# Indian Wind Power

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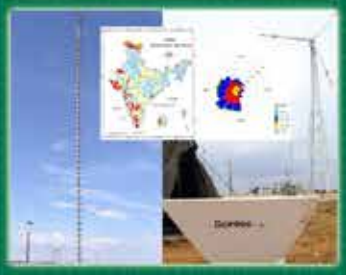
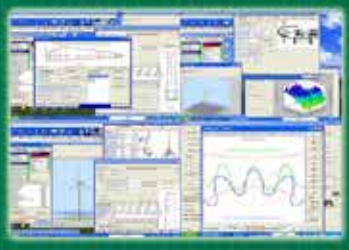
*Bimonthly, Chennai*

**WINDERGY India 2020 is postponed amidst COVID-19 scare and as per instructions from Government of India.**

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

# Expertise offered to Wind & Solar Energy Stakeholders





## Wind Resource Assessment

- 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 facilitation of clearances for Offshore studies and surveys
- On-site wind measurement campaign
- Demarcation of potential Offshore wind blocks
- Call for proposal for development of Offshore wind energy blocks
- Promoting indigenous research for technology development

## Testing (Large & Small) & Forecasting

As per Internationally accepted procedures and stipulations for

- Power Performance measurements
- Power Quality measurements
- Yaw efficiency test
- Load measurements
- Safety and function tests
- User defined measurements
- The services are not limited by type or size of the Wind Turbines

The services are certified as per the requirements of ISO 9001: 2008 and accredited as per the requirements of ISO/IEC 17025 : 2005

- Wind Power Forecasting Services
- Duration Test

## Standards & Certification

- Preparation of Indian standards on wind turbines
- Accord Type Approval / Type Certification to Wind Turbines. Type Certification Services are certified as per ISO 9001 : 2008
- Issue the recommendation for grid synchronization to facilitate installation of prototype wind turbines
- Supports Multi institutional research on Wind Energy

## Training

- National, International and Customized Training for various types of clients on
- Wind / Solar Resource Measurement & Analysis
- Wind / Solar Technology

## Solar Radiation Resource Assessment

- Solar Radiation Resource Assessment
- Consultancy on solar energy projects
- Investor & bankable grade solar / meteorological data
- Consultancy on solar resource assessment
- GIS enabled Indian Solar Atlas on website
- Calibration of solar sensors
- HR training program on solar energy under PPP mode
- Solar Power Forecasting Services

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IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

# Indian Wind Power

*A Bi-monthly Magazine of Indian Wind Turbine Manufacturers Association*

Volume: 5 Issue: 6 February – March 2020





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# *From the Desk of the Chairman – IWTMA*

Dear Readers,

On behalf of IWTMA, I pray and hope all members and their families are safe and healthy. The ongoing **COVID-19** pandemic has impacted businesses around the Globe and brought economies and Nations to a complete stand-still, barring essential products and services. It is too soon to predict the extent of the virus's impact on the wider global economy and energy markets. Closer home, we have seen delays in project execution due to the extended nationwide lockdown.

Uncertainty of the future is looming in everyone's mind, but, we have to look at the opportunity in these adverse times and be nimble to adapt to the changes of the new way of doing business.

We congratulate the Government for prioritizing health of the Nation and implementing the lockdown. As a country, we have exhibited discipline to flatten the curve and let's be optimistic to see the end of the tunnel for normalization soon. The downward run on oil price, changes in demand for power and the World with lesser pollution, will find its answer in alternate energy of Wind and Solar. Let me elaborate and congratulate our power engineers in Grid Management during the nine minutes lights out held to show solidarity on 5th April, 2020.

The lockdown period and 'work from home' (WFH) has actually shown higher productivity and a positive sign to interact with the Government on number of issues. The industry would like to personally thank and appreciate the initiative of MNRE to interact with the stakeholders and solve many concerns. Government is now proposing amendments to the Electricity Act 2003, which gives us a tremendous opportunity to resolve number of issues and bring Renewable Energy on center stage as a 'Power of Now and the Future'.

I wish to end this note with a small anecdote. When asked as to why the temples are closed, the answer is that Gods are working round the clock in white coats to take care of the patients. Let us all put our hands together to honor our doctors, nursing staff, police force and conservancy workers who are tirelessly working for our safety and wellbeing.

Let's all resolve and respond to the clarion call of the Hon'ble Prime Minister to maintain social distancing and stay at home and hope that this period of trying times will end soon and normalcy is restored.

With regards,

**Tulsi Tanti**
Chairman

## Secretary MNRE

Shri Indu Shekhar Chaturvedi, IAS, 1987 batch, Jharkhand cadre is the new Secretary in the Ministry of New and Renewable Energy (MNRE). He was earlier Additional Chief Secretary of the Forest and Environment Department, Jharkhand, besides being a member of the Revenue Council. Indian Wind Turbine Manufacturers Association (IWTMA) heartily welcomes Shri Indu Shekhar Chaturvedi and extends all support and cooperation.

## MNRE Grants Extension for RE Projects due to lockdown- to be Treated as Force Majeure

Ministry of New and Renewable Energy (MNRE) has issued an order on 17th April 2020 that the Renewable Energy implementing agencies may grant extension of time for RE projects, on account of lockdown due to COVID-19, equivalent to the period of lockdown and additional 30 (thirty) days for normalisation after end of such lockdown. Ministry has also said that all Renewable Energy implementing agencies of the Ministry of New & Renewable Energy (MNRE) will treat lockdown due to COVID-19, as Force Majeure. Referring to the Renewable Energy Departments (including agencies under Power/Energy Departments of States, but dealing in renewable energy), the Ministry has asked them that they may also treat lockdown due to COVID-19, as Force Majeure and may consider granting appropriate time extension on account of such lockdown.

## Must-Run status and Regular Payments by DISCOMs during COVID-19 outbreak

MNRE has come with an office memorandum dated 1st April 2020, where Renewable Energy Generation Stations (REGS) has given Must-Run status and Regular Payments by DISCOMs during COVID-19 outbreak.

## Accreditation of NIWE to offer Type Certification of Wind turbines

National Institute of Wind Energy (NIWE) has been accredited to offer type certification of Wind turbines by the National Accreditation Board for certification bodies (NABCB) under ISO 17065.

## MNRE Push for Setting up RE Equipment Manufacturing Parks in India

The Ministry of New and Renewable Energy (MNRE) has initiated action in big way towards setting up new hubs for manufacturing renewable energy equipments in the country to meet both domestic and also cater to global demand. Tuticorin Port Trust, Governments of Madhya Pradesh and Odissa have expressed keen interest in the moves to attract investments by firms shifting base from China. Ministry has also got in touch with Trade Commissioners/Representatives of various countries inviting them to invest in this promising opportunity in India. It may be stated that in a time when many companies are shifting their manufacturing firms from China, it is time for India to bring Policy changes for facilitating manufacturing in India

## COVID-19 Outbreak – Relief Package

To kick start the economy amid the COVID-19 outbreak, Ministry of Finance has announced the total package of Rs. 20 Lakh Crore. This includes the following related to power sector:-

a) Rs. 3 Lakh Crore as loan to MSME sector which will directly benefit the 48 Lakh MSMEs.

b) Rs. 90,000 Crore liquidity injection for DISCOMs which will help in the balance payments of Generation and Transmission companies.

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## Windergy India 2020 Postponed

Due to the evolving public health concerns and travel advisories around COVID-19, IWTMA and PDA, have decided to postpone Windergy India 2020 hitherto to be held at Greater Noida, India from 28-30 April 2020. The new dates will be notified in the later edition of Indian Wind Power, IWTMA plus Windergy websites, including other media on a later date after further assessment of the situation.

# Wind Power Technologies - Technical Due Diligence for Scaling Up Financial Viability

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## Renewable Energy Scenario in India and Targets

India is a large producer of energy from renewable sources. As of 2019, 35% of India's installed electricity generation capacity is from renewable sources, generating 17% of total electricity in the country.

In the Paris Agreement India has committed to an Intended Nationally Determined Contributions target of achieving 40% of its total electricity generation from non-fossil fuel sources by 2030. The country is aiming for even more ambitious target of 57% of the total electricity capacity from renewable sources by 2027 as given in Central Electricity Authority's strategy blueprint. According to 2027 blueprint, India aims to have 275 GW from renewable energy out of which nearly 100 GW from "other zero emission" sources. In the quarter ending December 2019, India's total renewable electricity capacity (including large hydro) was 131.31 GW. This represents 35.7% of the total installed electricity generation capacity in the country, which is around 368.8 GW.

As of October 2019, of the 175 GW interim target, 83 GW is already operational, 29 GW is under installation, 30 GW is under bidding and remaining 43 GW is under planning. 175 GW interim target is 100 GW of solar, 60 GW of wind, 10 GW of bio mass and 5 GW of small hydro.

To achieve the targets, keeping in mind the financial viability of the project and to achieve the target generation from the projects, a thorough due diligence of the project & the turbine is required.

## Project Financing for Wind Power Projects

Financing a wind energy project is directly dependent on 3 parameters namely the expected energy output of the turbine, years of operation of the turbine and the feed in tariff at which the produced power would be procured by DISCOMs.

## A. Expected Energy Output

Financing a wind power project is based on different factors out of which the critical factor is the estimated energy output, which directly translates into the returns on investment.

The expected energy output is usually calculated and projected by the turbine manufacturer to the IPP, in parallel to the internal projections done by the IPPs Wind Resources Assessment team.

For funding a wind power project, usually the lenders appoint a neutral party who are referred to as Lender's Engineer, who would usually be an accredited measurement and testing laboratory to have unbiased projections. In many instances, the OEM or the IPP as well would appoint a neutral independent consultant to have more reliable and neutral projections to gain confidence on the project viability.

The expected energy yield output is usually calculated at different probability levels of exceedance from 50% till 90% or even 99% which is based on Gaussian distribution, a statistical function.

A thorough knowledge on good measurement techniques of wind and other contributing atmospheric parameters, inter annual wind variations, terrain and obstacle assessments, wind flow modelling would ensure a more realistic estimate of the energy output.

Usually around 2 years of measured wind data from an IEC compliant met mast or from Remote Sensing Devices like LIDAR or SODAR would be used in conjunction with Long-term Re-Analysis data for long-term correlation for which there are many sources of data like MERRA-2, CFSR, ERA-5, ERA-I to name a few.

Wind flow modeling would require good quality topographic maps (Roughness and contour map in vector format) along with the wind data, turbine layout, turbine power and thrust coefficient values to compute the expected energy output. There are commercial linear and non-linear wind flows modelling tools available.

## B. Life Time of the Turbine

Usually, the financial model of projected cashflow would be modelled considering a design life time of 20 years to be assumed as the operational life time of the turbine.

To ensure 20 years of healthy operation of the turbine, there are numerous factors contributing to the health or life of the turbine, to achieve the same, suggested actions would be failure analysis, performance assessment of the turbines, maintaining good database of historical failures, to name a few.

## C. Feed-in Tariff

Feed in tariff is the rate at which the generated power is bought by the DISCOMs. Government has implemented a reverse bidding process, to avail sanctions for project implementation.

## Various Activities and Different Stages of Due-Diligence

### Why Due-Diligence?

A thorough due-diligence is required to be done to ensure the above cited expected energy output of the wind farm project to be of good confidence levels and the life time of the turbine is maintained to ensure smooth and healthy operations throughout the design lifetime of the turbines, as the expected energy output and healthy lifetime of the turbines result in achieve the projected cashflow.

There are 3 different categories of due-diligence namely, planning phase, construction phase and operational phase.

### 1. Planning Phase

Here are few of the critical activities of due diligence to be done for upcoming wind power projects.

- Review of energy yield assessments (including technical losses).
- Assessment of blockage effects or future wake effects from anticipated wind farms in the surrounding.
- Review of technical availability, usually time-based availability is assumed, it is suggested to consider energy-based availability.
- Typical losses assumed are as follows:

| Technical (Energy) Losses | Typical Range |
|---|---|
| Operational Curtailments<br>- "Wind-Sector-Management" (Load Reduction)<br>- Grid (Feed-in) Limitation | 0 – 5%<br>0 – 5% |
| Turbine Availability | 0 – 5% |
| Electrical Transmission | 1 – 3% |
| Turbine Maintenance Works | 0.5 – 1% |
| Grid Availability (country-specific!) | 0 – ??% |
| Environmental Conditions (country-specific!) | 0 – ??% |
| Rotor Blade Degradation | 0 – 3% |
| Additional Turbine Installations at the Site | 0 – 10% |

- Review of building permit and underlying expertise (i.e. site suitability of wind turbines, environmental protection, soil, etc.).
- Review of project contracts (i.e. Turbine Supply Agreements, O&M and Technical Management Contracts, Balance of Plant Contracts, Power Purchase Agreements, etc.).
- Assessment of O&M and other cost assumed in the project's cashflow model.
- Technical assessment of project implementation schedule.
- Technical assessment of wind turbine type and manufacturer would include the following:
  - General turbine design and concept.
  - Status of type certification and measurements.
  - Capability of staff members.
  - Quality of production, quality management system.
  - Supply of components.
  - Delivery capacity.
  - Financial situation of turbine supplier, risk coverage.
  - Grid connection conditions.
  - Planning of infrastructure (BoP) and transportation, capability of the involved firms.

### 2. Construction Phase

After a thorough due diligence during planning phase, we need to focus on construction phase of the wind energy project and few of them are listed here:

- Inspection of component manufacturing
- Inspection of components after delivery to the site
- Inspection of foundation construction and turbine installation
- Construction monitoring in general
- Inspection and acceptance of contract works after commissioning; wind turbine acceptance tests
- Monitoring of project implementation schedule and monitoring of costs.

