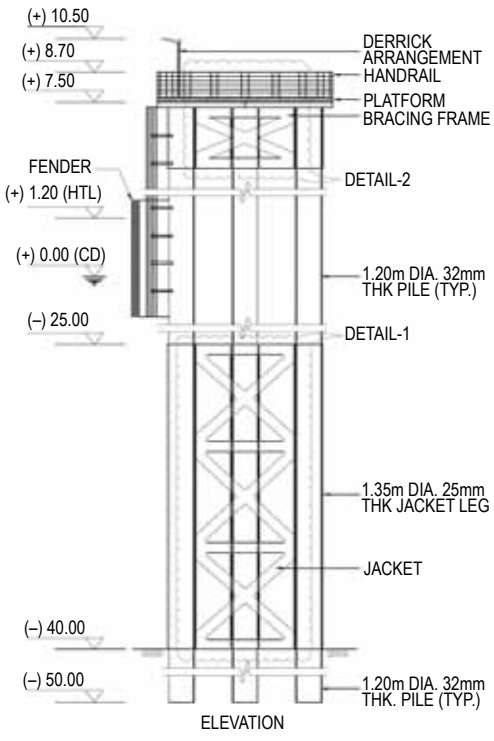


Figure 4: *Tripile Configuration*

safety and also act as a guiding frame for driving of the piles. The Tripod Jacket with X bracings is utilised. The bracings are 0.5m in diameter with a thickness of 9mm. There are three such bracings, 5m each. Jacket legs have a diameter of 1.35m and 25mm thickness is considered good. The piles will run inside the jacket legs. The structural aspects of the tripile is shown in Figure 4.

Applied Loads

The offshore structures in general are subjected to complex loading conditions with static, hydrodynamic, stochastic loadings, etc. apart from the corrosion and marine growth, it is subjected to. For structural analysis, these loads are often simplified using relevant codal provisions. The loads considered in this study pertain to vertical gravity load, horizontal wind, wave, current and berthing loads are shown in Figure 5 below.

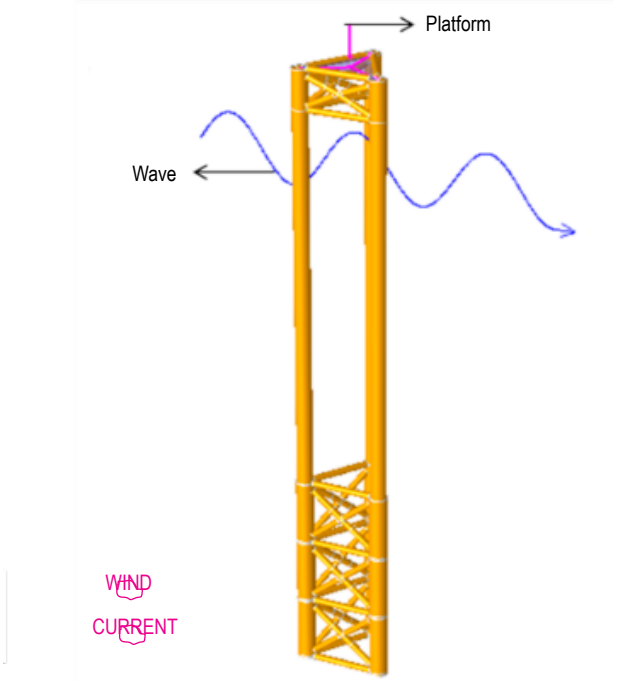


Figure 5*: Loads Applied on the structure*

Gravity Load

The Dead Load on the structure is due to the self-weight of the support structure, observation platform, non-structural members like hand rails, ladder and various instruments mounted on the platform as per IS 875 Part-I. Live loads on support platform accommodate movement of people during operations and installation of instruments on platform as per IS 875 Part-II.

Wind Load

The Wind loads are considered as per IS 875 Part-III. According to the Basic Wind Speed map of India, the location has survival (extreme) basic wind speed at reference height of 10m above SWL as 39 m/s. Appropriate factors are applied to these wind speeds due to probability risk, terrain, structural size and topography. From the obtained design wind speed, pressure acting over the exposed surface is calculated and applied as a distributed load. The factors are as given below:

Probability risk, $k_1 = 1$
Terrain coefficient, $k_2 = 1.05$
Topography, $k_3 = 1$
Importance factor for the cyclonic region, $k_4 = 1.15$

Wave Load

The critical condition for estimation of Hydrodynamic load due to wave and currents is considered. Wave kinematics are estimated using appropriate wave theory based on height, period and water depth as per API RP 2A WSD. The parameters considered for selection of Stokes 5th order wave theory have been selected for the above location based on the hydrodynamic parameters. The wave and current forces are estimated using Morison's equation, which is semi empirical formula assuming total forces as some of inertia and drag forces. The force on the structure depends on ratio of diameter to wavelength. The total force estimation from Morison's equation:

$$F = C_D \frac{\rho}{2} DV^2 + \frac{\pi}{4} D^2 \rho C_m U^2$$

Where, F is force per unit length,

ρ = mass density of water,
C_D = drag coefficient for tubular section,
C_m = inertia coefficient for tubular section,
U = acceleration of water particle,
V = velocity of water particle.

For each sea state the phase of the wave was varied from 0° to 120° for every 10°. The phase for which base shear and base moment are maximum have been used for design and serviceability check.

Berthing Load

The boat landing is considered for small boats, which will be used for transporting people for inspection and maintenance of equipment. As per clause 3.2 of IS 4651: Part 3, a small fishing vessel displacement tonnage is considered for the analysis.

Other Considerations

A marine growth of 38mm is considered based on API standards. This in-turn increases the drag coefficient of the wave load utilised in the Morison Equation. It also influences the area on which the wave load is applied, thus increasing the lateral load on the structure. The weight of the marine growth acts axially and is not significant and is therefore ignored. A corrosion allowance assuming the thickness reduces due to corrosion as per DNVGL standards, is provided. However, cathodic protection and protective coatings are also provided to prevent corrosion from occurring.

NUMERICAL ANALYSIS

The numerical analysis was carried out using a Finite Element Package, SACS, an offshore structural analysis and Design software. The static analysis was carried out to determine the structural integrity followed by a Pile-Soil Interaction model to study the behaviour of the structure's interaction with the soil present. Seismic Analysis was performed to see the capability of

the structure to the dynamic loading caused due to earthquake. A modal analysis is then carried out to find the frequency in which the structure vibrates to determine the resonance phenomenon.

Static Analysis

The compressive stress for both the structures are analysed for the loads acting as described previously. The stress contour for both the structures is shown in Figure 6. Monopile has its maximum stress at sea bed level and minimum at the pile tip. In case of Tripile the maximum stress concentration is at the bracings, with minimum stress concentration at the sea bed level. The compressive stress for both the structures are analysed for the loads acting as described previously by considering the interaction of structure with embedded pile and soil. The stress contour for both the structures is same as for the static analysis (Refer Figure 6).

The deformation analysis is carried out for the same loading. It can be seen that the deflection increases towards the top and is minimal towards the seabed. The deflection profile for Monopile and Tripile is shown in Figure 7. Monopile has a maximum pile tip displacement of 57.6 mm and a rotation of 0.09 deg with the maximum utilization of pile at 17%. Tripile has a displacement of 75.6 mm and rotation of 0.04 deg with maximum utilization of the piles at 30%. Utilization contours for Monopile and Tripile is shown in Figure 8. In terms of rotation, Tripile is conservative.

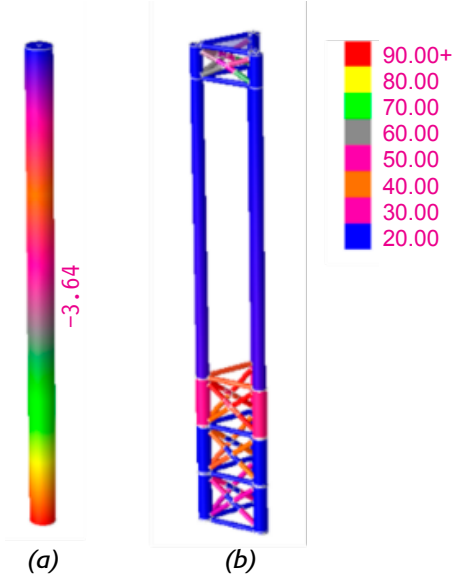


Figure 6: *Compressive Stress profile for (a) Monopile and (b) Tripile*

Figure 7: *Deflection Profile for (a) Monopile and (b) Tripile*

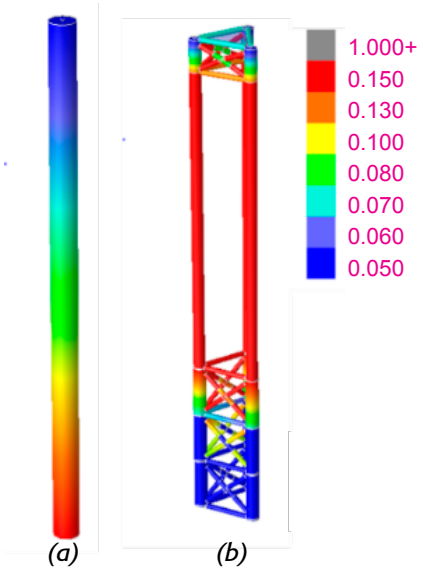


Figure 8: *Utilization profile for (a) Monopile and (b) Tripile*

Pile Soil Interaction Analysis

The monopile has a maximum pile tip displacement of 111.56 mm and a rotation of 0.15 deg with the maximum utilization of pile at 17%. Tripile has a displacement of 168 mm and rotation of 0.14 deg with maximum utilization of the piles at 40%.

Modal Analysis

The Eigen value analysis is the basis of dynamic analysis and is performed to obtain the natural frequencies and the corresponding mode shapes of the structure. The obtained modal masses are useful in the analysis of dynamic response of the structure in its linear range of behaviour.

Figure 9: *First Three Modes of Monopile*

Figure 10: *First Three Modes of Tripile*

The first three mode shapes of the Monopile are shown in Figure 9. Time period of the first three modes are 1.597, 1.597, 0.36 seconds. For Tripile, the natural periods at first three modes are 1.367, 1.367, 0.495 seconds.

The mode shapes for the Tripile are shown in Figure 10. The natural period for both the structures is far away from the wave period. Therefore, both the structures are safe against the resonance effect. The Tripile has shorter periods and higher frequency when compared with the Monopile.

Dynamic Analysis

The stress contour for both the structures is shown in Figure 11. Monopile has its maximum stress at sea bed level and minimum at the pile tip. In case of tripile the maximum stress concentration is at the bracings, with minimum stress concentration at the sea bed level.

Monopile has a maximum pile tip displacement of 116 mm and a rotation of 0.16 deg with the maximum utilization of pile at 17%. Tripile has a displacement of 189 mm and rotation of 0.15 deg with maximum utilization of the piles at 42%. The deflection and utilization profile for both the structures is shown in Figure 12 and Figure 13, respectively.

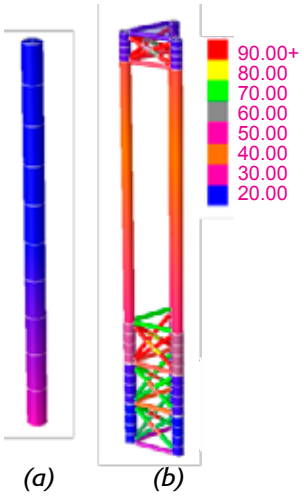


Figure 11: *Compressive Stress Profile under Seismic Loading for (a) Monopile and (b) Tripile*

Figure 12: *Deflection Profile under Seismic Load for (a) Monopile and (b) Tripile*

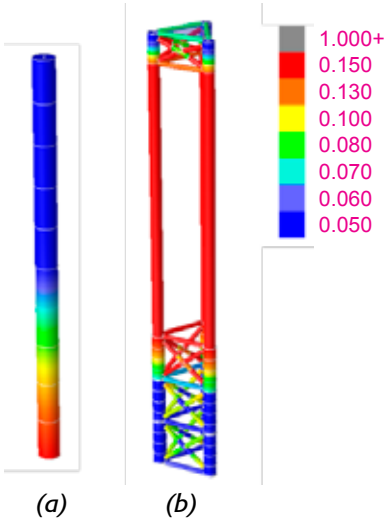


Figure 13: *Utilization under Seismic Loading for (a) Monopile and (b) Tripile*

It can be seen for the structural analysis that all the results produced by both the structures are comparable and therefore, the key factor is the installation and handling of the structure during and post installation.

FABRICATION AND INSTALLATION

Both structures are to be fabricated onshore and transported through barge to the desired installation location. This brings in constraints with regard to size of the barge required for transportation, lifting capacity of the barge and the size of hammer required for installation. These in-turn affect the cost of the entire project.

Fabrication

The fabrication of the platform is almost similar for both structures as the functionality is the same for the platforms. The weight of steel required for the fabrication of monopile platform is around 11 tons while the weight of platform for tripile along with the top bracing to connect the platform to the piles is around 23.5 tons. The weight of the guiding jacket is 61 tons. The weight of pile

for monopile amounts to 326 tons while that of tripile amounts to 201.5 tons.

Though the weight of the observation platform and jackets is significantly low for monopiles, the cost of piles easily counters the offset in weight in the case of tripile. The total quantity of steel material in the case of monopile amounts to 337 tons while that of tripile is 287 tons. By adopting tripile, 17% of steel material is conserved.

Transportation

The barge size requirement depends on the maximum size and weight of the object. In the case of monopile, the pile of around 326 tons with a length of 77.5m is to be transported as a single piece offshore to the point of installation. Apart from the barge capacity, the bathymetry of the tow route, the floatation stability of the barge, all are to be studied in detail, which is a complex study. The tripile has multiple components and is comparatively easier to transport.

Lifting Capacity

The lifting capacity of the equipment in the barge allows for the components to be unloaded from the barge to be installed in the predefined location. The heaviest component in each case is the governing criteria for lift capacity. In the case of monopile, the pile happens to be the heaviest component weighing 326 tons. In the case of tripile, from all components such as platform with top bracing, guiding jacket and piles, the jacket weighs around 61 tons and individual pile weighs about 67 tons.

Therefore, a lift with a carrying capacity of about 70 tons is sufficient in the case of tripile while a monopile requires a lift capacity of around 4.5 times the tripile. This in turn affects the size of the barge as the lift is also to be placed on the barge and the weight of the lift is determined by the required capacity of the lift.

Driveability of Pile

Drivability of the pile plays a crucial role in the determination of feasible structure in a particular location. As the pile diameter and the depth of penetration increases, the driving energy also increases. In the case of driven piles, the hammer requirement is computed using New Engineer's formula.

In the case of monopile, the depth of penetration that is to be achieved is 30 m with a pile diameter of 2.5m. The soil at a depth of 30 m consists of silty sand with the frictional angle as 30 deg and cohesion as 5kPa. This in turn, requires a hammer capacity of 13 ton hammer to drive the pile to its last depth where each hammering leads to a penetration of 2cm. An average hammer size of 8 tonnes can be adopted with higher number of blows.

In the case of tripile, three piles of 1.2m diameter need to be installed at a depth of 20m. The soil at a depth of 20m consists of silty sand with the frictional angle as 30 deg and cohesion as 5kPa. This requires a hammer of 2.5 ton for the final depth. A 1.5 ton hammer can be utilised for nominal energy distribution.

Just as in the case of lifting capacity, the size of hammer to be transported to site and the energy for the hammer to operate influences the type of barge to be adopted, which influences the cost of the project.

In the process, it is concluded that the tripile is proposed for deep-water depth and environmental condition at Tamil Nadu coast for fostering the growth of offshore wind development in the country.

Niti VC urges Tesla to make electric cars in India

Niti Aayog Vice Chairman Mr. Rajiv Kumar has urged US-based Tesla to manufacture its iconic electric vehicles in India, while assuring the company that it will get the tax benefits it wants from the government. Speaking at a virtual conference of the Public Affairs Forum of India (PAFI), Kumar further said Tesla should not just ship its products into India as this will not create jobs in the country.

Source: PTI, Oct. 22, 2021

GAIL to Build India's Largest Green Hydrogen Plant

GAIL (India) Ltd will build India's largest green hydrogen-making plant as it looks to supplement its natural gas business with carbon-free fuel. "It will take 12-14 months to put the plant. The company has finalised 2-3 sites for the unit including one at Vijaipur in Madhya Pradesh. The plant planned is for 10MW capacity, the largest announced so far in the country. State electricity producer NTPC has announced a 5MW green hydrogen plant.

Source: PTI, October 22, 2021

PXIL to Launch ESCerts Trading

The Power Exchange India (PXIL) has said that the trading of ESCerts under the Perform, Achieve and Trade (PAT) scheme - cycle II will commence from October 26, 2021. The company had conducted a mock trading session on October 8, 2021, which received encouraging reception. 'ESCerts' are the Energy Savings Certificates issued by the Central Government in the Ministry of Power to the Designated Consumer under sub-section (1) of section 14 (A) of Energy Conservation Act, 2001. ESCerts is a tradable certificate for EE (energy efficiency) mandates under Energy Conservation Act 2001, which will be transacted every Tuesday of the Week on PXIL platform or as decided by CERC/BEE (Central Electricity Regulatory Commission/Bureau of Energy Efficiency).

