Indian Wind Power

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Wind Power for
Green Hydrogen

IWTMA
INDIAN WIND TURBINE MANUFACTURERS ASSOCIATION

Expertise and Research & Development for Wind and Solar Energy Stakeholders

Resource Assessment

Wind Energy

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

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- Met-Ocean Measurement
- Demarcation of Offshore Wind Energy Blocks
- Geophysical and Geotechnical Studies

Solar Energy

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- Solar Power Forecasting Services

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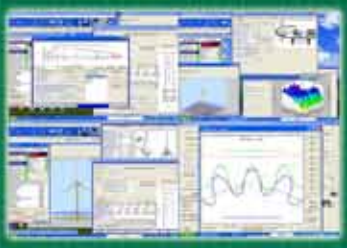
- Wind and Solar Energy Technology
- Testing and Certification of Wind Turbines
- Installation, Commissioning and Operation & Maintenance of Wind Turbines
- Grid Integration of Renewable Energy System
- Forecasting of Wind and Solar Energy Production
- Seminar / Workshops on Wind and Solar Energy



NATIONAL INSTITUTE OF WIND ENERGY

An Autonomous Research & Development Institution under the Ministry of New and Renewable Energy, Government of India

Velachery - Tambaram Main Road, Pallikaranai, Chennai - 600 100

नीवे NIWE

Phone : +91-44-2246 3982 / 83 / 84 Fax : +91-44-2246 3980 E-mail : info.niwe@nic.in Website : http://niwe.res.in

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Contents

Indian Wind Turbine Manufacturers Association
4th Floor, Samson Tower, 403 L, Pantheon Road, Egmore
Chennai - 600 008.
Email : secretarygeneral@indianwindpower.com
associatedirector@indianwindpower.com
Website : www.indianwindpower.com

(For Internal Circulation only)

From the Desk of the Chairman – IWTMA

Dear Readers,

Greetings from IWTMA!

No one imagined that the second wave of pandemic would hit the country so hard. The Centre and the states are doing their best to control and handle this massive unprecedented rise in cases and we pray that the vaccination drive would pick up with scaling up of domestic production of vaccines and we see a safer 2022. Currently the balance is towards "Life over livelihood". The Association would like to give our condolence to every Indian who has lost his/their loved ones.

The slowdown of the wind industry started in 2017 with the introduction of competitive and transparent bidding. It is a matter of concern that in the last four years the industry has only installed 1.5 GW per annum. Adding to the woes the calendar years 2020 and 2021 have had devastating effects on the entire economy and wind energy was no exception.

There were other serious concerns apart from low installations. Some of them are:

1. The entire wind energy market (installations) is bid by 7 or 8 bidders with a minimum of 50 MW (SECI).
2. The pride of 70 to 80% - 'Make in India'/'Atmanirbhar Bharat' supported by MSME industries of over 4000 numbers has seen erosion. This is a very serious concern and it is a herculean task to reinstate a robust supply chain that has been built to achieve year on year installations of 11 GW irrespective of the procurement model to reach a target of 140 GW by 2030.
3. Large component manufacturers are leveraging their size and trans-global presence to now concentrate on exports. Export obligations could be long term and sudden increase in domestic demand will pose new problems.
4. This is an unfavorable situation for a vast numbers of retail Investors who have invested with passion and commitment so far. While these investors could well continue to invest in 1.5 to 2 GW of wind energy per annum, the current procurement ecosystem poses several hurdles. Wind Energy is a dynamic source and a critical mass is required to mainstream this energy with storage to supply uninterrupted power. Wind energy industry is comparable to the aircraft industry where safety is supreme over performance. Compromising the quality of rotating equipment weighing hundreds of tons at a height of hundreds of meters and above is unimaginable. Today, by the parameter of LCoE, the cost of turbines and wind farms in India is the lowest in the world.

Now, the industry wonders what more can be done to accelerate the progress. The answer perhaps lies in promoting the concept of a National Tariff. The industry is aware that power is a concurrent subject and financially strained DISCOMs are looking at the lowest tariffs available. Lowest tariffs can be quantified by a few paisas below the National or State APPC. This fundamental change in outlook will alone promote the RE sector at a macro level allowing us to achieve our targets of carbon footprint reduction to combat global warming and climate change.

I once again appeal to the Government policy makers to not see Wind Energy as just another source of power. We must see the Wind Energy Industry in totality by private investment championing 'Atmanirbhar Bharat', rural employment, support to MSME sector and a positive impact on India's rural economy. The positives of wind energy are limitless.

We believe, that the future lies in storage technologies and production of Green Hydrogen form wind energy. In this issue we will also talk about Green Hydrogen and its production from wind energy.

I wish our readers a Happy Reading!

Before I sign off, I would like to re-emphasize the importance of following all the protocols of COVID-19 safety. Stay Healthy and Safe.

With regards,

Tulsi Tanti

Chairman

ASSOCIATION INSIGHT

Excerpts of the Stakeholders Meeting with Secretary MNRE on 28th April 2021

Preamble: Secretary MNRE had called for a virtual meeting of wind, solar and biomass stakeholders to discuss the prevailing Covid situation in the country. The meeting was chaired by Secretary, Ministry of New and Renewable Energy (MNRE) and assisted by Joint Secretaries of wind and solar departments.

Wind manufacturing industry led by Chairman, Indian Wind Turbine Manufacturers Association (IWTMA) outlined that the industry in the last four years is recording an installation of 1.5 GW per annum as against the manufacturing capacity of 10 GW per annum. The current installation in the country is at 40 GW and would require a massive 11 GW year on year to meet the target of 140 GW by 2030.

To achieve this end, IWTMA placed on record alternate markets over and above SECI auctions and policy issues which will accelerate the growth of the wind sector.

Policy Issues

1. **GST:** IWTMA detailed the need for uniform 5% GST in the entire value chain. It has also been suggested that sale of electricity should be under GST @ 5% so that it can be pass through. A ratio of 70:30 for Goods and Services would adversely impact the industry. It is appropriate to mention that Government of India is considering a study to bring electricity under GST.

2. **Exclusive RPO for Wind:** It was emphasized that Wind requires an exclusive RPO and should not be clubbed as 'Non-Solar' (Solar and hydro enjoy exclusivity). The exclusive Wind RPO will help the industry to take up and petition various states that are not fulfilling the RPO commitments.

Policy - Scheme Enablers

1. **CPSU Scheme for Wind:** Government has announced a CPSU Scheme for Solar. CPSUs in the past have invested over 2500 MW of wind power and have greatly benefited primarily for captive use. CPSU Scheme should be extended to wind as it is 70 to 80% localized and champions the cause of 'Make in India' or 'Atmanirbhar Bharat'. It was also suggested that the CPSU Scheme be extended to Wind-Solar Hybrid projects.

2. **ISTS Waiver for RPO Entities and Open Access:** ISTS waiver is currently available to Solar Energy Corporation of India (SECI) bids for sale to DISCOMs. ISTS waiver for RPO entities was withdrawn by Ministry of Power vide their circular dated 15th January 2021. It was suggested that if the transmission utilities are not able to absorb the transmission cost, ISTS charges be applied on kWh basis which will cover Open Access customers, Captive and Group Captive customers and meet the requirement of entities having RPO obligation. It was emphasized that there would be a need for extending ISTS waiver beyond June 2023 considering the target of 140 GW of wind by 2030 set by the Government.

3. **Uniform Wheeling and Banking across the States:** Captive and Group Captive markets can unlock a huge potential and this is being denied as most of the states are insisting on month to month banking. This requires intervention of Forum of Regulators to promote Uniform Wheeling and Banking policy to enable captive and group captive investments to come in. It is needless to mention that wind power generation is seasonal and predominantly spread over 5 to 6 months and the requirement on Wheeling and Banking is on annual basis.

4. **Retail Investment:** The threshold limit of 25 MW in State Bids and 50 MW by SECI bids have denied participation by retail investors who built the first 20 GW in almost all the wind states. This resulted in an all-inclusive growth on a PAN India basis compared to Central bid which are restricted to a few states. Opportunity for retail investment from 0.5 MW to 15 to 20 MW can unlock a huge potential. This segment requires specific determination of tariff either by the State SERC or a tariff a few paise below APPC. The tariff differential may be incentivized directly to the DISCOMs to encourage Retail Investment.

5. **Production Linked Incentive (PLI) Scheme:** Government has announced PLI Scheme for 13 different Sectors; it is unfortunate that wind sector has not been included in the scheme. PLI Scheme is required more importantly for the MSME Sector who is the backbone of the robust supply chain by hundreds of components required for the wind sector. The current market situation of aggressive tariffs is forcing manufacturers to bring new models and fresh investments are required by component manufacturers as components for the wind sector are customized.

6. **Exports:** India has a place of pride of lowest cost in the world both for wind turbine and wind farms. This fact is well documented by BloombergNEF (BNEF) and Global Wind Energy Council (GWEC). The high quality standards of international repute give a great opportunity for exports to

different geographies of the world. Exports of wind turbine/ components which were previously around USD 600 Million can be scaled up to USD 1.5 to 2 Billion. India unfortunately has disadvantage on high interest cost and unfavorable freight cost compared to competitors. There is an urgent need for Ministry of New and Renewable Energy (MNRE) and Ministry of Commerce to draw up a plan for boosting exports. The Association has submitted a Study Report on Exports prepared by a well-known consultant to MNRE.

7. **Repowering:** Repowering policy was issued by Government of India (MNRE) in 2016 with very little progress. There is a great need to optimize land usage as wind locations are very specific. Issues of land ownership and legal agreements do come in the way of Repowering programme. There is a requirement of a holistic approach keeping in mind maximizing generation and also safety over performance after their declared product life. Repowering will also require a comprehensive policy on decommissioning and recycling of components. The current turbines eligible for repowering is in the range of 3000 to 4000 MW.

IWTMA has also requested the Government to speed up the programme on offshore wind and quick implementation of Wind Parks which will help mitigate project risk and to a large extent eliminate time and cost overrun.

Powergrid Corporation Raises Rs 2,736 Crore through Invit OFS

Power Grid Corporation of India Ltd (PGCIL) has received Rs 2,736.02 crore through sale of 27.41 crore units in the PowerGrid Infrastructure Investment Trust (PGInvIT) offer for sale. Earlier in the day, the units issued by PGInvIT were listed on NSE and BSE. PGCIL has created the PGInvIT to monetise its assets. The initial portfolio of assets in the InvIT comprises five special purpose vehicles (SPVs) -- PowerGrid Vizag Transmission Ltd (PVTL), PowerGrid Kala Amb Transmission Ltd (PKATL), PowerGrid Parli Transmission Ltd (PPTL), PowerGrid Warora Transmission Ltd (PWTL) and PowerGrid Jabalpur Transmission Ltd (PJTL). PGCIL, under the process of monetisation of assets through the InvIT, has transferred 74 per cent of its shareholding to the PGInvIT, it said in a BSE filing.

Source: PTI, May 15, 2021

India Ranks Third in Renewable Energy Country Attractiveness Index

New Delhi: India moved up a position to the third spot in EY's Renewable Energy Country Attractiveness Index released on 19th May 2021 as a result of an exceptional performance on the solar PV front and with generation from solar forecast to exceed coal before 2040.

The US retains top position and China has remained maintains second position. India has moved one position above from the previous index. The economic attractiveness of solar PV and intense competition from the private sector has led to record low tariff bids.

Source: ET Energy World, May 19, 2021

COVID-19: MNRE Grants Time Extension for RE Projects

The Ministry of New and Renewable Energy (MNRE) has announced a timeline extension in the scheduled commissioning date (SCD) of renewable energy projects considering disruption due to the second wave of COVID-19 cases. The ministry in its order said that RE projects being implemented through implementing agencies designated by the MNRE having their SCD on or after 1 April 2021 would be eligible to claim time-extension for completion of their project activities. The actual quantum of time-extension shall be decided in due course depending on the COVID-19 related developments that take place in the coming weeks. Such time-extensions were not to be used as a ground for claiming termination of power purchase agreement (PPA) or for claiming any increase in the project cost.

Source: ET Energy World, May 12, 2021

Over Rs 9K worth of RECs Sold in India to date

India's renewable energy certificate (REC) market has recorded net sales worth Rs 9,266 crore during its decade of existence as per study by the CEEW-Centre for Energy Finance (CEEW-CEF). It said that this was an encouraging sign, given that the country would increasingly bank on market instruments such as RECs to support its energy transition. 99% of all RECs sold have served to fulfill RPO requirements. Still, poor RPO compliance across India has contributed to a demand shortfall of 7 per cent, represented by the 5.1 million RECs unsold as of December 2020.

Source: ET Energy World, May 20, 2021

China to add at least 90 GW Wind and Solar Capacity to the Grid in 2021

China has ordered power transmission firms to connect a minimum of 90 GW of wind and solar capacity to the grid this year, the National Energy Administration said, as part of a new policy initiative aimed at meeting its low-carbon targets. The NEA also said it will set targets for the transmission of renewable power rather than the construction of new capacity in a bid to avoid waste and ensure that wind and solar plants can sell all their electricity on the market. China, the world's biggest greenhouse gas emitter, has vowed to increase its non-fossil fuel energy consumption to around 20% of primary energy use by 2025 and to around 25% by 2030. As of end 2020, China had total installed solar and wind capacity of 535 GW.

Source: Reuters, May 20, 2021


Innovations for
a better tomorrow
Manufacturing wind turbines and
its components in India since 1996
With 14 manufacturing units and wind farms across 8 states, Suzlon creates local jobs at the grass-root level, energizes micro-economies, supports a local supply chain and reduces imports by making India more 'Aatmanirbhar' in the manufacturing of Wind Turbine Generators and its components. Suzlon is also a flag bearer of the ambitious 'Make in India' program for Wind Energy and a key partner in the nation's Renewable Energy mission. We are committed to energy security and low-carbon economy for the country by providing sustainable and affordable energy to power a greener tomorrow, today.
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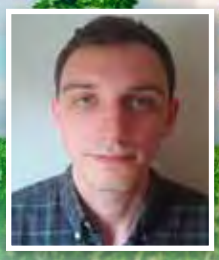
Wind Energy for Green Hydrogen

Avant-Garde Technique



Dr. Raj Shah
Director, Koehler Instrument Company
New York &
Adjunct Full Professor, Dept. of Material Science and Chemical Engineering, State University of New York, Stony Brook, New York

Alexandra Przyborowski
Intern

Nathan Aragon
Intern

Koehler Instrument Company
New York

Introduction

Nearly all of the hydrogen produced today is from fossil fuels, such as natural gas and oil, which contribute significant carbon dioxide emissions. World production of pure hydrogen is about 75 million metric tons which is utilized for industrial purposes such as oil refining, the production of ammonia and methanol, and also as a fuel in transportation[1]. With 95% of hydrogen in the United States produced through the burning of fossil fuels, hydrogen production is a primary contributor to the ongoing crisis of global warming and climate change. The production of green hydrogen through renewable energy resources like wind instead of fossil fuels holds many advantages, such as abundance, permanence and lack of environmental pollution[2]. Wind-generated electricity can power the electrolysis of water to produce hydrogen, leaving nothing but oxygen as a byproduct. Hydrogen produced from renewable resources can be used to fuel vehicles or stored and then used in fuel cells to generate electricity during times of the day when wind resources are low. Renewable power, energy efficiency and direct electrification through wind energy show great potential to be high in demand worldwide.