### 3. Operational Phase

Following are some of the activities that may be performed on operational wind assets.

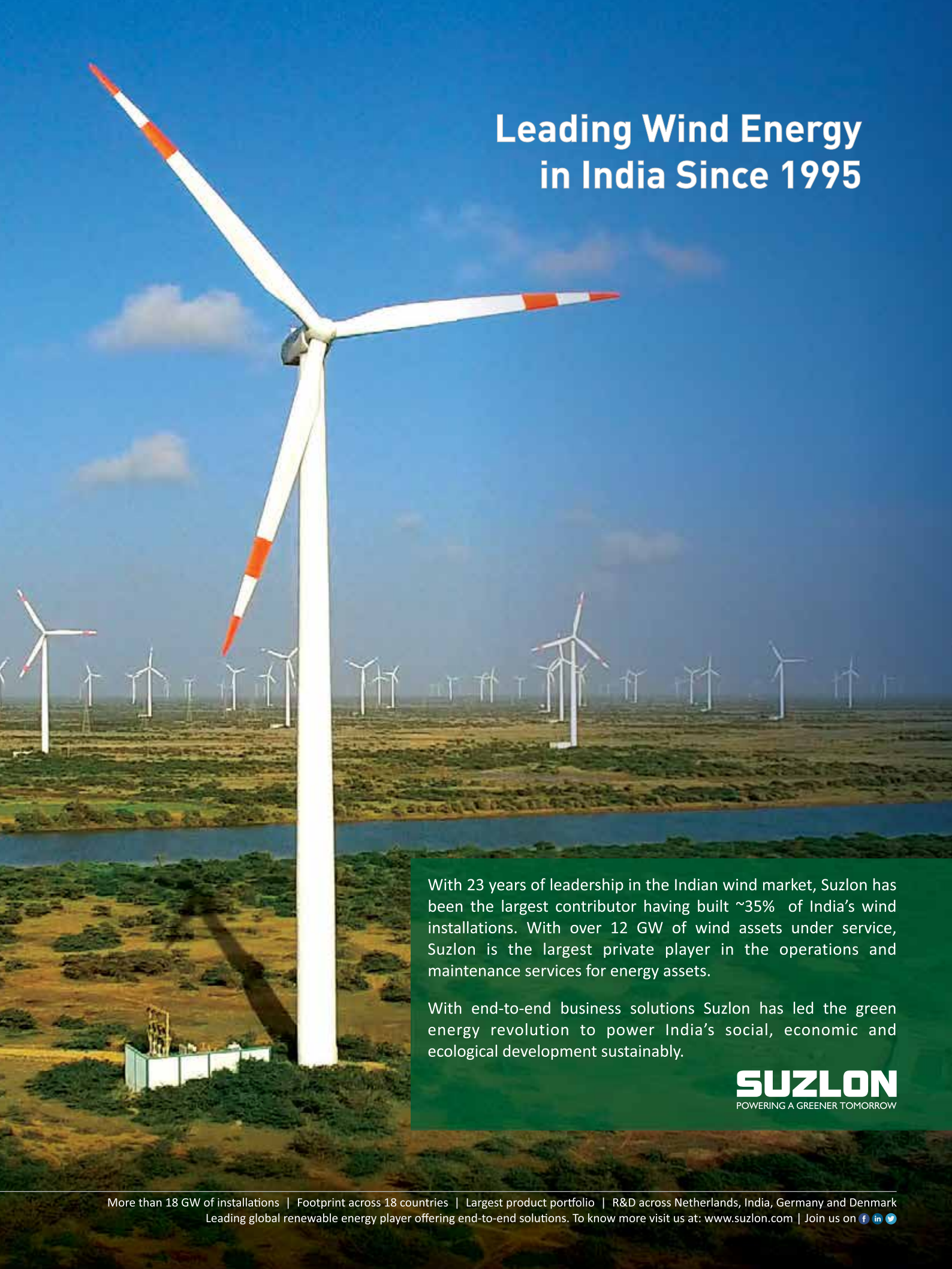
- Analysis of wind farm performance based on SCADA data.
- Long-term assessment of power production.
- Particular measurements (power performance, noise emission, etc.), verification of warranties.
- End-of-Warranty Inspections.
- Monitoring of costs.

### 4. Due-Diligence for Old Windfarms

- Future energy output estimation
- Future availability losses considering the turbine health
- Analysis of inspection documents and maintenance records
- Visual inspection of components
- Gearbox endoscopy
- Estimation of future O & M expenses
- Anticipated extended turbine life time

### Summary

India has an ambitious target of achieving 40% of its total electricity generation from non-fossil fuel sources by 2030, it is our responsibility to work towards the goal, ensuring the best possible performance of the wind farms, to achieve high plant load factor, to have a win-win situation for both the investor as well as the utility. A thorough due diligence during the pre-construction (Planning), construction and operational phase would help us achieve the goal.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With 23 years of leadership in the Indian wind market, Suzlon has been the largest contributor having built ~35% of India's wind installations. With over 12 GW of wind assets under service, Suzlon is the largest private player in the operations and maintenance services for energy assets.
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# Understanding the Differences in Lidar Measurement Principles

**Robert Cole,** Product Manager
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In 2018, we acquired Direct Detect Lidar (DDL) technology, including Spidar. DDL utilizes a distinct type of Lidar measurement that has some key differences when compared to the Doppler-based systems commonly used by the wind energy industry. NRG distributes and services both DDL and Doppler Lidar, giving us a unique vantage point to evaluate the strengths of both. What follows is a brief description of the DDL measurement principle employed by Spidar, and how it offers a unique value for many applications in the wind space.

## DDL Measurement

Laser pulses from one Spidar beam sample the atmosphere. The reflected intensity of these pulses is received, analyzed, and sampled in time. The sampled time-series represents the aerosol density in the line of sight of the transmitted pulse.

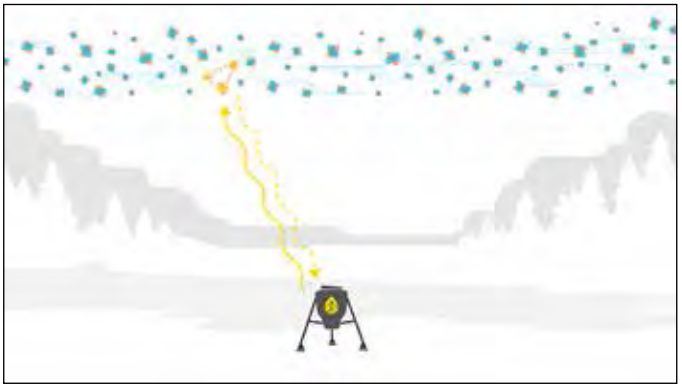

*Figure 1: Spidar Pulsed Sampling Aerosol density structures persist over time and travel with the wind.*

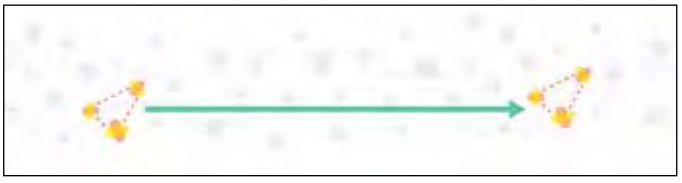

*Figure 2: An Identifiable Aerosol Density Structure Moving with the Wind*

Laser pulses from the downwind Spidar beam sample the atmosphere. The same aerosol density signature is identified. This establishes the time of flight between the two beam locations. Combined with the known distance between the two locations, Spidar is able to determine both wind speed and direction.

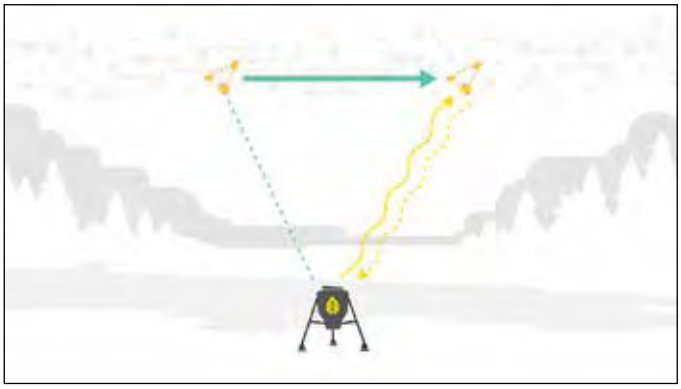

*Figure 3: Spidar Pulsed Sampling at a Second Beam Location*

The Spidar measures wind speed and direction at 10 configurable range gates, as well as temperature, barometric pressure, relative humidity and precipitation presence at ground level.

## Doppler Measurement

Doppler-based measurement devices sample the atmosphere with pulses of light (Doppler Lidar) or sound (Sodar). The pulses reflect off aerosols (Lidar) or are echoed by temperature or moisture gradients in the air column (Sodar) and are received back at the original device for analysis.

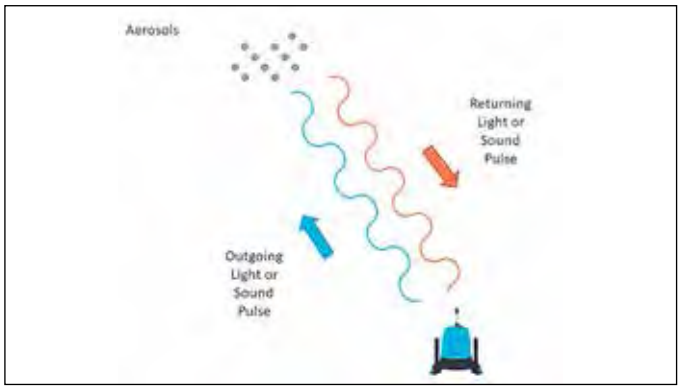


*Figure 4: Doppler Measurement Pulses*

As the pulses are reflected, they experience a shift in wavelength that is proportional to the line of sight velocity of the medium they were reflected off. Each system precisely measures the initial and final wavelengths of the pulse, calculates the magnitude of wavelength shift, and then line of sight wind velocity. The line of sight wind velocity is reduced into horizontal and vertical vector components.

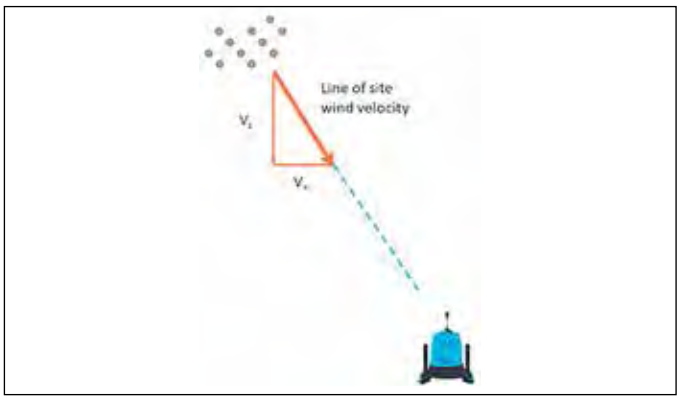


*Figure 5: Doppler Lidar Vector Components*

The horizontal components are then combined with other samples taken around the measurement disk to calculate a horizontal wind speed for the specific measurement height directly above the system.

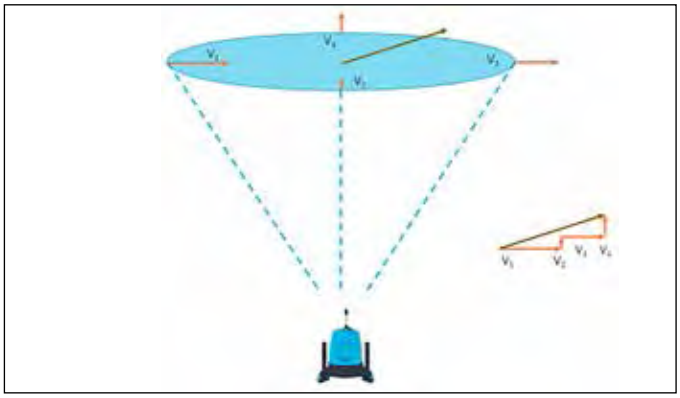

*Figure 6: Combination of Horizontal Wind Speed Vectors*

## Measurement Principle Trade-offs

Each measurement principle relies on some fundamental assumptions. When these assumptions are violated, the measurement breaks down and accuracy or data availability can suffer. Since DDL and Doppler technology make different assumptions, there are instances where one technology might break down while the other operates as expected.

One of the fundamental assumptions made by Doppler Lidar is that wind speed and direction is consistent at each point in the sample volume and remains constant through the observation period. While this is a fairly reasonable assumption at lower heights where the sample volume is small, at higher heights this sample volume is much larger, and the assumption of flow homogeneity becomes less valid. The homogenous flow assumption can also fail in areas with high turbulence.

DDL, including Spidar, does not rely on a homogenous flow assumption, so its measurement does not break down in some cases where a Doppler system will struggle. Instead, Spidar relies on a variable aerosol field above the system in order to pick out discrete patterns that can be tracked in time. Sometimes the aerosol field is constant, particularly in simple terrain conditions with benign flow. The Spidar will struggle in these environments, whereas a Doppler device might perform fine, since it does not rely on aerosol structure to take a valid measurement.

There is no perfect Lidar solution. To get the most out of Lidar, it is crucial to understand the unique constraints of a measurement site as well as the advantages and limitations of the different technologies available today.