Vestas to Install Prototype of World's 'Tallest and Most Powerful Wind Turbine' in 2022

According to Vestas, prototype of the V236-15 MW offshore wind turbine will stand 280-meters tall. The turbine is expected to produce 80 GW hours a year, or enough to power roughly 20,000 households.

Source: CNBC, October 18, 2021

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Tailored blades are fundamental to a high-performance, competitive wind turbine. And for us, tailored blades are the standard

We know what it takes to:

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Electricity Amendments Bill 2021

A Game Changer for the Power Sector!

OPINION

The Bill promises to unlock the next round of reforms the sector needs.

- Sumant Sinha, Founder, Chairman and CEO, ReNew Power

It is no secret that a healthy and efficient power sector can catalyse India's post pandemic economic recovery. Universal access to affordable, clean and modern energy is key to the wellbeing of a growing population besides enhancing industrial competitiveness. In this context, the recent amendments proposed by the government to the Electricity Act 2003 can be a game changer, by unleashing the next generation of legislative and regulatory reforms, in tune with the radical transformation the sector has undergone. The power sector today is seeing increased private participation, a thrust on renewables and other structural changes across the value chain, that call for a fresh set of ground rules addressing current pain points. The Electricity Amendments Bill 2021 aims to reinvigorate the sector while focusing on the 4 Cs—customer, competition, compliance and climate. The changes can potentially make the sector more viable, transparent and investor-friendly, besides helping achieve India's ambitious clean energy targets. It is thus critical that after two previous unsuccessful attempts, these amendments see the light of day.

At present, distribution is the sector's Achilles heel, with most discoms in abject financial and operational health. In 2021, India recorded AT&C losses of 24.54%, more than double the global average. Cash strapped discoms have failed to meet their payment obligations to generators with dues of nearly Rs. 70,000 Crore (March 2021), creating stress across the value chain. Being perennially in the red has also prevented modernisation of their infrastructure and investment in technology such as smart meters. The new Bill looks to tackle legacy issues responsible for this by proposing that retail tariffs be "cost-reflective", i.e., should no longer incorporate subsidies, which states would pass onto customers via Direct Benefit Transfer (DBT). This is a welcome rationalisation that should ease the liquidity crunch discoms face, improve the quality of power supply and boost overall profitability of the sector. The government has also proposed a progressive reduction in cross-subsidy surcharges which should reduce the cost of commercial power, thereby enhancing the competitiveness of domestic industries as we look to build an Atmanirbhar Bharat. These reforms will also provide financial relief to the states burdened by discom resource crunch, while helping attract more investments due to reduced industrial tariff. DBT should ensure targeted subsidy, further easing the burden on states.

A stand-out feature is the proposal to "delicense" distribution, by adopting a sub-licencee or franchisee model. This will facilitate private firms in entering and competing with discoms. While consumers benefit through lower tariffs and improved service, this will also attract fresh capital, novel practices and the latest technology, boosting efficiency and reducing losses.

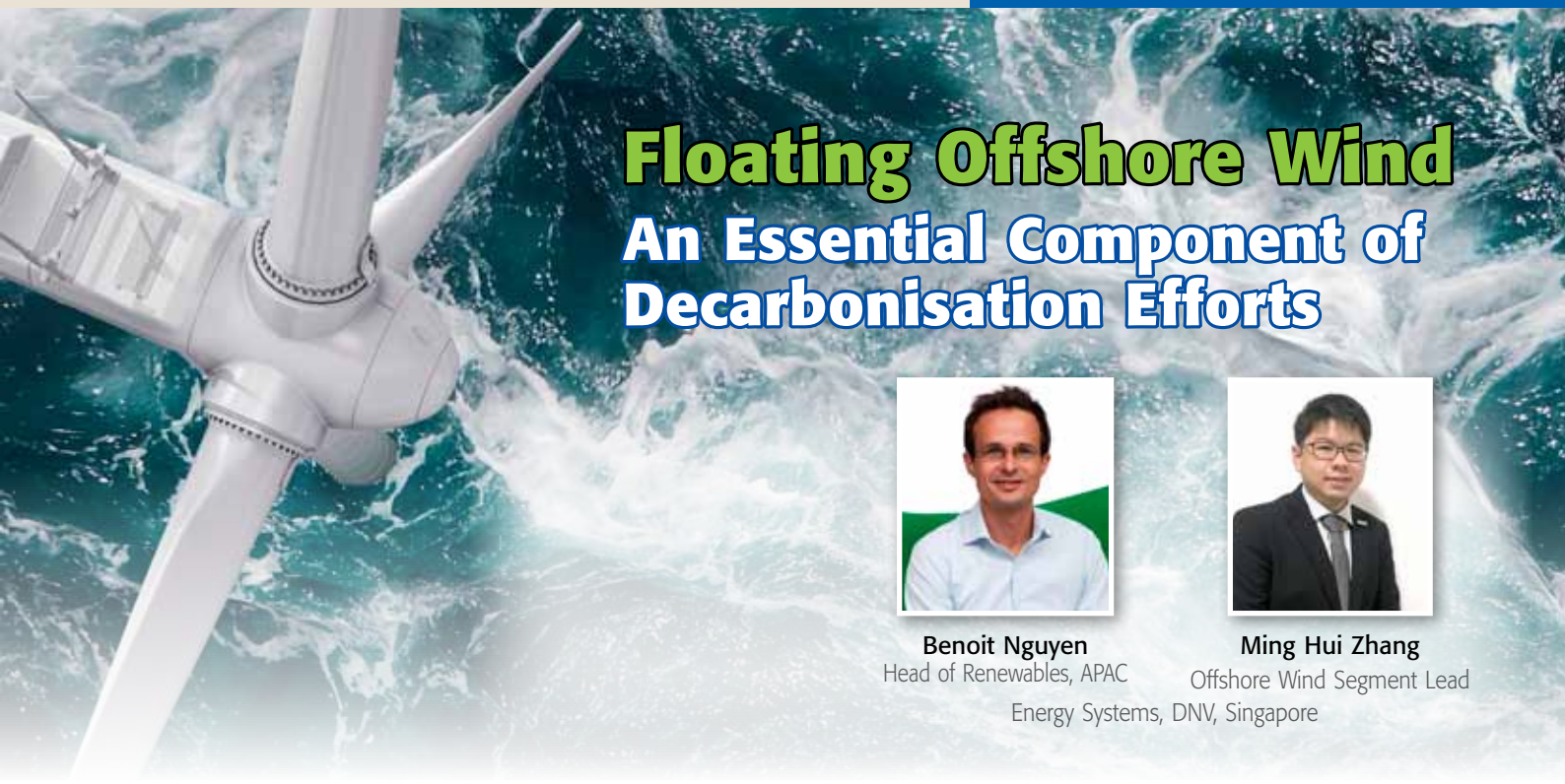
The proposed amendments should galvanise the power sector as we pursue a "greener" grid and affordable power for all. However, on ground implementation will be key and this will be possible only when the Centre actively engages with the states and takes them along in the true spirit of cooperative federalism

Another key area of focus is compliance as the Bill seeks to strengthen and streamline various regulatory bodies, for better governance and faster dispute resolution. The proposal to establish an Electricity Contract Enforcement Authority (ECEA) with powers of a civil court will inspire confidence amongst investors who have often been at the receiving end of discoms unilaterally reneging on PPAs or renegotiating tariffs. The Bill also recommends an expansion of the Appellate Tribunal (APTEL) for speedier disposal of cases, inclusion of a member with experience in law in SERCs for stricter enforcement, a common Selection Committee and uniform criteria for appointing members of APTEL, CERC, ECEA and SERCs in a transparent manner and a legal sanction for the NLDC to monitor overall grid operations and security. All of these are well conceived and timely changes that should instill greater discipline and remove bottlenecks.

Perhaps the most dramatic transformation the sector has seen is the rising adoption of renewable energy, with India focused on reducing its carbon footprint, in line with Paris Agreement commitments. Backed by a favorable policy framework, renewables capacity has surged in the last few years, crossing the 100 GW milestone recently. This transition to clean energy is set to continue as India eyes 450 GW by 2030 with concomitant growth in battery storage, clean mobility, energy efficiency and Green Hydrogen. The sector needs to be ready and provide an enabling ecosystem to accelerate this change. This is exactly what the proposed National Renewable Energy Policy is expected to do - by setting emission reduction targets, creating a conducive investment climate, fostering R&D and establishing required market mechanisms. Another important reform is the planned shifting of the responsibility of fixing RPOs & HPOs from states to the Centre, given our national climate goals. This, coupled with stringent penalties for non-compliance, will greatly incentivise RE generators.

The proposed amendments should galvanise the power sector as we pursue a "greener" grid and affordable power for all. However, on ground implementation will be key and this will be possible only when the Centre actively engages with the states and takes them along in the true spirit of cooperative federalism. I do hope that the states will align themselves to the broader vision and extend their full cooperation, in the interest of a sustainable, efficient and future ready power sector.

Source: **Financial Express**, *November 15, 2021*



Floating Offshore Wind
An Essential Component of Decarbonisation Efforts

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With the Paris Agreement strengthening the global response to climate change, countries around the world are facing increasing pressure to phase out carbon-intensive fuels in favour of clean energy. Onshore and offshore wind power, especially large-scale floating turbines, can play a leading role in the clean energy revolution, with global capacity expected to increase tenfold in little over a generation.

Falling hardware prices and growing confidence from investors have seen onshore wind farms become a popular and cost-effective solution. Fixed offshore technology is also maturing at a significant pace and will be an important part in the new energy mix. However, as fixed offshore wind turbines need to be sited in relatively shallow water (with depths of up to 60 meters), their scope is limited.

With higher capacity factors compared to onshore wind or solar, offshore wind provides greater energy reliability to emerging markets where power demand is growing, especially if aggregated over large geographical areas[1]. To access the huge potential of offshore wind globally will require large-scale, floating facilities. This technology has the potential to harness wind power at greater ocean depths, providing large-scale renewable power to help countries meet ambitious decarbonisation targets.

New versions of floating wind turbines and seabed moorings can tap wind power in water depths of over 50m or more, opening up large swathes of deep water zones to renewable power generation for countries that have limited onshore space for large-scale solar or wind. For example, deep waters and strong winds make Japan one of the most attractive countries in the world for commercializing floating wind energy. Once floating wind technology has moved past the demonstration stage to become commercially viable, Japan expects to add over 1 GW per year of the technology up to 2040.

Growth Potential

Through technological innovation and economies of scale, the global wind power market has nearly quadrupled in size over the past decade and established itself as one of the most cost-competitive, resilient and low emissions power sources in the world, according to the Global Wind Energy Council (GWEC).

Over 733 GW of total wind generation capacity has been installed worldwide as of end-2020[2] of which 95% is onshore wind and the remaining 5% offshore wind. The vast majority of total installed capacity is located in Asia (322 GW) followed by Europe (208 GW), North America (139 GW) and 54 GW in the rest of the world. As of end-2020, China led in over-all installations with 282 GW, followed by the United States (118 GW), Germany (62 GW) and India (39 GW).

Offshore wind has enjoyed a bumper year globally in 2020, driven by a surge of renewable energy capacity auctions, favourable feed-in tariffs (FITs) in countries such as China and a 67% reduction in the levelized cost of high-performance, thanks to giant offshore wind turbines, according to BloombergNEF. The first half of 2020 alone saw US$35 billion allocated in financing to offshore wind, a rise of 319% year-on-year and well above 2019's full-year figure of US$31.9 billion.

Despite the COVID-19 pandemic denting electricity demand, nearly 100 GW of new wind generation capacity was installed worldwide in 2020 - a 59% year-on-year increase - driven by a surge of installations in China and the US[3]. The world's two largest wind power markets installed nearly 75% of new installations in 2020 and now account for over half of the world's total wind power capacity[4].

This year looks set to be another record year. In the first half of 2021, nearly 7 GW of wind power capacity was auctioned

globally, a 160% year-on-year increase compared to Q1 2020. With 3.9 GW awarded in Q1 2021, offshore wind accounted for the majority of the sanctioned wind power capacity.

This year and next, the IEA is predicting that global offshore wind capacity additions will increase 60% to over 10GW, with China expected to account for nearly 60% of this as developers rush to take advantage of FITs before they expire at end-2021.

In Asia, Japan and Korea are also set to commission smaller projects for the first time in 2022. Both Japan and Korea have implemented initiatives aimed at supporting floating offshore wind. In Japan, a feed-in-tariff is available for floating wind projects while an auctions scheme has been implemented for fixed bottom projects.

In June, the proposal for a 16.8 MW floating wind farm off the coast of Goto City in Nagasaki Prefecture was confirmed in Japan's floating wind auction. Once built, this will be the country's first commercial floating offshore wind farm. The coast of Goto City has a water depth of 100m–150m which will require floating solutions as fixed substructures will not be economical at such depths.

In South Korea, additional RECs are awarded for every MWh of offshore wind generation compared to onshore renewables like solar and onshore wind. However, investors are still seeking clarity on guidelines and are pushing for additional support.

Ulsan in South Korea has been receiving much attention as a floating wind hub with the numerous collaborations observed between international investors and local developers.

In Taiwan, additional subsidies for floating wind projects are currently not available. As such, the bulk of the initial applications for the upcoming round 3 auctions which focuses on projects from 2026 onwards are expected to be based on fixed bottom technology. The round 3 auctions will be highly competitive and will most likely be oversubscribed. Taiwan's offshore wind allocation plan for 2026-2035 proposes a total of 15 GW of new capacity to be added.

For China, most offshore wind projects are still focused on shallow water where fixed bottom installations are suitable. While a floating wind turbine was installed in July 21 off the coast of Guangdong Province, it was deployed mainly for demonstration purposes. Commercial scale deployments of offshore floating wind (>1GW) are only expected after 2030. Initial plans for such projects are being considered in the Qingdao area.

By 2050, up to 50% of floating wind capacity demand is expected to come from Asia Pacific countries as decarbonisation efforts across the region gather pace[5].

According to the International Energy Agency (IEA), the offshore wind energy market is expected to grow faster than the onshore wind sector, driven by rising cost-competitiveness, with an average LCOE of US$50/MWh being within reach. The International Renewable Energy Agency (IRENA) forecasts global weighted average capacity factors for onshore wind will increase to 32-58% by 2050 and to 43-60% by 2050 for offshore wind[6].

Such is the potential and growing appetite for large-scale offshore wind that DNV's *Energy Transition Outlook*[7] predicts that it will make up 20% of all offshore wind resources by 2050. This implies capacity of 250 GW by the middle of this century compared to just 34 GW today.

With each doubling of installed capacity, offshore wind costs fall by around 16%, a cost learning curve driven by technology improvements, more effective manufacturing, economy of scale, broader supply chain efficiencies and competition.

We expect nine capacity doublings between now and 2050 for floating offshore wind, which will see costs fall to around €40 (US$ 47) per MWh. Most of these doublings in capacity will take place over the next decade which will be when most cost benefits are realized. Within 10 years, we expect that offshore floating wind will be close to half of today's cost levels.

Demonstration to Commercialisation

Getting large-scale floating wind generation to a bankable scale will require a coordinated effort from governments, regulators, investors, developers, shipyards and customers.

It will also require a consolidation and maturing of the complex technology required for various components, including the foundations (floaters) which sit on the water's surface. Finding ways of mounting a tower and turbine in deep water environments is where most R&D is currently focused.

There are also engineering and modelling challenges associated with concrete versus steel foundation structures, wave and wind motion and load variables, network stability and transportation issues associated with supplying power into the onshore grid.

Around 40 different floater designs are being explored with four basic technologies at a commercial or pre-commercial stage: floaters with spar, semi-submersibles, barge-mounted turbines and tension-leg platforms. Determining which ones will become the dominant technologies – some of which may be suited to specific areas such as typhoon zones - will be critical in advancing the sector to a commercial stage.

Thereafter, standardisation of design concepts and certification against an agreed standard will be required to build stakeholder confidence in the technology and move to mass production. Collaboration and integration across domains will also be needed to build an effective supply chain and create a thriving industry involving turbine manufacturers, shipyards, cable manufacturers and substation providers.

Spar and Semi-Sub are popular architectures in Asia and are being considered by a number of international developers who are strong advocates of these technologies.

In the offshore space, the oil and gas sector's longstanding experience of deep-water conditions is a major advantage, coupled with their significant balance sheets and an incentive to transition to cleaner business models.