The production of green hydrogen through renewable energy resources like wind instead of fossil fuels holds many advantages, such as abundance, permanence and lack of environmental pollution

Energy security and fuel affordability are two important considerations when deciding to pursue a transition in energy systems. Alternative fuels and technologies are being discovered and developed daily in efforts to outperform the current competitors. The production of hydrogen through renewable resources is a technology that is steadily gaining widespread recognition. Hydrogen is the most abundant element in the universe, occurring naturally on Earth only in a compound form requiring electricity to decompose water into oxygen and hydrogen gas without emissions in the process. Renewable electrolysis of water driven by wind energy is a promising option for hydrogen production, only currently taking up 4% of the methods used to produce hydrogen today. The reaction of producing hydrogen using wind energy takes place in a unit called an electrolyzer. Electrolyzer devices can range in size from small, appliance-size equipment that is well-suited for small-scale distributed hydrogen production to large-scale, central production faculties[3].

There are two common electrolysis technologies applied on a utility-scale through the means of wind power: alkaline (A-EL) and the proton exchange membrane (PEM-EL) electrolysis[4]. Already on the market for more than 100 years, A-EL technology is typically composed of electrodes, a microporous separator, and an aqueous alkaline solution of sodium or potassium hydroxide that serves as the electrolyte[5]. Alkaline electrolyzers operate via the transport of hydroxide ions (OH^-) through the electrolyte from the cathode to the anode with hydrogen being generated on the cathode side. The overall process is operated at about 80 either at atmospheric or high pressure with an efficiency that varies between 71 and 86% from electricity to the higher heating value of hydrogen[6]. The proton exchange membrane electrolysis is still a developing technology that is typically used for small-scale hydrogen production but can be connected in

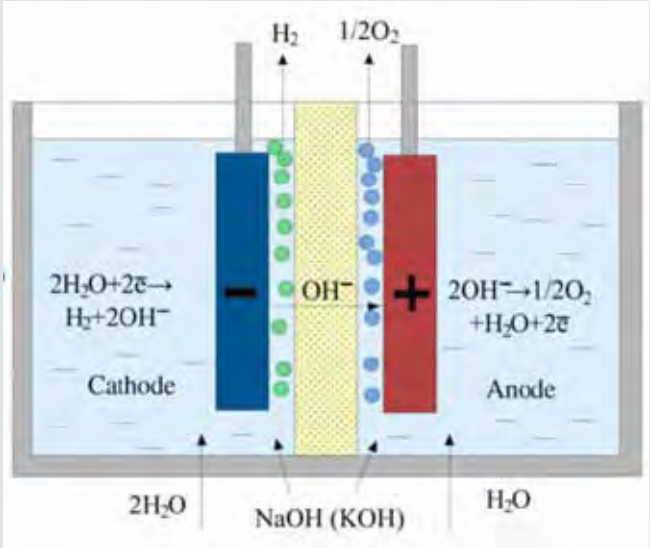


Figure 1: *Schematic diagram of the alkaline electrolysis cell*

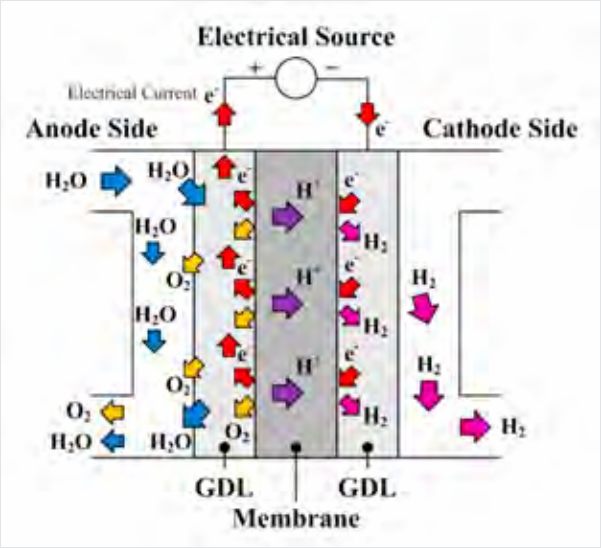


Figure 2: *Principle of proton exchange membrane electrolyzer*

series to form a multi-layer electrolyzer for large-scale systems[7]. The PEM-EL converts electrical energy into chemical energy, where water is oxidized electrochemically within the anode catalyst layer combined with electricity at the anode side, and then broken down into oxygen gas, protons, and electrons. The protons transport across the proton conductive membrane to the cathode side while the electrons move through the outer circuit and also reach the cathode side. The protons and electrons electrochemically react with the cathode catalyst layer and produce hydrogen gas[7]. Operation pressure is typically below 30-50 bar due to high pressures reducing electrolyzer efficiency. Overall conversion efficiencies for large-scale systems are between 60 and 87%[8], similar to alkaline electrolysis technology.

Renewable clean wind energy provides the production of hydrogen that has the potential to replace fossil fuels and produce almost zero pollutant gases in the atmosphere

Wind energy is one of the fastest-growing energy sources in the world. Land-based utility-scale wind is one of the lowest-priced energy sources available today, costing 1-2 cents per kilowatt-hour after the production tax credit in the United States[9]. It is estimated that a 4GW wind farm can produce enough hydrogen to power 1.4 million homes[10]. By 2050, there is potential that more than 600,000 jobs in manufacturing, installation, maintenance, and supporting services within the wind sector will be available[11]. With great economic potential and industry growth projected, wind energy is viewed favorably by all experts on the subject. Wind energy, like many other renewable energy resources, is geographically widespread and highly available, but it is also dispersed and has a highly fluctuating nature. Therefore, conducting extensive research on land-base and location is necessary for securing a profitable operation that can replace fossil fuels. In efforts to minimize the cost of building wind farms that will efficiently sustain energy consumption requirements, several factors influence the criteria to construct a successful system. Wind conditions, topographical conditions, population, distance from the distribution grid, and land price are all effective factors that studies have shown to influence hydrogen production through the use of renewable resources. Wind farms require land where there is a high degree of persistent wind and take into consideration the air pressure and temperature. Data shows that the wind speed taken during the warm summer months is much more important than other months because of electricity consumption rising 50% during these months mainly due to air conditioners. Topographical conditions take into account the industrialization of the area that is being powered and the physical features of structures surrounding the premises of the wind farm that affect wind patterns. The distance from the center of the city being powered is considered to represent the criterion of distance from the power distribution grid. Lastly, the land price that wind farms will be built on, usually found in agricultural land due to it being cheaper than building close to residential areas, and the population that the wind farm has to provide for is considered.

Studies show worldwide that air pollution through the burning of fossil fuels, shortens lives by more than two years on average. The releasing of nitrogen oxides into the atmosphere not only results in the warming of the climate but contributes to the formation of smog and acid rain. Today environmental pollution is one of the most important causes for concern pushing for green, eco-friendly solutions. Renewable clean wind energy provides the production of hydrogen that has the potential to replace fossil fuels and produce almost zero pollutant gases in the atmosphere. With wind being an abundant resource, electrolyzers can use some of that energy to create hydrogen, which will be stored for days where the weather becomes unpredictable. As new green

technology enters the market to combat the ongoing issue of our climate and governmental support increases the future of wind energy can embark on a successful path.

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Wind Turbines Getting Even Bigger

The last few years have seen several OEMs, announced plans to develop new, large-scale turbines for the offshore sector — and the size of these new machines is considerable. GE Renewable Energy's Haliade-X turbine, for example, will have a tip-height of 260 meters (853 feet), 107-meter long blades and a 220-meter rotor. Its capacity will be able to be configured to 12, 13 or 14 megawatts (MW). A prototype of the Haliade-X, in the Netherlands, has a tip-height of 248 meters. Details of GE's Haliade-X were released in March 2018.

Competition within the sector is certainly heating up. In February, Vestas revealed plans for a 15 MW turbine. It wants to install a prototype in 2022 and expand production in 2024. For its part, Siemens Gamesa is working on a 14 MW model, the SG 14-222 DD, which can also be boosted to 15 MW if required.

Source: *CNBC, April 16, 2021*

US: Biden Boosts Wind Energy Efforts, Aims to Power 10 million Homes by 2030

Meeting the target could create jobs for more than 44,000 workers and employ nearly 33,000 others related to offshore wind activity, the White House has said.

The Biden administration is ramping up efforts to sharply increase offshore wind energy along the East Coast, announcing progress on a huge wind farm planned off the New Jersey coast and setting a goal to generate enough power to provide electricity for more than 10 million homes by 2030.

Meeting the target could create jobs for more than 44,000 workers and employ nearly 33,000 others related to offshore wind activity, the White House said on Monday. The effort also would help avoid 78 million metric tons of carbon dioxide emissions per year, a key step in the administration's fight to slow global warming.

President Joe Biden "believes we have an enormous opportunity in front of us to not only address the threats of climate change but use it as a chance to create millions of good-paying, union jobs that will fuel America's economic recovery," said White House climate adviser Gina McCarthy. "Nowhere is the scale of that opportunity clearer than for offshore wind."

The administration's commitment to the still untapped industry "will create pathways to the middle class for people from all backgrounds and communities," she added.

Source: AP, March 29, 2021

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NGC TRANSMISSION INDIA PVT. LTD.
DG Square, Unit 6A, 127 Pallavaram – Thoraipakkam
200 Feet Radial Road, Kilkattalai, Chennai 600117
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Tata Power Mulling $473 Million Renewable Energy Unit IPO

Tata Power is weighing an initial public offering for its renewable energy business that could raise about 35 billion rupees ($473 million). The company has abandoned earlier plans to seek a partner to invest in its green assets via an investment trust, the people said, asking not to be identified as the information is private. Tata Power will seek approval for the IPO plan from its board, they said. If they approve, the proposed listing in Mumbai could take place as soon as this year. Tata Power's plan to list its green power business comes as India's renewables sector is forecast to expand rapidly, driven by increasing power demand and decarbonization efforts.

Source: Bloomberg, May 01, 2021

Green Certificates Trading Shrinks to 9.2 Lakh in 2020-21, 60.58 Lakh Inventory Piles Up

REC trading was recorded at 89.27 lakh in 2019-20 and 126.08 lakh in 2018-19. The renewable energy certificates market shrank to 9.2 lakh RECs in 2020-21 while 60.58 lakh RECs (7.71 lakh solar and 52.88 lakh non-solar) piled up till March 2021 due to a halt in trading. This has also impacted the ability of distribution companies to meet their renewable purchase obligation (RPO). The trades were suspended in July 2020 after the Appellate Tribunal for Electricity (APTEL) decided to postpone the trading by four weeks while hearing three separate petitions related to an issue of fixing floor and forbearance prices of RECs by the Central Electricity Regulatory Commission (CERC). The matter is still before the APTEL.

Source: PTI, April 25, 2021

APTEL Allows Open Access, Banking Facility to Four Wind Power Generators in Maharashtra

The Appellate Tribunal for Electricity (APTEL), in a recent order, directed the Maharashtra State Electricity Distribution Company Limited (MSEDCL) to grant open access facility to four wind developers and also compensate them for the banked energy until the full quantum of open access is granted. Four wind generators in Maharashtra – Roha Dyechem, Arvind Cotsyn, Jsons Foundry, and Western Precicast, had appealed to APTEL, demanding grant of open access. The generators also asked for MSEDCL to be directed to compensate for the banked energy. APTEL took the case of Jsons Foundry as all the four appeals were similar. The Tribunal noted that the state Commission had wrongly interpreted the Wind Tariff Order.

Source: Mercom India, April 30, 2021

InvIT to Monetize Rs 22,500 Projects

Powergrid Infrastructure Investment Trust (InvIT) has announced the launch of its Rs 7,735 Crore Initial Public Offer (IPO) as part of a larger asset monetization strategy. The issue is an excellent opportunity for investors looking for stable long term returns and the firm eventually plans to monetize projects worth Rs 22,500 crore. Asset monetisation as a strategy to recycle the operational assets and the capital has been in the focus of the government.

Source: ET Energy World, April 26, 2021

India and UK Deepen Work to Combat Climate Change by 2030

Prime Minister Mr. Narendra Modi and his UK counterpart Mr. Boris Johnson signed off on a new shared roadmap during their virtual meeting that included measures to help limit global temperature rises and support the communities most vulnerable to the impact of climate change. It includes new collaboration on clean energy transition and protecting forests, and joint leadership to develop resilient infrastructure in climate vulnerable countries. It also talks about jointly launching a new global Green Grids Initiative at COP26 for countries to work together on interconnected grids for renewable energy, to help deliver India's vision of One Sun One World One Grid.

Source: ANI, May 06, 2021

India May Build New Coal Plants Due to Low Cost despite Climate Change

Environmental activists have long rallied against India adding new coal-fired capacity. Still, the fuel accounts for nearly three-fourths of India's annual power output. Solar and wind energy prices are falling to record lows, which would help the world's third-largest greenhouse gas emitter cut emissions. But a 28-page February draft of the National Electricity Policy (NEP) 2021 - which has not been made public - showed India may add new coal-fired capacity, though it recommended tighter technology standards to reduce pollution. "While India is committed to add more capacity through non-fossil sources of generation, coal-based generation capacity may still be required to be added in the country as it continues to be the cheapest source of generation," the NEP draft read. All future coal-based plants should only deploy so-called "ultra-super critical" less polluting technologies "or other more efficient technology", it added.

Source: Reuters, April 19, 2021

White House Pushing for 80% Clean U.S. Power Grid By 2030

The White House hopes to capitalize on growing support from U.S. utilities, unions and green groups for a national clean energy mandate by pushing Congress to pass a law requiring the U.S. grid to get 80% of its power from emissions-free sources by 2030. The goal would fall short of President Joe Biden's stated ambition of net zero carbon emissions in the grid by 2035, but is an interim milestone that could be passed without Republican support through a process called budget reconciliation.

Source: Reuters, April 27, 2021

Use of Wind Power to Produce Green Hydrogen - **Key to a Clean Future**


Aishwarya Patankar **Sarath Koundinya**

Consultants, Idam Infrastructure Advisory Private Limited

Context

Globally hydrogen is perceived as the 'fuel of the future' due to its potential to provide clean, carbon free energy. With rising climate change concerns globally, decarbonisation of energy and industrial sector which accounts for nearly 75% of India's GHG emissions is need of the hour. Accordingly, India is rapidly increasing the share of renewables in its energy mix and as of 28 February 2021, the RE sources contribute 24.5% of India's installed capacity. With India's ambition to install 175 GW of RE by 2022 and 450 GW by 2030, there is tremendous potential to utilize RE for decarbonisation through Hydrogen.

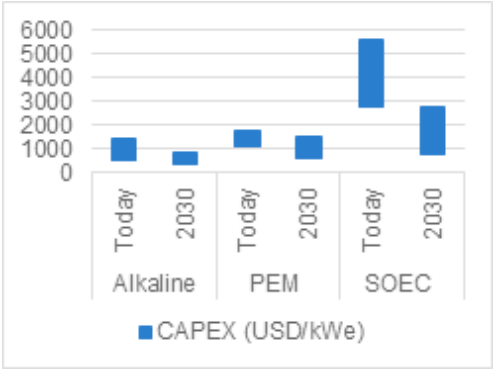
Hydrogen is conventionally produced from natural gas and coal through steam methane reforming for use in petroleum refineries, fertilizer industries and for chemical production. However, in the quest to transition to climate friendly production technologies various primary energy sources are being explored. Hydrogen depending on the source and production process can be classified as green, blue or grey hydrogen as illustrated in Figure 1.