NRG distributes and services both DDL and Doppler Lidar, giving us a unique vantage point to evaluate the strengths of both.

**Snippets on Wind Power**

### Offshore Wind Energy Should be India's Topmost Priority

Henriette Faergemann is Environment, Climate and Energy Counsellor in the European Union (EU) Delegation to India based in New Delhi. She is working for cooperation between the EU and India in the area of climate change, urbanisation and smart cities. Talking to ET Energy world in an exclusive interview, she talks about the India-EU Clean Energy & Climate Partnership, including initiatives to support offshore wind, energy efficiency, smart grids and the solar park programme in India.

We have a partnership agreed between India and EU which is known as "European Union - India Clean Energy and Climate Partnership" signed between the head of the states from both sides in 2016. The European Investment Bank (EIB), which is our climate bank has been investing upto 3.4 billion euros in climate related activities in India. I would say that offshore wind energy development should be the utmost priority for India at the moment and the country needs to have a sustained policy on that front.

*Source: ET Energy World, February 20, 2020*

# Safeguarding the Health of Wind Turbine Personnel through the Effective use of Available Access Solutions

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## Introduction

Health and safety of the people working in any industry is of prime importance. Though, the wind energy is good for the environment, the workers in the industry have to work on great heights and also in adverse climatic conditions many times. The technicians and workers are exposed to hazards working on the wind mills during the installation, operations and maintenance. To avoid fatalities and serious injuries during the various phases of a wind farm project, awareness and safety precautions are needed. This article explains the awareness and safety aspects while working on the wind mills.

Employers who invest in workplace safety and health can expect to reduce fatalities, injuries and illnesses. This will result in cost savings in a variety of areas, such as lowering workers' compensation costs and medical expenses, avoiding catastrophic penalties, and reducing costs to train replacement employees and conduct accident investigations. In addition, employers often find that changes made to improve workplace safety and health can result in significant improvements to their organization's productivity and financial performance.

## Tower Climbing Awareness

Climbing 60 to 100 or 120 meter tower is a complex and dangerous operation that requires a high level of mental alertness, physical fitness, preparation, knowledge, experience and training. Accidental falls are the second leading cause of occupational fatalities worldwide, resulting in about 11,000 deaths per year in various industries. Death is common in falls of 2 meters or more. While climbing the tower the professional and trained personnel on-site should get an extensive understanding of the following points.

1. Hazards associated with tower climbing operations
2. Medical examination requirements
3. Training requirements applicable to employees participating in tower climbing operations
4. Safety and rescue equipment including usage within climbing operations and
5. Safe working procedures while performing tower climbing operation

## General Requirements

1. Be examined and get medically certified as physically capable of climbing towers by a qualified physician.
2. Be trained and certified in the proper and safe procedures for climbing towers, including rescue procedures.
3. Be trained and certified in first aid and cardio-pulmonary resuscitation (CPR).
4. Be provided and get training with approved tower climbing safety and rescue equipment (including a full-body harness) which is appropriate for the different type(s) of tower(s).
5. Be attached to an appropriated place within the tower at all times during climbing operations.
6. Follow all tower climbing safety procedures.

## Medical Examination

Prior to being trained, all affected employees shall be examined by a qualified expert who will certify if the employee is physically capable to perform the stressful and strenuous activities involved in climbing towers. The written certification should be addressed to the employee's direct supervisor, who should sign and date it to indicate that he/she has received and read it. Medical examinations of certified employees shall be conducted at a minimum of 1 year intervals.

## Training and Certification

After being medically certified, and prior to climbing any towers, all affected employees must successfully complete tower climbing and rescue training courses including product or manufacturer specific certifications. The training and certification shall include:

1. A classroom session, a written examination, and actual climbing and rescue exercises on a real tower in the field similar to the type of tower that employees will face during their job.
2. A personalized and dated certificate to each affected employee that successfully completes the written examination and the field exercises

Training and Certification shall be repeated depending on the specific training every 2, sometimes every 3 years.

*Figure 1: Ladder and Fall Arrests*

## The Tower Access Equipment

The tower access equipment consists of the following:

1. Ladders
2. Rail-guided aluminum fall arrest system for maximum durability, fast installation and long-term safety
3. Rope-guided (steel cable) fall arrest system

## Types of Service Lifts

The service lifts are of the following types:

1. Ladder-guided
2. Rope-guided

## Features Required in Service Lifts

1. Reliability and quality
2. Should be developed according to customer's requirements
3. Should have state of-the-art security features
4. Modular construction with high quality and user-friendly design
5. Extensive service and training portfolio
6. Available for offshore turbines, cold climate conditions and lattice towers

*Figure 2: Service Lift with Ladder Guided Lift*

*Figure 3: Service List with Rope Guided Lift*

## Tower Access Equipments

The tower access equipment consists of the following:

1. Ladders
2. Fall arrest system
3. Rail-guided aluminum profile, Maximum durability, fast installation and long-term safety
4. Rope-guided (steel cable)

## Personal Protective Equipment

The personal protective equipment (PPE) consist of the following:

1. Safety harness (Harness AX-60)
2. Safety rope with double Hook GB27-A
3. Lanyard for work positioning belts ASK8

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4. Movable platform having high safety standard
5. Climb assist 80% less physical burden
6. Mobile climb assist up to 40 kg lower physical burden

*Figure 4: Safety harness (like Harness AX-60)*

*Figure 5: Safety rope with Hook (GB27-A)*


*Figure 6: Lanyard for work positioning belts (ASK8)*

*Figure 7: C-Lift- Movable platform having high safety standard*

*Figure 8: E-Lift- Climb assist which reduces physical burden up to 80%*

*Figure 9: H-Lift: Climb assist which reduces physical burden up to 40 kg*

## C-Lift: The Smart Movable Platform

The smart movable platform C-Lift is driven via two steel ropes and is guided by the fall arrester rail of the ladder system. It is operated via wireless connection by a drive unit installed on the ground. The movable platform transports one person (up to 120 kg) reliably and safely. Versatile safety features such as limit switches for automatic switching off, overload detection, wireless signal redundancies and an emergency-off function, as well as the mandatory two hand operation, ensure safety standard.

Wind technicians climb up and down a tower ladder, typically between 60m to 90m (200 to 300 feet) height and even 120 meter (400 feet) in some cases to perform these procedures in tight, enclosed working spaces. Working in awkward body positions, carrying heavy load and routinely climbing multiple vertical ladders put site technicians and site engineers at risk for developing new or exacerbating existing Musculoskeletal disorders (MSDs), such as lower back pain and muscle strains (Cooper, Kirkpatrick & Stewart, 2014).

## Benefits of Upgrading Wind Towers with Service Lifts

1. Reach top of 80 meter (262.5 feet) tower in 4.5 minutes!
2. Health protection of employees (reduction of repetitive stress injuries, knee damages, lower back pain, etc.)
3. Higher output – More turbines can be maintained by same crew i.e. smaller work force needed.
4. Mid to long-term cost reduction.
5. Improving quality of life especially for older/more experienced technician, which will be seen as a great benefit to stay with the company and make it easier to entice experienced technician from joining competitors as they do not have to climb 300 feet tall tower ladders.
6. Complicated mechanical, hydraulic and electrical problems including repair or replacement of parts to correct malfunctions occur and this will create a revenue loss if the turbines cannot start to operate.
7. Moving material via chain hoist up and down takes about 30 minutes compared to material transport with service lifts lasting about 9 minutes. Using a service lift is a tremendous time saver and in times where the chain hoist is needed to transport tools several times a day, it almost feels priceless.

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2. Ladder climbing is associated with an increased risk of Musculoskeletal disorder, lower back pain and knee osteoarthritis, and this may be exacerbated by workers adopting prolonged kneeling or stooping postures, and having a high Body Mass Index. Source: https://journals.lww.com/pages/results.aspx?txtKeywords=health+effects+associated+with+working+in+wind+power+generation+industry
3. Musculoskeletal diseases account for more than 50% of disabling health conditions reported by adults. Source: http://www.boneandjointburden.org/2014-report/iib0/low-back-pain (Andersson & Watkins-Castillo (2014)


## Snippets on Wind Power

### Andhra Pradesh Govt Releases Rs. 2,984 Cr to Clear Power Dues

The Andhra Pradesh government has released a sum of Rs. 2,984 crore to clear long- pending dues to solar and wind power generators, central generating stations and state generating stations. Of this Rs. 2,199 crore will go to CGS and SGS while solar and wind power generators will get the balance. With this, pending payments to renewable energy generators have been cleared up to December 2019, according to an order issued by Energy Secretary Mr. N Srikant. The amount has been released towards payment of 25 per cent losses of DISCOMs taken over for the years 2017-18 and 2018-19 under Ujwal Discom Assurance Yojana Scheme (UDAY) of the Government of India, the order said.

*Source: PTI, 27 Feb 2020*

### Rs 1.5 Lakh Crore: The Bill India is Set to Pay for The Coming Power Gamechanger

The prepaid meters are expected to help to improve billing and collection, which are the most basic problems facing the country's ailing distribution companies, known as discoms.

India's nationwide roll-out of smart power meters, aimed at supporting ailing utilities and bolstering reliable electricity supply, will cost about Rs 1.5 lakh crore ($21 billion), according to a government estimate. These utilities, mostly controlled by their state governments, lose money because of poor billing and theft of power, which often leads to them delaying payments to generators and depriving their customers of reliable supplies.

*Source: Bloomberg, February 27, 2020*

# Demand Dispatch - Smart Demand Side Management (DSM) to Help High Wind Penetration in the Grid

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## Introduction

As electric power system evolved over the years, the demand for electric power ever increased faster than the growth of the generation capacity. Integration of renewable energy (RE) technologies like wind and solar power looks promising. These resources being distributed in nature with small power densities, to have a dominant impact all these resources need to be tied to the grid. The concept of distributed generation emerged as a solution to address this need, where more RE resources could be integrated and it can happen even at the low voltage distribution side of the power utility network.

The prospects of distributed generation need to be immensely explored for green energy development plans of the future in any country. But addition of RE sources aggravates technical issues existing in the grid due to intermittency and variability. Large wind penetration can affect power angle, voltage stability and power quality[1-3]. Researchers in the past have suggested methodologies to assess the maximum wind penetration limit, beyond which system stability is at stake[4]. Such restrictions imposed on the maximum limit of wind penetration, counteract on the scope of distributed RE generation, especially wind energy. A proactive strategy to address this issue is to improve the system stability through fast coordinated control, rather than limiting the wind penetration. Load following by conventional generation will not be sufficient when more wind power is integrated on the grid. Wind farms cannot be effectively scheduled as diminutive climatic change can affect the power output. The need for dispatchable generation such as gas and hydropower plants to compensate the fast ramping of power will increase as more RE resources are integrated to the grid; and it is not a practical solution. In such scenarios where generation is not dispatchable the alternative is to go for dispatchable demand[5].

Fast responding energy storage systems such as super capacitors, battery storage, etc. are promising in this respect[6-11]. Bulk energy storage systems of fast responding type are very expensive and have to be placed in optimum locations and capacities. Distributed generation demands storage units at distribution level and hence distributed energy storage is preferred to centralized ones. Western countries envisage electric vehicle (EV) as a means of distributed energy storage. The concept of EVs as storage medium might not be feasible for developing countries due to various reasons including public acceptance. To mitigate the issues with high wind penetration, a new control strategy is needed in developing countries.

## Demand Response

The concept of Smart Grid nurtured development of various Demand Side Management (DSM) strategies for utilities to deploy and to maintain supply-demand synergy. The variations in RE sources, especially wind energy, adversely affect generation scheduling by utilities. This prompted several researchers to identify Demand Response (DR) through third party Demand Side Response (DSR) aggregators as a remedy[12]. Demand Response (DR) was initially deployed by Federal Energy Regulatory commission in 2008, to reduce peak hour demand. The success of a DR programme depends on identification of schedulable and controllable loads. Such loads are collectively named as Dispatchable Load. Utilities primarily depend on DSR aggregators in identifying and controlling dispatchable loads.

Demand Response (DR) programs were originally proposed to curtail some of the bulk loads during peak times, via telephone calls[5]. Demand Response (DR) is usually associated with a few consumers and used infrequently. In a DR contract with the utility the consumer entrusts the utility to disconnect the contracted load when the latter feels the need. When demand control is deployed for compensating the fluctuations in injected wind power, real time decisions and controls are needed. The traditional SCADA system based on RTUs are not suited for dynamic analysis of power system[13]. Realisation of real time monitoring and control of the grid is facilitated on smart grid[14], which knows its own state of operation and can act upon it. Smart grid makes use of advanced communication technologies which overlays the power system network, so that the grid operations could be monitored and controlled in real

time. Smart grid uses Phasor Measurement Units (PMU) to identify power system dynamics.

## Demand Dispatch

With advanced communication technologies on the smart grid the DR schemes could be extended to be called as Demand Dispatch (DD), where the utility can aggregate consumer loads and dispatch them depending on the generation[15], thus forcing demand to follow generation. DD uses dispatchable loads, which can deviate from their normal consumption pattern without affecting their operational constraints. For the success of DD, utility need to identify, aggregate and precisely control dispatchable loads. A few examples for such loads are dish washers, washing machines, large battery chargers, plug in electric vehicles, water heaters, etc.

Demand Dispatch (DD) requires real time communication with appliances/loads and utility control centres. The latency of the communication is of great importance as some loads should be dispatched in case of power system urgency. Internet is a promising medium through which DD could be achieved, as the infrastructure already exists. In conjunction with DD the utility can implement a dynamic tariff plan[16], so that the change in price for electric power generation is reflected to the consumer side as well. Dynamic tariff will promote voluntary co-operation of consumers with respect to DD schemes. More over the consumer can select the operation of loads in such a way as to minimize his total consumption.