Global Wind Capacity Forecast

Installed Wind Capacity by Region (Units : GW)

Region	2020			2030			2050		
	Onshore	Fixed Offshore	Floating Offshore	Onshore	Fixed Offshore	Floating Offshore	Onshore	Fixed Offshore	Floating Offshore
NAM	136	0	0	389	26	1	573	232	47
LAM	33	0	0	81	4	0.1	259	72	9
EUR	183	25	0	250	102	2.6	330	280	43
SSA	4	0	0	8	0.1	0	146	12	4
MEA	13	0	0	61	5	0	417	50	3
NEE	3	0	0	8.5	0	0	16	8	3
CHN	280	10	0	960	58	5	1494	470	102
IND	41	0	0	105	7	0	460	109	27
SEA	3	0	0	26	10	1	331	167	15
OPA	13	1	0	70	18	2	122	82	11
World	**709**	**35**	**0**	**1960**	**230**	**11**	**4150**	**1484**	**264**

Source: DNV Energy Transition Outlook, 2021 Report

Legends

North America (NAM) *– United States and Canada*
Latin America (LAM) *– the region stretches from Mexico to the southern tip of South America*
Europe (EUR) *– all European countries including the Baltics but excluding Russia, all the former Soviet Union Republics and Turkey*
Sub-Saharan Africa (SSA) *– the region consists of All African countries except Morocco, Algeria, Tunisia, Libya and Egypt*
Middle East and North Africa (MEA) *– Morocco to Iran, including Turkey and the Arabian Peninsula*
North East Eurasia (NEE) *- Russia, Mongolia, North Korea and the former Soviet Union states except the Baltics*
Greater China (CHN) *– Mainland China, Taiwan, HK, Macau*
Indian Subcontinent (IND) *– India, Pakistan, Afghanistan, Bangladesh, Sri Lanka, Nepal, Bhutan and the Maldives*
South East Asia (SEA) *– region stretches from Myanmar to Papua New Guinea and includes the Pacific Ocean States*
OECD Pacific (OPA) *– Australia, New Zealand, Japan and South Korea*

There are early signs that energy majors are looking at repurposing the oil and gas space for the floating offshore wind sector, leveraging their understanding of floaters, substrate structures, anchoring and offshore power interconnectors.

Floating wind power is expected to be a driving force to change the energy paradigm from a largely fossil fuel-driven energy system to one based on renewables, enabling offshore wind to make up a significant share in the global energy mix by 2050.

As the push for hydrogen-driven societies gathers pace, large-scale floating wind could be used to produce electricity which in turn could be used to produce hydrogen for export. In this regard, the repurposing of offshore oil and gas platform in regions such as Australia's Bass Strait could form part of a hydrogen export infrastructure system.

We look forward to continuing working closely with stakeholders across industries to accelerate floating offshore wind development which offers much potential for space-constrained nations to achieve carbon neutrality while meeting growing power needs close to demand centres.

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'Greenflation' A Risk for Renewable Energy, But Long-Term Viability Intact

The rising costs, as well as supply chain problems for some of the commodities and goods needed for green projects, won't be a long-term threat to the economic viability of clean energy. Overhead costs that will fall with economies of scale include items such as permit fees, labour costs for installations and customer acquisition costs. Overall costs for the industry will trend downwards as there are few barriers to scaling up, said Mr. Harry Boyd Carpenter, Managing Director for Green Economy and Climate Change at the European Bank for Reconstruction and Development (EBRD).

Source: Reuters November 23, 2021

Wind Power Risks Becoming Too Cheap, Says Top Turbine Maker

The head of Siemens Gamesa Mr. Andreas Nauen has warned that a decade-long race to bring down the cost of generating wind power could not continue, as it would reduce the financial muscle of turbine producers to continue investing in new technologies. A boom in investments in green energy to address climate change has helped bring down the cost of wind power to a level where it can compete with fossil fuels like coal and natural gas. "We have probably driven it too far," Mr. Nauen said. The industry's ability to keep investing in new technologies and factories will be reduced if the drive to cut the cost wind power continues at the same rate, he added.

Source: Reuters November 25, 2021

MP to get Rs 13,000 Cr for Modernisation, Infrastructure Development in Energy Sector

Madhya Pradesh will get Rs 13,000 crore for modernisation and infrastructure development in the energy sector. The reforms being carried out in the energy sector are praiseworthy and the innovations by the state for reducing energy losses are novel and implementable.

Source: PTI, November 27, 2021

Gujarat will Become Renewable Energy Capital of the Country by 2025

Gujarat Chief Minister Mr. Bhupendra Patel said that by 2025, the state will consolidate its position as the renewable energy capital of the country. Gujarat's development will witness many mega infrastructure projects and one such mega-project is Dholera, India's First Greenfield Smart City.

Source: ANI, November 26, 2021

Cabinet Approves Privatisation of Electricity Distribution in Dadra & Nagar Haveli and Daman & Diu

The Union Cabinet has approved the formation of a special purpose vehicle (SPV) to privatise electricity distribution business in the union territory of Dadra & Nagar Haveli and Daman & Diu. The Union Cabinet, chaired by Prime Minister Shri Narendra Modi, also approved the sale of equity shares of the newly formed company to the highest bidder and formation of trust(s) for serving employees' liabilities. Privatisation process will fulfill the desired outcomes of better services to over 1.45 lakh consumers of DNH & DD, operational improvements and functional efficiencies in distribution and provide a model for emulation by other utilities across the country.

Source: PTI November 25, 2021

Schneider Electric Launches 'Green Yodha' Initiative in India

Schneider Electric on Thursday launched its sustainability engagement initiative - Green Yodha, in India to encourage industries, businesses and people to take concrete climate action. The company has urged energy intensive sectors - cement, iron and steel, commercial & industrial, buildings, non-metallic minerals and chemical- to join forces to achieve the common goal.

Source: PTI, 25 September 2021

ONGC inks pact with SECI to develop renewable, ESG projects

In a bid to strengthen its footprint in the renewable space, state-owned Oil and Natural Gas Corporation (ONGC) has signed an agreement with Solar Energy Corporation of India (SECI) to scale up its clean energy projects. The MoU provides a broad, overarching framework for ONGC and SECI to collaborate and cooperate for undertaking renewable energy projects including solar, wind, solar parks, EV value chain, green hydrogen, storage, etc.

Source: PTI December 02, 2021

Tariff of Rs 2.69 to Rs 2.70 per unit Discovered in SECI's Latest Wind Power Generation Bid

The tariff discovered in the latest bid of the Solar Energy Corporation of India (SECI) for wind power generation stood at Rs 2.69 to Rs 2.70 per unit, according to the official press release.

Source: ET Energy World December 02, 2021

SECI Discovers Rs. 2.69 to 2.70/unit Tariff in Latest Wind Bid

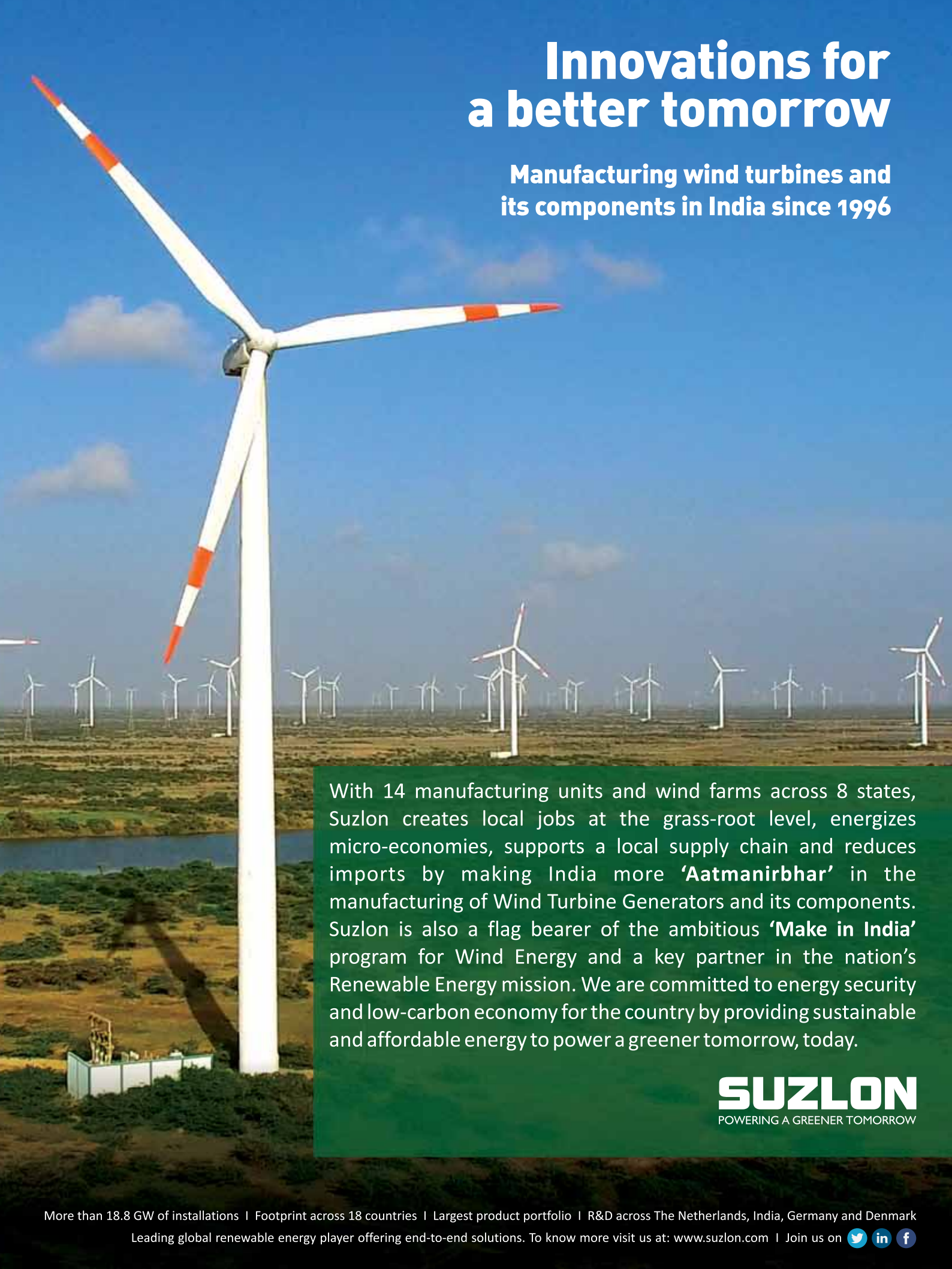
The tariff of wind power generation discovered in latest bid of SECI is Rs 2.69-2.70 per unit. Adani Green Energy and Azure Power quoted the second lowest bid of Rs 2.70/unit.

Source: Financial Express,03 Dec. 2021

IREDA Signs Pact with BVFCL for RE Projects

Indian Renewable Energy Development Agency Ltd has signed a memorandum of understanding (MoU) with Brahmaputra Valley Fertilizer Corporation Ltd for providing its techno-financial expertise in developing renewable energy projects and fundraising.

Source: PTI December 01, 2021



Innovations for a better tomorrow

Manufacturing wind turbines and 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.

SUZLON
POWERING A GREENER TOMORROW

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

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The Dawn of Artificial Intelligence in Wind Energy

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1. Artificial Intelligence (AI): The Genesis

Way back in 1950 when Alan Turing, often referred to as the 'father of computer science', proposed to consider 'Can machines think?'[10,p.1] to set off rapid conversation on 'Artificial Intelligence (AI)' through his seminal work, 'Computing Machinery and Intelligence', he would have been rather sceptical to contemplate that decades later the seed in time would eventually grow into a full-fledged literary discipline in itself. He offered the all-time famous and much scrutinized 'Turing Test'.

Subsequently, 'Artificial Intelligence: A Modern Approach' by Stuart Russell and Peter Norvig, first published in 1995, went on to become one of the leading textbooks in the history of AI[7]. This marked the dawn of Artificial Intelligence.

2. Wind Energy: A Journey through Time

While AI was considered to be quite a novel concept in 1950s, people had been using wind energy for thousands of years – although, absolutely not in the way we know it today. The U. S. Energy Information Administration[13] states that:

> 'People used wind energy to propel boats along the Nile River as early as 5,000 BC. By 200 BC, simple wind-powered water pumps were used in China, and windmills with woven-reed blades were grinding grain in Persia and the Middle East.
>
> New ways to use wind energy eventually spread around the world. By the 11th century, people in the Middle East were using wind pumps and windmills extensively for food production. Merchants and the Crusaders brought wind technology to Europe. The Dutch developed large wind pumps to drain lakes and marshes in the Rhine River Delta. Immigrants from Europe eventually took wind energy technology to the Western Hemisphere.'(para.1-2)

As time elapsed, a lot changed in flow of past few decades. Whilst AI firmly became a thing of unambiguous reality, with progressive research and development the inherently intermittent wind energy[2] gradually evolved as the next generation mainstream sources of power generation. The U. S. Energy Information Administration[13] further states that:

> 'The oil shortages of the 1970s changed the energy environment for the United States and the world. The oil shortages created an interest in developing ways to use alternative energy sources, such as wind energy, to generate electricity.'(para.5)

Ever since inception, rapid advancements in AI revolutionized the way conventional businesses operate. Wind energy was no exception.

3. Artificial Intelligence in Wind Energy

The times have changed and as a matter of fact the intrinsic trait of AI is now all set to catalyze the wind energy industry[14]. AI has not just been an inconsequential buzz, in-fact in its current form it has in real terms meticulously redefined the very core of business efficiencies.

3.1. Machine Learning (ML) and Deep Learning (DL): The Engines of AI Computing

The advent of AI has put wind power sector on the brink of an inevitable massive transformation. Apro software[1] duly cites plausible scenarios to augment the significance of AI in Wind Energy:

> 'ML algorithms can identify structures and patterns in data sets, build mathematical models to represent these relations, and use them to make predictions or decisions without being explicitly programmed.'(para.23)

Machine Learning (ML), a branch of Artificial Intelligence, focuses on the use of data and algorithms to imitate the way humans learn, gradually improving its accuracy[8].

'Artificial intelligence is expected to help increase energy generation from wind and reduce maintenance costs for wind farms.'

A subset of Machine Learning and essentially a neural network with three or more layers which learns directly from large amounts of data – is the Deep Learning (DL)[9].

3.2. AI Data Processing Algorithms: Redefining Wind-Business Efficiencies

From real-time processing of complex data to lucid decision making, ML and DL present promising use cases for Artificial Intelligence in swift development of wind energy sphere. In accord, Cornelissen[3] summarises the importance of Artificial Intelligence in Wind Energy, stating that:

> 'Artificial intelligence is expected to help increase energy generation from wind and reduce maintenance costs for wind farms.'(para.2)

4. Industry Outlook: Rise of the Early Birds

It is now time for concepts to witness a steady transformation from planning phase towards their defined point of execution. Information Technology (IT) industry has duly acknowledged the call of the moment. Industry giants are resolutely keeping vigil at AI breakthroughs in the wind power segment with ever rising positive outlook.

DeepMind Technologies, a British Artificial Intelligence subsidiary of Alphabet Inc. and research laboratory founded in September 2010, acquired by Google in 2014[4], has optimistically ventured into the world of wind power prediction. In the words of Desmond[5]:

> 'Google and its DeepMind AI subsidiary have combined weather data with power data from 700 megawatts of wind energy that Google sources in the Central US. Using machine learning, they have been able to better predict the wind, which pays off in the energy market.'(para.2)

5. Scope of AI Integration in Wind Energy

Seamless and steadfast integration of AI with business setups attributes to its bottomless capabilities. Likewise, even a sincere attempt to explore and radically define the very limits and nature of AI deployments in wind energy might just turn out to be utterly futile. It would rather be sane to constrain discussions to the current applications of AI in wind power industry.

Consequently, for ease of comprehension AI implementations in wind power sector can broadly be classified to encompass, by and large the management of –

a. Supply-side System (primarily involving Wind Energy Forecasting and Wind-Farm Operations & Maintenance (O&M) activities)
b. Demand-side System
c. Transmission and Distribution (T&D) Network Infrastructure
d. Energy Storage-Buffer Infrastructure, and last but not the least
e. The Miscellaneous Stakeholders

6. Artificial Intelligence Use Cases

Opportune intervention of AI in all the more proficient management and revitalization of Supply-side System and T&D Network Infrastructure undeniably deserves a due mention. For a closer perception, it becomes even more imperative to dive right in and see how AI works in Wind Energy. According to Budny (n.d.) as cited by Froese[6]:

> 'One of the best examples of AI use cases is automated detection of yaw misalignment, which, if left undetected leads to lost energy production and increased loads on the turbine. Other examples include pitch-bearing, generator stator insulation, and transformer failure prediction, as well as detection of poor bearing lubrication conditions.
>
> AI platform continually monitors wind-turbine operation in the background, so it needs no operator input. [In order to facilitate fail-safe induction of AI, as a minimum, businesses should reasonably] be sure to look for a system that is supported by wind industry domain experts, as the combination of data science expertise and wind industry expertise leads to the best outcomes.'(para.7-8)

'One of the best examples of AI use cases is automated detection of yaw misalignment, which, if left undetected leads to lost energy production and increased loads on the turbine.'