To mainstream hydrogen in India, the Government of India has been actively taking measures since the last two decades. The National Hydrogen Energy Board was set up in 2003 followed by introduction of the National Hydrogen Energy Roadmap (NHERM) in 2006. During the budget speech of 2021-22 the Finance Minister proposed to launch National Hydrogen Energy Mission (NHEM) for generating hydrogen from green power sources. The NHEM aims at developing India into a global hub for manufacturing of hydrogen and fuel cells technologies across the value chain with demand creation by setting suitable mandates for use of green hydrogen in industry such as fertilizer, steel, petrochemicals, etc. Moreover, new segments of use in India are likely to be RE storage, transport and steel production. As per a recent study conducted by TERI, in India the hydrogen production in 2020 was 6 million tonnes which is envisaged to increase to around 25 million tonnes by 2050.

	SOURCE	PROCESS
Green	Solar, Wind, Hydro	Electrolysis
Blue	Methane	SMR + Carbon Capture
Grey	Methane	SMR

Figure 1: *Colours of Hydrogen*

	Alkaline	PEM	SOEC
Electrical efficiency (%, LHV)	63-70	56-60	74-81
Operating pressure (bar)	1 to 30	30-80	1
Operating temperature (°C)	60-80	50-80	650-1000
Stack lifetime (operating hours)	60000-90000	30000-90000	10000-30000



Source: The Future of Hydrogen - International Energy Agency, 2019

Figure 2: *Comparison of Electrolyser Technologies*

Green Hydrogen Production

Historically, hydrogen is produced through carbonaceous sources for captive use. However, decrease in cost of electricity production from renewable energy sources, rising environmental consciousness and a plethora of new potential uses of hydrogen has provided a stimulus to hydrogen production through electrolysis using RE sources. The most widely used and researched electrolysis technologies include Alkaline Water Electrolysers (Alkaline), Polymer Electrolyte Membrane Based Electrolysers (PEM) and Solid Oxide Electrolysis Cell (SOEC). The Figure 2 provides a comparison of the current status of electrolyser technologies.

Alkaline is the most mature technology amongst the three electrolyser technologies, however, over the next decade PEM costs are expected to become comparable to Alkaline electrolyser cost. Hence both Alkaline and PEM electrolyser technologies hold interest for hydrogen production. Although SOEC is the least developed technology, in addition to hydrogen production, SOECs can be used for electricity generation from hydrogen in a reversible mode as fuel cells. Thus, SOECs hold interest for hydrogen production and utilization for grid balancing services.

Applications of Green Hydrogen

One of the inherent aspects of RE based electricity generation is that it depends on climate variables which have uncertain patterns. Wind based generation depends on intensity of the wind in the locations where the wind patterns are unmanageable. Photovoltaic generation depends on radiation profiles. This leads to the sources of energy that cannot assure a specific production of energy at specific time. One possible method to make better use of high-generation electricity peaks from these RE sources is to use the surplus energy to produce hydrogen. The produced hydrogen could be sold directly or used to generate electricity when there is a scarce supply of RE source.

Hydrogen can be used where it is produced or transported elsewhere. Unlike batteries that are unable to store large quantities of electricity for extended periods of time, hydrogen can be produced from excess renewable energy and stored in large amounts for a long time. Though the battery technologies are evolving, long-term storage issue is not yet solved. Hydrogen can be a solution here not only because it can store energy for longer periods of time, but because of easy handling due to lower weight as the energy density of compressed hydrogen tanks is greater than those of Li-ion batteries.

Apart from its use for storage and re-electrification the produced green hydrogen can be supplied to refineries for hydro treatment to remove Sulphur impurities and hydrocracking to upgrade heavy residual oils into higher-value oil products. Green hydrogen can also be used to substitute grey hydrogen used in methanol and ammonia production. Green Hydrogen can thus be used to replace existing grey hydrogen use generated through carbon-intensive processes to meet the needs of Industry. One of the green field applications of hydrogen is in the Transport sector for powering Fuel Cell Electric Vehicles which are 'zero emission vehicles'. World over multiple pilot projects are deployed in the material handling, passenger car and bus transport segments.

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Upcoming Wind Powered Green Hydrogen Projects

Globally several power producers are exploring wind powered hydrogen production:

- The world's first project capable of producing green hydrogen directly from air with the help of a wind turbine is under development by Siemens Gamesa. The project is off-grid and pilot includes a 3 MW Siemens Gamesa wind turbine owned by local partner Uhre Windpower, Denmark that will produce clean electricity to power a 400 kW electrolyser. Hydrogen produced through electrolysis can be stored and later delivered to refueling stations by Everfuel.

Table 1: *World's Largest Green Hydrogen Projects under Development*

Sr. No.	Name of the Project	Location	Power Source	Developers	Planned use of H_2	H_2 Output	Planned Date of Completion	Expected Cost
1.	Asian Renewable Energy Hub	Pilbara, Western Australia	16 GW of onshore wind and 10 GW of solar to power 14 GW of electrolysers	InterContinental Energy	Green hydrogen and green ammonia for export to Asia	1.75 million tonnes per year (which would produce 9.9 million tonnes of green ammonia)	2027-28	$36bn
2.	North H_2 (Atleast 10 GW)	Eemshaven, northern Netherlands	Offshore wind	Shell, Equinor, RWE, Gasunie, Groningen Seaports	To help power heavy industry in the Netherlands and Germany	One million tonnes per year	2040 (1GW by 2027, 4GW by 2030)	–
3.	AquaVentus (10 GW)	Heligoland, Germany	Offshore wind	A consortium of 27 companies, research institutions and organisations, including RWE, Vattenfall, Shell, E.ON, Siemens Energy, Siemens Gamesa, Vestas, Northland Power, Gasunie and Parkwind	General sale via a European hydrogen network	One million tonnes per year	2035 (30MW by 2025, 5GW by 2030)	–
4.	Murchison Renewable Hydrogen Project (5GW)	Near Kalbarri, Western Australia	Onshore wind and solar	Hydrogen Renewables Australia and Copenhagen Infrastructure Partners	A demonstration phase would provide H_2 for transport fuels; an expansion stage would produce H_2 to blend into local natural-gas pipelines; and a final, large expansion would produce H_2 for export to Asia, with a focus on Japan and South Korea	–	2028	$10-12bn
5.	Beijing Jingneng Inner Mongolia (5GW)	Eqianqi, Inner Mongolia, China	Onshore wind and solar	Chinese utility Beijing Jingneng	–	400,000-500,000 tonnes per year	2021	$3bn
6.	Helios Green Fuels Project (4GW)	Neom, a planned city in northwest Saudi Arabia	Onshore wind and solar	Air Products, ACWA Power, Neom	To produce green ammonia (NH_4), which would be transported around the world and converted back into H_2 for use as a transport fuel.	About 240,000 tonnes per year (to create 1.2 million tonnes of green ammonia annually)	Not stated, but first ammonia production due in 2025	$5bn
7.	Pacific Solar Hydrogen (3.6 GW)	Callide, Queensland, Australia	Solar	Austrom Hydrogen, a start-up	Export to Japan and South Korea	More than 200,000 tonnes per year	–	–

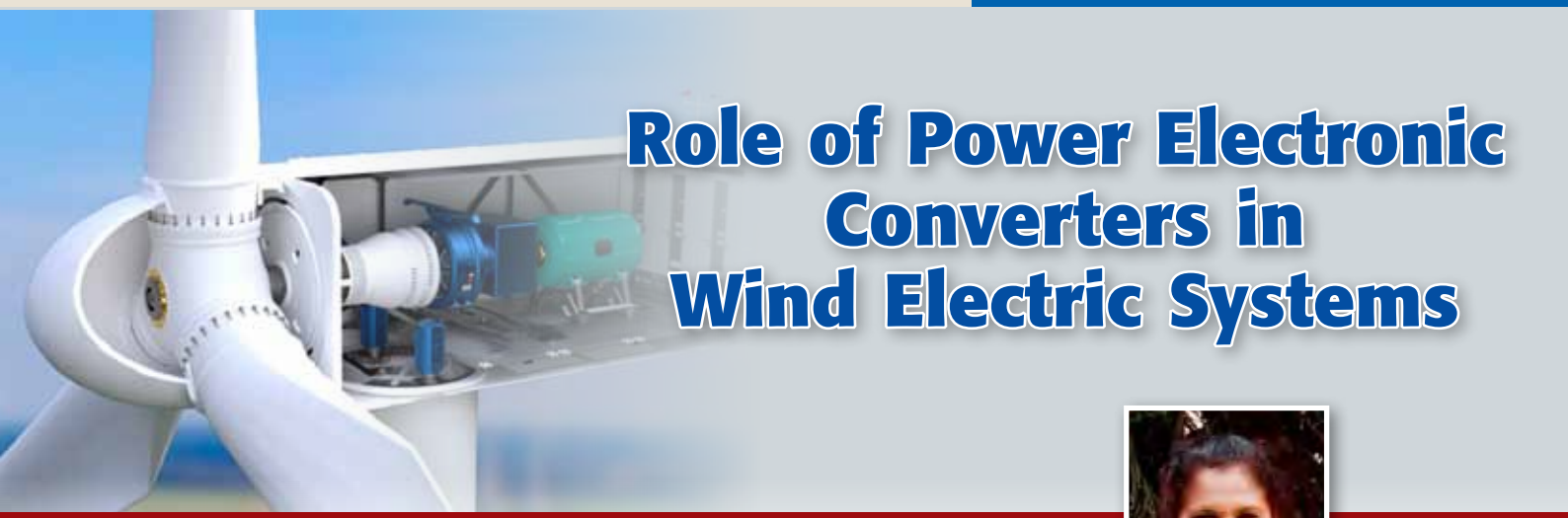
Sr. No.	Name of the Project	Location	Power Source	Developers	Planned use of H_2	H_2 Output	Planned Date of Completion	Expected Cost
8.	H_2-Hub Gladstone (3GW)	Gladstone, Queensland, Australia	Renewable energy, but not otherwise specified	The Hydrogen Utility (also known as H_2U)	Green ammonia for export to Japan and other countries	Not stated, but developer says it would produce "up to 5,000 tonnes of green ammonia per day"	Not stated, but initial operations due to begin in 2025	$1.6bn (not including sources of power)
9.	HyEx (1.6GW)	Antofagasta, Chile	Solar	Engie and Enaex	Green ammonia, half of which will be used at Enaex's ammonium nitrate plant; the remainder will be targeted for fuel, green fertiliser and export markets.	124,000 tonnes per year (700,000 tonnes of green ammonia)	26MW pilot by 2024	–
10.	Geraldton (1.5 GW)	Geraldton, Western Australia	Onshore wind and solar	BP/BP Lightsource	Production of green ammonia for domestic and export markets	Not stated, but about one million tonnes of green ammonia per year	–	–
11.	Greater Copenhagen (1.3 GW)	Greater Copenhagen area, Denmark	Offshore wind preferred	Orsted, Maersk, DSV Panalpina, DFDS, SAS	Hydrogen for buses and trucks, e-fuel (derived from green hydrogen and captured CO_2) for shipping and aviation	Not stated, but it would produce "250,000 tonnes of sustainable fuel" per year.	2030 (10MW pilot as soon as 2023, 250MW by 2027)	–
12.	H_2 Sines (1 GW)	Sines, southwest Portugal	Undecided, but likely to be onshore wind and solar	EDP, Galp, Martifer, REN, Vestas	Domestic consumption and export	–	2030	€1.5bn ($1.84bn)
13.	Rockstock (1 GW)	Rostock, Germany	Offshore wind and other renewable sources	Consortium led by RWE	All avenues being explored	–	–	–

Source: Article in rechargenews.com by Leigh Collins under Energy Transition

- Danish energy company Orsted wants to develop a large-scale offshore wind farm in the North Sea and link it to renewable hydrogen production on the European mainland. Orsted proposes to develop a 2 GW offshore wind facility coupled with a 1 GW of electrolyzer capacity (built in two 500 MW phases) for hydrogen production from electricity from the wind farm.
- Wind to Hydrogen project formed in partnership with Xcel Energy, NREL's wind to Hydrogen ($Wind2H_2$) pilot project links wind turbines and PV arrays to electrolyzer stacks. The resulting H_2 is stored for later use at the site's hydrogen fueling station or converted back to electricity and fed to the utility grid during peak-demand hours – National Wind Technology Center, Boulder, Colorado.

Way Forward for India

Globally several organizations have already begun exploring the potential of using offshore wind to produce green hydrogen. This is based on the understanding that gigawatt-scale offshore wind farms will be able to provide the economies of scale needed to reduce the cost of green hydrogen. Further, it would be cheaper to transport the hydrogen via existing natural-gas pipelines than sending offshore wind energy to shore via cables for onshore H_2 production. However, at present capital cost incurred for green hydrogen production is higher than that compared to other sources. In India, collaborations for exploring green hydrogen production have picked up speed. Organizations such as IOCL, Adani Enterprise (AEL), NTPC and NISE have joined the green hydrogen wave. With the National Hydrogen Energy Mission set to be released in 2021, India is on the cusp of a decarbonization revolution and set to attract more partnerships, opportunities, innovations, through creation of enabling provisions for Green Hydrogen deployment in India.



Role of Power Electronic Converters in Wind Electric Systems

We are sorry to inform our readers that the author of this article Dr. A. Vijayakumari has passed away due to Covid on 11 May 2021. We pray to God to give peace to her soul and the strength to the family members and friends to bear the loss. – Editorial Board

Dr. A. Vijayakumari
Associate Professor
Department of Electrical and Electronics Engineering,
Amrita School of Engineering, Coimbatore, India

Introduction

Power electronics is the breakthrough technology which paved way to the new age variable speed wind turbine-generator systems, while the veteran technologies advocated the fixed speed machines in which the tip-speed ratio is optimum only at one wind velocity, while practically each wind speed will fetch a different value of tip-speed ratio. Often the fixed speed wind turbine is operated off its optimum operating point, as it is impossible to match the wind regime's peaking point (that is the maximum duration wind speed) with the wind velocity which corresponds to the optimum tip-speed ratio. This leads to less energy extraction than its maximum possible volume which results in consequential revenue loss. Once, the concept of a wind turbine that can operate continuously at or near its optimum tip-speed ratio was fanciful, though it could yield a substantial revenue hike. Even today, there are several technical issues associated with the variable speed wind turbine generators which need intense levels of controls. However, in early-1990's the variable speed wind turbine came into reality in the advanced economies like the US and Europe, as large grid tied systems as well as small stand-alone systems. Thyristor-based circuits were then adopted to convert the variable voltage-variable frequency output of the variable speed generators into constant voltage-constant frequency to tie to the grid.

But the cost of energy was very high due to the expensive power electronics, highly integrated control system and the special design of the variable speed generators. Also, the thyristor-based circuits were not competent enough to feed clean power into the grid. Continued efforts for development of new technologies are still on, as there are challenges imposed by the standards to generate clean power, that too at a reduced cost. Unfortunately, this variable speed turbine concept contributed much in the infancy years to the company's bankruptcy. However, the technology has evolved over these years with more advanced sensors, integrated digital controls and high-performance power electronics to accomplish improved performance with decrease in costs.