A smart controller is required to perform DD on appliances, unless an appliance is a smart one. Though dispatchable loads exist in large numbers, their power ratings are less and the available ones will be sparsely dispersed on the grid. The identification and selection of dispatchable loads for DD will be challenging for utilities. The selection of loads should consider distribution feeder capacities and bus voltage limits, etc. The entities participating in DD and the respective roles need to be defined. When more RE sources are integrated through micro-grids a coordinated control of DSR aggregators is essential. In such scenario DD could be a more viable solution than using traditional DR techniques.

## Development and Testing of a Demand Dispatch Application

Investigating on DD, the authors of this article developed a framework for DD and its architecture has been tested on a Smart Micro Grid Simulator (SMGS) available at Amrita School of Engineering, Coimbatore[17,18]. The SMGS is fed from a conventional alternator as well as a wind turbine generator (WTG); regular as well as dispatchable loads are connected to it. Wind speed variation disproportionate to demand variation caused frequency excursions in the SMGS. The DD application developed by the authors was then implemented in the same scenario of generation-load mismatch. The application performs optimum allocation of dispatchable loads based on the real time monitored data and then connects/disconnects the dispatchable loads through load control units (LCU) added on the SMGS. The commands to connect or disconnect dispatchable loads are sent from the cloud to LCU, through *Message Queuing Telemetry Transport* (MQTT) protocol and then the LCU interprets the data and controls the loads.

## Results

Figure 1 presents the frequency plots of the same scenario when operated with and without DD. The frequency regulation capability of DD is evident in it.

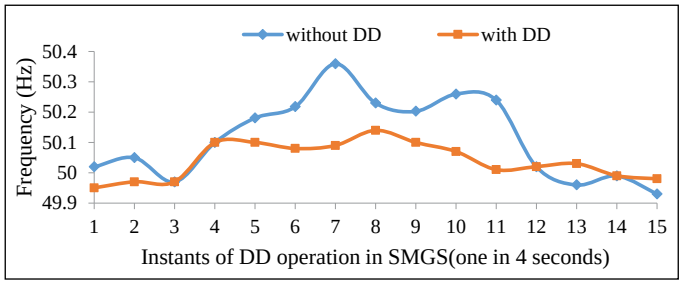


*Figure 1: Frequency Plot of SMGS with and without DD*

The DD application was also tested on a small WTG on rooftop that operated in autonomous mode. Identifying suitable dispatchable loads, DD is tested on this DC micro grid system too. The results are shown in Figures 2 to 4. It proves the effectiveness of DD, besides validating the versatility of the DD application developed.

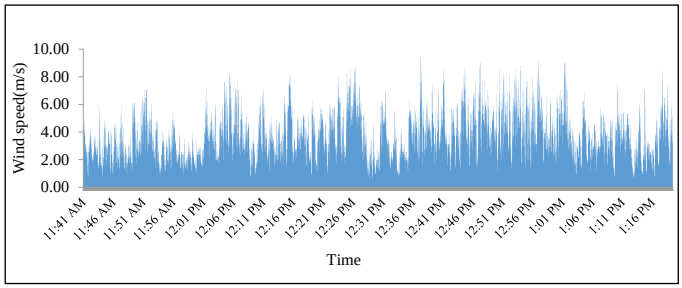


*Figure 2: Wind Speed Recorded (Every Second) at the Test Site*

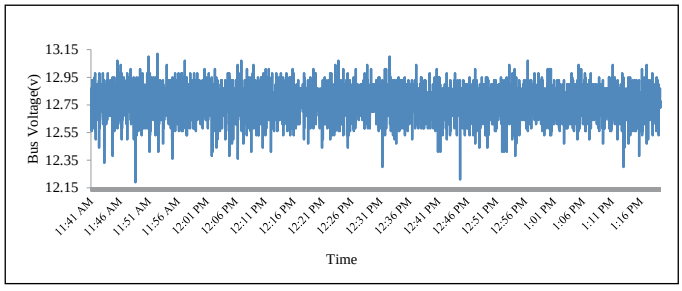


*Figure 3: Voltage Fluctuations in the Small WTG System When Operated without DD*

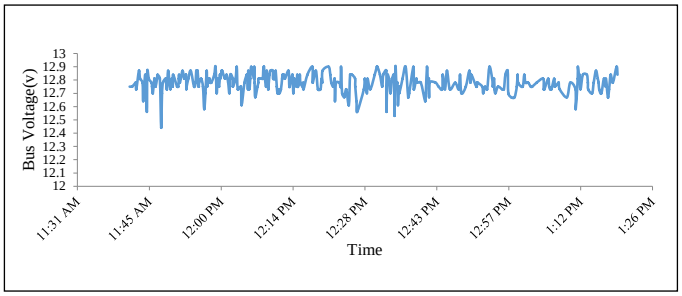


*Figure 4: Small WTG System Voltage with DD*

We also studied the dynamics involved in DD operation when implemented in large utilities, by modelling IEEE-118 bus test system, modified to a wind power penetration of 50% incorporating several WTG units of 2 MW size, in MATLAB Simulink. The study revealed that DD is effective in smoothing frequency excursions.

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# Emerging Trends in Wind Power Technology

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The wind power has become one of the fastest growing source of renewable energy due to the technological innovations in design, manufacturing and controls of wind turbine. The trend is for higher capacity turbines, higher hub-heights to enhance capacity utilization factor, new methods of installation for further cost reduction and so on. New ideas, concepts and innovations are emerging and taking shape at various research and testing organizations, mainly in Germany, United States, The Netherlands, Denmark, United Kingdom, Spain, Canada and India. This paper describes the innovative research directions in wind technology and highlights some of the emerging trends.

## 1. Higher Hub Height

Technological advancements are enabling longer blades and taller towers to generate more energy. In India, the installable wind power potential has been estimated at different heights above ground level as given in Table 1.

**Table 1: Estimated Installable Power Potential above Different Ground Levels[1]**

| Height Above Ground Level | Estimated Power Potential |
|---|---|
| 50 metre | 49,130 MW |
| 80 metre | 1,02,788 MW |
| 100 metre | 3,02,251 MW |
| 120 metre | 6,95,508 MW |

The Ministry of New and Renewable Energy constituted a Committee in September 2014 to re-assess India's onshore wind power potential. The objective was to develop a common methodology for re-assessing onshore wind power potential at 100 m and 120 m using GIS techniques along with data sets on Land-Use Land-Cover and wind speeds. The WinDForce Management Services Pvt. Ltd., Gurgaon, CSTEP, Bengaluru, India Shakti Foundation, Delhi submitted the report to MNRE in June 2015. As per the report, the wind power potential estimated is much higher as compared to the assessment by NIWE.[2]

In the offshore of Alabama, USA, much larger areas and capacity utilization factors (CUF) with the increase in hub height may be seen in Figure 1. As a thumb rule, each metre increase in the hub height adds 0.5 to 1% in annual energy yield which makes such sites economically viable. The CUF of 35 to 40% and above is quite desirable for a wind farm.

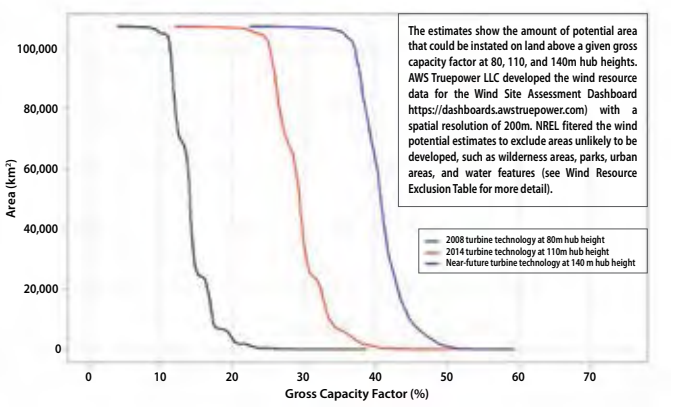


*Figure 1: Capacity Factors of Wind Turbines at Different Hub Heights[3]*

## 2. High Capacity Wind Turbines

The maximum unit capacity of 3.6 MW in 2005 has now gone up to 12 MW in 2019 and 20 MW (offshore) turbine is also in the making. Thus, in a span of fourteen years, the turbine rating has gone up many times. The wind turbine rated 8 MW was commissioned in 2017 at Burco Bank offshore wind farm in Irish Sea, U.K.

Parkwind, the Belgian offshore wind power developer is executing a wind farm with 23 numbers, MHI Vestas make 9.5 MW wind turbines for the 219 MW Northwester-2 offshore wind power project. The first 9.5 MW turbine, the highest unit capacity in the world, has been installed in 2019 and has started exporting electricity to the power grid from January 2020.

The GE Haliade-X 12-MW turbine is expected to be commercially available by 2021. Its direct-drive prototype was installed in the Dutch port of Rotterdam, Netherlands in 2019. The large capacity wind turbines are given in Table 2.

Table 2: Large Capacity Wind Turbines[4]

| Manufacturer | Reference | Capacity (MW) | Diameter (m) | Generator |
|---|---|---|---|---|
| Siemens Gamesa | SG 8.0-167 DD | 8.0 | 167 | Synchronous permanent |
| MHI Vestas Offshore | V164-8.3 MW | 8.3 | 164 | Synchronous permanent |
| MHI Vestas Offshore | V164-8.8 MW | 8.8 | 164 | Synchronous permanent |
| MHI Vestas Offshore | V164-9.0 MW | 9.0 | 164 | Synchronous permanent |
| MHI Vestas Offshore | V164-9.5 MW | 9.5 | 164 | Permanent Magnet |
| AMSC | wt1000dd SeaTitan | 10.0 | 190 | HTS synchronous |
| MHI Vestas Offshore | V164-10.0 MW | 10.0 | 164 | Permanent magnet |
| Swiss Electric | YZ150/10.0 | 10.0 | 150 | Synchronous permanent |
| | YZ170/10.0 | | 170 | |
| | YZ190/10.0 | | 190 | |
| Siemens Gamesa | SG 10.0-193 DD | 10.0 | 193 | Synchronous permanent |
| General Electric | GE HALIADE-X (GE investing to develop) | 12.0 | 220 | Synchronous permanent |
| UK Offshore Renewable Energy Catapult facility | By Germany GreenSpur Wind (Under Development) | 20.0 | | Permanent Magnet |

## 3. Trend in Turbine Blade Design and Materials

The turbine blades are exposed to varying mechanical impacts and extreme weather conditions. The blades get delaminated due to the rain or ice which erodes leading edge that increases drag but decreases lift resulting loss in energy yield. These damages adversely affect aerodynamics and energy yield.

The design of blades poses challenge in striking the balance between structural adequacy, appropriate aerofoils, and aerodynamic efficiency. Thus, designers optimize the aerodynamics of the blades, increase hub-height, and the best materials for blades. However, to prevent rapid deterioration of blades to maintain high energy yield is a major issue.

The materials used in the fabrication of turbine blades are mostly fibre-reinforced polymer composites such as glass, carbon or natural fibres. The researchers continue their efforts to develop low density, low cost materials with high stiffness to facilitate transportation and installation besides improved performance.

The trends in designs and materials are summarized below:[5]

- **Bigger, Taller and More Powerful Turbines:** The rotor diameter, tower height and capacity of turbines have increased manyfold in 21st century itself. For example, the GE Haliade-X can reach up to 260 metre tip height – almost as long as a football field and almost 1.5 times taller than the Gateway Arch found in St. Louis, Missouri.
- **Segmental Ultra-light Morphing Blades** have been inspired by the palm trees, whose trunks survive hurricane-force by morphing and aligning with the direction of wind. Thus, the blades can morph and sway with the wind and thus minimizing the structural cost.
- **The modular blades and composites** developed by Gamesa facilitate road transportation and installation.
- **3-D printing Technology** is being developed by Sandia National Laboratories, U.S.A. to fabricate large turbine blades of fibre-reinforced polymers. This technique will save time and will make the large scale fabrication and testing cost effective.
- **Leading Edge protection:** The Leading Edge for Turbines project in the U.K., is exploring the possibility of applying aerospace technology to offshore wind turbine blades by providing a nickel-cobalt alloy based leading edge protection system. This light weight alloy possesses high tensile and yield strengths and is ideal for use as a protection shield against erosion of the leading edge of blades.
- **Artificial Intelligence:** VTT, Finland's antiAGE project found a functional solution to the material problem with the help of artificial intelligence and 3D printing. AI will help to visualize fine-scale variations from an unlimited number of materials used in the fabrication of wind turbine blades that are imperceptible to human eyes. AI will help to determine the best materials for specific purposes. Likewise, manufacturing of highly tailored materials will be handled by 3D printing dictated by the AI's material selection in any shape and will be cheaper than any traditional manufacturing technique.

## 4. Flying and Floating Wind Turbines

The power contained in wind increases as a cube of the wind speed. The wind speed increases with height above ground. However, the cost of tower and foundation increases rapidly with the increase in hub height. This has led to a concept of flying turbine, which eliminates the need for expensive tower, foundation, and yaw mechanism. Various concepts have been

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emerging but the best architecture has yet to be established. The generator may be either flying (flygen) with the turbine or installed on ground (groundgen).