In point of fact, contemporary AI implementations rather tend to focus on the two most important functional aspects of Supply-side System management – The:

i. Wind Energy Forecasting, and
ii. Operations and Maintenance (O&M) activities

6.1. AI in Wind Energy Forecasting

Even as O&M activities do secure majority of attention most of the times, Wind Energy Forecasting is indeed in no way less significant. It is literally as important as any other influential parameters of project success. Budny (n.d.) as cited by Froese[6] highlights Forecasting in Wind Energy as an indispensable feature of composed AI systems, further stating that:

> 'Many types of forecasts are possible, including power production, availability, component over-temperature events, spare parts needs, and other such use cases. Having such increased visibility provides tremendous benefits to wind-turbine operators.'(para.9)

6.2. AI in Wind-Farm Operations and Maintenance (O&M)

Besides, the incessant escalation in scope of Artificially Intelligent Systems, apparently with specific spotlight on Wind-Farm Operations and Maintenance (O&M) activities, could explicitly outperform the impetus of AI system implementations in other industries. An excerpt from Apro Software[1] summarises the importance of pivotal role AI could play in tranquil facilitation of O&M activities in a typical Wind-Farm setup:

> 'An efficient way to reduce O&M costs is to predict failures before they occur, using a robust condition monitoring (CM) approach. Condition monitoring involves observing the components of a wind turbine to detect changes in its operation that could be a sign of future failure.
>
> Recent developments in sensors and signal processing systems, combined with machine learning algorithms, offer new opportunities for efficient and rapid CM analysis. This

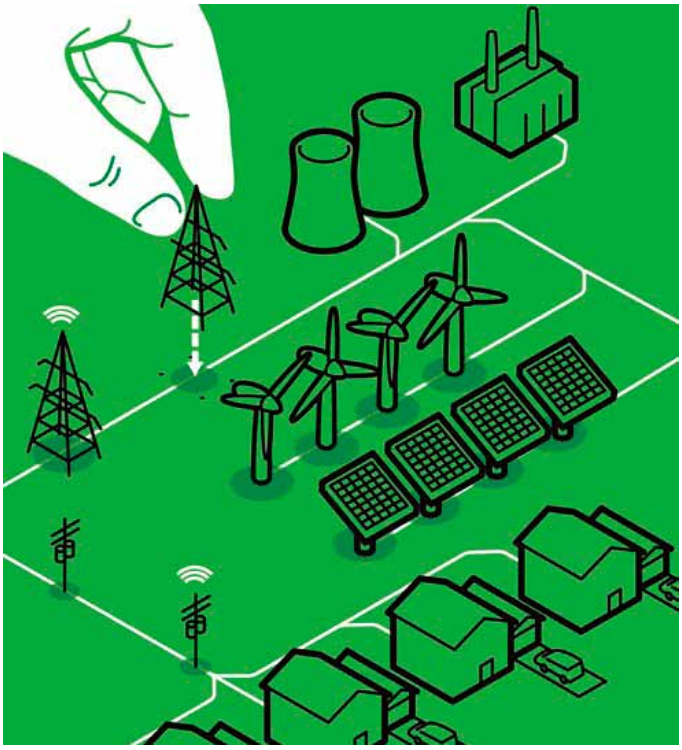
data is collected by specific sensors and processed through a wide range of ML-based methodologies. In particular, Neural Networks (NN), Support Vector Machines (SVM), and decision trees are the most commonly used.'[para.43-45, 47]

6.3. Wind Energy Data Sources for AI Computing

Strategic placement of master AI control system in centre or an array of tactically positioned AI sub-systems could judiciously fetch in real-time key information from the following tentative sources of raw / partially processed Wind-Farm data[6]:

- Supervisory Control And Data Acquisition (SCADA) data (e.g., mean, minimum, maximum and standard deviations, etc.)
- Maintenance logs (e.g., component replacement dates, lubrication events, etc.)
- History of past failures
- Firmware updates
- CMS data

'Many types of forecasts are possible, including power production, availability, component over-temperature events, spare parts needs, and other such use cases.'



6.4. AI Powered Multi-Criteria System: An Inclusive Approach to Wind-Farm Management

Further, Cornelissen[3] states that signs of imminent damage could be detected well in advance through deployment of an AI driven Multi-Criteria System to support all manners of technical decisions:

> 'This should not only make such parks more efficient but also lead to a reduction in maintenance costs. The system monitors all the technical components of the turbines in the park. These parameters and measurement data can be used to determine if certain components will break down in the short-term. Replacing them on time prevents a complete breakdown of the whole turbine. Moreover, the artificial intelligence learns to recognize signs – such as specific vibrations or parts that are starting to overheat – as a symptom of potential future damage. Replacements of parts can be grouped together this way too. As a result, a mechanic would not have to go to the wind farm every single time to carry out repairs or maintenance on a turbine. This saves a lot of expensive travel costs, especially for large complexes at sea.'[para.5]

7. Smart Grids: The Next-Gen Power Networks

Smart Grid is yet another dimension to thrive on technological intervention with onset of Artificial Intelligence. There is no denial to the fact that AI will prove to be the most commendable technology when it comes to the ultimate realization of futuristic Smart Grid initiatives. The U. S. Department of Energy[11] states that:

> 'The current grid has difficulty accommodating variable sources of power like wind, [one of] the fastest-growing sources of renewable power on the grid. As these resources begin to supply increasing percentages of power to the grid, integrating them into grid operations will become increasingly difficult. The Smart Grid will be able to make better use of these energy resources. It will give grid operators new tools to reduce power demand quickly when wind power dips, and it will have more energy storage capabilities to absorb excess wind power when it isn't needed, then to release that energy when the wind power dips. In effect, energy storage will help to smooth out the variability in wind resources, making them easier to use.
>
> Studies have shown that connecting wind resources from a diversity of geographic locations helps to balance out fluctuations in wind power. Having such geographically diverse wind resources on a single electric superhighway will result in a more steady supply of wind power to the

nation's power grid, making it easier for grid operators to make full use of this resource.'(para.1)

Sooner or later, digital technology is destined to come for rescue of wind energy from what is now termed as the innate concern of intermittence associated with renewable sources of power generation. The momentum will effectively shift from legacy to AI powered grid infrastructure. Smart Grids would ultimately simplify things to a greater extent. In line, the U. S. Department of Energy[12] further states that:

> 'The digital technology that allows for two-way communication between the utility and its customers, and the sensing along the transmission lines is what makes the grid smart. Like the Internet, the Smart Grid will consist of controls, computers, automation, and new technologies and equipment working together, but in this case, these technologies will work with the electrical grid to respond digitally to our quickly changing electric demand.
>
> The Smart Grid represents an unprecedented opportunity to move the energy industry into a new era of reliability, availability, and efficiency that will contribute to our economic and environmental health.'(para.2-3)

'… Like the Internet, the Smart Grid will consist of controls, computers, automation, and new technologies and equipment working together, but in this case, these technologies will work with the electrical grid to respond digitally to our quickly changing electric demand.'

8. The Road Ahead

Artificial Intelligence demonstrates extensive calibre in wind energy. The contemporary AI systems are progressively being adopted in vital domains of wind industry. From rational Forecasting of Wind Power to real-time facilitation of Operations and Maintenance (O&M), to smart automation of Transmission and Distribution (T&D) Networks, and beyond, AI is profoundly recording its righteous presence. Besides, Artificial Intelligence is evenly revolutionizing precise management of Demand-side System in tandem with the Supply-side. When the time is ripe, AI will expand to include miscellaneous stakeholders in the mainstream.

The dawn of AI in the world of wind energy is a guaranteed ticket to brighter horizons. The rise of Artificially Intelligent Wind Power Systems is deemed to redefine the dominance of the very constituents of Energy Portfolio, as AI Innovation and Creativity take absolute authority of the R&D drive. In due course of time, wind energy systems will become even more ingenuous and self-discriminating. AI driven intellectual business process automation and optimization techniques will render inclusive access to dimensions never known before. Apt R&D, universal standardization of benchmarks and substantial rollout of wind-specific Machine Learning (ML) and Deep Learning (DL) algorithms and data patterns will (considerably) outperform human instinct and disposition in shrewd decision making.

The day AI takes the definitive charge will firmly mark the genesis of a new era of enduring sustainable growth in the splendid history of wind energy. Until then? Spread the wings of imagination and ride on the winds of change!

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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

www.siemensgamesa.com

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.

SIEMENS Gamesa
RENEWABLE ENERGY

> "As utilities do not depend on customers to report outages, this self-healing capability is vital component of the smart grid. It provides real-time information of all the grid events."

Renewable Energy with SMART Grid

Tejas Sole
Emerging Market Lead, Powercon

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

Introduction

India has set an ambitious target to achieve a capacity of 175 GW of renewable energy by the end of 2022, now which expands to 450 GW by 2030. In India, RE penetration is increasing day by day and it is imposing a challenges on demand-side flexibility, power plant flexibility and grid-side flexibility.

With the use of Inflexible, rigid, conventional grid networks, it will be difficult to accommodate higher levels of variable renewable energy penetration smoothly and effectively. Conventional grid networks are less able to extract maximum kWh units from renewable energy, which is having a multi-billion of investments. The solution is to seamlessly adopt Smart grid networks.

What is a Smart Grid?

The Smart Grid is defined as an electrical system that uses multiple advanced sensorics information, two-way, cyber-secure communication technologies and computational intelligence in an integrated fashion across electricity generation, transmission, substations, distribution and consumption. Flexible, strong, and smart grids play a crucial role in the integration and adoption of variable renewable energy.

Smart grid technology is enabling the effective management and distribution of renewable energy sources such as solar,

Table 1: Technology Comparison Between Conventional Grid and Smart Grid

Particulars	Conventional Grid	Smart Grid
Type of Technology	The system is basically electro-mechanical in nature.	The smart grid fully employs digital technology.
Way of Distribution	Power can only be distributed from the main power plant.	Power can go back up the lines to the main plant from a secondary provider.
Use of Sensorics	System is not equipped with many sensors. This makes it difficult to pinpoint the location of a problem which results in longer downtimes.	System is equipped with multiple sensors. This would help to identify the exact location of a problem and reduce downtime.
Way of Monitoring	Manual monitoring due to use of traditional infrastructure.	Throughout digital technology is used to monitor remotely.
Time of Restoration	For attending faults and trouble shooting, the technicians have to physically go to the location of the fault to make repairs. It increases outage time.	With use of advanced sensorics, problem area pinpointing and troubleshooting is simple. On detection of fault, the smart grid can immediately report and guide to technicians at the monitoring center to begin the necessary repairs.
Chances of Blackouts	Traditional energy network is prone to failures. Failure of network can lead to blackouts.	Power can be re-routed to go around any problem areas. This limits the area impacted by power outages.
Possibility of Control	Energy control is bit troublesome.	With the use of advanced sensorics, other smart network and monitoring 24 x 365, energy control is easy.
Communication mode	One-way communication	Two-way communication
Used Topology	Works on radial topology.	Works on network topology.
Data security	Least requirement of cyber security	Cyber security is mandatory.

wind, and green hydrogen. The smart grid connects a variety of renewable energy assets to the power grid. By leveraging the smart sensorics and use of Internet of Things (IoT), utilities can quickly detect and resolve service issues through continuous self-assessments. As utilities do not depend on customers to report outages, this self-healing capability is vital component of the smart grid. It provides real-time information of all the grid events.

The technology comparison referred in Table 1 is helpful to understand the advantages of smart grid over conventional grid.

Sensors Used for the Smart Grid

1. Smart Precise and accurate voltage senser, current senser, temperature senser, moisture senser, and phase measurements.
2. Automated Meter Infrastructure (AMI) with wireless networks.
3. Smart sensors for outage detection.
4. Advanced sensors for power transformer health, condition, and predictive state monitoring.
5. High voltage transmission line temperature and weather condition sensors.
6. Distributed generation sensors for load balancing.
7. Smart Grid storage, on load monitoring and dispatch of energy monitoring mechanisms.
8. Synchronized phasors.

When these sensorics would be added to the gird network then they will provide massive amounts of data about consumption, voltage, the health of infrastructure and many other aspects of the electricity supply to the control centers. More importantly, it is the rate of communication that is revolutionary.

Conclusion

Smart grid technologies can enhance flexibility of grid operation, improve utilization of existing infrastructure, and improve the cost effectiveness of grid operations. Smart grid technologies helps the systems operators and policy makers to affordably attain renewable energy deployment goals, lower greenhouse gas emissions and ensure reliable system operation.

For implementation of smart grid, innovative policy, regulations and business models are needed.

Adani Group Exploring Investment in Sri Lanka's Renewable Energy Sector

The Adani group is exploring the possibility of investing in the Sri Lanka's energy and wind sector, a senior official from the state-owned Ceylon Electricity Board said. The Board of Investment said the Phase II of the Mannar Wind Energy Park with a capacity of 100 MW is open on a Build, Own, Operate and Transfer (BOOT) basis for potential investors.

Source: PTI, 26 October 2021

No New Coal-Based Power Plants to be Set Up in Sri Lanka

Sri Lanka will stop commissioning new coal-fired power plants as part of a push to ditch the dirty fossil fuel, the government said ahead of the COP26 global summit on climate change. Coal and hydroelectricity contribute about 44 per cent each to Sri Lanka's power supply. Diesel accounts for nine per cent, the rest coming from wind and solar. "The cabinet approved a proposal by the minister of electricity to support the no new coal initiative (of COP26) and allow both local and foreign investors to set up more renewable energy projects," cabinet spokesman Ramesh Pathirana told reporters in Colombo.

Source: AFP, 26 October 2021

REC raises $75 mn Term Loan from Sumitomo Mitsui Banking Corporation

State-run REC has said that it has raised a USD 75 million (about Rs 561 crore) term loan from Sumitomo Mitsui Banking Corporation (SMBC). The proceeds from this facility shall be utilised to fund power sector projects as permitted under the external commercial borrowing (ECB) guidelines of the Reserve Bank of India (RBI).

Source: Press Trust of India, October 21, 2021

BP and Equinor Pick Vestas 15 MW Turbines for US Offshore Wind Projects

Vestas will provide 138 V236-15.0 MW turbines for Empire Wind 1 and 2, located 15-30 miles off the coast of Long Island. With this project, New York, Equinor, bp, and Vestas are together bringing the USA one step closer to achieving President Biden's goal of 30 GW of offshore wind capacity installed by 2030 as well as New York State's goal of installing 9 GW of offshore wind capacity by 2035.

Source: Offshore Wind.biz, October 18, 2021

India Needs $15 bn to Set up 15 GW Green Hydrogen Electrolyser Capacity by 2030

India will require an estimated $15 billion in public and private funding to set up 15 GW of green hydrogen electrolyser capacity by 2030, according to industry body, India Hydrogen Alliance (IH2A). This electrolyser capacity is expected to produce 3 million metric tonnes (MMT) of green hydrogen and would need 30 GW of renewable energy.

Source: ET Energy World, November 08, 2021

Ministry of Power Notifies the Rules for Sustainability of the Electricity Sector and Promotion of Clean Energy

India's commitment to environment friendly green energy further gets strengthen through the notification of "Rules for Timely recovery of costs due to Change in Law", and "Rules for Promotion of generation from renewable sources of energy by addressing Must Run and other matters"

Ministry of Power notifies rule for the sustainability of the electricity sector and promotion of clean energy to meet the India's commitment towards Climate Change.

The investors and other stakeholders in the power sector had been concerned about the timely recovery of the cost due to change in law, curtailment of renewable power and other related matters. The following Rules notified by the Ministry of Power under Electricity Act, 2003 are in the interest of the electricity consumers and the stakeholders:

i) Electricity (Timely recovery of costs due to Change in Law) Rules, 2021.

ii) Electricity (Promotion of generation from renewable sources of energy by addressing Must Run and other matters) Rules, 2021.

Timely recovery of the costs due to change in law is very important as the investment in the power sector largely depends upon the timely payments. At present the pass through under change of law takes time. This impacts the viability of the sector and the developers get financially stressed. The Rules would help in creating investment friendly environment in the country.

The energy transition is happening across the globe. India has also made commitments to bring about energy transition. India has also announced international commitment to set up 175 GW of RE capacity by 2022 and 450 GW by 2030. These Rules will help in achieving the targets of RE generation. This will ensure that the consumers get green and clean power and secure a healthy environment for the future generation.

A formula has been provided to calculate adjustment in the monthly tariff due to the impact of Change in Law.

The Rules also provide that a must-run power plant shall not be subjected to curtailment or regulation of generation or supply of electricity on account of merit order dispatch or any other commercial consideration. The electricity generated from a must-run power plant may be curtailed or regulated only in the event of any technical constraint in the electricity grid or for reasons of security of the electricity grid. For curtailment or regulation of power, the provisions of the Indian Electricity Grid Code shall be followed. In the event of a curtailment of supply from a must-run power plant, compensation shall be payable by the procurer to the must-run power plant at the rates specified in the agreement for purchase or supply of electricity. The RE generator is also allowed to sell power in the power exchange and recover the cost suitably. This helps in realisation of revenue by the generator and also the power is available in the electricity grid for use of consumers.

The Rules also provides for the Intermediary procurer to procure electricity for distribution licensees. In this regard, the Rules inter-alia states that "the intermediary procurer, an agency nominated by the Central Government or State Government, may procure electricity through a transparent process of bidding in accordance with the guidelines issued by the Central Government under section 63 of the Act for sale to one or more distribution licensees."