The total global wind power capacity is expected to reach nearly 1,000 GW by the end of 2024, with an increase of 54 per cent on the cumulative installed capacity of 2019. The most powerful multimegawatt wind turbines (GE Haliade-X) have emerged as a competitive source of clean energy in this decade with hub heights of 260 meters and with capacities upto 14 MW and are cost-effective too. Large penetration of multimegawatt wind turbines into the electric grid has significant impact on the grid operation which necessitate complex power converter topologies and their control. This article reviews the state-of-the-art wind turbine-generator concepts, their associated power electronic converters, the control concepts and their structures.

Power Electronics in Fixed Speed Wind Turbine Systems

Power electronics was mere a soft starter in the fixed speed wind turbine systems with squirrel-cage induction generator, the initial technology in 1980s, adopted in the interconnected systems. The phase-controlled thyristors used in the soft starter were

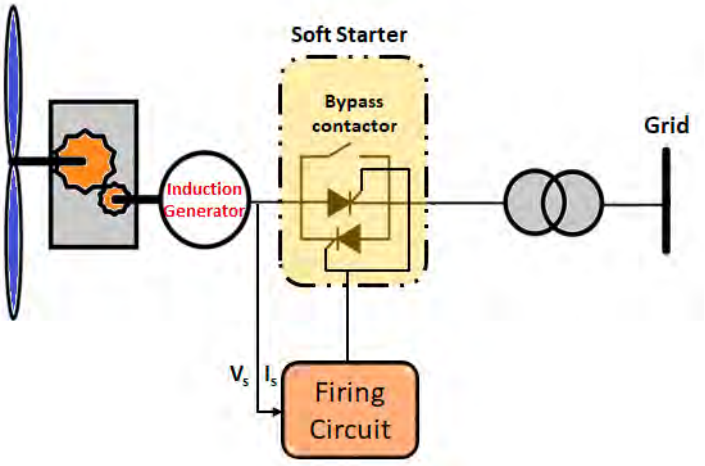


Figure 1: *Thyristor Soft Starters in Fixed Speed wind turbine-Induction Generator*

not meant to carry the rated power of the generator and so the controls were very simple. The thyristor based soft starters shown in Figure 1 is employed to limit the high inrush current of the induction generator during the starting for a short transient time by controlling the stator voltage through the delay angles of the thyristors.

Variable Speed Operation with Rotor Resistance Control

A limited-edition revision in fixed speed wind electric systems brought Wound Rotor Induction machines to be operated with power electronic converters to realize rotor resistance control. This technology was introduced to assist the slow responding pitch control in the power regulation operation. It extended a fast power ramp rate control which was much needed to address the power oscillations due to surging wind velocities.

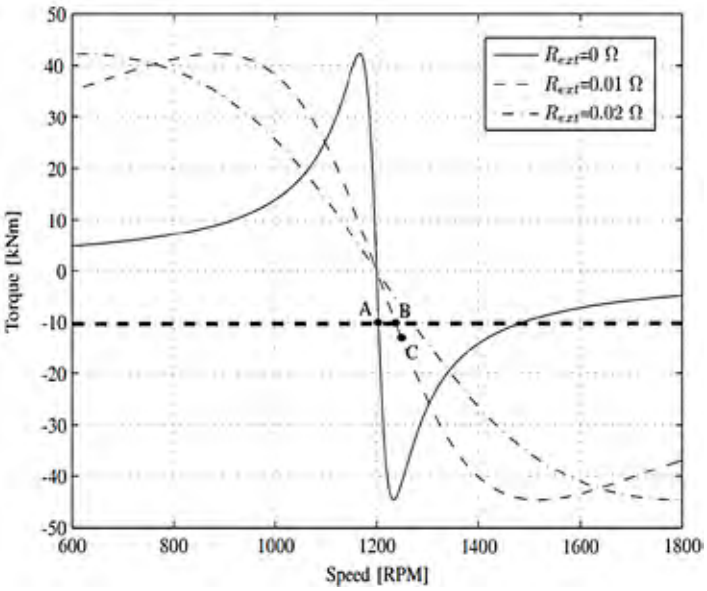


Figure 2: *Torque – Speed Characteristics of WRIM for Variation in Rotor Resistance*[2]

The torque-speed characteristics in Figure 2 shows, how the increase in rotor resistance increases the speed of the induction generator g. However, large wind speed changes will demand large resistances in the rotor circuit and can result in their heating upto undesirable levels and so the blade pitch is eventually be adjusted to maintain rated power above rated wind speed. Nevertheless, through power electronics, a continuous variation in the rotor resistance with much faster response to wind speed variations is achieved. Pitch control is enabled for operation beyond the rated wind speed. Upon any large wind speed variation, the blade pitch is varied first to reach the operating point corresponding to the new wind speed and giving the rated output power. Further, the output power is maintained constant for small deviations around this wind speed through the rotor resistance control. Rotor resistance control method is useful in stall-regulated wind turbines to regulate the output power for wind speeds above the rated value.

A system of rotor resistance controlled variable speed wind electric system is shown in Figure 3. Diode rectifiers cascaded

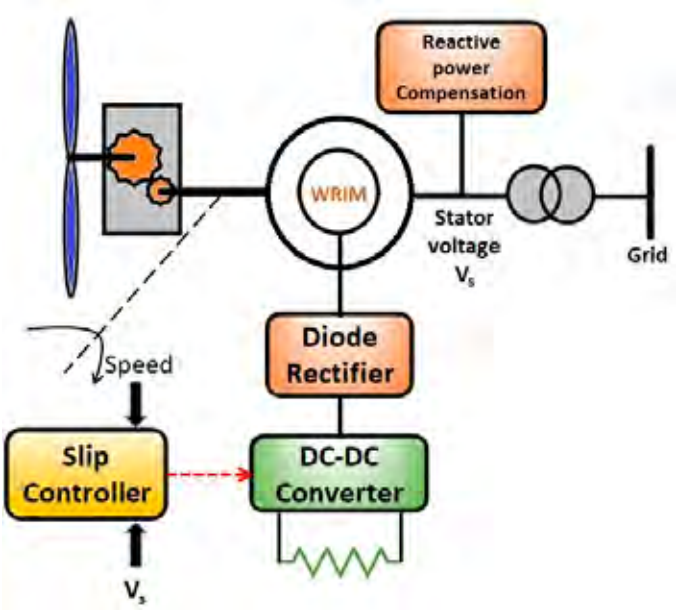


Figure 3: *Variable Speed Wind Electric System with Rotor Resistance Control*

with DC choppers were employed on the rotor circuit to control the rotor power delivered which represents a rotor resistance variation. The rectified rotor voltage is the input to the DC chopper that is operated at a high switching frequency in the order or several tens of kHz. In any chopper circuit, the input resistance is a function of the operating duty ratio such that a varying duty ratio produces a variable resistance, that too with in very short switching periods as low as a few tens of μs. Such short response times of the power electronics gave the necessary dP/dt control capability for these type of wind electric systems. This control is generally used to minimize the output power oscillation and it also reduces the mechanical stress on the turbine.

But this technology has become obsolete after the advocation of the variable speed wind electric generation systems. However, the recent grid code for ramp rate limit and power oscillation limit may soon bring this technology back in the future models of Doubly Fed Induction Generator systems. The Flexi-Slip variant from Suzlon in India used such power electronically varied slip technology to achieve a slip up to 16.67%[2].

Power Electronics in Variable Speed Wind Turbine Systems

Wind turbine coupled with squirrel cage induction generator through a gear forms, the fixed speed wind turbine system. Induction generator always operates in a narrow speed range that involves its synchronous speed at the lower end, and hence the wind turbine operates within a very small speed range which is treated as a fixed speed, regardless of the operating wind speed. In such systems, the rated power can be extracted at an appreciable value of wind turbine efficiency (it is normally called as the power coefficient) only at the rated wind velocity. At higher wind speeds the aerodynamic efficiency of the wind turbine needs to be deliberately reduced either by a stall design of the blades or by their pitch control – such curtailment of efficiency is essential to prevent overloading of the electrical

generator coupled to the wind turbine at wind speeds above the rated wind speed. On the other hand, wind speeds below the rated wind speed do not have such restrictions on power extraction. Yet, unfortunately the aerodynamic characteristics of the fixed speed wind turbine allows only one wind speed to be extracted at the maximum efficiency – all other wind speeds will be handled less efficiently.

This yields poor average efficiency and suboptimal aggregate energy extraction for the installed wind turbine capacity resulting in limited generation and revenue. On the contrary, the variable speed wind turbine generators employing Doubly Fed Induction Generator (DFIG) or Permanent Magnet Synchronous Generator (PMSG) allow controlled variation of their shaft speed with varying wind speeds, while simultaneously maintaining grid connection achieved through power electronics. Such a freedom for wind turbines to increase or decrease its speed if the wind speed and torque vary reduces wear and tear on the tower, gearbox and other components in the drive train. Moreover, the turbine can be operated at its optimum efficiency over a range of wind speed whereas the fixed speed wind turbine generator could do it at a single wind speed only. Therefore the variable speed wind turbine generator has a higher average efficiency and higher energy output; it also has longer plant life because of the reduction in the stress on tower, blades, gear, shaft, etc.

Concept of Variable Speed Operation of Wind Turbine

The power coefficient, C_p of any wind turbine represents the numerical value of the fraction of power extracted from the available wind power at a wind speed and shaft speed. A typical C_p vs λ curve, of a wind turbine shown in Figure 4, where λ is the Tip speed ratio of a wind turbine system defined as,

$$\lambda = \frac{R\omega}{V_w} \quad ...(1)$$

where ω is the shaft speed, R is the length of the blade, and V_w is the wind velocity. The C_p- λ curve reveals that at a unique value of tip speed ratio, viz., λ_{opt}, the wind turbine operates at its maximum efficiency of C_{pmax}. Other values of λ, either higher or lower than λ_{opt}, yield C_p less than C_{pmax}. When the wind speed in equation (1) varies, the value of λ will shift away from λ_{opt} if the shaft speed, ω, is kept constant as in the case of fixed speed wind electric systems. This will make wind turbine to deliver lower power than the power available for any wind speed and thus leading to a reduced aggregated energy for the installation. If suppose ω is varied to counter act the effect of variation of V_w in equation (1), then retention of both λ and C_p at the optimum point is possible. In other words, if the turbine speed is allowed to vary through power electronic control of the generator, then continuously wind turbine will be operating at C_{pmax} and can increase the wind electricity generation at any site. This in turn will maximize the profitability of that wind plant. Operation of wind turbine at C_{pmax} is termed as maximum power point tracking (MPPT) in a wind turbine powered system.

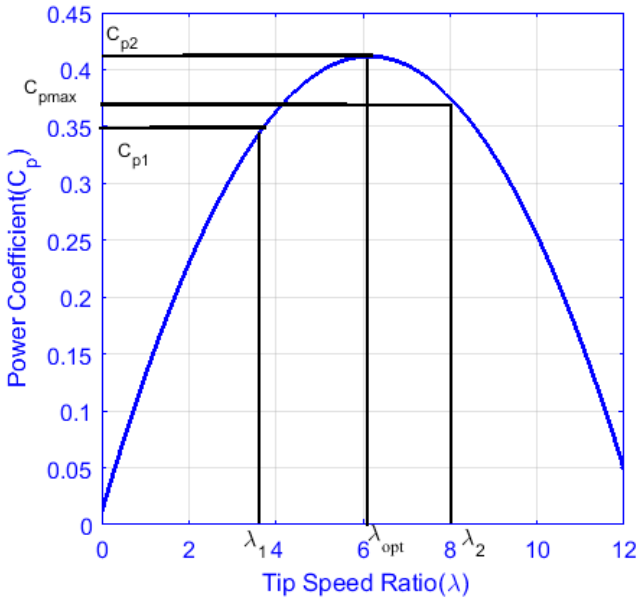


Figure 4: *Power Coefficient versus Tip-Speed-Ratio*

The wind turbine power characteristic curve is yet another visual through which the variable speed operation may be understood. Figure 5 is the turbine power characteristics curve published by International Energy Association (IEA) as per IEC 61400-12.

The two operating modes - the parking and the operating - depend on three distinctive values of wind speeds viz. cut-in, rated, and cut-off wind speed. Below cut-in the wind turbine remains in the parking mode and above cut-off the wind turbines made to park. Rated wind speed is wind speed at which the wind turbine produces generator's nominal power output. Beyond this wind speed the output power of a wind turbine is regulated to the rated generator power for any increase in wind speed till the cut-out speed through progressive decrease in Cp attained aerodynamically. Besides the parking modes, in Figure 5, there are two operating regions, the first being in the range between cut-in to rated wind speed in which the variable speed technologies work. In this region the wind turbine power is proportional to the cube of the wind speed, and there is a possibility of MPPT by keeping the Cp at its maximum value by control of shaft speed through power electronics. As already stated, there is no scope for MPPT in the next region spanning from the rated to the cut-off wind speed.

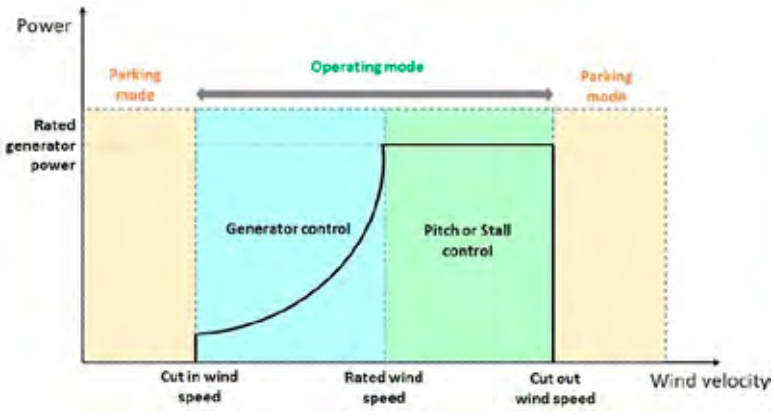


Figure 5: *Typical Wind Turbine Power Characteristic Curve Involving MPPT for Generator Control below Rated Wind Speed*

Generators for Variable Speed Wind turbine Technologies

There are three types of generator technologies widely used for variable speed wind turbine systems. With respect to the capacity of power electronics the options are between full rated or partial rated power converters for the three different types of generators. Irrespective of the generator type, the controls in the three systems are generic and are shown in Figure 6. If the generator is DFIG, the stator is directly connected to grid, while the power converters are placed on the rotor circuit with the controls as described in Figure 6. But, in the cases of Squirrel Cage Induction Generator (IG) and Permanent Magnet Synchronous Generator (PMSG) the stator is connected through the power converter stages as shown in Figure 6.

output and deliver power to the grid for shaft speeds above synchronous speeds. The power electronic control maintains the optimal generator speed, to produce optimal output power through controlling the generator currents and voltages.