One of the concepts is a drone based airborne wind energy system which seems to be feasible. A single and multi-drone system is shown in Figure 2. They are connected to the ground with a single cable which reduces the aerodynamic drag of the cables considerably and also enhances the feasibility as demonstrated in preliminary studies. The concept has been investigated by numerical simulation as well as experimental model testing under controlled conditions. The upscaling envisages multi-megawatt units. The challenges of this technology yet to be addressed are:

- **Design :** design of drones, flight dynamics for stable operation, etc.
- **Architecture :** number and types of drones, connections among them and to ground.
- **Control :** during take-off, generation and landing.

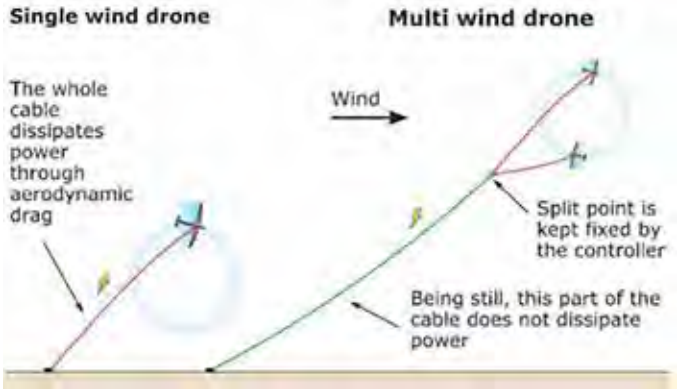


*Figure 2: Drone based Airborne Wind Energy System[6]*

ABB Corporate Research has proved a linear take-off system for a rigid tethered aircraft. Refer Figure 3. Further, rigorous testing in various wind conditions would be required. The landing phase has also to be established experimentally. The low speed take-off and landing of the aircraft are challenging.

*Figure 3: Linear Take-off System Tested by ABB Corporate Research[6]*

## 5. Typhoon Turbine

Storms are very common in Japan. Atsushi Shimizu, Japan invented the first typhoon turbine to tap the huge wind energy contained within the storms. The energy in one typhoon, if harnessed, could power the country for 50 years. Shimizu's concept is a vertical axis Magnus wind power robust generator to withstand the forces exerted by a typhoon. The results obtained from the tests conducted on a scaled model of the wind energy generator have been promising. Shimizu plans to associate the investors for developing the prototype and feed typhoon power into the national grid. Typhoon Wind Turbine are shown in figure 4.

*Figure 4: Typhoon Wind Turbine[7]*

## 6. Hybrid Wind–Hydro Power Project

It is possible to generate electric power when there is no breeze. Max Boegl Wind AG, Germany and GE Renewable Energy, France have merged traditional wind turbines with hydropower technology for the world's first large capacity hybrid wind–hydro power generation project. The project is situated at Swabian-Franconian Forest, Germany.

It is basically a reversible pumped storage scheme in which the turbine acts as pump and the generator acts as motor when rotated in the reverse direction (Figure 5). The wind energy will be used to pump up water into 30 metre reservoir with the storage capacity of 9 million gallons. When there is no wind power generation, water from the reservoir will flow down to generate hydroelectric power. A man-made lake in the downstream will collect water that will again be pumped by wind energy into the upstream reservoir. The project comprising of four wind turbines with a capacity of 13.6 MW and a 16 MW hydroelectric power plant is scheduled to come into the operation by 2020.

## 7. Hybrid Wind-wave Floating Energy Platform

Hybrid energy platform takes advantage of the compatible aspects of different energy types or even different technology types. The hybrid unit consists of a wind turbine, submerged wave electric converter, horizontal axis generator at sea level, and a mooring with integrated cable moored to the seafloor.

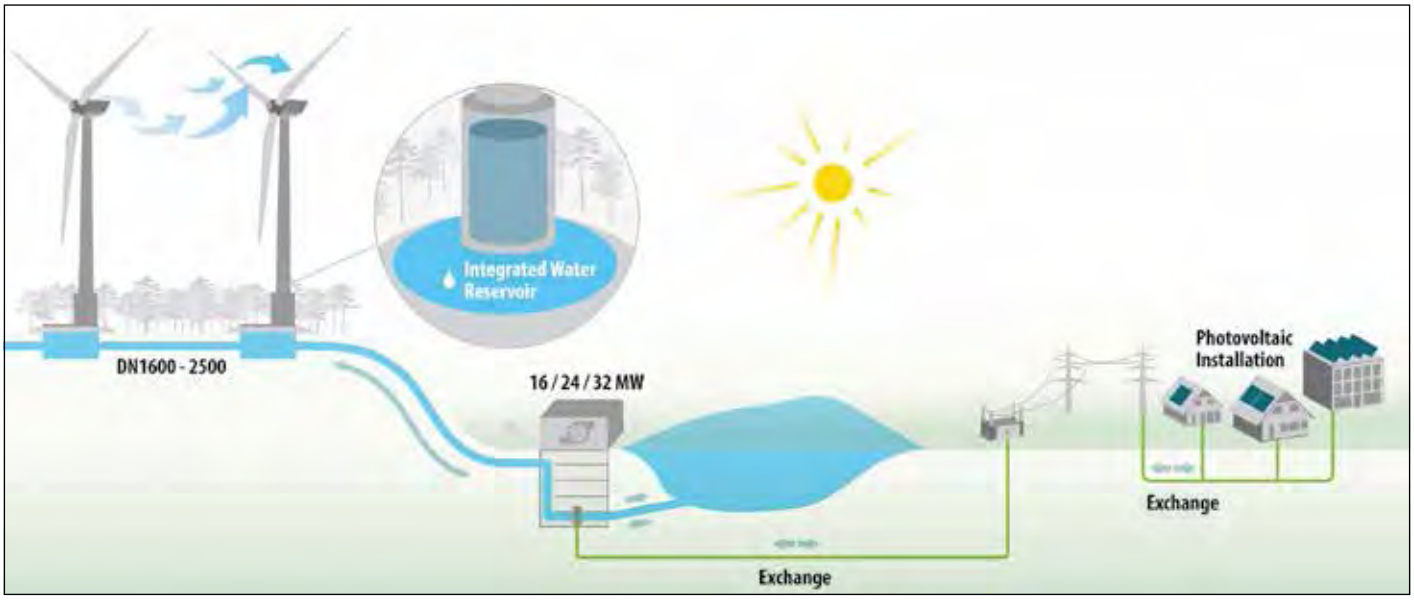


*Figure 5: Wind–hydro Hybrid Power Plant*[8]

The hybrid platform with floating wind and wave energy was developed in the framework of the Poseidon (a concept of floating power plant). Refer to Figure 6.

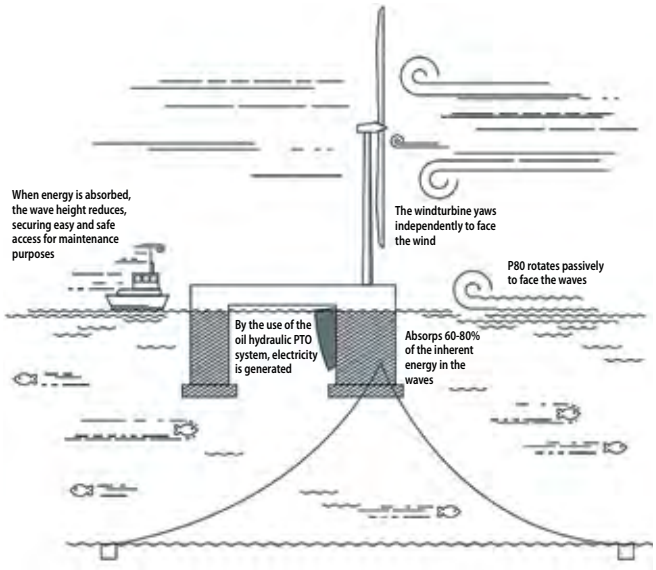


*Figure 6: Hybrid Wind-wave Hybrid Power Project*[9]

The hybrid wind-wave floating hybrid energy system comprising of 33 kW wind power and 50 kW wave power was tested in North Sea conditions. The flaps of wave energy converters must always be aligned towards the incoming waves in order to maximise power generation.

The P80 is a floating platform of M/s Floating Power Plant which accommodates a 5-8 MW wind turbine and integrates 2-3.6 MW wave power dependent on the wave resource. The platform is moored at a single point allowing the platform to orient so as to face the waves to ensure safe landing of offshore boat. The platform rotation is secured by the high wave absorption of 60-80% of the inherent energy in the waves.

Floating Power Plant (FPP) intends to deploy commercial hybrid floating wind-wave energy system in the Oceanic Platform of the Canary Islands (PLOCAN) site and also to set-up the R&D subsidiary in Gran Canaria. FPP and PLOCAN have signed a MoU to work together to identify a suitable site. It is anticipated that the FPP's technology could be installed by end 2021.[10]

## 8. Vortex Bladeless Wind Turbine

The vortex converts breezes into kinetic energy which is further transformed into the electrical energy. The bladeless wind turbines are tall and thin as shown in Figure 7. In the same space, more number of vortex wind turbines can be accommodated.

This bladeless wind turbine wobbles in the wind and generates electricity. It works on the principle of vortices created behind an obstacle in the path of wind. The Vortex Bladeless, a Spanish firm, has designed thin, cone-shaped turbine of carbon and glass fibres with the generator at the bottom to make it sturdy. The design ensures that the wind's vortex spins synchronously along the entire cone. The swirls have to work together to achieve good performance. There is also a ring of magnets at the base of the cone that gives boost to help rotations regardless of wind speed. It works silently and is safe for the birds.

The vortex bladeless turbine is economical to manufacture and maintain since there are no moving parts and hence no friction. It reduces the manufacturing cost by 53% and maintenance costs by as much as 80% compared to the traditional wind turbines.[7] The traditional wind turbines need laminar wind free from turbulence. But, Vortex wind turbines have no such

requirement. They adapt to even turbulent wind with the assistance of the magnets in its core.

The model of Vortex turbine has been developed by computation and tested in a wind tunnel. There are prototypes also for field testing but details on tests carried out by the company or independent labs are inadequate.

The idea of bladeless turbines existed in the past also but it has not been very successful, so it will be interesting to see how Vortex Bladeless overcomes these challenges.

*Figure 7: Bladeless Vortex Wind Turbines*[11]

## 9. Wind Tunnel Tower

The U.S. based SheerWind Company has developed and patented its tunnel based Invelox technology which captures breezes at the ground level and funnels them inward through a tapering passage, thus accelerating the wind speed. This innovative wind turbine is capable of generating 600 times more power compared to a conventional wind turbine. Unlike other turbines, it also minimizes environmental impact and is safe for birds. All these features make Invelox a potentially game-changing renewable energy solution that could be easily integrated within commercial renewable energy operations.

It is claimed that Invelox turbine can operate at low wind speeds of 1 mph (0.447 m/s) and generate power at 72% capacity. The low cost of US$10 per MWh makes the Invelox wind turbine a true game-changer.[12] It has no blades, and hence it needs hardly any maintenance and is safe for the birds. An Invelox wind turbine is shown in Figure 8.

## 10. Catching Wind Turbine

Raymond Green at the age of 89 years designed the catching wind turbine. The air is squeezed and compressed to create more power at the turbine. The blades are mounted at the back as shown in Figure 9 which makes inaccessible to birds. Also, these turbines make virtually no noise. The design can be scaled up or down for commercial or residential use.


*Figure 8: Wind Tunnel Turbine*[13]

*Figure 9: Catching Wind Turbines*[14]

Sigma Design Company was hired to test the turbine, analyze, modify to optimize and manufacture. Raymond Green's patented invention, 'Catching Wind Power' compressed air enclosed Wind Turbine was tested in July 2012.

## 11. Segmental Blades for 50 MW Offshore Wind Turbine

Sandia National Laboratories of United States is developing a design of 100 m long blades that will form the basis for the segmented ultra-light morphing low-cost rotor for 50 MW offshore wind turbine. Wind turbine blades will be developed for 50 MW wind turbine which will be more than 200 m long i.e. longer than twice the football ground.

Studies reveal that alignment of blades with the load can drastically minimize stresses and fatigue on blades. The blades remain spread out to maximize power generation. The blades bend and align with wind direction in the operating range of wind speeds. Thus, the risk of failure of blades is substantially minimized. The arrangement of blades is shown in Figure 10.

# Boosting turbine performance and profitability

SKF is designing and developing bearings, seals, condition monitoring systems, and lubrication systems that enable more cost-effective wind energy generation. Working together with original equipment manufacturers and wind farm operators, SKF engineers provide dedicated solutions that can optimize the reliability and performance of new and existing wind turbine designs.

SKF's dedicated wind turbine solutions can help both turbine manufacturers and wind farm owners to:

- Increase energy production
- Increase turbine performance and reliability
- Reduce operating and maintenance costs
- Reduce lubricant consumption
- Minimize environmental impact
- Reduce energy losses
- Decrease warranty claims
- Reduce time to market
- Customize solutions

For these and more solutions, visit www.skf.com/wind
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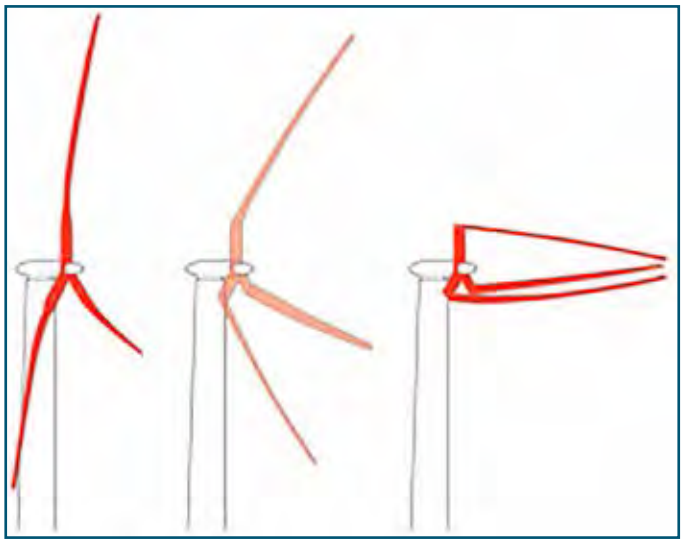

*Figure 10: Segmented Rotor Blades*[15]

## Conclusion

Wind industry technology continues to evolve in order to ensure growth of industry and further improve reliability, increase capacity factors and reduce costs. A number of technological innovations continue to take place across the globe in the field of wind power technology. A few such innovations are discussed in the paper. Several organizations are engaged in research, development and testing of other designs. The paper aims to encourage researchers to explore innovative ways to improve technology and performance of wind turbines.