Source: **Press Information Bureau**, *23 October 2021*

India's Renewable Energy Investment Likely to Cross $15 Billion in 2022

After witnessing cloudy skies this year, the country's renewable energy sector is expected to boom with a likely investment of over USD 15 billion in 2022 as government focuses on electric vehicles, green hydrogen, manufacturing of solar equipment as well as achieving the ambitious 175 GW renewable capacity target.

Source: PTI December 24, 2021

Tata Steel UK Plant Helps Build World's Largest Offshore Wind Farm

Steel made at Tata Steel's Port Talbot plant in Wales is behind the world's largest offshore wind farm due to be completed by 2026, the Indian steel major said. The Dogger Bank Wind Farm, capable of providing green energy for 6 million homes in the UK, will make use of steel processed into hollow sections at the Indian steel major's Corby and Hartlepool sites in north-east England and fabricated to build the first two phases of the wind farm.

PTI December 23, 2021

Siemens Gamesa to Install First of its SG 11.0-200 DD Machines

Siemens Gamesa has received 242 MW firm order from Ørsted Gode Wind 3 German offshore wind power project for 23 SG 11.0-200 Direct Drive offshore wind turbines with five-year Service agreement. Installations expected to be completed in CY2024. The machine features a 200-meter diameter rotor.

Source: WindInsider.com, 21st December 2021

Coal to Stay as Major Source of Energy in Foreseeable Future: Mr. Pralhad Joshi

Coal will stay as a major source of energy in the foreseeable future as it is an affordable source of energy with substantial reserve, Parliament was informed. Despite push for renewables, the country will require base load capacity of coal generation for stability and also for energy security, Coal Minister Mr. Pralhad Joshi.

Source: PTI December 21, 2021.

61% of Power Plants to Miss Meeting their 2022 Deadline on Emission Standards

An analysis by the Center for Science and Environment (CSE) shows that 48 out of 79 power plants (61%) in Category A will miss the deadline of their emissions standards – this means non-compliant power plants Pollutants will continue to emit more than their permissible limits, polluting air in cities with a population of millions.

Source: Bharattimes.co.in, December 24, 2021

India Achieves 2030 Target of 40% Non-Fossil Based Electricity Goal

As part of its Nationally Determined Contributions (NDCs) at COP 21, India had committed to achieving 40 per cent of its installed electricity capacity from non- fossil energy sources by 2030. However, the country has achieved this target in November 2021 itself. The country's installed Renewable Energy (RE) stands at 150.54 GW (solar: 48.55 GW, wind: 40.03 GW, small hydro power: 4.83, bio-power: 10.62, large hydro: 46.51 GW) as on 30 November 2021 while its nuclear energy based installed electricity capacity stands at 6.78 GW. This brings the total non-fossil based installed energy capacity to 157.32 GW which is 40.1 per cent of the total installed electricity capacity of 392.01 GW, he Ministry of New and Renewable Energy has said.

India's renewable energy programme is driven by private sector investment. As per REN21 Renewables 2020 Global status Report, during the period 2014-2019 renewable energy programmes and projects in India attracted an investment of US$ 64.4 billion. In the year 2019 alone, US$ 11.2 billion were invested.

Germany to Pull the Plug on Three of its Last Six Nuclear Plants

Germany will pull the plug on three of its last six nuclear power stations, another step towards completing its withdrawal from nuclear power as it turns its focus to renewables. The government decided to speed up its phasing out of nuclear power following Japan's Fukushima reactor meltdown in 2011 when an earthquake and tsunami destroyed the coastal plant in the world's worst nuclear disaster since Chernobyl 25 years earlier. The reactors of Brokdorf, Grohnde and Gundremmingen C, run by utilities E.ON and RWE, will be shut down on 31st December 2021 after three and half decades in operation. The last three nuclear power plants - Isar 2, Emsland and Neckarwestheim II - will be turned off by the end of 2022.

Total costs for the dismantling are estimated by E.ON at 1.1 billion euros ($1.2 billion) per plant. In 2020, E.ON made provisions of 9.4 billion euros for the nuclear post-operational phase, including dismantling the facility, packaging and cleaning up the radioactive waste. The dismantling is expected to be completed by 2040.

NTPC Arm NREL to Float Global Tender to Set Up 3GW RE Project

NTPC arm NTPC Renewable Energy Ltd (NREL) will float a global engineering procurement and construction tender to set up a 3GW renewable energy project with a battery storage system worth around Rs.15,000 crore by February 2022.

ApTEL Sets Aside CERC Order on REC Price Revision - RECs Trading likely to start soon

In an important advancement, ApTEL has delivered its judgment on the matter of REC on 9th November 2021. According to the order of ApTEL dated 9th November 2021, they set aside the order dated 17.06.2020 passed in Petition no. 05/SM/2020, by the Central Electricity Regulatory Commission (CERC), revising the floor and forbearance price of solar and non-solar RECs at Rs. 0/MWh and Rs. 1000/MWh respectively.

In practical terms, it means:

- The price revision made by CERC to a floor price of Rs 0/ MWh and forbearance price of Rs 1000/ MWh is no longer applicable.
- Trading is likely to resume in the near future with the older prices being applicable (for Non-solar a floor price of Rs 1000/MWh and forbearance price of Rs 3000/MWh, and for Solar a floor price of Rs 1000/MWh and forbearance price of Rs 2400/MWh)

The primary reasons for ApTel setting aside CERCs order are:

- Inadequate consultation with FoR, POSOCO and other stakeholders. The order states:

  115. The process of consultation mandated by the Regulations is not an empty formality. The Commission has failed to show, either in the impugned order, or by proceedings drawn anterior hereto, conscientious consideration of, or sufficient reasons cited for, either accepting or rejecting such comments as noted above. The requirement in Regulations of "consultation" with the two specified agencies – POCOSO and FOR – is, as observed in Cellular Operators Association of India (supra), a means of holding the statutory authority (CERC) "accountable for administering the laws in a responsible manner, free from arbitrary conduct". The ultimate decision of the authority after "consultation" mandated by law "must articulate a satisfactory explanation for its action, including a rational connection between the facts it found and the choices it made". The impugned order fails to pass this muster as well. We find the observations of CERC vis-à-vis the above-extracted comments of DERC, KERC, POCOSO rather vague." (Emphasis supplied)

Incorrect approach in considering competitive bid tariffs for determining RECs prices. The order states:

78. We agree with the appellants that CERC has fallen into grave error by relying upon the competitive bid tariffs adopted by some ERCs because of the declining trend of bid discovered tariff on assumption that such phenomena could only be due to a reduction in cost of generation and for the reason that various Commissions have stopped passing generic tariff orders." (Emphasis supplied)

- The validity of existing RECs to be extended for the remainder of their validity as it stood on the date of the original order (17/6/2020).
- Inefficient implementation of RPO. The order states:

  98. There seems merit in the plea that due to non-compliance of the RPO targets by the Obligated Entities, the recovery of green components (RECs) by the RE generators have been seen generally to lag behind, adding to the reasons for huge unsold inventory.

  Likely impact of the order:

  - RECs trading is likely to commence soon at the previous floor and forbearance prices. Trading may even commence as early as on November 24 (but we will have to wait and watch).
  - Since trading has been suspended since June 2020, there is likely to be significant demand when trading resumes.
  - We may see changes in the REC mechanism in the near future based on proposal by Ministry of Power. (see summary here - https://reconnectenergy.com/power-minister-approves-revamped-rec-mechanism)
  - The finding by ApTEL that it is incorrect to use competitive bid based tariff's for price determination of RECs may have an impact on the case currently being considered by the Supreme Court. *(https://reconnectenergy.com/supreme-court-allows-conditional-trading-for-non-solar-recs/)*

ApTEL has directed CERC to issue formal orders to give effect to its order within two weeks.

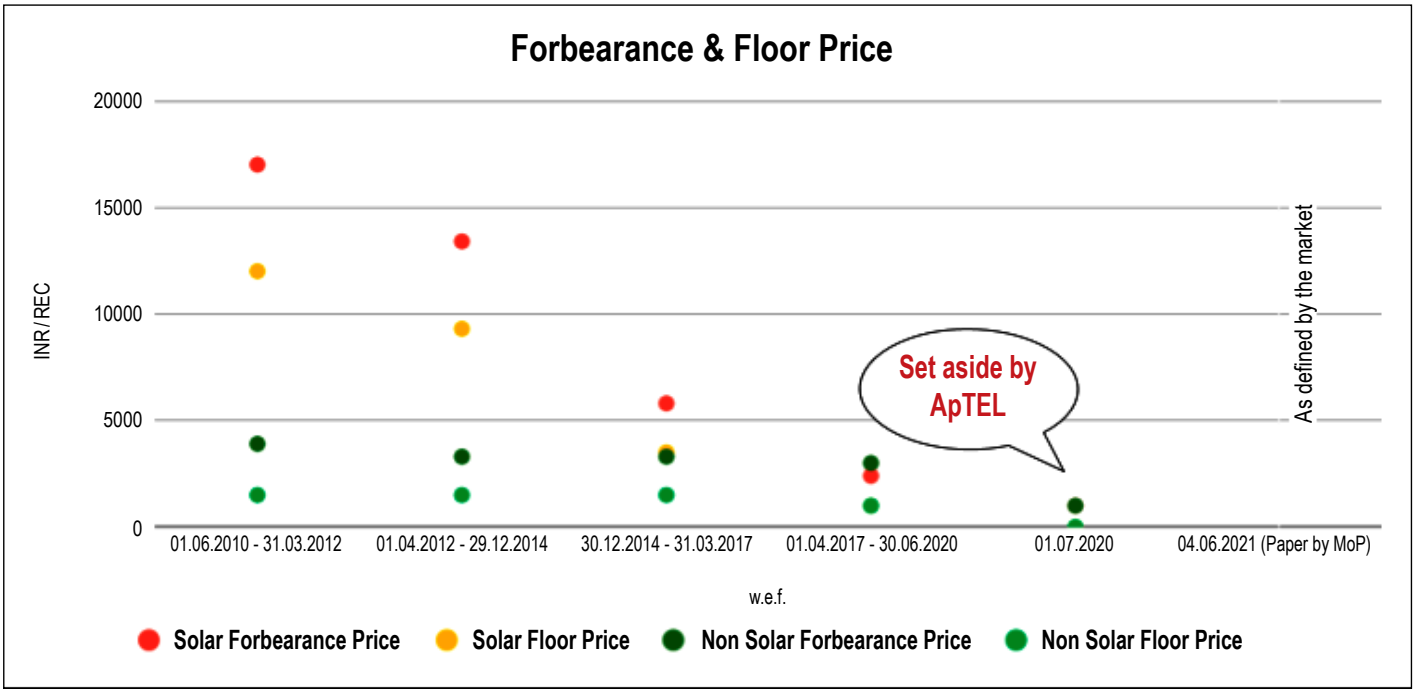
Quick snapshot of the past trends of REC related phenomenon and our speculation once the trade resumes, are as follows:

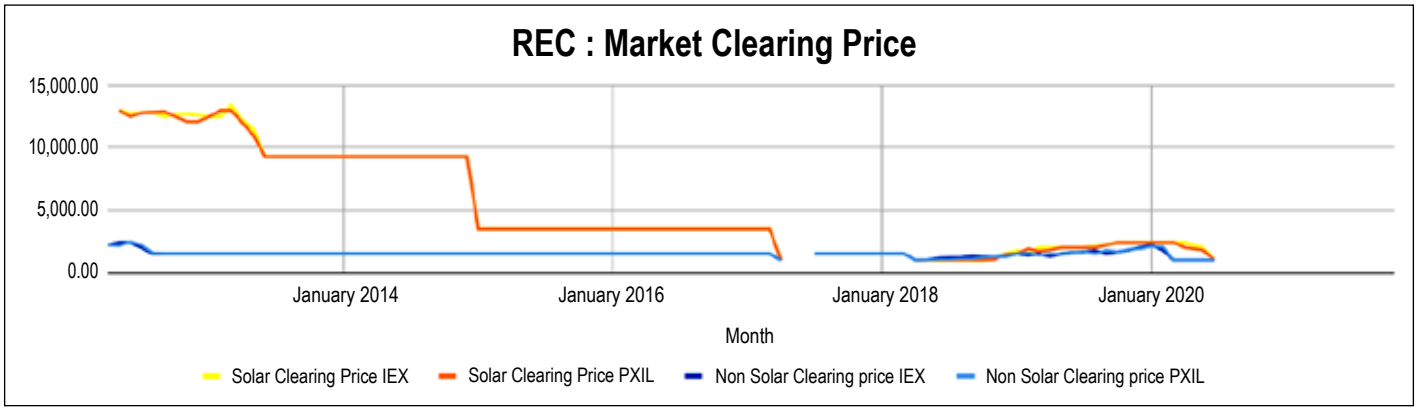
1. Floor and Forbearance Price:

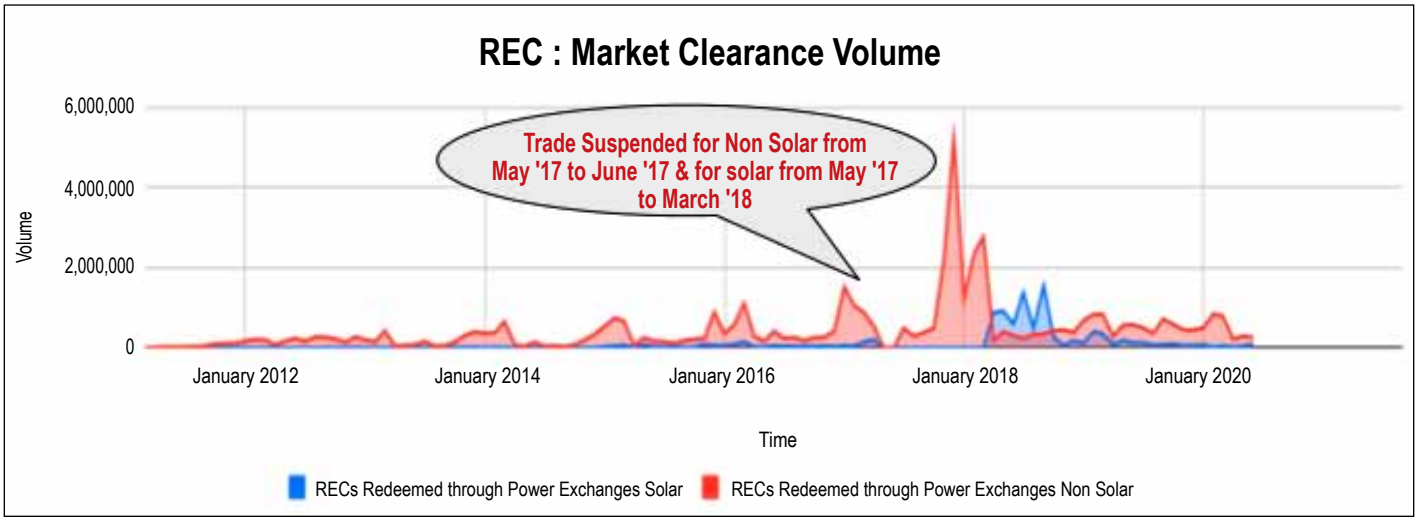
Past Trend: Forbearance and Floor Price

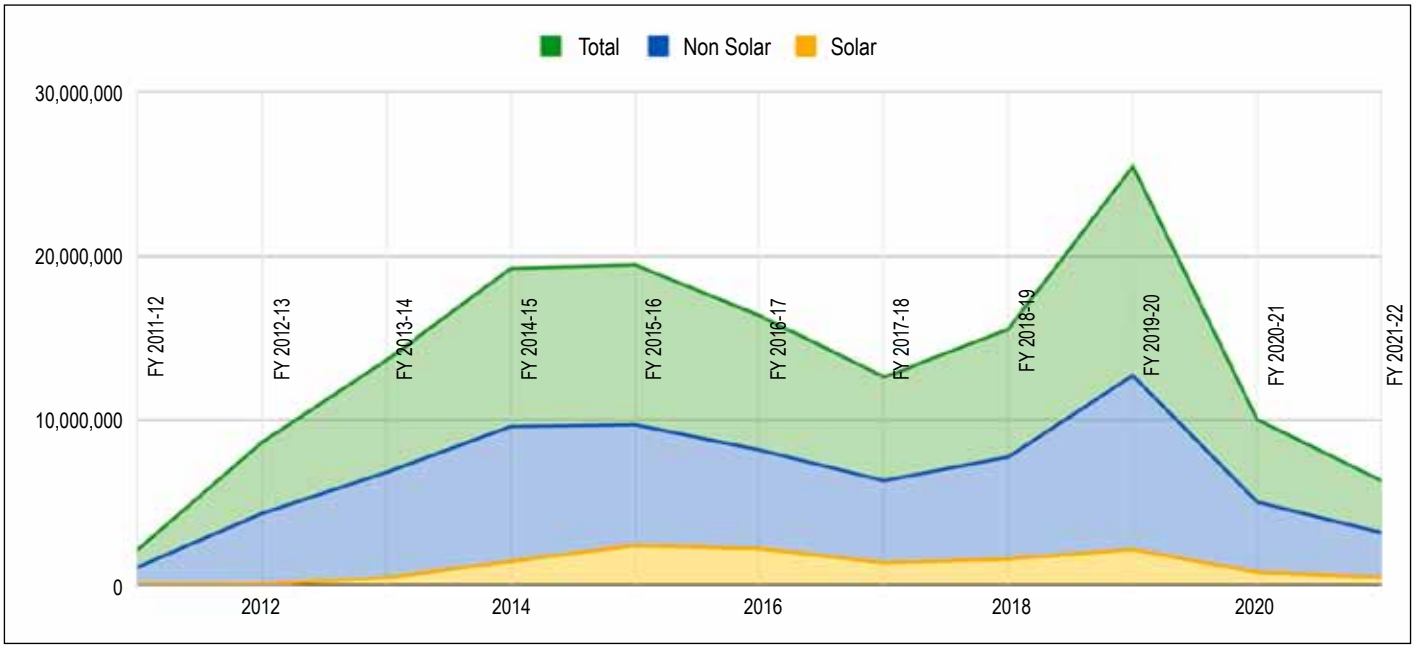
2. Market Clearing Price & Market Clearing Volume

Owing to the stay order for REC trading for more than a year now, the supply of RECs have piled up in the last couple of


Forbearance & Floor Price
20000
15000
10000
5000
0
INR / REC
As defined by the market
Set aside by ApTEL
01.06.2010 - 31.03.2012
01.04.2012 - 29.12.2014
30.12.2014 - 31.03.2017
01.04.2017 - 30.06.2020
01.07.2020
04.06.2021 (Paper by MoP)
w.e.f.
Solar Forbearance Price
Solar Floor Price
Non Solar Forbearance Price
Non Solar Floor Price


REC : Market Clearing Price
15,000.00
10,000.00
5,000.00
0.00
January 2014
January 2016
January 2018
January 2020
Month
Solar Clearing Price IEX
Solar Clearing Price PXIL
Non Solar Clearing price IEX
Non Solar Clearing price PXIL


REC : Market Clearance Volume
6,000,000
4,000,000
2,000,000
0
Volume
Trade Suspended for Non Solar from May '17 to June '17 & for solar from May '17 to March '18
January 2012
January 2014
January 2016
January 2018
January 2020
Time
RECs Redeemed through Power Exchanges Solar
RECs Redeemed through Power Exchanges Non Solar



months. On the other hand, RPO clients could not fulfill their obligation for over a year due to the unavailability of REC.