(ii) The Doubly Fed Induction Generator (DFIG)

DFIG with back-to-back converter on its rotor achieves stator side regulation at the nominal grid frequency. As the power converter is on the rotor side, its rating is only a fraction of the machine's capacity in the ratio of 1: s, where "s" is the slip, which is always less than 1, thus named as partial rated power converter. Power generation is possible with shaft speeds both above and below the synchronous speed. In DFIG, the power is delivered to the grid from both the stator and the rotor when operated above synchronous speed. A three winding transformer is used to

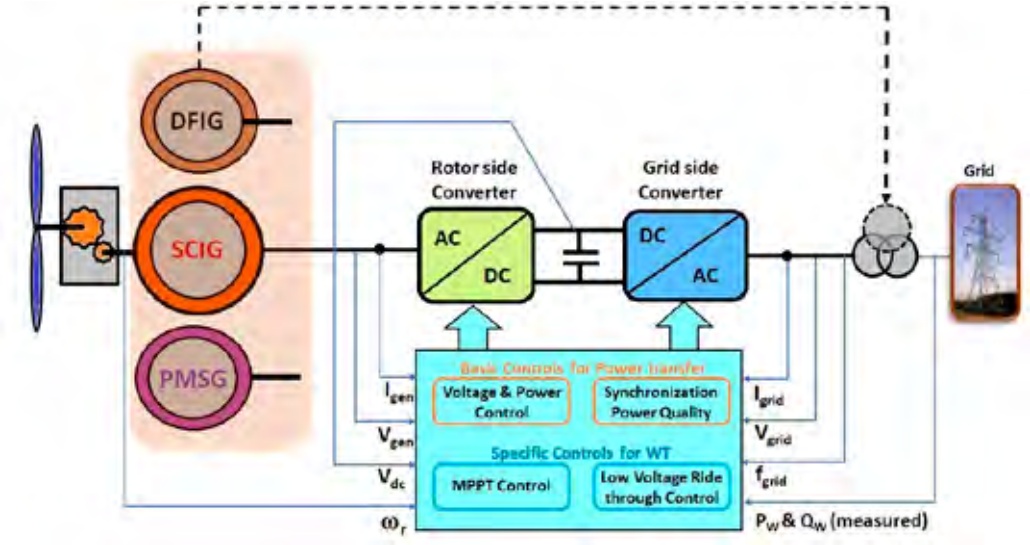


Figure 6: *Variable Speed Wind Turbine Control Schemes*

The main objective of the overall scheme is to control the power delivered by the wind turbine by control of the aerodynamic system with the set points on the power electronics. It also targets to achieve maximum power conversion for the available wind power. The electrical and mechanical control schemes are meant for different control tasks, but they interact to control the wind turbine power injected into the utility. As seen in Figure 6, there are two categories of controls- basic power transfer controls and specific wind turbine controls. The basic power control involves establishing interconnection to grid, active-reactive power control and power quality control. The specific wind turbine control is responsible for MPPT, power limiting and fault ride-through facilitation. The current delivered by the generator is changed by controlling the generator side AC-DC converter, which in turn vary the power delivered by the generator. This varying generator power will make the shaft speed to vary until it yields λ_{opt} to achieve maximum power extraction from the available wind speed.

(i) Squirrel Cage Induction Generator

In case of SCIG with full rated converters, the magnetizing VAR will be drawn from the AC mains and delivered to the machine through the DC link. Because of the DC link, the generator is allowed to operate with variable frequency-variable voltage

connect DFIG to the grid; with the transformer primary on the grid side, the secondary connects the stator and the tertiary winding is used for connecting the rotor through back-to-back AC-DC-AC converters, namely rotor side converter (RSC) and grid side converter (GSC).

Two distinctive operating conditions can be used to explain the DFIG operation in variable speed wind turbine.

1. When the shaft speed is greater than the synchronous speed the operation is termed as super-synchronous. In super-synchronous mode, the rotor delivers power to the DC bus through RSC. This will increase the voltage of the DC bus. Now the GSC control will regulate the DC link voltage and increase the power delivered to the grid until it matches the power delivered by the rotor. In this mode, RSC works as a rectifier and GSC works as an inverter.
2. When the rotor speed is lower than the synchronous speed, the operation is termed as sub-synchronous. By injecting a definitive amount of power into the rotor from the DC link through RSC a dip in the DC link voltage is created first. Then the GSC control will draw power from the grid into the DC link and regulate the DC link voltage to its nominal value. In this mode, RSC works as an inverter, while GSC works as a rectifier.

The Grid Side Control regulates both the DC bus voltage and the grid voltage at PCC in two steps as explained below:

1. The present value of DC link voltage is compared with its nominal value and a reference current value is generated. When the GSC delivers this reference current at the rated grid voltage, it corresponds to the maximum possible power extraction by the wind turbine at the given instant.
2. The aforesaid current reference is compared with the present value of current delivered by the inverter and a reference voltage is obtained. This is the voltage intended to be generated at the inverter output for delivering the reference current mentioned in the first step.

The magnetizing reactive power requirement of the generator has to be met either by VAR compensators on the stator side or by supplying a controlled VAR on the rotor side. VAR management with rotor side control is more cost effective and reliable. By control of the rotor side current, the stator power factor can be maintained as close as to unity.

(iii) Permanent Magnet Synchronous Generators (PMSG)

PMSG working with variable shaft speed generates variable frequency- variable voltage output. This power is fed to an inverter through a rectifier to get synchronized to the electric utility which is operating at the nominal frequency. Here, the inverter needs to handle the rated power of the generator; so the converters are referred to as full rated power converters.

Generally, the synchronous generator can be of wound rotor type or can be excited using permanent magnets. Mostly it is a multipole, low-speed type generator which does not need a gearbox for coupling to the wind turbine rotor.

Thanks to the permanent magnets, the magnetizing reactive power requirement of the generator is absent. The grid side control will be aiming at synchronization to grid and regulation of the DC link voltage. Regulation of DC link voltage ensures the generated power from the machine is pushed into the grid and MPPT operation can be achieved by proper choice of DC link voltage. The generator side converter will be operated in the rectifier mode converting the variable voltage-variable frequency output to a variable DC voltage. Sometimes, the variable DC from the AC-DC converter is regulated with a DC-DC converter. This DC-DC converter with proper control is also used to obtain high power factor as well as harmonic free current delivery by the generator.

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2. Wind turbine drive systems: a commercial overview. Author links open overlay panel, E.de Vries. https://doi.org/10.1533/9780857097491.2.139
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Measuring the Performance of Europe's Smart Grids

European system operators have proposed a set of indicators to monitor the evolution of smart grids at the distribution level.

The key performance indicators (KPIs) comprise seven for distribution system operators (DSOs) and one common for transmission and distribution operators.

These were developed for Europe's national regulatory authorities in response to EU Electricity Directive requirements for a new methodology to enable them to monitor infrastructure upgrades with smart grids, focussing on energy efficiency and the integration of renewable energies.

The review identified six common challenges facing DSOs as cooperation in network operation and in network planning, exchange of information on long term planning of network investments and regarding generation and demand response for daily operation, cooperation for coordinated access to resources, and ensuring the secure and reliable development and operation of the networks.

The DSO KPIs that have been identified are as follows:

1 – System observability: To measure the capability to keep under 'proper monitoring' of the relevant nodes/lines of the grid.
2 – System controllability: To measure the capability to keep the grid under 'proper control'.
3 – Active system management: To measure the capability to perform active management of the grid in daily/short-term operation.
4 – Smart grid planning: To measure the capability to use design and planning procedures to fulfil actual grid needs in medium and long-term, guaranteeing cost efficiency in grid updating and the most efficient use of existing assets.
5 – Transparency in data access and sharing between relevant stakeholders: To measure the capability to make accessible and share data between stakeholders.
6 – Local flexibility markets and customer inclusion: To measure how much the customer is involved in grid management and enabled to provide services to the grid and to measure how much the local flexibility market/customer agreements are implemented and how much it can contribute to grid (and system) management.
7 – Smart asset management: To measure the use of advanced asset management strategies, tools and methods focusing on assets condition monitoring and risk mitigation.

The common TSO-DSO KPI is:

1 – TSO-DSO coordination capabilities: To measure coordination capability between TSOs and DSOs.

Each of the KPIs are presented with key indicators as examples of performances that can be measured or alternatively adapted to national specificities.

The KPIs were prepared from the work of a joint TSO and DSO task force created in March 2020 under the initiative of ENTSO-E and the four European DSO associations CEDEC, E.DSO, Eurelectric and GEODE.

The report states that the KPIs are intended to supplement existing indicators such as SAIDI and SAIFI and further work should be done at country level to select the most appropriate defined parameters.

With the indicators in place, the national regulators are required under the Directive to report smart grid assessments every two years.

Source: Smart Energy International, April 9, 2021

SG 3.4-145, our next -generation turbine

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

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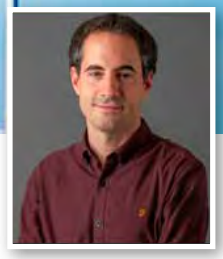
RENEWABLE ENERGY

Extended Validation and Certification of New-Generation Power Converters Reduces the Cost of Energy



Ion Etxarri
Quality & Innovation Manager
Ingeteam Wind Energy, Spain

As market demand for wind turbines has grown, so too have the demands for quality and performance, in order to reduce the levelized cost of energy (LCoE) and demonstrate that the technology is not just a clean solution for electric power generation, it is also a profitable addition to the energy mix. This is especially the case for critical components such as power converters because the performance of the whole turbine depends on them.

The response is focused on increasing the reliability and durability of these components, making wind turbines more economically viable assets. High quality design and extended validation methods of power converters are the key to guarantee the reliability and durability of the turbines in wind farms facing the toughest operating conditions.

New-generation power converters have been validated using the toughest test scenarios and most realistic configurations, to prove in advance that the converter will be properly integrated within the turbine and operate correctly under the most demanding situations.

...in order to reduce levelized cost of energy (LCoE) and demonstrate that the technology is not just a clean solution for electric power generation, it is also a profitable addition to the energy mix.

The market demands continuous performance improvement and regulatory innovations take this factor into account. Ingeteam participates in the committees which issue these requirements and integrates the latest regulatory developments at the design phase of the company's new generation power conversion solutions.

This method is also applied to the company's manufacturing plants to comply with all marking requirements. Indeed, the certification of the converter facilitates the certification process for the whole wind turbine.

Validation Process

International Electro-technical Commission (IEC) standards are the reference conformity assessment for all electrical, electronic and related technologies. The new-generation power converters must meet the highest quality requirements, since wind turbine performance is dependent upon them.

The new power conversion solutions have been subjected to the tests required by IEC61400 for wind turbines, and IEC62477-1 and IEC61800-3 for power converters, verifying the correct performance and the highest level of safety.

Within this validation process, a large number of tests are focused on the assessment of energy and temperature hazards. For example, the behaviour of the converter in the event of failure of a cooling system or insulation components is assessed by means of functional tests, simulating these failures or in temperature rise tests. In addition, mechanical tests such as IP degree, corrosion, impact, or vibration also form part of the validation. All these tests guarantee the safety and the correct performance of the power conversion solutions.

Based on experience in the wind turbine market, an "extended validation" of power converters is appropriate in order to optimize the design and minimize any potential issues that may arise during the integration of the component within the wind turbine.

The objective of this "extended process of validation" can be summarized as follows:

- To identify design improvements or detect any design failures of the converter at the earliest stage of development, thereby minimizing subsequent design and manufacturing costs due to modifications at a later stage of implementation that would imply the use of more resources.
- To test the converter under the most realistic conditions to validate the design under all possible scenarios and to verify it complies with requirements. The more accurate the test is regarding the behaviour onsite inside the turbine, the greater the reliability of the tests and the results obtained.

Four types of test are carried out to provide accurate data about the behaviour of the converters when installed onsite:

- Combination tests in full-scale test benches.
- Extreme climatic condition tests.
- Extreme mechanical condition tests.
- Electromagnetic compatibility tests

Combination Tests in Full-Scale Test Bench

The correct behaviour of a power converter can be verified without the use of a generator by means of external power supplies and passive components; however, this kind of validation process cannot fully guarantee the correct integration in the field.

Specific characteristics of the generator could affect the behaviour of the converter, and combination tests make it possible to anticipate them. Some processes are not possible to simulate and assess by means of calculations, and empirical methods are the best way to do that.

In addition, combination tests with power-limited generators or mock-ups may not allow the required points to be assessed.

These tests are carried out, using the same generator as in the final application, which is critical. The schematic of this kind of tests, together with the final layout of the test bench is shown below:

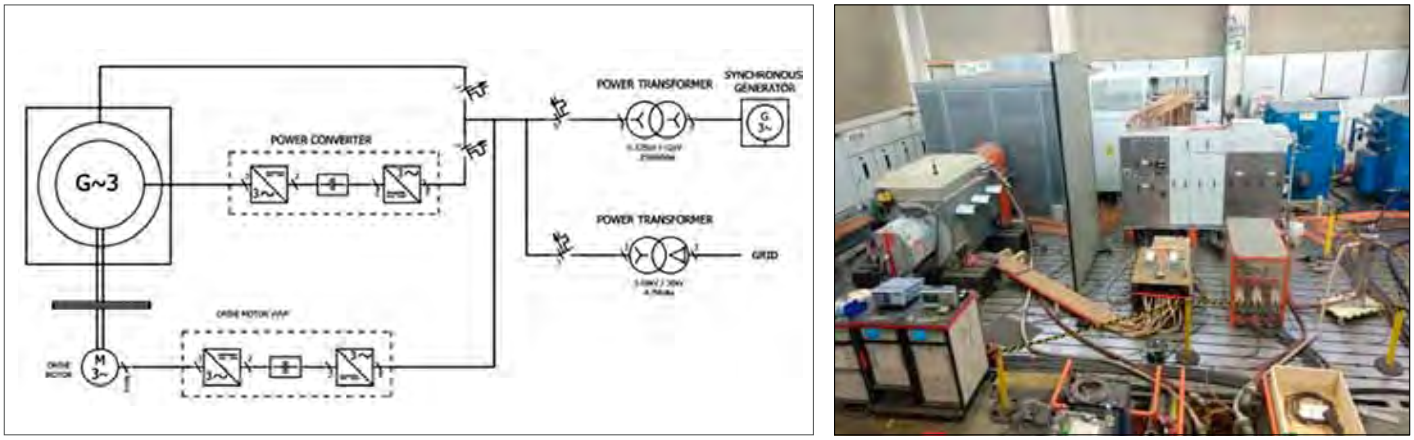


Figure 1: *a. Schematic and b. Final Layout*

Combination tests with a generator at full scale enable the correct performance assessment of the converter at any desired point. Thus, a full validation process is obtained as the converter operates along the whole operation ranges. This process includes at least the following variable parameters including grid voltage and frequency, generator speed, reactive or active power, or temperature:

- **Operational Range:** Static (long-time) and dynamic (short-time) load points are used in order to confirm the correct operation of the converter. The limits of the converter are tested and include all the strategies of the control in order to fulfil the requirements of the grid. These tests cover all the operation points of the application and include the following cases:
  - Steady and overspeed points within PQVF range
  - Static VAR mode
- **Efficiency along the P-n curve**
- **Harmonics**
- **DVDT**
- **Dynamic Response (Torque and Q steps)**

As an example, Figure-2 shows an overspeed working point where GSC & MSC currents, N, P & Q can be seen.

- **Heat Run Test:** The thermal behaviour of the converter is assessed under several operation points of the generator. These tests are used to confirm that no temperature is outside the expected limits as well as to characterize the thermal model of the components. This information is particularly useful in order to detect potential cost reductions based on different geographic areas of wind farms. The new-generation power converter has been tested this way under the worst operation conditions for GSC, MSC and stator circuit.
- **Special Tests:** The configuration used for combination tests also allows some additional tests that reduce integration and FRT behaviour uncertainty to be carried out. In this case, the power converter has been subjected to motor mode test and short circuit at stator, which is critical in case of DFIG application.