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## Snippets on Wind Power

### India's Cultivable Land Has the Highest Potential For Wind Energy Generation: NIWE

India's cultivable land areas have the highest potential compared to wasteland and forest land for installing wind energy projects at an estimated 347 gigawatt (GW) at 120 metre above ground level, according to a report by the National Institute of Wind Energy. It added that out of India's total estimated wind potential of 695 GW, 340 GW is possible in wasteland, 347 GW in cultivable land and 8 GW in forest land. The report further added that the future land allocation scenario would depend on supportive land policies of different state government and competing demand for land for other sectors.

*Source: ET Energy World, February 26, 2020*

# Telescopic On-Shore Tower

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## 1. Introduction

In 2011 ESTEYCO started research activities on a disruptive solution for the substructure of offshore wind turbines and in 2013 a self-lifting telescopic tower came as a solution. Such technology was developed focusing on the capability of commissioning off-shore wind turbines and its substructures with full independence of the costly and scarce heavy-lift vessels. This technology was initially proven in 2015 with an on-shore prototype in Daganzo (east of Madrid) and again in Q2 2018 in Gran Canaria Island -first off shore WTG in Southern Europe and first in the world that does not need any significant and expensive marine means- with the construction of the self-installing bottom-fixed offshore wind turbine designed, built and certified by ESTEYCO.

Its design and construction are based on pioneering experience when it comes to conventional precast concrete towers. Since ESTEYCO's first precast concrete tower realization in 2004, more than 1600 towers for several turbine manufacturers have been built, with hub heights ranging from 80m to 120m.

*Figure 1: Telescopic On-Shore Tower*

The increasing hub-height demands, considering already heights from 140 to 190m, at certain wind farms, driven by challenging non-conventional renewable energy policies and a market where reduction of the CoE is the main driver, the self-lifting telescopic tower has become a key solution not only on the off-shore market but also on on-shore wind farms where large, costly and scarce cranes are no longer required when this solution is implemented.

That's the case of India, where higher and more powerful turbines are expected to appear as a way of putting down the LCoE. Dealing with such heights from 140m up, requires solutions beyond conventionalism and the self-lifting precast concrete tower by ESTEYCO is ready to face this challenge, as it is doing right now somewhere else with the design and upcoming construction of the tallest tower in the world, with a HH of 175m.

The solution, in general terms, is formed by several prismatic concrete sections which at the same time are formed by several prefabricated concrete panels V-shaped, C-shaped or just flat, depending on the case. These sections are preassembled one inside the other prior to the self-erecting phase. Additionally, the most upper steel tubular section from conventional steel towers can be used combined with the previous configuration (becoming a hybrid solution) as a variable to reduce the CoE, if applicable.

The solution, patented by ESTEYCO, uses heavy-lift strand jacks always acting at a 40-50m height which are reused to lift one tower section after the other. The recoverable jacks that lift each section are supported by the one below, which also guides the hoisted section as it rises, in a self-installing procedure in which the tower itself is the only supported structure required, as stated, always working from a single access platform at 40-50m height.

## 2. Description of the Solution

The combination of prefabricated concrete sections with heights around 25m and steel tubular sections from conventional steel towers to shape the tower (full concrete or hybrid) depends on the overall cost analysis once the turbine is defined as a known variable.

Such analysis is based on the study of the wind farm location and the precast concrete panel's factory location (within or outside the wind farm), the lifting means to be used to manipulate the precast panels, the transport availability and

restrictions between the two locations, geometrical aspects such as the blade tip and the steel sections geometry to be used, the expected production, the type of cranes available and the local costs variation (labor and materials).

On this section, and as an example, a hybrid tower for a 3.X MW turbine and 165m HH composed by 3 standard steel sections at the upper level and 4 concrete sections at the lower levels is explained.

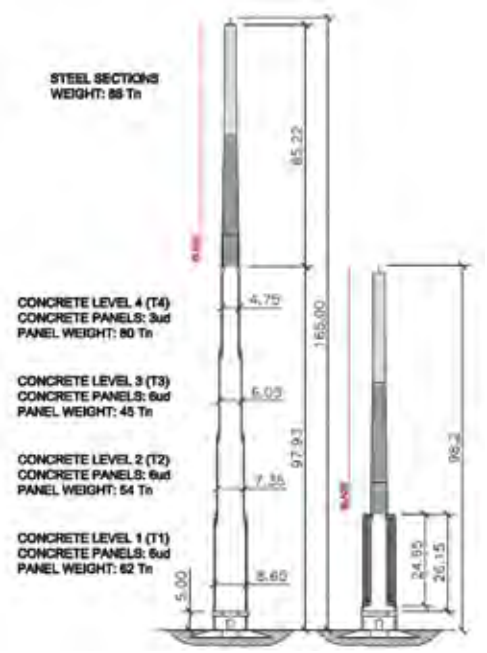


*Figure 2: General view and main dimensions and weights of the tower*

*Figure 3: General views of the tower in folded position (before lifting) and unfolded position*

The steel upper part contains 3 sections totaling 65m long with a bottom diameter of 4.3m.

Below the steel sections there are 4 concrete levels made up of precast concrete V-shaped panels prestressed with pretensioned bonded strands totaling around 100m with panels from 40 Tn to 70 Tn weight aprox.

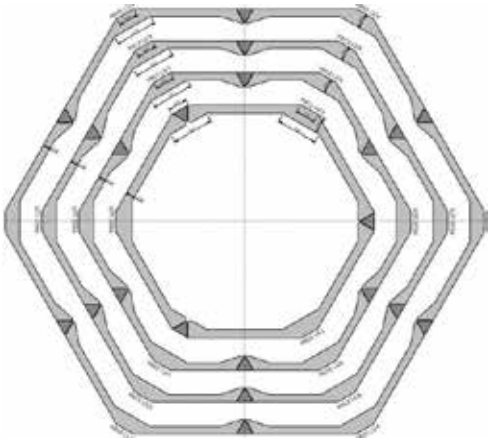

*Figure 4: Plan view of different levels cross-sections*

Every concrete panel has concrete flanges at both ends to enable the connection between the different sections by means of the horizontal joints.

Panels of the same section are connected by means of concrete-filled vertical joints while the connection between each section is achieved by means of a grout-filled horizontal joints with posttensioned bolts.

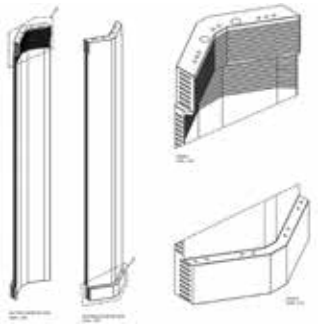

*Figure 5: General view of V-shape concrete panels*

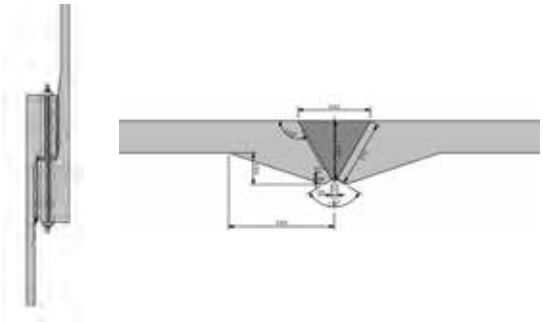

*Figure 6: Joints between panels (vertical joint) and sections (horizontal joint)*

As a matter of example, the next table summarizes some likely figures for a 165mHH hybrid precast telescopic tower prototype:

| | Num. panels per section | Panel weight | Panel thickness | Panel length | Panel width | Panel width* | Panel volume | Section weight |
|---|---|---|---|---|---|---|---|---|
| T4 | 3 | 79 | 0.18 | 24.65 | 4.84 | 5.44 | 31.5 | 248 |
| T3 | 6 | 45 | 0.15 | 24.65 | 2.73 | 3.33 | 18.0 | 295 |
| T2 | 6 | 54 | 0.15 | 24.65 | 3.38 | 3.98 | 21.5 | 348 |
| T1 | 6 | 64 | 0.15 | 26.15 | 4.03 | 4.63 | 25.5 | 407 |

* Including reinforcement bars at both sides / Weight in metric ton (T) and dimensions in meters (m)

Table with main dimensions and weights of concrete panels

## 3. Construction Process

The construction process of the precast concrete telescopic tower involves the following stages:

- Manufacturing of precast concrete panels.
- Transport of the panels.
- Pre-assembly of the panels, conforming levels.
- Upper steel tower, rotor and nacelles assembly.
- Self-erection system (3 lifts).

Following, all these stages are briefly outlined.

### 3.1. Manufacturing of the precast concrete panels

As mentioned before, the tower is composed by levels, which in turn are composed by precast concrete panels. The manufacturing of these panels is carried out on a factory either within or outside the wind farm.

*Figure 7 and 8: General view of the precast panels*

The manufacturing process consist of the following sub-processes:

- Reinforcing steel arrangement of the panel
- Prestressing panel system
- Panel concreting
- Painting of the outer surface (optional, as per client demand)
- Installation of temporary and permanent internal elements

The following pictures show the reinforcing steel arrangement of the panels and the concreting phase in a conventional concrete tower factory.

*Figure 9 and 10: Reinforcement of the panels. Concreting of the panels*

The following pictures were taken during the Off-shore Gran Canaria Island telescopic concrete tower prototype construction yard.

*Figure 11: Panel handling*

It is important to highlight the concepts of scalability and modularity of the factory, allowing to adapt the weights and dimensions of the panels to many different constraints and particularities (stockage capacity, transport limitations, etc.). Thus, the initial investment may be well adapted to the size of the specific project.

## 3.2. Stockage and Transport

After the manufacturing process, the panels are stocked inside the facilities of the factory, waiting to be transported to their final locations.

*Figure 12: General view of the factory stock area*

Handling of the panels within the factory is made by pairs or individual gantry cranes - depending on the available capacity- and transported to the final location thanks to conventional extensible trucks. The supporting tools for the panels are made of steel and adequately positioned for each panel dimension in the truck.

*Figure 13 and 14: Transport of concrete panels with truck and dolly*

## 3.3. Pre-assembly of the panels

As a general description, the tower pre-assembly consists of positioning the concrete panels from inside out (starting with T4 and finishing with T1) on top of the foundation pedestal slab by using a 500 Tn mobile crane or similar and specifically designed reusable tools. Once the panels pre-assembly is finished, the assembly of the steel tubular sections, nacelle and rotor takes place by using a 600 Tn crawler crane or similar, regardless of the final height of the tower, as all these installation works take place at a limited height (40-50m).

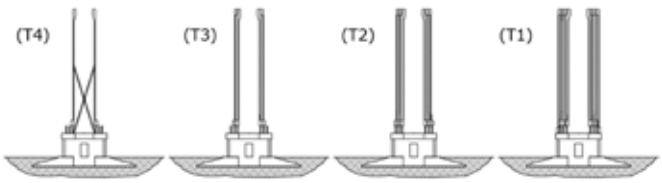


*Figure 15: Concrete panels pre-assembly stages on top of the pedestal slab.(T4 stability by mans of internal tempoarary props)*

The main activities included in the pre-assembly stages are as follows:

- Previous works on top of the pedestal.
- Concrete panels lifting from trucks and rotation to vertical position (T4).
- Positioning and levelling of concrete panels (T4).
- Execution of vertical joints (T4).

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- Panel lifting, positioning and leveling and execution of vertical joints (T3, T2, T1).
- Filling with grout of T1 horizontal joint with the pedestal.
- Pre-assembly tools removal.

The previous works on site consist of setting up the central axis and installing the temporary supports both on the pedestal top slab.

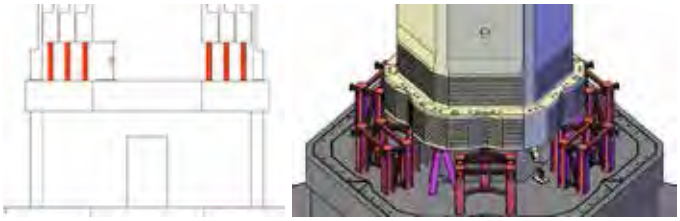

*Figure 16: Temporary concrete panels support*

The panels need some prior installation of internal elements such a working platform, internal props on T4 to provide stability once its panels are erected or vertical joints external jacks to keep contiguous panels vertically aligned, among others.

*Figure 17 and 18: Internal elements installation (working platform and prop on T4)*

The following step consists of tilting the panels to its vertical position to assemble the first tubular concrete section T4. They will be placed on top of the installed temporary supports. External vertical jacks will keep the panels vertically aligned when concreting the vertical joints.