Even though the impugned order on price revision is being set aside by ApTEL, the order prevailing prior to 17 July 2020 order would be applicable so long as a fresh order on the subject is not issued.

3. REC Issuance Trend

In recent years, the stay on REC trading because of last CERC order on floor and forbearance price has resulted in steep decline in REC issuance. On the other hand, the offtake of RECs had also been stopped since July 2020. Currently, as on 09.11.2021, total inventory of Solar RECs are 11,63,599 and Non Solar RECs are 76,35,934 as per the REC Registry report.

Courtesy: **ReConnect**

Snippets

AIIB Projects $50-Billion Investment for Climate Finance by 2030

The Asian Infrastructure Investment Bank (AIIB) has said that it currently estimates its climate finance approvals to be $50 billion by 2030 and added that it will align its operations with the goals of the Paris Agreement by July 1, 2023. This amount will represent a four-fold increase in the annual climate finance commitments since we started publicly reporting the numbers in 2019," said Mr. Jin Liqun, President and Chair of the Board of Directors at AIIB at virtual press conference.

Source: ET Energy World, October 26, 2021

AGEL Arm Bags 450 MW Wind Energy Project

Adani Green Energy subsidiary Adani Renewable Energy Holding Fifteen has received a letter of award (LOA) for setting up a 450 MW wind energy project in a tender issued by Solar Energy Corporate of India Limited (SECI) for setting up 1,200 MW ISTS-connected Wind Power Project (Tranche-XI) and has received the Letter of Award (LOA) to set-up 450 MW wind power project under this tender," a BSE filing said. The fixed tariff for this project capacity is Rs 2.70/ kWh for 25 years.

Renewable Energy Jobs Grew Globally in 2020 Despite Covid 19 Crisis

The number of jobs in renewable energy worldwide increased in 2020, despite the huge economic disruptions caused by the COVID-19 pandemic, with the growing industry holding up better than fossil fuels, international agencies said. In an annual report on clean energy employment, the International Renewable Agency (IRENA) and the International Labour Organization (ILO) said there were 12 million jobs in renewable energy and its supply chain last year, a third of them in solar power. That was arise from 11.5 millioin jobs in 2019.

Source: Reuters October 22, 2021

Ofgem, IRENA, IEA and World Bank launch Regulatory Energy Transition Accelerator

The Regulatory Energy Transition Accelerator has been launched by UK regulator Ofgem, the International Renewable Energy Agency, the International Energy Agency and the World Bank to accelerate the global transition to low-carbon energy technologies.

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NGC

Multi-Rotor System and Smart Rotors

> "The power production in multi-rotor system was estimated to be 8% higher than a single rotor system of the same overall swept area."

Srinivasu Pitaka
Assistant Manager
TUV Rheinland (India)
Private Limited, Noida, U.P.

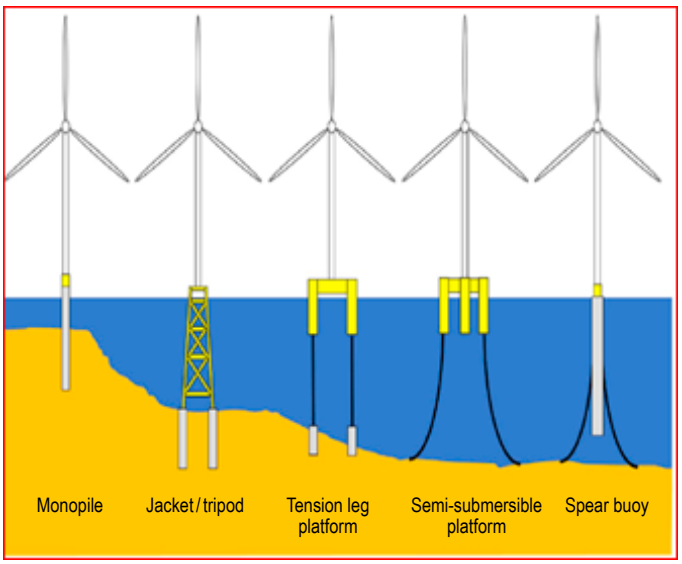
Introduction

Wind power presents a significant opportunity in terms of providing low carbon energy and cost competitiveness compared with the use of fossil fuels. We have seen rapid development in their underlying technology in order to increase their competitiveness. Future emerging technologies are believed to have potential and we can expect further growth and development. The ultimate goal of advanced technology in to wind turbines is to bring down the cost of electricity from wind. The information presented below gives the brief technical description and the degree of development in few areas of wind turbine technology.

Future Wind Generation Technology

Offshore Floating Wind

These floating structures have no foundation on the sea floor but instead are based on either separate platforms or tension leg kept in a place by mooring and anchoring system. The development of floating wind structures has grown rapidly than existing fixed structure technology in other countries. Therefore potential for optimization of floating offshore system ultimately realise lower cost than fixed structure. Floating design allows lower transportation, installation and lower assembly cost. The turbine and foundation for offshore structures comprise very lower then fixed structure turbine. However floating structures may have to be designed to operate and survive extreme environmental conditions.



Offshore Floating WTGs

Multi-Rotor System

This innovation allow us a large power system to be installed at single site with high number of standardised rotors. For improved

Multi-Rotor WTG

efficiency and reduction of the overall loads on a wind turbine it is possible to replace large single rotor with multiple rotor system. A major advantage of this technology is in the standardisation. The production process of smaller rotors could be industrialised and have lower costs while present production methods of large turbines require customisation. Moreover, in the case of malfunctioning of one rotor this does not imply any interruption of energy production from the working rotors of the array. The power production in multi-rotor system was estimated to be 8% higher than a single rotor system of the same overall swept area.

Optimum rotor size is likely to be determined by operation and maintenance logistics rather than aerodynamics. Overall design optimisation and maintenance is interactive with aeronomics, electrical, loading consideration and the other factors.

Smart Rotor

The smart rotor is an upgrade to the wind turbine rotor that facilitates active modification the blade aerodynamics and enhanced control of the rotor loads. Smart rotor has lower pitch motion when there is high wind shear but low turbulence intensity. Smart rotor wind turbine posses additional control over variable wind speed turbines that operate using torque and pitch control. Therefore it is considered the defining factor in valuing the smart rotor, rather than purely load reduction.

Potential of smart rotor technology would be enabling and scaling up to larger wind turbines and it is as a viable option to reduce the levelized cost of energy. It may also contribute to reducing the cost of energy by increasing the length of the blades and swept area. In the case of smart rotors the advantage is in improving annual energy production in the later years of their life without affecting the loads on the components; such as nacelle and generators.

Advanced Passive and Active Control Systems

Blades with movable parts can be considered both active and passive systems. Bend Twist Coupling (BTC) and Low Drag Vortex Generator is another type of passive system.

Bend Twist Coupling (BTC)

Bend Twist Coupling allows a twist of the blade caused by a primary bending deformation. During extreme weather conditions, these blades can fold together and reduce the risk of damage.

Low Drag Vortex Generator (LDVG)

This technology consists of small vane typically attached to suction side of blades where it causes local mixing in the boundary layer and thereby can prevent flow separation. It can be used to reduce or mitigate separation in the root region and to prevent erosion of turbine blades.

A specific type of active control system is circulation control on wind turbine aerofoils. This delivers compressed air from special slots located on the blade surface. Compressed air dynamically adjusts the aerodynamic performance of the blades and can be used to control lift drag and ultimately power.

Individual Pitch Control (IPC) is a multi-variable control which controls the power production and loads experienced by wind turbine.

Another important feature related to active control system is the use of the rotor as a wind sensor, which can allow drive and control systems to use the data they themselves provide.

These are some of the advance control systems, which increases life span of the turbine and reduce the O&M cost.

Green Energy Capex on a Charged-up Rebound, Says CRISIL Analysis

Capacity addition in the renewable energy segment surged 145 per cent year-on-year in the first eight months of the current financial year (FY22) with 8.23 GW added as of November. The solar segment led the additions with 7 GW, way above the 5.4 GW it added in the entire FY21. The outlook for FY22 remains positive, with 11.5-12 GW of solar energy and 2 GW of wind energy expected to come online by March, involving an investment of Rs 53,000-55,000 crore. In FY23, the solar and wind segments are expected to see capacity additions and investments of 17-18 GW and Rs 76,000-78,000 Crores.

IITM, Suzlon Join Hands to Develop Wind Energy and Related Forecasts

The Indian Institute of Tropical Meteorology (IITM) and Suzlon Energy Limited will collaborate and undertake joint projects in mesoscale modelling and wind forecasts required for wind energy purposes and have inked a three-year MoU in this regard. IITM will install weather research and forecasting mesoscale models and set up necessary infrastructure on the premises of the renewable energy provider company in Pune. The two institutions will also work to enhance the wind and rain forecasting models. There will also be efforts to establish a platform facilitating the technical exchange of data and knowledge in renewable energy and atmospheric modelling, particularly mesoscale modelling for wind energy purposes.

Source: Express News Service, October 30, 2021

11 Suppliers in India Now Part of Apple's Clean Energy Programme

Apple has announced that it now has 11 manufacturing sites in India operated by suppliers who have joined its clean energy programme. Taking another step towards its goal of becoming carbon neutral across its supply chain and products by 2030, the tech giant said another 175 Apple suppliers will transition to using renewable energy, bringing in more than 9 GW of clean power around the world. means they have committed to using 100% renewable energy for their Apple production. These actions will avoid over 18 million metric tons of CO_2e annually - the equivalent of taking nearly four million cars off the road each year. In India, these suppliers include Cheng Uei (Foxlink), Avary, CCL Design, Flex Ltd, Hon Hai, Jabil, Lingyi Tech, Pegatron, Sunwoda Electronics, Wistron and Yuto.

IIT-Madras Research Park Partners with St Andrews University for RE Goals

IIT-Madras Research Park has said that it is collaborating with University of St Andrews (UoSA), UK, to help India achieve 100% of the country's energy requirements through renewable energy

The project – funded by the UK government – is aimed at sharing knowledge and understanding of low-carbon energy systems and showcasing examples of low-carbon energy in practice.

Source: TNN, October 29, 2021

Niti Aayog Proposes RBI to Group EVs under Priority Sector Lending

Niti Aayog has proposed the Reserve Bank of India (RBI) to classify loans for purchasing electric vehicles under the priority sector lending (PSL) division. Under this lenders must loan at least 40% of their total credit to certain industries - Agriculture, export credit, small companies, housing, education, social infrastructure, and renewable energy are among these sectors. Reserve Bank of India is considering this proposal.

Source: E Mobility Plus, 7th December 2021

India Invites GCC Nations to Invest in Sustainable Energy Sectors

India invited the Gulf Cooperation Council (GCC) member countries yesterday to invest in the sustainable energy sectors in the country, which is one of the major focus areas of the government. Addressing the representatives of the GCC countries at India pavilion EXPO2020 Dubai, Mr Vipul, Joint Secretary, Gulf, MEA said that India's sustainable energy sector has immense opportunities, and the Government of India has taken a series of measures, including increasing the FDI limits along with opening up of the sectors like defence, telecom and insurance.

Source: PTI November 10, 2021

Study Suggests India Could Economically Meet Electricity Demand through RE By 2030

The Lawrence Berkeley National Laboratory (LBNL) has released an in-depth study of India's future power system investments. The report shows that India could economically meet its electricity demand, which is expected to double by 2030, through renewables and complementary flexible resources, including energy storage, agricultural load shifting, and hydropower, and optimally utilizing the existing thermal power assets in the country. The study sets forth national roadmap for India to meet 500 GW of non-fossil electricity capacity goal by 2030.

Source: ANI December 10, 2021

IEX Resumes Trade in REC

The Indian Energy Exchange has resumed the trading of Renewable Energy Certificates (REC) with effect from Wednesday 24 November 2021, after a gap of almost 16 months. The last REC trade session took place in June 2020. The trade has been resumed in line with APTEL's recent order dated 09.11.2021 and CERC order dated 18.11.2021.

Adani Green Energy Signs World's Largest Green PPA with SECI

Adani Green Energy Ltd (AGEL), the world's largest solar power developer and the renewable energy arm of the diversified Adani Group, has signed an agreement with the Solar Energy Corporation of India (SECI) to supply 4,667 MW of green power. This is the world's largest ever green power purchase agreement.

Source: Adani Renewables, 14 November 2021

Power Ministry Tells Banks to be Cautious When Lending to Discoms

The power ministry has urged banks to exercise caution while giving loans to state power distribution utilities to avoid putting the financial system at risk. This is the first time that the Centre has warned banks, expressing concern about the financial position of distribution companies and potential adverse impact on the banking system. Union power secretary Alok Kumar wrote to various financial institutions last month asking them them to follow prudential checks introduced by Power Finance Corp PFC and REC Ltd before sanctioning loans to state electricity distribution utilities. "A burgeoning debt and outstanding payables of distribution companies to their creditors, predominantly gencos and transcos, is a matter of concern," he wrote in the letter.

Source: Economic Times, Dec 17, 2021

'No Renewable Energy Investor will come if Energy Bills not paid, stringent action needed,' says Mr. R K Singh

Power Minister Mr. R K Singh has expressed concern over rising dues of renewable energy producers that have not been paid by discoms, saying no investment will come in the sector if investors find power bills are not being cleared. The minister said that it is a matter of worry because the quantum is just Rs. 15,000 Crore or Rs 16,000 Crore but it amounts to 11-month of their billing. A latest status report of the power minister finalised on November 29, 2021 showed that the total overdue amount of discoms towards renewable energy producers stood at Rs. 19,013 Crore (11.8 times of their average monthly billing) as on October 31, 2021, which constitutes 20 per cent of total overdues of Rs. 93,906 Crore.

Source: PTI December 15, 2021

Rapid Growth of Offshore Wind Will Trigger an Unprecedented Race for Ocean Space

The exponential growth of offshore wind power will be the main driver of a nine-fold increase in demand for ocean space by the middle of the century, according to DNV's Ocean's Future to 2050 report. The report forecasts that by mid-century, offshore wind will require ocean space which is the equivalent to the landmass of Italy. The growth will be particularly pronounced in regions with long coastlines and presently have low penetration of offshore wind. Demand for ocean space is set to grow 50-fold in the Indian Subcontinent and 30-fold in North America. The rise of wind will be pivotal to the transformation of the Blue Economy.