  As an example, Figure 3 shows the behaviour of the converter during a short circuit test. Fig-3(a) shows MSC currents (peak current up to 9kA) in case of a short circuit at stator of 100% of Voltage drop. Fig-3(b) shows the rapid increase of chopper resistor ambient temperature.

Extreme Climatic Condition Tests

A critical point of a validation process is the climatic one. To be able to verify empirically the correct behaviour of a converter and its components along the whole climatic range is important in order to detect unexpected behaviours that cannot be predicted by means of calculations. A detailed validation is carried out thanks to test benches which are able to control the temperature and the humidity over a very wide range, and where the converters can operate at rated conditions.

Executing tests at the extreme limits of temperature and humidity allows the observation and understanding of the specific behaviour of components when they operate close to their limit, and to define the best options regarding functionality and cost. Without this empirical analysis, the selection of components would be based on theoretical calculations and datasheets, making a conservative selection that would imply overrun, more likely. With this validation the optimum design is obtained.

In addition, the performance in case of failure can be assessed in detail. Without this kind of test infrastructure, it would be impossible to know how the converter really reacts

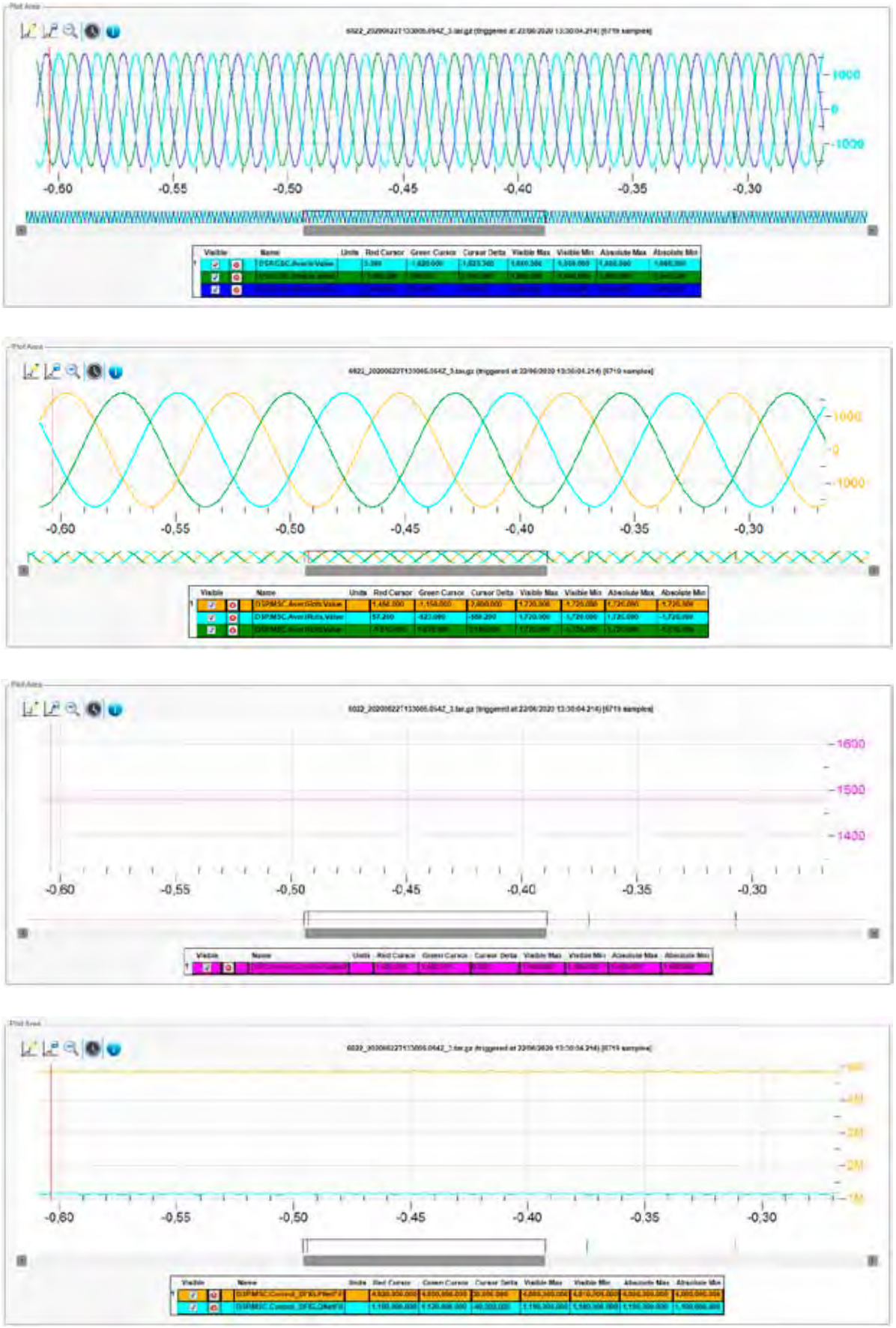
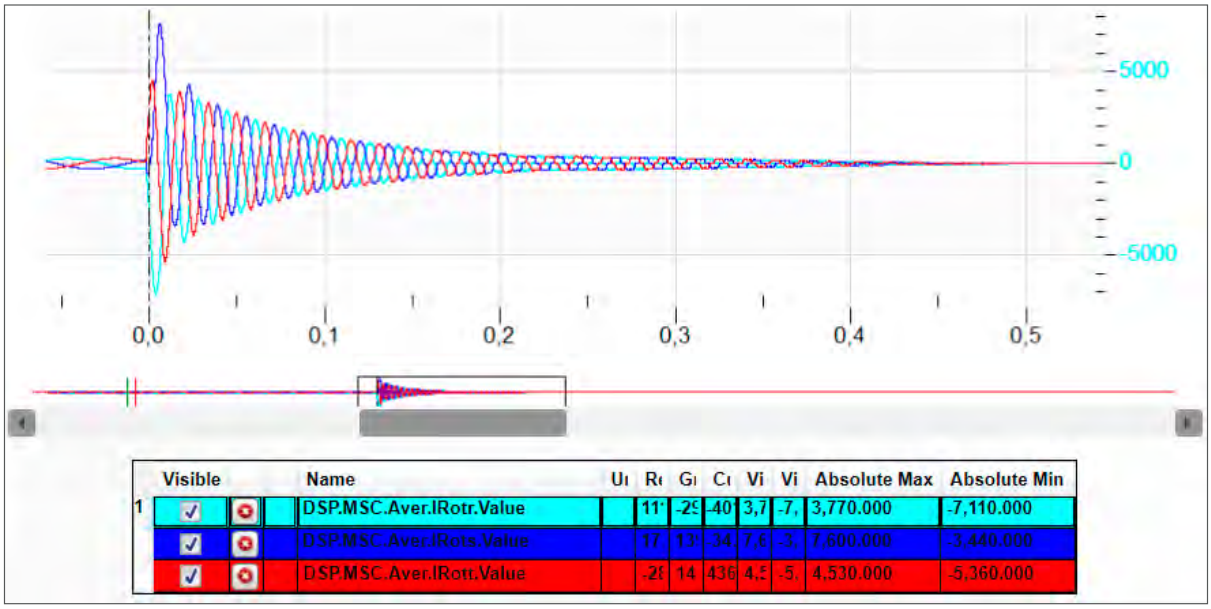
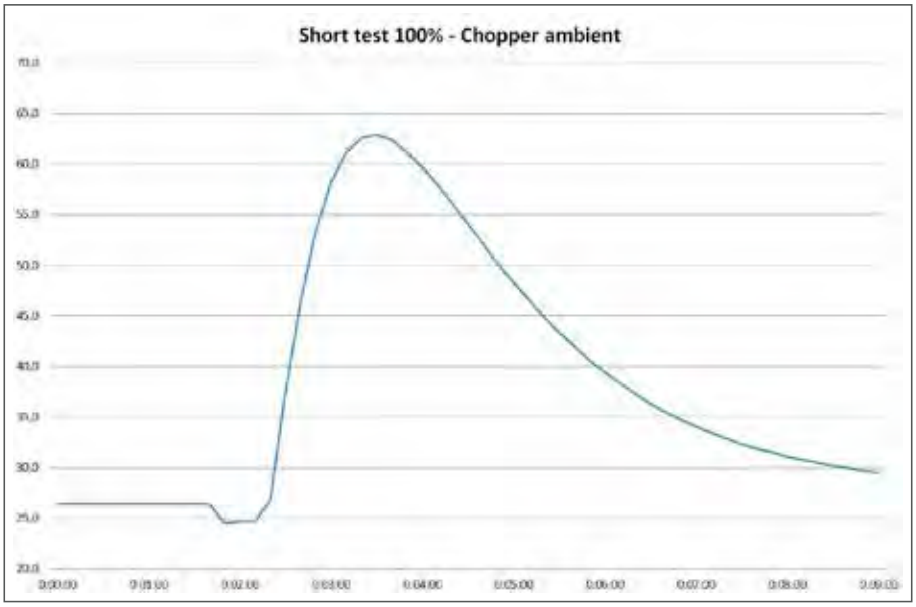


Figure 2: *Overspeed Working Point*



3(a)



3(b)

Figure 3: *Short Test at 100%*

when a component such as a fan or a cooler fails. The behaviour at a specific room temperature or humidity value could differ drastically from another value. This uncertainty is overcome by carrying out failure tests at several climatic points to identify the real performance at each point without depending on assumptions and calculations that could provide erroneous conclusions and lead to designs that do not fulfil the requirements or could even be dangerous.

The climatic extreme conditions validation includes the following type of tests:

- **Heat run tests:** the thermal behaviour of the converter is assessed, setting maximum current values and the worst temperatures. The whole range for both operation temperatures and for external ambient and external cooling system is covered.
- **Cold Climate Tests:** in this test, it is verified that the converter is operative in the desired time under the lowest environmental temperatures and once operating starts the cooling/heating logics are valid. Thus, in addition to temperature, DI/DO are monitored. In addition, the operation under variable cycles of external temperature is assessed.
- **Condensation tests to cover the following processes:**
  - Detection of the points where condensation could occur by provoking it by means of extreme variations of temperatures with high RH values.
  - Verification of de-humidification time required by heating system once condensation has occurred under the worst conditions.
  - Confirmation of anti-condensation logics validation, where all the possible scenarios are validated.

Figure 4: *Climatic (Temp & RH) Chamber*

- **Damp heat tests:** Tests of several days (>96h) are carried out at maximum temperature and RH values. After that, dielectric properties are verified.

Extreme Mechanical Condition Tests

Another critical part of the validation process of the converter for its final application is the assessment of its behaviour and response to low frequency vibrations. Incorrect behaviour could cause severe damage to the converter and the wind turbine.

Depending on the wind turbine, the location of the converter and the fastening structure, the response could change drastically. Thus, this is a process to be carried out for each wind turbine-converter combination.

Prior to the test, detailed Finite Elements Models (FEM) are developed to predict the response of the converter and to assess the different design options.

The main test consists in sinusoidal sweeps using the specific "Frequency-Acceleration profiles". These profiles are defined based on accelerated test processes with the aim of simulating the whole accumulated damage along the life of the turbine in only a couple of hours.

During the tests, the resonances are checked because any change on their frequencies could lead to structural damage.

In addition, shock tests with extreme acceleration values are carried out.

Following these tests, the converter must remain operational. No damage affecting safety can be accepted.

Passing these tests guarantees that the combination of converter and wind turbine is correct and will withstand the

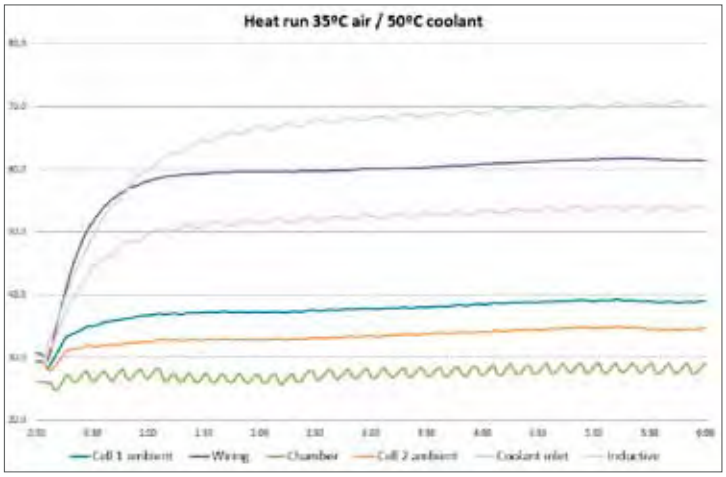


Figure 5: *Heat Run Test*

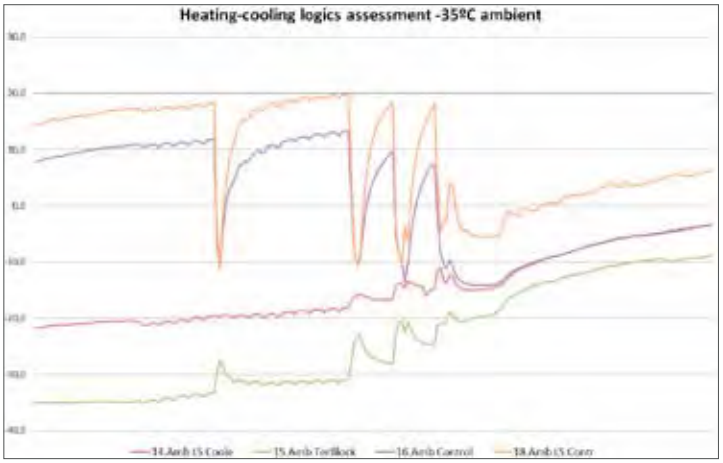


Figure 6: *Cold Climate Test Temperatures Evolution (Peaks Due To Activation/Deactivation Logics)*

Figure 7: *Vibration Test*

lifetime of the turbine. The results are also correlated with the FEM models developed.

Electromagnetic Compatibility Tests

The immunity of the converter against the emissions of the environment or generated by nearby devices is critical to guarantee the maximum availability of the turbine.

Also, the converter itself can generate emissions that could affect the correct operation of nearby items (within or outside the turbine).

To confirm that the converter is able to operate in an environment within the expected emissions limits, compatibility tests according IEC61800-3 standard are included in the validation process.

These tests are carried out in the manufacturing plant, using the most representative configuration, and by certification bodies.

Passing them minimizes drastically the risk and uncertainty regarding EMC.

Certification Process

Another cornerstone of the design process is certification. Achieving the combined requirements of maximum durability and reliability with cost-optimization is essential, but different international standards can present a barrier for wind turbine installation.

Therefore, the strictest international standards are considered for all designs.

We participate in the committees that issue these requirements and thus it stays up to date of the latest regulatory innovations and implements them from the design phase of the converter. Being proactive regarding regulatory demands leads to the improvement of new converter designs and avoids late modifications that could delay a project. Any new design within the company integrates the strictest standards for all the applicable marks and labels including CE, UL or DNV-GL.

The participation in IEC committees such as TC22 (Electronic Power Conversion) and TC88 (Wind Energy Generation Systems), IECRE (IEC Renewable Energy), as well as in specific working groups within IEC including WG05 (Hazardous Substance) or WG26 (SW testing), or STP UL groups for development of standards like UL508 (Industrial Control Equipment), proves the commitment of Ingeteam to the quality of its products.