*Figure 19: Tilting of the panels*

*Figure 20: External jacks on vertical joints*

Once the T4 section is installed, the same procedure is applied on T3, T2 and T1. The stability of the panels on sections T3, T2 and T1 is achieved by means of positioning plates attached on the upper flange of the panels connected to T4.

Once all panels are pre-assembled and vertical joints are filled, the horizontal joint of level T1 with the pedestal can be filled with grout. The bolts will be placed after T1 preassembly.

*Figure 21: Vertical joints*

*Figure 22: T1 horizontal joint*

## 3.4. Upper steel tower, rotor and nacelle assembly

Once the concrete panels have been pre-assembled, and prior to the lifting phase, the steel segments, if existing, turbine and blades are installed. In case the telescopic tower is a full concrete tower this phase will consist of installing just the connection steel adapter, the turbine and blades.

*Figure 23: Upper steel tower, rotor and nacelle assembly*

## 3.5. Self-lifting phase

Once the steel tower sections and turbine have been installed, the tower can be lifted. The key of the lifting process is the use of high capacity lifting jacks, and their efficiency for large heights allowing a much lower price than a conventional crane. This system is based on a proven technology in multiple industries, with a track record of over 30 years.

Heavy lifting is made with strand jacks that are attached to the top of the outer section of the concrete tower. All the required works are performed from a single platform, reducing the risk of personnel moving up and down.

*Figure 24, 25 and 26: Stand- jack positioning*

The main activities included in the lifting phase are as follows:

- Preparations of all auxiliary elements and installing jacks at T3 upper flange.
- Inner section T4 lift with jacks reacting on T3 outer section.
- Performing T4-T3 horizontal joints.
- Jack displacement from T3 upper flange to T2 upper flange (some centimeters outwards).
- Lifting of T2 section.
- Performing T3-T2 horizontal joint.
- Jack displacement from T2 upper flange to T1 upper flange (some centimeters outwards).
- T2 lift with jacks reacting on T1 upper flange.
- Performing T2-T1 horizontal joint.
- Dismantling of auxiliary elements.

On the following image, all elements installed on the preparation phase are shown. Mainly, the elements to be placed on the preparation phase are the platforms on Level 1 and Level 2, the

*Figure 27: Tower lifting process*

guidance system, the upper lifting kits with the strand jacks, a system to collect the strands and setting up the power system.

Once the preliminary stage is fulfilled, the three (3) lifting phases start. On the next image, the lifting phases of T3 and

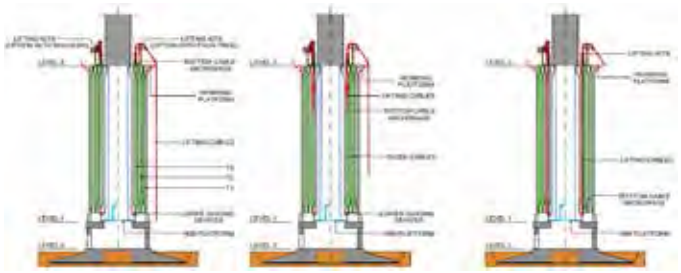

*Figure 28: Auxiliary elements arrangement*

T2 are shown together with the connection of each horizontal joint by means of a prestressing bars and shear keys filled with grout. The grout is poured in the keyed joint once the bars have been prestressed, adding stiffness and water-tightness to the joint and protecting the elements within the tower.

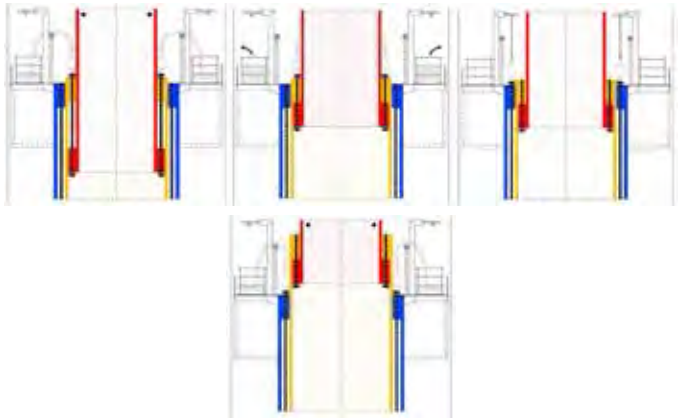

*Figure 29: Stages of the lifting process: lifting, prestressing, relocation of jacks and lifting again*

Once the lifting phase has finished, all auxiliary elements and lifting equipment is removed and taken to the next tower to start the process again.

## 4. Manufacturing And Assembly Rates

The rate at which regular height towers are generally produced in the wind energy sector is 2 tower/week. These rates haven't ever been achieved when heights go over 120-130m. However, ESTEYCO's self-lifting technology is able, after the usual learning curve that drives these kinds of processes, to get very close, providing construction schedules that may fulfill even the most challenging projects.

### 4.1. Manufacturing rates

Considering the on-shore telescopic tower prototype, the number of panels per tower required would be 21 (3 panels for T4 and 6 panels on T3, T2 and T1). A factory with a serial production of 21x2 panels/week would require two parallel working lines with one mold for each type of panel on each working line.

### 4.2. Pre-assembly rates

The pre-assembly procedure considers a group of 3 towers where specialized teams perform the same activity on each tower in a "batch working" manner instead of a "one-piece working" manner. This system provides 3 preassembled towers every eighteen working days (3x6-day weeks). A 2 tower/week schedule would just need to double the rate during half of the time, without impacting in the unitary cost.

### 4.3. Steel upper segments, rotor and nacelle assembly rates

This phase will be performed right after the pre-assembly phase once every tower is fully preassembled. In a same "batch working" manner, a cluster of three towers would be operated together to avoid changing crane configuration to place all steel elements one after another on one single tower.

### 4.4. Self-erecting phase

Following the same approach as the preassembly procedure, the self-erecting phase consists of a production of three towers every eighteen working days (3x6-day weeks) with 3 lifting sets. As a reference all the previous works prior to the first lift take 2 days, each lifting phase takes 1 day, and activities related to the horizontal joints execution amounts 2 days per horizontal joint.

## 5. Enhancement: Precast Braced Foundation Posibility of Use

Driven by the reduction of the CoE, ESTEYCO came up with the braced foundation patented solution where quantities of materials are reduced up to 40% for concrete and up to 25% for steel leading to overall cost reduction up to 10% depending on the case.

*Figure 30: Braced foundation 3D*

This solution brings not only a CAPEX reduction but also an increase of the AEP since the foundation geometry rises the pedestal up to 6m maximum above the ground level and hence the hub height for a defined tower. With a hub height increase and a favorable shear gradient the AEP can be increased by 1-3%, depending on the wind shear of the specific location.

Based on the assumption that the tower door is placed on the foundation itself, the general geometry of a braced foundation compared to a conventional foundation for a precast telescopic tower is shown next.

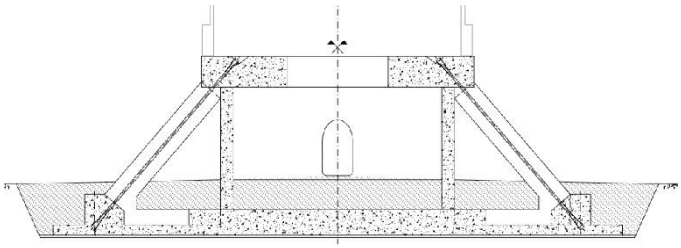

*Figure 31: Braced foundation for a telescopic tower*

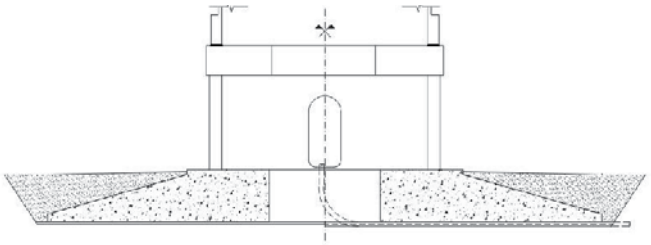

*Figure 32: Conventional foundation for a telescopic tower*

## 6. Conclusions

The self-lifting telescopic tower is ready to enter in wind energy markets as India, where a tight competition brought by the auction system is currently taking place. This technology will make possible to reach hub heights not even considered so far, as a result of the avoidance of big and expensive assembly cranes, since not only the tower but also the turbine is installed at a very reasonable height. The technology is available for every turbine manufacturer or developer willing to go beyond the current limits, putting down the LCoE to the greatest extent, thus maximizing the profit of the project.

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# Wind Power - Regulatory Updates - February-March 2020

## Central Updates

### Ministry of Defence Clearance for Wind Power Projects

Ministry of New and Renewable Energy (MNRE) has come up with an "Amendment in the Guidelines for Forwarding of Applications" to Ministry of Defence for grant of clearance for construction of wind power projects. (11th February 2020)

### Bids

### SECI Wind Tranche IX

**1200 MW** is announced on 13th February 2020 without upper cap.

### SECI: Extension of dates for Completion of Projects

Solar Energy Corporation of India (SECI) is taking up with bidders and corresponding OEMs on extension of Scheduled Commercial Operation Date (SCOD) on a case to case basis for reasons such as land, partial commissioning, and clearance of Ministry of Defence, etc.

### RECs for Third-Party Sale and Captive Use of Wind Energy

Third party sale and captive use of wind energy will be eligible for availing Renewable Energy Certificates (RECs) as per CERCREC Regulations and subsequent amendments. In case of wind power projects availing open access for captive use/ third party sale and opting for Renewable Energy Certificates (REC), the surplus power after set off will be purchased by the concerned Distribution Licensee at the rate of Rs. 1.50 per kWh. Last date for submission of comments is 25th February 2020.

## State Updates

### Gujarat

Gujarat Electricity Regulatory Commission (GERC) has come up with a Discussion Paper on Tariff Framework for Procurement of power by distribution licensees from wind turbine generators and other commercial issues for the state of Gujarat.

The Key Findings of this Discussion Paper are:

The Commission proposes to determine the tariff for all prospective wind power projects, based on the rates discovered through competitive bidding, and discontinue the practice of determining the generic tariff for wind power projects. In order to ensure regulatory certainty for such projects set up in the intervening period, it is clarified that the Control Period shall be deemed to be extended till the date of effectiveness of the tariff framework proposed in this Discussion Paper.

The tariff for Wind Power Projects below the threshold limit of eligibility (below 25 MW) for participating in Competitive Bidding. It is proposed that the tariff for such projects shall be considered equal to the latest tariff discovered through Competitive Bidding by state own DISCOMs for wind power project and adopted by the Commission.

Others Commercial Issues: (Few important points)

a. Purchase of Surplus Power from Wind Power Projects opting for Captive use and Third Party Sale under Open Access.

b. In case of wind power projects availing Open Access for captive use/third party sale but not opting for Renewable Energy Certificates (REC), the surplus power after set off will be purchased by the concerned Distribution Licensee at the rate of Rs. 1.75 per kWh.

### Maharashtra

Maharashtra Energy Development Agency (MEDA) has invited comments on 7th February 2020 from stakeholders on proposing following policies for wind Power project.

a. Re-Powering
b. Wind –Solar Hybrid
c. Wind Power Policy

(IWTMA has submitted its comments on 10th February 2020.)

### Tamil Nadu

In February 2020 TNERC came up with Draft Consultative Paper for procurement of wind power and related issues. The following issues are discussed in the Paper:

a. Banking
b. Open access charges – Transmission and Wheeling, and Line losses
c. Cross subsidy surcharge
d. Reactive power charges
e. Grid availability charges

f. Energy Accounting and Billing Procedure
g. Energy wheeling agreement and fees
h. Security Deposit
i. Power factor disincentive
j. Metering
k. Connectivity and evacuation of power
l. Harmonics

(IWTMA has submitted the comments by 11th March 2020)

### TNERC Approves Tariff for Wind Projects

Tamil Nadu Electricity Regulatory Commission approves tariff of Rs. 2.91/kWh for 441 MW of wind projects through Solar Energy Corporation of India (SECI) for a period of 25 years.

(Feb 21, 2020)

### SECI Wind Tranche IX for 2000MW

RFS was uploaded on 20th March 2020. The following clauses have been added in the RFS.

- No upper cap
- The exception for MSME has been introduced for the first time, however Green Shoe Option (20% over and above the Bid size) for PSU and Small Retail Investors has not been considered.
- Bid Size-Minimum is 50 MW and Maximum is 2000 MW

***Compiled by: Rishabh Dhyani, IWTMA, New Delhi***

## Snippets on Wind Power

### ICO and ENGIE Join Forces in a Unique Partnership

International Car Operators (ICO) and ENGIE are joining forces in a unique partnership. 11 Wind Turbines in the Port of Zeebrugge will supply the largest electric loading island in Belgium, with green electricity Installed by EVBox. It will be Flanders' largest onshore wind project carried out by one operator on a single site; 44 MW of locally produced green energy will be produced from 11 wind turbines. The energy will be available for the local community, ICO itself, and moored ships in the second half of 2020. The annual production amounts to no less than 110 GWh, enough to supply approximately 30,000 households with electricity, and keep 50,000 tonnes of CO2 emissions out of the air every year.

***Source: EMobility, 24th January 2020***

### Take Corrective Measures: Parl Panel to MNRE on Missing Annual Renewable Targets

A Parliamentary Panel has expressed dismay over Ministry of New & Renewable Energy (MNRE) missing targets continuously and has suggested the ministry to identify weak areas and take corrective actions without any further delay. The Ministry has continuously failed to achieve its yearly physical targets, the Parliamentary Standing Committee on Energy said in a report tabled in Parliament. The committee said it "feels that with continuous non-achievement of the assigned yearly physical targets, the Ministry may find it difficult to achieve 175 GW by 2022. The committee highly dissatisfied with the performance of the Ministry and expect the Ministry to improve its target achievement in the coming year."