Source: Windinsider.com, 16th December 2021

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ENERGY SAVING CERTIFICATES (ESCerts)

Introduction

National Action Plan for Climate Change (NAPCC) has launched eight missions to promote and enable sustainable development of all citizens, while promoting low carbon and high resilience development path. The National Mission on Enhanced Energy Efficiency (NMEEE) is one of the Missions under NAPCC. The objective of NMEEE is to promote innovative policy measures, regulatory regimes, financing mechanism and business models which will create and sustain markets for energy efficiency in a transparent manner. The Perform Achieve and Trade (PAT) Scheme is one of the initiatives under NMEEE.

Perform Achieve and Trade (PAT) is a market based mechanism to reduce the Specific Energy Consumption (SEC) in energy intensive large industries. The PAT scheme is designed to reduce the specific energy consumption i.e. energy used per unit of production of industrial units of energy intensive large industries. Those which consume more energy are given higher targets as compared to those industries which are more energy efficient. An energy audit is done to verify the baseline data (current level of efficiency) and thereafter targets are given. Hence the units do not compete with each other but with themselves.

Energy Saving Certificates (ESCerts)

Energy Saving Certificates (ESCerts) are issued to those plants that have over-achieved their targets. Based on the recommendations made by Bureau of Energy Efficiency (BEE) to the Ministry of Power Energy Saving Certificates (ESCerts) are issued. This mechanism is facilitated through the trading of ESCerts which are issued to those plants who have over-achieved their targets. Those plants which under achieve their targets are entitled to purchase ESCerts.

Perform Achieve and Trade (PAT) Cycles for Implementation of Scheme

a. PAT Cycle – I (2012-2015)

PAT Cycle – I commenced from 1st April 2012 covered 478 industrial units in 8 sectors viz. aluminium, cement, chlor alkali, fertilizer, iron and steel, pulp and paper, thermal power plants and textiles. The overall reduction target in eight sectors was 4.05% with an energy saving of 6.686 million tonnes of oil equivalent. The first cycle of PAT was completed in March, 2015. Thereafter verification of the performance of the Designated Consumers (DCs) with regard to Energy Savings was done and based on recommendations made by BEE to the Ministry of Power issued 38.25 lakhs (approx.) ESCerts to 306 DCs.110 DCs have been entitled to purchase 14.25 lakhs (approx.) ESCerts. The DCs have contributed to the success of PAT Cycle I and this cycle has witnessed an energy saving of 8.67 million tonnes of oil equivalent (Mtoe) against the target energy saving of 6.886 Mtoe, which is about 30% more than the target. This has also resulted in an emission reduction of 31 million tonnes of CO_2. In monetary terms Rs. 9,500 Crores have been saved due to reduction in energy consumption.

b. PAT Cycle - II (2016-17 to 2018-19)

PAT Cycle - II was notified with effect from 1.4.2016 for a period of 3 years i.e. upto 2018-19. The overall energy consumption reduction target under PAT II given to 621 units is 8.869 Mtoe in which 11 sectors are covered. This includes the 8 sectors of PAT I and 3 new sectors viz. railways, DISCOMS and petroleum refineries.

c. PAT Cycle - III (2017- 18 to 2019-20)

PAT Cycle - III has been notified with effect from 1.4.2017 for a period of 3 years. 116 units have been given a reduction target of 1.06 Mtoe. The PAT Scheme is now being implemented as a rolling cycle i.e. every year new units will be notified for a period of 3 years cycle. There will not be a gap in notifying new units as was the case between PAT I and PAT II. Earlier PAT II was notified only on the completion of PAT I.

d. PAT Cycle - IV (2018-19 to 2020-21)

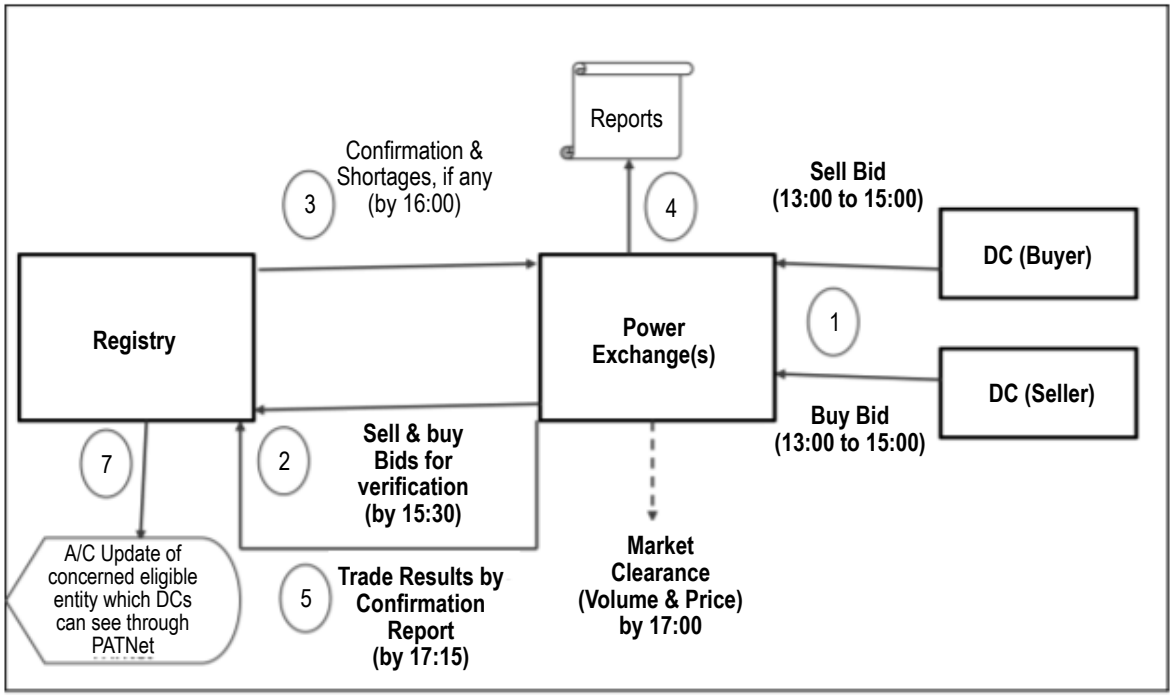
PAT Cycle - IV was notified on 28th March 2018. A total of 109 DCs with a total reduction target of 0.6998 MTOE was notified under PAT Cycle - IV. The DCs notified under PAT Cycle - IV are from 8 sectors consisting of 6 existing sectors and two new sectors. The new sectors are Petrochemicals and Buildings.

e. PAT Cycle - V (2019-2020 to 2021-22)

PAT Cycle - V had commenced with effect from 1st April 2019. Under PAT Cycle - V, 110 DCs from the existing sectors of PAT i.e. Aluminum, Cement, Chlor-Alkali, Commercial Buildings (Hotels), Iron & Steel, Pulp & Paper, Textile and Thermal Power Plant were notified. Total energy savings of 0.5130 MTOE through the implementation of PAT Cycle - V is expected to be achieved.

f. PAT Cycle - VI (2020-21 to 2022-23)

PAT Cycle - VI has commenced with effect from 1st April 2020. Under PAT Cycle - VI, 135 DCs from six sectors, i.e. Cement, Commercial buildings (hotels), Iron and Steel, Petroleum



Energy Saving Certificates (ESCerts) Trading Flow

Refinery, Pulp and Paper and Textiles, have been notified. With implementation of PAT Cycle - VI, it is expected to achieve a total energy savings of 1.277 MTOE.

BEE has rolled out six PAT cycles till 31st March, 2020, with a total of 1073 DCs covering 13 sectors. It is projected that total energy savings of about 26 MTOE translating into avoiding of about 70 million tonnes of CO_2 will be achieved by March 2023.

Trading of Energy Saving Certificates (ESCerts)

For the trading of ESCerts, Central Electricity Regulatory Commission (CERC) is the Market Regulator and Bureau of Energy Efficiency is the Administrator. POSOCO (Power System Operation Corporation limited) has been appointed as Registry for making DCs as eligible entities for trading of ESCerts and book-keeping of ESCerts. There are two Power Exchanges i.e. IEX and PXIL where trading of ESCerts shall take place. CERC has already approved the Procedure for Transaction of Energy Savings Certificates (ESCerts).

Indian Energy Exchange (IEX) has commenced Energy Saving Certificate trade. Trading is to take place every Tuesday as per the Regulations.

The Flow Chart for ESCerts trading may be seen in the picture above.

Courtesy: **Bureau of Energy Efficiency**

Azure Power and Adani Green Energy Win MSEDCL's 300 MW Wind Auction

Azure Power and Adani Green Energy Fifteen were declared winners in the Maharashtra State Electricity Distribution Company's (MSEDCL) auction to procure 300 MW of power from grid-connected interstate and intrastate wind projects. Azure Power won a capacity of 180 MW by quoting Rs. 3.43 (~$0.045)/kWh, and Adani Green Energy won a capacity of 120 MW with a tariff of Rs. 3.44 (~$0.046)/kWh.

Source: Mercom India, October 29, 2021

India to Invest $316 billion for De-carbonisation by 2030: Bofa Securities

India will spend $316 billion (about Rs 23 lakh crore) in the decade to 2030 towards de-carbonisation, with a high proportion of the investment to be allocated to renewable sources of energy, a foreign brokerage said. The investment will be in addition to the estimated Rs 6 lakh crore or $84 billion already spent since the country joined the Paris climate accord in 2015, Bofa Securities said.

Source: PTI, October 28, 2021

India Opens Door for Nepal to sell Power in India's Energy Exchange Market

The Nepal Ministry of Energy, Water Resources and Irrigation has said that Central Electricity Authority, India has allowed Nepal to sell 39 MW of electricity produced by the 24MW Trishuli and the 15MW Devighat Hydropower Projects developed with India's assistance in the India Energy Exchange Limited (IEX), after receiving a nod from India's Ministry of Power. Nepal has already received approval from India in April to purchase electricity from IEX.

Source: The Kathmandu Post, 2 November 2021

Snippets

Regulatory Update on Wind Power

Re-constitution of the "National Committee on Transmission" (NCT)

I. Ministry of Power, Government of India has reconstituted National Committee on Transmission (NCT) vide order No. 15/3/2018-Trans-Pt(S) dated, the 28th October 2021 as follows:

1. Chairperson, Central Electricity Authority (CEA) – Chairman

The following officials will be the members

2. Member (Power System), CEA
3. Member (Economic & Commercial), CEA
4. Joint Secretary level officer nominated by Secretary, MNRE
5. Director (Trans), M/o Power, Govt. of India
6. Chief Operating Officer, Central Transmission Utility
7. CMD, POSOCO
8. Advisor (Energy), NITI Aayog
9. Two experts from Power Sector to be nominated by MoP (Will be nominated for a maximum period of two years from the date of their nomination).
10. Chief Engineer (from Power System Wing), CEA will be the Member Secretary

II. Terms of Reference (ToR) of the NCT are as under:

i. The NCT shall evaluate the functioning of the National Grid on a quarterly basis.

ii. The Central Transmission Utility (CTU), as mandated under the Electricity Act, 2003, is to carry out periodic assessment of transmission requirement under Inter-State Transmission System (ISTS). The CTU shall also make a comprehensive presentation before the NCT every quarter for ensuring development of an efficient, co-ordinated and economical ISTS for smooth flow of electricity. The CTU, in the process, may also take inputs from the markets to identify constraints and congestion in the transmission system.

iii. The CTU after consulting Regional Power Committee(s) [RPC(s)] shall submit the proposal for expansion of ISTS to the NCT for their consideration.

iv. As per provision of Electricity (Planning, Development and Recovery of ISTS charges) Rules 2021, the CTU shall also prepare a five-year rolling plan for ISTS capacity addition every year. The Annual Plan shall be put up to the NCT six months in advance.

v. After considering the recommendations of the CTU and views of the RPCs, the NCT shall propose expansion of ISTS after assessing the trend of growth in demand and generation in various regions.

viii. The NCT shall recommend to Ministry of Power (MoP) for implementation of the ISTS for projects with cost more than Rs 500 crore, along with their mode of implementation i.e. Tariff Based Competitive Bidding (TBCB) / Regulated Tariff Mechanism (RTM), as per the existing Tariff Policy.

ix. The NCT shall allocate the task of carrying out survey amongst the CTU and Bid Process Coordinators by maintaining a roster.

For enabling growth of Renewable Energy (RE) capacity, areas which have high solar/wind energy potential, as identified by MNRE, need to be connected to ISTS, so that the RE capacity can come up there. This is a national mission as a part of our energy transition goal.

General Instructions on Procurement and Project Management

Execution of public projects on time has been a challenge for various government departments. On 29 October 2021, the Union Finance Ministry has released guidelines for reforms in public procurement and project management, which seek to incorporate "innovative rules for faster, efficient and transparent execution of projects". The new instructions, the formulation of which were led by the Central Vigilance Commission (CVC) and involved detailed consultations with experts from relevant fields, will help the government better meet the challenge of "executing public projects on time, within the approved cost and with good quality".

Some of the key reforms are as follows:

1. Timely release of ad hoc payments is expected to improve liquidity with the contractors, especially Micro, Small and Medium Enterprises (MSMEs).
2. Section 12; 75% of the running bill payments to be released within 10 days of submission. Quality cum Cost Based Selection (QCBS) has been modified with 70% weightage for cost (Earlier it used to be reverse: 70% weightage for technical and 30% for cost. This order limits weightage of non-financials to 30%.)

3. Remaining payment is to be made after final checking within 28 working days.
4. The final bill should be paid… within three months after completion of work.

Waiver of Inter-State Transmission Charges

Superseding earlier order, Ministry of Power, in an order dated November 23, 2021 has notified key changes to its existing orders allowing waiver of ISTS (Inter State Transmission Charges) on Wind and Solar Sources.

As per order for Wind, Solar, Hydro PSP (Pumped Storage Projects) and BESS projects commissioned upto 30.06.2025 (As amended on 30/11/2011, Also applicable for projects, which has been granted extension by competent authority) the ISTS charges would stand waived for the following categories and additional ones added now.

a) Wind and solar energy generated by any person or any entity, for self-consumption or for sale through competitive bidding, power exchange or bilateral arrangement.

b) Any power used from solar and/or wind sources by Pumped Hydro Storage systems or BESS (Battery Energy Storage Systems) subject to the following conditions.
   - At least 51% of the energy requirement for pumping water in case of PSP & BESS system to be met from solar/wind sources.
   - Electricity generated or supplied from such systems above.
   - Trading of electricity from such systems in the GTAM or GDAM market till 30.06.2025.
   - For Green Hydrogen production plants set up till 30.06.2025. The waiver in this case will be valid for 8 years after commissioning of the H_2 plant.
   - Power generated for the ministry's recent thermal bundling scheme, as long as it does not add to the power evacuation cost for the transmission system.

To provide a clear roadmap on the applicability of the waiver, the ministry has also shared a trajectory as follows:

S. No.	Period of Commissioning	Inter-State Transmission Charges
1	01.07.2025 to 30.06.2026	25% of the applicable ISTS charges
2	01.07.2026 to 30.06.2027	50% of the applicable ISTS charges
3	01.07.2027 to 30.06.2028	75% of the applicable ISTS charges
4	From 01.07.2028	100% of the applicable ISTS charges

The waiver is applicable for 25 years in case of Solar, Wind and Hydro PSP. For BESS projects, it is 12 years.

It is also clarified that waiver is allowed for Inter-state transmission charges only and not losses. However, it is clarified that waiver of losses shall be applicable for the projects whose bidding was completed upto 15.01.2021.

Compiled by **Om Taneja**, Renewable Energy Consultant

ReNew Power Ranks 10th in Fortune's Change the World List 2021

ReNew Power has been ranked 10th by Fortune magazine in its annual "Change the World' list for 2021 for expanding India's energy transition by building an alternative to fossil fuels, the firm said in a press release. The annual list recognizes businesses that are working to improve human condition even as they pursue their business goal of seeking profitable growth. The magazine said that ReNew has the daunting task of building an alternative to fossil fuels in the nation that is the world's third-largest oil importer and one of the fastest-growing energy consumers.

Source: ET Energy World, October 29, 2021

India Needs to Further Reduce Solar, Wind Costs For Green Hydrogen Plans

Mr. Amitabh Kant, NITI Aayog India should accelerate wind and solar power installations and bring down costs radically for its green hydrogen plans, said Mr. Amitabh Kant, chief executive officer, Niti Ayog. He said that India was poised to become a global hub for electrolyser manufacturing and green hydrogen products in the coming years only because the solar prices are low and should be further brought down. "In the initial years, we will have to mandate the use of green hydrogen in the hard-to-abate sectors so that the prices come down. The prices are between $4 per kg. They need to come to $2.5 per kg by 2024-25 and $1 per kg by 2030," he said.

Source: ET Energy World, October 21, 2021

Denmark to Donate USD 15.6 Mn in New Energy Sources

The Danish government has said that it will donate 100 million kroner (USD 15.6 million) to efforts to purchase and decommission coal power plants and invest in new energy sources. "As part of our comprehensive climate efforts, the Danish government is working to phase out coal while also investing massively in new green energy sources," Foreign Minister Mr. Jeppe Kofod said in a statement. The money "will help coal-intensive countries reduce their coal consumption and create new income opportunities in local communities, which is absolutely vital to accelerating the energy transition."