Moreover, this approach is not only applied to product design, but also the manufacture of the products in its plants. For that purpose, the plants are certified for the manufacture of any component and marked with the main wind mark labels. These certifications confirm international compliance and avoid project delays due to any marking regulations and barriers. In addition, they facilitate the certification process of the wind turbine. The company has already certified its plants for power converter within DNV-GL and UL scopes, and in addition has been trained for APQP4Wind.

Conclusion

Extended validation of new generation power converters confirms operational performance under the most severe conditions. The use of full-scale test benches for integration assessment and climatic behaviour evaluation are the key to optimize the design and detect potential improvements at an early stage. The information obtained from the tests assures the optimization of the design and guarantees that the converter is going to operate properly in the field.

The incorporation of the latest and most stringent regulatory requirements at the design phase and also in the certification of the manufacturing plant, allows to facilitate the wind turbine certification process, wherever the geographical location, thereby reducing the project time-to-market and saving costs throughout the development and validation design processes. Clients can be confident that thanks to extended validation, the new products deliver the best in-field value for money.

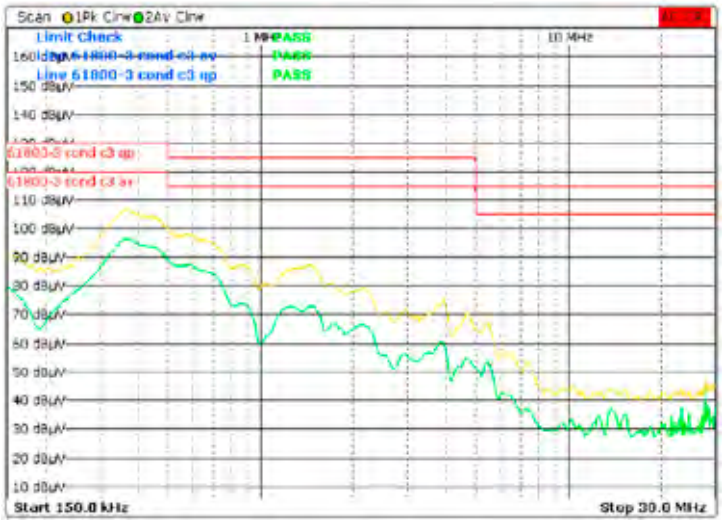


Figure 8: *Results for Conducted Emissions*

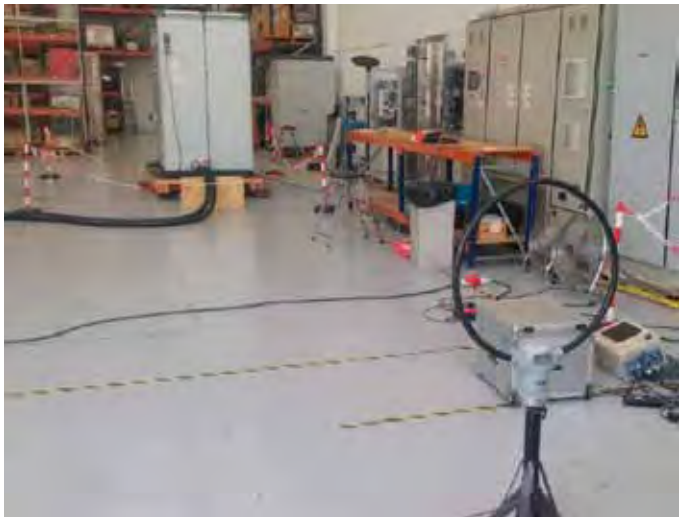


Figure 9: *Radiated Emissions Test*

Goa Electric Vehicle Promotion Policy Proposes Huge Subsidies for Electric Vehicles

Goa Electric Vehicle Promotion Policy has proposed huge subsidies for promoting eco-friendly electric two-wheelers and as per the draft, buying electric two-wheelers would be nearly 30% cheaper in Goa compared to buying two-wheelers running on petrol. There are also plans to have charging stations every 25km on highways and every 3km within city limits. Battery swapping and fast charges are also included in this policy.

Source: Emobility, April 12, 2021

Tata Power deploys first NB-IoT smart meters in Delhi

Tata Power-DDL has launched India's first smart meter deployment with Narrow Band-Internet of Things (NB-IoT) communications. With the initiative, Tata Power Delhi Distribution is at the forefront of technology, with NB-IoT set to future-proof smart metering as data volumes grow. So far Tata Power-DDL has deployed 230,000 smart meters with RF technology. NB-IoT is a new technology that is both 4G and 5G compatible offering a dedicated channel for the smart metering and avoiding any reduction in performance from interference or obstruction due to congestion on the public network. It also will enable an increased number of remote meter readings.

Source: Smart Energy International, April 13, 2021

Efforts from All Stakeholders Strengthening Electric Vehicle Ecosystem In India, Says Globaldata

Concentrated efforts from the government and other stakeholders will boost the supply and demand of electric vehicles (EVs) and subsequently drive the adoption of the EVs in India. However, customer challenges such as high costs, range anxiety and charging infrastructure along with more attractive incentives are needed to lure price conscious Indian customers. Indian central and state governments have been introducing conducive policies to boost FDI in EVs and create new manufacturing hubs.

Source: Globaldata.com, April 10, 2021

Green Hydrogen from Renewable Power

Policymakers in Europe aim to produce green hydrogen from renewable power through electrolysis, to replace coal and gas-based hydrogen and open up new areas of usage to substitute oil products across manufacturing industries, heating and transport. German utility Uniper is studying the conversion of its coal-fired power plant site at Wilhelmshaven on Germany's North Sea coast into an import and electrolysis hub to tap into emerging demand for "green" hydrogen.

Source: Reuters, April 14, 2021

Green Hydrogen Auctions, Purchase Obligations in the Offing

The Indian government is planning to use 2,000 MW solar and wind power capacity for hydrogen production. It will also hold green hydrogen auctions as part of a broader plan to curb greenhouse gas emissions. Apart from industrial use, hydrogen technology can also be used to store electricity and potentially to run vehicles. Sources said plans were also afoot to make it mandatory for user industries like fertilisers and petroleum refineries to purchase 10% of their hydrogen requirements from domestic green hydrogen sources.

Source: Financial Express, April 15, 2021

UP, Bihar, Karnataka top the list of states with highest EV sales

India's electric mobility sector has registered nearly 1.35 lakh EVs in FY21, according to CEEW Centre for Energy Finance's (CEEW-CEF) electric mobility dashboard. Uttar Pradesh alone contributed 23% of the country's sales, with 31,584 EVs sold in FY21.

Source: Times News Network, April 15, 2021

Softbank Scraps Renewable Deal with CPPIB, to Continue Running SB Energy with Bharti

Softbank Group has abandoned its plans to divest its renewable business in India -- SB Energy Holdings – after carrying out a full blown global sale process for over a year. It has terminated its agreement to sell its 80% stake in the joint venture to Canada Pension Plan Investment Board (CPPIB), earlier this week, after disagreements over valuation, terms and conditions of the shareholder agreement (SHA) and governance rights could not be resolved between all parties concerned, said multiple people aware of the developments. The plan, for now at least, is to continue running the business together with its original JV partner Bharti Enterprises.

Source: ET Energy World, May 14, 2021

Saving GIB: Rs 300 Cr Extra to Bury Power Lines

The Gujarat state government is likely to incur an additional expenditure of about Rs 300 crore for diverting electricity lines to save the habitat of the critically endangered Great Indian Bustards in Kutch district. The impact on the consumer will be about 1 paisa per unit only against the claimed 10-15% hike in the project cost due to underground piping. The Supreme Court had recently directed the Gujarat government to ensure the protection of the birds' habitat in Kutch, where the world's largest hybrid (solar and wind) renewable energy park is coming up.

Source: TNN, May 13, 2021

Green Hydrogen Auctions, Purchase Obligations in the Offing

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Source: Financial Express, April 15, 2021

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- **In-house aerodynamic experts,** combined with innovative software, not only ensure tailored blade designs – our engineers also develop customized add-on's to optimize blade performance and reduce noise
- And ultimately, engineers **verify the designs** in our unique, onsite research facilities – including a rain erosion laboratory, full-scale test center and wind tunnel

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Regulatory Update on Wind Power

CERC Announces APPC

The Central Electricity Regulatory Commission, in discharge of its responsibilities under the Electricity Act, 2003 has notified the Average Power Purchase Cost (APPC) rate at the national level as Rs. 3.85/kWh. After addressing the stakeholders' comments and based on the tariff orders issued by the SERCs/JERCs for FY 2020-21, the APPC at the National level has been worked out as Rs. 3.85/kWh. This APPC shall be applicable during FY 2021-22 or until further orders for the purpose of deviation settlement in respect of the open access and captive wind and solar generators fulfilling the requirement of regional entities, in terms of the provisions of sub-clause (v) of clause (1) of Regulation 5 of the CERC (Deviation Settlement Mechanism and related matters) Regulations, 2014.

S.No.	State (linked Sheet)	Volume of Power procured from Non-RE Sources (Estimated)	Cost of Power procured from Non-RE Sources	Average Cost of Non RE Power
		"X"	"Y"	"Y*10/X"
		(MUs)	(INR Crores)	(INR/Unit)
1	Andaman & Nicobar Islands	295.60	545.44	18.45
2	Andhra Pradesh	54509.60	25670.40	4.71
3	Arunachal Pradesh#	429.94	147.60	3.43
4	Assam	9323.19	4789.79	5.14
5	Bihar	29357.83	12500.41	4.26
6	Chandigarh	1705.85	586.78	3.44
7	Chhattisgarh	32685.02	10663.51	3.26
8	Dadra & Nagar Haveli	5514.82	2121.40	3.85
9	Daman & Diu	2465.75	977.46	3.96
10	Delhi	29099.83	11967.54	4.11
11	Goa	4279.62	1211.62	2.83
12	Gujarat	100333.50	36854.49	3.67
13	Haryana	60026.27	23932.88	3.99
14	Himachal Pradesh	9045.29	2325.93	2.57
15	Jammu & Kashmir*	14014.00	3887.00	2.77
16	Jharkhand$	15425.94	6233.10	4.04
17	Karnataka	70514.21	30254.09	4.29
18	Kerala	27095.77	7766.85	2.87
19	Lakshadweep	58.87	94.97	16.13
20	Madhya Pradesh	62512.20	21450.40	3.43
21	Maharashtra	136234.02	54501.06	4.00
22	Manipur	2627.05	956.36	3.64
23	Meghalaya	2083.86	642.47	3.08
24	Mizoram	654.26	292.80	4.48
25	Nagaland	779.76	317.49	4.07
26	Orissa	26781.96	6589.24	2.46
27	Puducherry	3179.94	1294.42	4.07
28	Punjab	50883.00	18548.46	3.65
29	Rajasthan**	67456.00	26595.00	3.94
30	Sikkim	577.08	234.58	4.06
31	Tamil Nadu^	95370.33	35545.48	3.73
32	Telangana^^	52431.61	20570.73	3.92
33	Tripura	2627.05	956.36	3.64
34	Uttar Pradesh	103654.34	45374.82	4.38
35	Uttarakhand	13566.87	4681.58	3.45
36	West Bengal##	60400.40	21427.81	3.55
	ALL INDIA	**1148001**	**442510**	**3.85**

Proposal National APPC applicable during FY 2021-22

Draft National Electricity Policy 2021

Under Section 3 (3) of the Electricity Act, 2003, the Central Government may, from time to time, in consultation with the State Governments and the Central Electricity Authority, review or revise, the National Electricity Policy. In compliance of section 3 of the Electricity Act 2003, the Government of India had notified the National Electricity Policy on 12th February 2005.Ministry of Power vide Order dated 12.04.2021 has constituted an Expert Committee under the chairmanship of Shri Gireesh Pradhan, Ex-Chairperson, CERC to prepare and recommend National Electricity Policy (NEP), 2021. The Expert Committee is required to submit its suggested draft NEP 2021 within two months.

The National Electricity Policy, 2021 needs to play an important role in deciding the future of the power sector with renewed reform measures for the economic growth of the country. The main focus is expected to be on decarbonization, power market development, distributed generation in view of rooftop solar and other reliable new technology, etc. The policy may be consumer centric i.e., giving choice to consumers, better services, reliable and quality power, etc. Security of supply, cyber security, resilience in the power sector in view of the disasters management, securing supply to all consumers but in particular, all the essential loads in the event of any crisis, etc. are others areas of importance.

The suggestions of the various stakeholders including State Governments, Financial Institutions, Industries, consumers, etc. have been invited.

OBJECTIVES OF NATIONAL ELECTRICITY POLICY 2021

- Promote clean & sustainable generation of electricity
- Development of adequate & efficient transmission system
- Revitalizing the distribution system
- Development of efficient market for electricity
- Manufacturing of goods & services in India for sector
- Supply of reliable & quality power
- Lucid & light touch regulation
- R&D on new technologies for electricity sector
- Review of roles & functions of personnel on timely basis
- Creation of electric vehicle charging infrastructure

AREAS ADDRESSED

National Electricity Policy covers the different major areas as given below.

Generation

- Adequate raw material security of coal & gas for upcoming advanced thermal power plants
- Hydro projects with reinforcement of the pumped storage
- Nuclear power of 10 GW in 10 yrs.
- Cogeneration through renewables
- Promoting Microgrids extensively
- Renovation and modernisation of old thermal power plants, Hydro Power, Wind & Solar Plant to enhance the useful life
- Energy storage with battery and new emerging technologies needs to be promoted

Transmission

- CEA to formulate short term plan for inter & intra state transmission
- Streamlining the process for approvals of transmission project with necessary infrastructure
- Need for maintaining consistency in transmission pricing frameworks
- New measures to be explored to mitigate the issue of Row
- Cross border transmission corridors needs to be strengthen

Distribution

- Need to strengthen the distribution system to provide 24 X 7 power
- Inviting PPP model in distribution sector to improve efficiency
- Introduction of distribution system operator for real time operation
- Special impetus for consumer indexing & asset mapping
- Promoting usage of smart meters
- Reduction measure for AT&C losses
- Expedition on tariff filing & adoption

Power Markets

- Govt intend to increase the share of spot market to 25% by FY 2023-24
- Suitable mechanism to create aggregate demand, renewable power generation, demand response & micro-storage to help small consumer
- Procuring power on competitive basis

Grid Operations

- System operator to be equipped with state of the art technologies.
- Separation of SLDCs from state transmission companies has been proposed
- Load despatch centres to publish real time system operations
- Protection audits to take at regular intervals to minimize tripping

Regulatory Process

- Regulatory commission to focus more on emerging tasks such as market monitoring & surveillance, ensuring resource adequacy, balancing, demand response etc.
- Evolving procedures to move towards light touch regulation

Energy Conservation and Energy Efficiency

- SERC must mandate utility driven DSM programme & customer engagement as a means of peak load management, energy conservation and saving in cost of power to sectors such as buildings, transportation, rural electrification.

Manufacturing - Atmanirbhar Bharat

- Promoting the manufacturing of goods & service across value chain
- Quality control standards are being developed for products
- Manufacturing zones for power sector equipment/items/ material
- Measures to prevent cyber attack

Environmental Issues

- Promoting New technologies for water conservation, sewage treatment & controlling of emissions
- Gainful utilization of fly-ash
- Disposal of electronic waste & recycling policy of batteries
- Identify Land banks for power plants

All Power Distribution Companies (Discoms) to undertake Annual Energy Audits

The Ministry of Power has made energy audits an annual requirement for electricity distribution companies in a regulation notified on 15th April 2021.