On Green Energy Corridor Project, it said, the project was supposed to be completed by March 2020, but commissioning schedule has been extended till December 2020. The Committee has recommended that the Ministry should work on mission mode to get the Green Energy Corridor Project ready within the reasonable time frame in order to avoid grid congestion and to facilitate integration and evacuation of large scale renewable power capacity. "The Ministry should eschew playing ducks and drakes with an important project like Green Energy Corridor," the committee said.

***Source: PTI, March 13, 2020***

# Summary on Proposed Amendments to Electricity Act 2020

Ministry of Power, Government of India has come up with proposed Amendments to Electricity Act 2003 on 17th April 2020. The comments can be given in 21 days (6th June 2020). The summary on Amendments is given below.

## New Definitions

**Distribution sub-licensee** means a person recognized and authorized by the distribution licensee to distribute electricity on its behalf in a particular area within its area of supply, with the permission of the appropriate State Commission. Any reference to a distribution licensee under the Act shall include a reference to a sub-distribution licensee;"

**Franchisee** means a person recognized and authorized by a distribution licensee to distribute electricity on its behalf in a particular area within his area of supply, under information to the appropriate State Commission. Subject to the provisions of the agreement entered into between the distribution licensee and the franchisee, any reference to a distribution licensee in the Act shall include a franchisee;"

## Renewable

**Section 3A National Renewable Energy Policy -** The Central Government may, from time to time, after such consultation with the State Governments, as may be considered necessary, prepare and notify a National Renewable Energy Policy for the promotion of generation of electricity from renewable sources of energy and prescribe a minimum percentage of purchase of electricity from renewable and hydro sources of energy."

## Payment Security

## Section 49: Agreement with respect to supply or purchase or transmission of electricity

(1) A generating company or a licensee may enter into an agreement with a licensee for supply, purchase or transmission of electricity on such terms and conditions, as may be agreed upon by them, including tariff and **adequate security of payment** consistent with the provisions of this Act.

(2) Where the Appropriate Commission has allowed open access to certain consumers under section 42, such consumers, notwithstanding the provisions contained in clause (d) of sub-section (1) of section 62, may enter into an agreement with any person for supply or purchase of electricity on such terms and conditions (including tariff) as may be agreed upon by them."

## Adoption of Tariff By Appropriate Commission

## Section 63 (Determination of tariff by bidding process)

The Appropriate Commission shall, after receipt of application complete in all respects, adopt the tariff determined in a timely manner but not later than **sixty days** from the date of application:

Provided that on expiry of sixty days from the date of application, if it is not decided by the Appropriate Commission, the tariff shall be **deemed** to have been adopted by the Appropriate Commission."

## New Addition

## Section 109 A -Establishment of Electricity Contract Enforcement Authority for strengthening of APTEL

Electricity Contract Enforcement Authority shall be sole authority and having original jurisdiction to adjudicate upon matters regarding specific performance of contracts related to purchase or sale of power between a generating company and a licensee or between licensees; and contracts related to transmission of electricity between a generating company and a licensee or between licensees. Orders of the Electricity Authority shall be executable as a decree of civil court. The Appeal against orders of the Electricity Tribunal shall be heard by Appellate Tribunal for Electricity. It is proposed to strengthen the Appellate Tribunal in terms of strength of Members and powers of Tribunal.

# Snippets on Wind Power

## Jobs: Renewable Energy Sector Can Employ 42 Million People Globally By 2050

The number of people employed in renewable energy could reach 42 million globally by 2050, up from about 12 million in 2017, according to a recent report by the International Renewable Energy Agency (IRENA). It added that an accelerated uptake of renewables could also boost total energy jobs to 100 million worldwide by 2050. "The most rapid expansion has occurred in the solar photovoltaic (PV) industry, which now employs over 3.6 million people, putting it ahead of bioenergy, hydropower and wind power," said the report titled 'Measuring the socio-economics of transition: Focus on jobs'.

*Source: ET Energy World, February 26, 2020*

## Maharashtra Students Bring Back Electricity to School through Windmill

A science project by four students with help from teachers brought electricity to a school in Maharashtra's Beed district after nearly a year. The television set and loudspeakers at the Zilla Parishad school in Beed's Kurla area were lying unused after power supply was disconnected a year ago after a bill of Rs 20,000 was pending. The students were asked to work on the windmill and solar panel project to overcome this, science class teacher Bahusaheb Rane told PTI. The project was taken up by Class VII students using the material, costing Rs. 5,000 which was paid by teachers, was sourced from scrap and it took a week to complete and has storage batteries as well. If the windmill does not work due to low intensity of winds, then we fall back on the solar panels.

*Source: PTI, February 28, 2020*

## GE Signs $32 Mn Deal With CPRI to Create Highest Capacity Power Testing Lab in India

GE Steam Power India has signed a deal worth $32 million with Central Power Research Institute (CPRI), Bengaluru for supplying two 2,500 milli volt ampere (MVA) short-circuit generator systems. The addition of the two short-circuit generators to the existing one in HPL, Bengaluru, will upgrade the capacity of the high-power lab to 7,500 MVA, making it the highest capacity short circuit capacity laboratory in India. CPRI is developing infrastructure for research and testing activities of power sector including generation, transmission and distribution segments. "The scope of the project includes supply, installation, commissioning and testing of two sets of 2,500 MVA short circuit generators with super excitation, driving and auxiliary systems, ready for parallel operation in synchronisation with their existing 2,500 MVA generator to yield short circuit powers of 2,500 MVA, 5,000 MVA and 7,500 MVA, respectively," GE said in a statement.

*Source: ET Energy World, March 03, 2020*

## Power Trade at IEX Grew 57% in February 2020

The volume of power traded at Indian Energy Exchange (IEX), the country's largest online electricity platform, jumped 57 per cent to 4,516 million units in February this year. IEX said the increase in trade volume was mainly due to distribution utilities opting for replacement of their costlier power with exchange-based procurement. "The other key reason was an increase in demand on account of early onset of summer and agricultural demand in the southern as well the western states, particularly in Telangana due to lift irrigation," IEX said in its monthly power market analysis released today.

*Source: ET Energy World, March 04, 2020*

## Sterlite Power secures Rs 2K cr Funding to Execute Lakadia Vadodara Project

Sterlite Power has secured Rs 2,024 crore funding from IndusInd Bank and L&T Infrastructure Finance to execute Lakadia Vadodara transmission project.

According to the statement, this project is part of India's Green Energy Corridor (GEC) and will enable the country's renewable energy target of achieving 175 GW by 2022. The project (WRSS 21 - Part B) connects wind energy zones of Bhuj in Gujarat to the load centres in Gujarat and Maharashtra. It involves laying of 330 kms of 765 kV double-circuit transmission line to connect 765/400 kV Lakadia substation to Vadodara substation in Gujarat, in a timeframe of 18 months.

*Source: PTI, March 04, 2020*

## Wind Energy Leads Germany to Renewable Energy Record in February 2020

Frauhofer ISE maintains detailed records on an hour-by-hour basis of where Germany gets its electricity from. It then makes that information available online on a daily, weekly, monthly and annual basis in chart form. An alert Twitter user took a look at the data Fraunhofer provided recently for February and noticed something unusual. Germany derived 61% of its electrical energy from renewables last month- the highest ever for the country.

We regret to inform our readers the passing away of Padma Shri Mr. Rakesh Bakshi, Chairman and Managing Director, RRB Energy Limited on 13th April 2020. Mr. Rakesh Bakshi championed the cause of Wind Energy in India as early as in 1986 and was a "Green Ambassador" of India. He was an outstanding wind energy pioneer, who brought modern wind energy technology to India and showcased its successful operations.

Wind industry has lost a great good friend and all who knew him would certainly miss him.

IWTMA would like to record its condolence to his family and bid farewell to our dear friend Shri Rakesh Bakshi.

May his Soul Rest in Peace.

## Government Removes Tariff Caps For Solar, Wind Power Auctions

Responding to the longstanding industry demand of removing tariff caps in renewable energy auctions, the Ministry of New and Renewable Energy (MNRE) has decided that "cap or upper ceiling tariff will not be prescribed in future bids". The tariff cap was one of the reasons cited by the industry, which slowed down the pace of adding renewable generation capacities to 8.6 GW in FY 19 from 11.3 GW and 11.8 GW in FY17 and FY18, respectively. The other reasons were devaluation of the rupee, rising finance costs.

*Source: Financial Express, March 7, 2020*

## Union Power Minister Dedicates Eleven REMCs to the Nation

Minister of State (IC) Power and New & Renewable Energy & Minister of State (Skill Development and Entrepreneurship), Shri R.K. Singh inaugurated the Northern Region Renewable Energy Management Centre (NR-REMC) at a function in New Delhi, on 28th February, 2020. On the occasion, he also dedicated to the nation, eleven REMCs, placing India among a league of few nations, which have state-of-the-art management centers for renewable energy integration like Europe and Unites States when they started at renewable energy management.

REMCs are equipped with Artificial Intelligence based RE forecasting and scheduling tools and provide greater visualization and enhanced situational awareness to the grid operators. And are co-located with the State Load Dispatch Centers (SLDCs) in Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat & Rajasthan and in RLDCs at Bengaluru, Mumbai and New Delhi and at the NLDC. Presently, 55 GW of Renewable (Solar and Wind) is being monitored through the eleven REMCs.

Source: Press Information Bureau, GoI, Ministry of Power, *28 February 2020*

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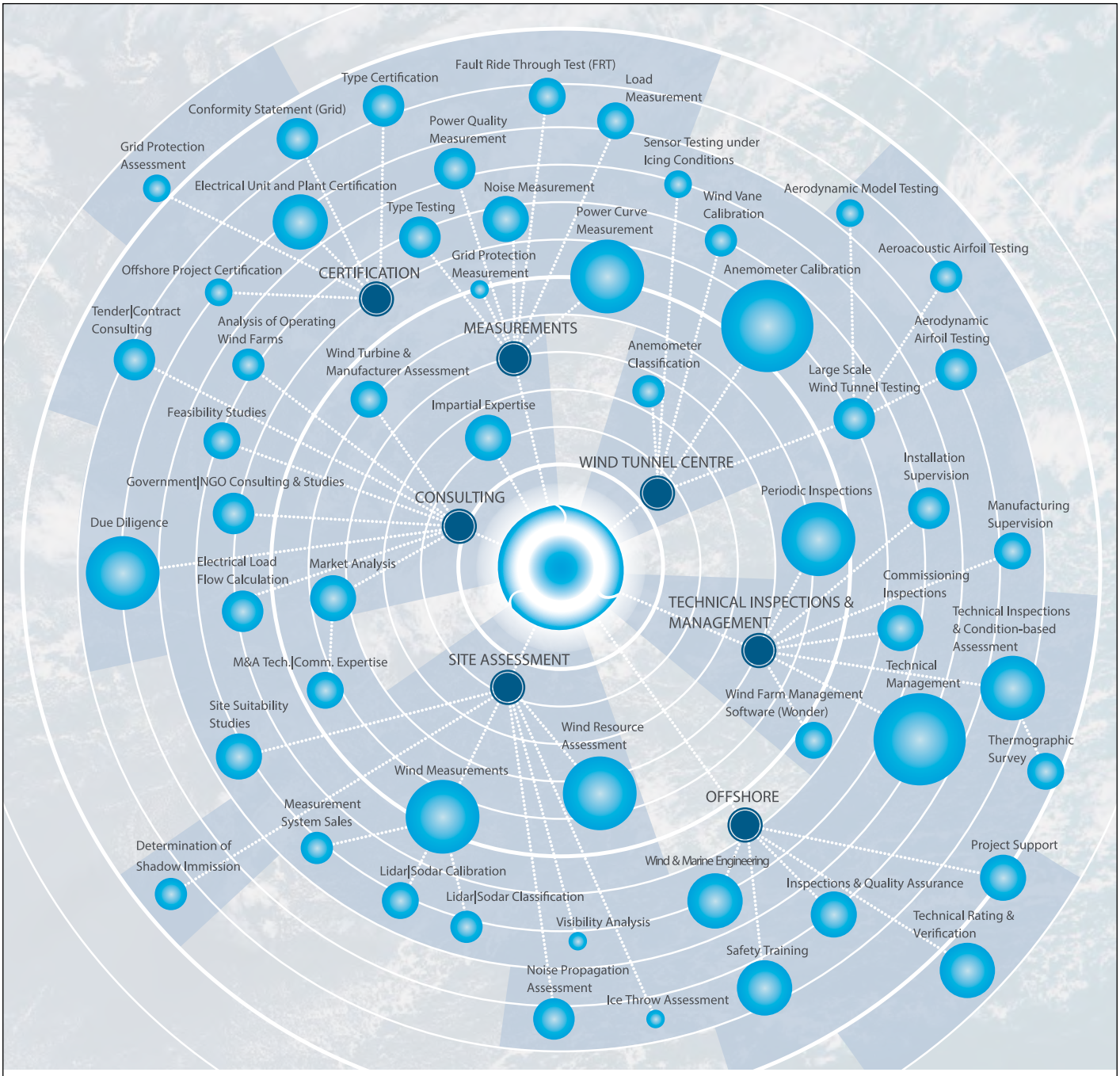


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