Source: AP November 06, 2021

COP26, Renewable Energy and Wind Power

The UN climate summit—the twenty-sixth Conference of the Parties (COP26), hosted by the UK in partnership with Italy, held at Glasgow from 31st October to 12th November 2021 is widely portrayed as a critical event for securing meaningful commitments to curb greenhouse gas emissions. The power sector accounts for a quarter of global greenhouse gas emissions. To meet the goals of the COP26, we need to move away from coal and towards clean power at an accelerated rate. There's a big opportunity for wind and solar power as they are now cheaper than fossil fuels in most countries, generating more jobs, and giving us cleaner air.

At COP26, Governments of various countries endorsed the Glasgow Climate Pact and made new pledges on deforestation, methane emissions, coal, and more. The aim of the endorsements is to turn the twenties in to a decade of climate action and support, so that the rise in the global average temperature can be limited to 1.5 degrees. The view of many experts is that the conference fell short of achieving the pledges needed to reduce emissions enough to reach the Paris Agreement's goal on limiting warming. But if governments follow through on commitments made during COP26 and ramp up ambition in the next few years, the goal could be within reach.

Glasgow Climate Pact

Phasing down Coal and Fossil Fuel Subsidies: COP26 urged the countries to phase down coal and fossil-fuel subsidies but it did not ask countries to completely phase them out. Countries also agreed on rules for international carbon markets.

Deforestation: More than 130 countries pledged to halt and reverse deforestation and land degradation by 2030. The signatories possess 90% of the world's forests. Notably, Brazil, home to the Amazon Rainforest, signed on. Mr. Jeff Bezos, chairman of Amazon pledged $ 2 Billion to help restore natural habitats and transform food systems.

Methane: More than 100 countries signed the U.S. and European Union–led Global Methane Pledge and agreed to slash methane emissions by 30% by 2020.

Coal and Fossil Fuels: Twenty-three countries went further than the Glasgow Climate Pact, making new commitments to phase out coal. Some signed on to an initiative to help developing countries, such as India and South Africa, transition away from coal. Twenty-five countries and five financial institutions committed to stop public financing for most fossil fuel projects by the end of 2022. And a handful of countries joined an alliance that aims to halt new drilling for oil and gas.

US-China Agreement: The United States and China, the world's top emitters of greenhouse gases, agreed to boost cooperation on combating climate change over the next decade and work together on increasing the use of renewable energy.

India's Net Zero Pledge: Prime Minister Mr. Narendra Modi announced that India will aim to achieve net zero emissions by 2070.

Climate Finance: In the Glasgow Climate Pact, governments agreed to set up a mechanism to help countries already suffering loss and damage due to climate change, though they did not work out the details. The pact also urged developed countries to double their collective amount of funding by 2025 to help developing countries adapt to the effects of climate change. During COP26, a few countries made such commitments. Among them, Japan pledged an additional $2 billion per year for the next five years, and Italy pledged an extra $1.4 billion per year.

Zero-Emission Vehicles: More than thirty countries, dozens of states and cities, and several automotive companies agreed to work to guarantee that new cars and vans sold are zero-emission by 2035 in leading markets and 2040 globally.

Firm's Net Zero Pledges: More than 450 banks, insurers, pension funds, and other firms that collectively manage $130 trillion committed to use their funds to reach net-zero emissions by 2050.

COP26 and Wind Power

The outcome of COP26 makes the wind and solar energy a winner as the whole summit was focussed mainly on phasing out coal and fossil fuels. Pledges to end fossil fuel use have been a cause for hope at COP26. But policymakers in various countries need to ensure renewables would take their place. Wind power is set to grow naturally as the world moves away from fossil fuels. How quickly it happens will depend on practical global action to tackle the climate crisis. In the most pessimistic scenario, where current policies continue, wind generation increases fivefold between 2020 and 2050. In the most optimistic scenario, with the world on a path to net zero by 2050, wind generation increases by a factor of 15.

Wind Industry Initiative

A group of 90 wind energy companies (such as Vestas, Siemens Gamesa, Equinor, Iberdrola, Ørsted, SSE and industry associations from the UK, Asia, Europe and the US) had submitted the COP26 manifesto to call on the governments to "get serious" on energy transition and accelerate their investment decisions in the run-up to COP26. In the manifesto the companies say that annual global wind installations need to scale up by four times current levels to help countries reach net zero by 2050. The consortium claims with the current projections wind energy projects will provide less than half what is needed. The group calls for urgent actions including the implementation of sensible permitting schemes, voluntary cooperation on carbon pricing and increased wind power ambition reflected on updated Nationally Determined Contributions.

Mr. Ben Backwell, Chief Executive Officer of Global Wind Energy Council (GWEC), said: "The recent volatility in global energy markets shows the importance of moving decisively to phase out of coal and other fossil fuel-based generation and create energy markets which are fit for purpose for a clean and sustainable future."

What Do These Pledges Mean for Renewables?

Global Wind Energy Council has translated these pledges in to the actual installations needed in the field. GWEC has analysed the pledges as follows:

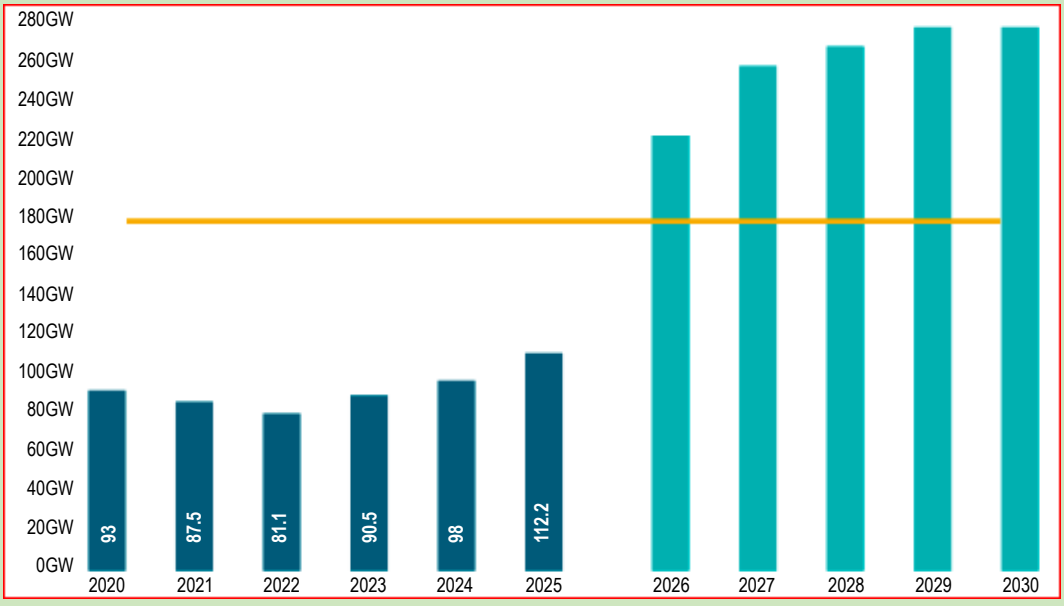
Increased emissions reduction targets in general are welcomed. Headline targets are an effective way of putting a stake in the ground, signalling your ambition, and declaring your nation open for clean energy investment. Increasingly the renewables sector will power the transformation of global economies, not just decarbonising electricity production, but also powering our cars, heating and cooling our homes, and helping make industrial processes cleaner. Setting ambitious headline targets can set an overall structure and direction of travel for these system-wide changes to happen.

Even better than a headline target is obviously a renewables or wind specific target. There are a few key players who have taken this approach. For example, the UK has a pledge for 40 GW of offshore wind, with at least 1 GW of floating wind, by 2030. President Biden has also set out a target of 30 GW of offshore wind in the US by 2030. There is now also buzz that the EU will scale-up its 2030 renewable energy share target to 38-40%, up from 32% today, which would require 452 GW of

Annual wind installations must ramp up in this decade to keep global warming well below 2°C*

*To keep global warming well below 2°C, annual wind installations must average 180 GW over this decade. Shortfalls in the first half of the decade will need to be compensated with a dramatic rise in wind growth in the second half of the decade to stay on-target.

Wind has already created millions of jobs and billions in investment for local communities – governments can unleash the full socio-economic power of wind energy by putting in place energy markets and policies that account for the true costs of fossil fuels and the true value of wind power.



NOTE: 180 GW is GWEC's calculation for the average annual wind installations required from 2020-2030 under IRENA's TES scenario, which targets 2,526 GW cumulative wind capacity by 2030 to keep global warming well below 2°C above pre-industrial levels by end of century. See: IRENA (2020), Global Renewables Outlook: Energy transformation 2050.

Graph Courtesy: GWEC

wind power capacity. These countries have recognised the huge economic potential of wind – and right now we have only just scratched the surface of what the technology can achieve.

Pretty much all credible decarbonisation scenarios and pathways show that global economies will need huge volumes of wind to help clean up their economies, whether that's through electrification or in the production and use of green hydrogen. Work we have done here at the Global Wind Energy Council shows that we will need to build 180 GW of wind on average per year over the next decade to stay within a 2°C pathway. The wind industry is ready to roll up its sleeves and help reduce emissions from transport, industry, heating and cooling. We have the technology and knowhow, and have already shown how quickly we can innovate to get emissions down, whilst creating jobs and supporting local economies. So, we are of course delighted to see a race to the top when it comes to renewables targets.

Renewables Industry Ponders How to Scale up at COP26

Leaders from the Global Wind Energy Council and IOC-UNESCO joined the UN Global Compact to voice their support for the roadmap to advance offshore renewable energy and discuss ways to intensify collaboration between the industry, government authorities and the marine spatial planning community.

COP26, Pledge by India and the Wind Power

With the pledges made by the countries to reduce the harmful emission, wind power is certainly the winner. India, the world's third-biggest carbon emitter, would go net-zero by 2070. The target for installed renewable energy capacity by 2030 has been enhanced from 450GW to 500GW, and also that 50% of India's total electricity would be generated from renewable energy sources by 2030 – an increase of 10% from the earlier target of 40%.

According to the Central Electricity Authority (CEA), projections for India's total installed power generation capacity by 2029-30, India will have 817GW of installed capacity out of which 525GW can be met by non-fossil based electricity capacity. Dr. Arunabha Ghosh, CEO, CEEW has said that India demands USD 1 trillion of climate finance as soon as possible and will monitor not just climate action, but delivered climate finance.

These targets would need for a quick transformation of the energy sector specially wind and solar. It will now depend on various aspects like regulatory provisions, tariff, land and other clearances, timely payment of dues, transmission lines, grid requirements, involvement of state agencies, etc. The heads at various ministries have yet to come out with a total or year wise targets for various types of renewable energy – like wind, solar etc. Wind industry has to wait and watch the situation to get a clear idea of the transition from 1500MW per year now to 10000 to 20000 MW per year, not a dream but ground reality, which we can see.

Source: COP26 Declarations, TERI, GWEC, IRENA, CEEW and contributed by **Om Taneja**, *Renewable Energy Consultant*

PM Mr. Modi Says Developed Nations Should Provide 1% Of GDP To Finance Green Projects in Developing World

Addressing the G20 Summit Session on 'Climate Change and Environment', Prime Minister Mr. Modi has said that by forgetting climate justice, "we are not only doing injustice to the developing countries, but we are betraying entire humanity". As a vocal voice of the developing countries, India cannot ignore the neglect of climate finance by the developed nations, he asserted.

Source: PTI, 1 November 2021

World's Largest, Most Powerful Wind Turbine Stands Complete

With the final blade in place, the SG 14-222 DD prototype has become the world's largest and most powerful turbine to be installed. The third and final 108-metre blade has been installed on Siemens Gamesa's SG 14-222 DD prototype offshore wind turbine at the test centre in Osterild, Denmark with a capacity of 15 MW and 222 m rotor.

Source: Offshore Wind, November 12, 2021

MNRE Team to visit Ladakh in Relation to 10 GW RE Project

The Ministry of New and Renewable Energy will send its team within a week to help the administration of Ladakh sort out issues, mainly related to land, in the implementation of the 10-gigawatt (GW) renewable energy project there. The decision was taken in a high-level meeting chaired by Union Power and New & Renewable Energy Minister Mr. R K Singh.

Source: PTI, November 17, 2021

CEOs of Indian Conglomerate Seeks Public Sector Help for Green Transition

Top executives of commerce giants, TATA Sons, Macquarie Group, and HSBC at Bloomberg New Economy Forum, which took place in Singapore advised governments to become more active in the green transition by offering incentives for innovative technology development and taking steps towards cost reduction. Tata Sons and Macquarie are working together on the Climate Finance Leadership Initiative in India.

Source: Solar Quarter, 20 November 2021

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COP26

Snippets

14 Million Tons A Day Show Why India and China Won't Quit Coal

There's a reason India and China defended coal's future at the Glasgow climate summit: No nations have added more coal-fired power-plant capacity in the past decade than these two major emitters. China and India are currently mining a combined 14 million tons a day of the dirtiest fossil fuel. Coal not only remains crucial to their current energy needs but it looks set to have a role for decades to come. That's even as the two Asian giants install huge volumes of renewables and chase targets to zero out greenhouse gas emissions. The government forecasts coal plant capacity to grow to 267 GW by 2030 from 208 GW now.

Source: Bloomberg November 16, 2021

Mr. Joe Biden Signs Order to Make US Government Carbon Neutral By 2050

US President Mr. Joe Biden has signed an executive order mandating that the US federal government become carbon neutral by 2050. The order relies on a variety of clean energy initiatives, including transforming the government's fleet of 600,000 vehicles into electric cars by 2035. The executive order will reduce emissions across federal operations, invest in American clean energy industries and manufacturing, and create clean, healthy, and resilient communities.

Source: AP December 09, 2021

India Needs $10.1 Trillion Investment to Achieve Net-Zero Emission by 2070: Study

At the recently concluded COP26, Prime Minister Mr. Narendra Modi has announced India's aim to achieve net-zero emissions by 2070. India will require a total investment of $10.1 trillion to achieve net-zero emissions by 2070, while the nation could face a shortfall of $3.5 trillion, a study by CEEW Centre for Energy Finance (CEEW-CEF) has said.

Source: PTI, November 18, 2021

U.S., Canada Among 20 Countries to Commit to Stop Financing Fossil Fuels Abroad

GLASGOW: The United States, Canada and 18 other countries committed at the COP26 climate summit on Thursday to stop public financing for fossil fuel projects abroad by the end of next year, and steer their spending into clean energy instead. But it did not include major Asian countries responsible for the bulk of such financing abroad. By covering all fossil fuels, including oil and gas, the deal goes further than a pledge made by G20 countries this year to halt overseas financing for just coal. The 20 countries that signed the pledge include Denmark, Italy, Finland, Costa Rica, Ethiopia, Gambia, New Zealand and the Marshall Islands, plus five development institutions including the European Investment Bank and the East African Development Bank.

Source: Reuters, November 05, 2021

COP26: India and UK Launch Green Grids Initiative

Prime ministers Mr. Boris Johnson of the UK and Mr. Narendra Modi of India has launched the Green Grids Initiative at COP26 in Glasgow to accelerate the construction of the new infrastructure needed for a world powered by clean energy. Such infrastructure includes massively expanded renewable energy generation capacity in energy-rich locations, connected by continental grids. It includes smart grids connecting millions of solar panels and charging points for electric vehicles, and micro-grids for rural communities and to ensure resilience during extreme weather events.

The initiative 'Green Grids Initiative – One Sun One World One Grid' – is intended to bring together governments, legislators, businesses and researchers to address this infrastructure challenge. The launch was accompanied with a 'One Sun Declaration' stated to be endorsed by more than 80 countries so far.

Source: Smart Energy International, Nov. 3, 2021

COP26: 40 Countries Agree to Phase Out Coal-Fired Power

More than 40 countries have agreed to phase out coal-fired power at the COP26 climate summit. The agreement includes 18 countries promising to phase out or stop investments in new coal-fired plants domestically and internationally for the first time. The list includes major coal using countries, including Canada, Poland, Ukraine, and Vietnam. Signatories to the agreement have committed to phasing out coal power in the 2030s for major economies and the 2040s for poorer nations. Dozens of private organisations have also signed up to the pledge, with HSBC and Export Development Canada among several major banks agreeing to divest from the coal industry. Notable exceptions are Australia, China, India, and the US, who were all missing from the deal. China, India, and the US alone accounted for 49.5% of all fossil fuel emissions in 2019.

Source: Power Technology, 4 Nov. 2021

Zero-Emission Vehicles, Wind and Solar Energy Seen Taking off - Climate Report

London: Government policy changes attacking global warming could result in zero-emission vehicles comprising around 30% of all vehicles on the road by 2030, and wind and solar providing 30% of global power generation, triple current levels, according to a policy report forecast. Such a policy acceleration would make it possible to keep warming to below 2 degrees Celsius above pre-industrial levels by mid-century, it said. However, the global target to limit warming to no more than 1.5 degrees C would be out of reach without more rapid action, said the report, issued ahead of next month's COP26 global climate talks in Glasgow.

Source: Reuters, October 18, 2021

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