Backdrop

The Ministry of Power had issued a notification on September 28, 2020 to cover all DISCOMs under the purview of the Energy Conservation Act, 2001. With the notification, all DISCOMs came under the purview of the various provisions of the EC Act, such as Appointment of Energy Manager, Energy Accounting and Auditing, identification of Energy Losses Category wise, implementation of energy conservation and efficiency measures, etc. for each DISCOMs.

In an official statement released at the time, the Ministry of Power had said, "The amendment is expected to help DISCOMs to monitor their performance parameters and bring in transparency in the distribution sector through professional inputs. It will also assist in developing projects for reducing the electricity losses by DISCOMs and implementing effective solutions. The amendment is expected to improve the financial state of the DISCOMs. The quarterly data of these DISCOMs will be collected and monitored by the government to suggest measures for increasing the efficiency and reduce the energy loss."

Notification

Now the government has notified a set of regulations that mandates all power distribution companies (DISCOMs) to undertake annual energy audits. In a gazette notification published on April 15, the Ministry of Power said that the Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit (Accounting) in electricity distribution companies) Regulations, 2021, "shall extend to all electricity distribution companies." It added, "Every electricity distribution company shall have its first energy audit (accounting) conducted, by accredited energy auditor within 04 months from the date of coming into effect of these regulations."

Major Points

- Annual energy audits mandatory for all DISCOMs; Government notifies the regulations.
- Every DISCOM shall have its first energy audit conducted, by accredited energy auditor within 4 months from the date of coming into effect of these regulations.
- The first energy audit conducted shall take into account the energy accounting of electricity distribution company for the last 12 months.
- Every electricity distribution company shall conduct energy audit (accounting) for every financial year within a period of three months from the expiry of relevant financial year.
- "There shall not be a gap of more than twelve months between two energy audits (accounting)," according to the Bureau of Energy Efficiency (Manner and Intervals for Conduct of Energy Audit (Accounting) in Electricity Distribution Companies) Regulations, 2021. The Discoms were earlier mandated to conduct an external audit once every three years.
- The external auditor will now verify the energy flow across the entire distribution chain of the Discom, from feeders and transformers to the consumer.
- The audit report shall "identify the areas of energy leakage, wastage or inefficient use" along with "high loss-making areas, for initiating target based corrective action," the notification said. The report will also provide for monitoring of input energy and consumption patterns to various voltage levels.
- In February, the union budget announced a Rs. 3.05 trillion financial assistance scheme for bleeding Discoms, most of which are controlled by State governments. The scheme will make annual payment transfers contingent upon the Discom improving its financial health.

Contributed by **O.P. Taneja**, *Energy Advisor*

Letters to the Editor

Dear reader,

It is our endeavour to make IWTMA Magazine Indian Wind Power, 'The Magazine' for the Indian Wind Industry. Your feedback on the general impression of the magazine, quality of articles, topics to be covered in future, etc. will be of immense value to us. We are thankful to your response. Kindly address your mail to 'associatedirector@indianwindpower.com.' All earlier issues are available on our website.

Thank you,

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India Needs to Generate 83% Power from Renewable Means

India would need to generate at least 83 per cent of its electricity from renewable (non-hydropower) sources by 2050, if it was to commit to achieving net-zero greenhouse gas emissions by mid-century. This would mean a massive 55-fold increase in use of non-hydro renewables in electricity generation within the coming three decades, from only 160 Terawatt-hour (TWh) (10 per cent) in 2019. This was revealed in a first-of-its-kind analysis, 'Peaking and Net Zero for India's Energy Sector CO_2 emissions', released by the Council on Energy, Environment and Water (CEEW), an Asia-based policy research institute. The study highlights that to achieve net-zero by 2050 the share of electricity in India's industrial energy use must rise three-fold, from 20.3 per cent in 2018 to 70 per cent in 2050.

Source: TNN, March 24, 2021

First Turbine Stands at World's Largest Wind Farm in Inland Fresh Waters in Netherlands

The first of the 89 numbers 4.3 MW wind turbines has been installed at Windpark Fryslân, the world's largest wind farm in inland fresh waters. Located in the IJsselmeer Lake and some six kilometres off the Frisian coast, the Netherlands, the 382.7 MW Windpark Fryslân wind farm is being constructed by the Zuiderzeewind consortium of Van Oord and Siemens Gamesa. The turbine components are feedered from ships and barges to the Sarens Soccer Pitch, a working platform devised specifically for this project.

Source: Offshorewind.biz, March 24, 2021

Actis to Invest $850 Million in Two Green Energy Platforms in India

Private equity firm Actis plans to invest $850 million to build two green energy platforms in India – one for its grid-connected solar and wind power parks and another for its commercial and industrial (C&I) segment in the country from the Actis Energy 5 LP fund. The move highlights growing investor interest in India's renewable energy space. Investment in the grid-connected solar and wind parks platform will be around $600 million and for the C&I platform will be around $250 million.

Source: Money Control, March 29, 2021

Fossil Fuel Stocks Lost $120 Bn in Decade: Analysis

Share offerings in fossil fuel producing and related companies lost $123 billion in the last decade, underperforming a baseline world equities index by 52%, according to analysis released. The trend was in stark contrast to gains made in renewable energy initial public offerings (IPOs), according to the analysis by industry think tank Carbon Tracker, which lays bare the yawning losses faced by investors in high-carbon energy. Issuance of fossil fuel offerings fell by 85% from $70 billion to $10 billion in the period analysed from 2012-2020. This contrasted with a record $11 billion in renewable public equity offerings, it found.

Source: AFP, March 31, 2021

Roaring Success of Floating Scottish Windfarm Shows Global Potential

It took 10 years to develop the first floating windfarm and it seemed to some a dangerous gamble to put it 15 miles off Aberdeen in the stormiest waters of the North Sea. But after three years of being in operation it has broken world records for maximum output. Its success even outstrips the speed with which Europe's other offshore windfarms, those standing in shallow water, have gone from being an expensive renewable option to a mainstream power source. Floating windfarms' worldwide potential is even greater.

The scale of the first five floating turbines is staggering– 175 metres above the sea with another 75 metres below to balance the weight of the tower and the rotor blade with a diameter of 154 metres. The enormous height makes them a commercial success because further out to sea they can catch a steadily blowing wind and deliver more power. It has allowed them to cut costs by 40%.

Source: The Guardian, 30 March, 2021

Power Generators Can Exit Loss Making Contracts with States

The government has given freedom to the central sector power producers such as NTPC, NHPC and SJVN to sell power relinquished by state discoms to new buyers under long or short-term contracts or place the surplus power on exchanges for discovery of price in the day ahead, term ahead and real time markets. The move is expected to provide new avenues to central generating stations (CGS) who could now find buyers with better paying capacity for power relinquished by state discoms that have often been found to delay payment to power generators. Total dues owed by electricity distribution companies to power producers have risen sharply to reach closer to Rs 1.40 lakh crore now, reflecting deep stress in the sector.

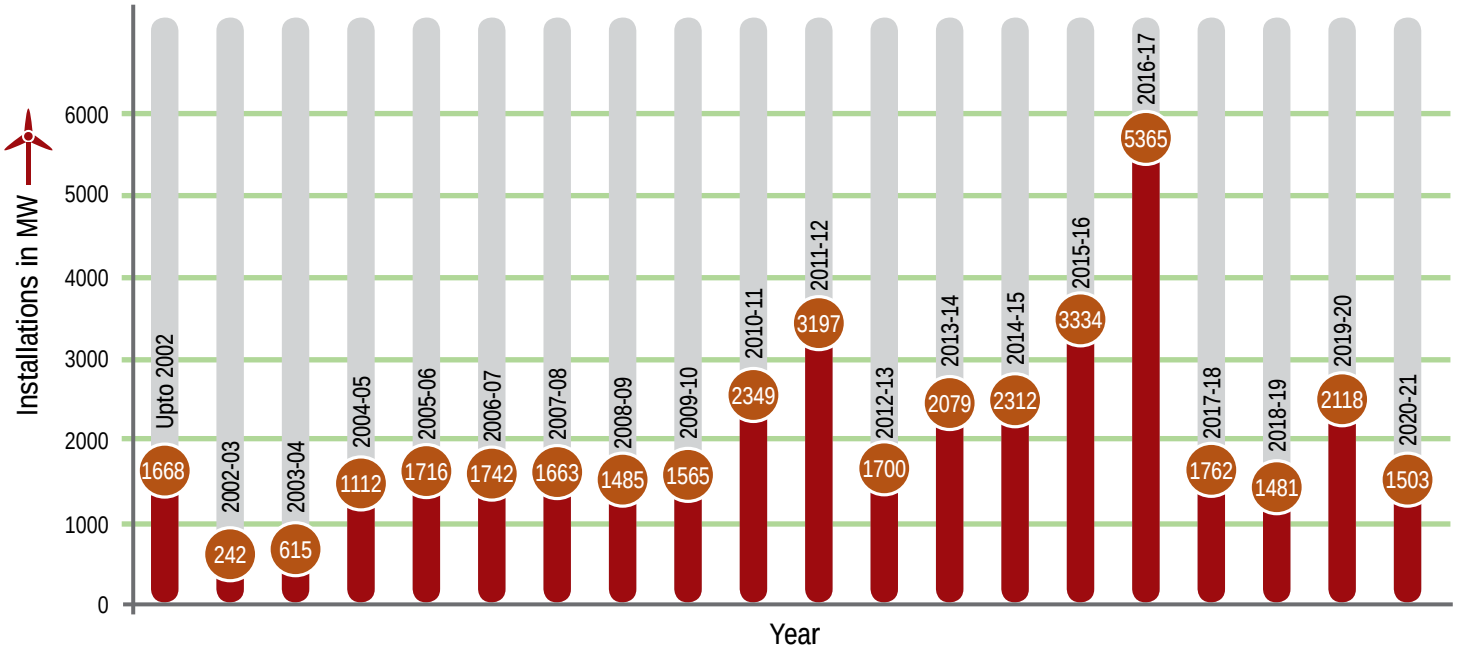
Source: IANS, March 25, 2021

India, United States to Revamp Energy Ties; To Focus on Cleaner Energy Sectors

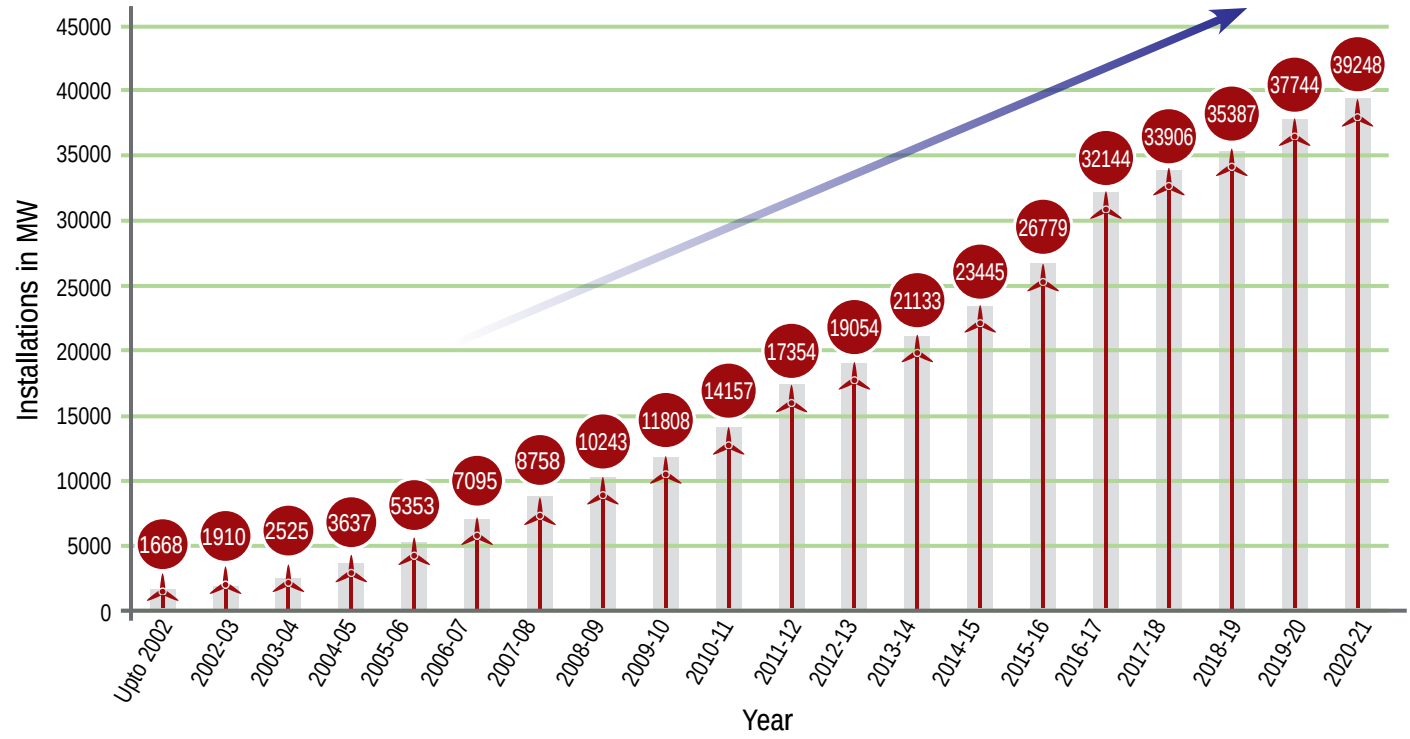
Oil Minister Mr. Dharmendra Pradhan had an "introductory meeting" with US Secretary of Energy Ms. Jennifer Granholm. The two leaders reviewed the India-US Strategic Energy Cooperation (SEP). The two nations will intensify efforts to take advantage of advanced US technologies and India's rapidly growing energy market, the statement said. Both leaders agreed to revamp the India-US SEP to reflect the new priorities of Prime Minister Narendra Modi and President Joe Biden with focus on promoting clean energy with low-carbon pathways and accelerating green energy cooperation.

Source: PTI, March 30, 2021

Year-wise Wind Power Installations in India (MW)



Cumulative Wind Power Installations in India (MW)



Note: The data may vary slightly as they have been taken from various sources and due to rounding off and also because the cumulative installations has been changed to operational installations.

Infosys and BP to Drive Integrated Energy Offers to Reduce Emissions at Campuses and Cities

Infosys and BP have signed a MoU to work together to develop an integrated Energy as-a-Service (EaaS) offering that will provide end-to-end management of a customers' energy assets and services. Together, the companies intend to explore opportunities using bp's energy and mobility expertise and Infosys' digital capabilities to manage energy assets, provide low carbon power, low carbon heating/cooling, and low carbon mobility to campuses, driven by an AI based digital platform. bp's integrated energy offer draws on technologies and businesses in solar and wind together with gas for power, fuels, electric vehicle charging, battery swapping and advanced mobility solutions. Infosys achieved carbon neutrality in 2020 – 30 years ahead of the timeline set by the Paris Agreement. bp has an ambition to become a net zero company by 2050 or sooner and help the world get to net zero.

Source: Solar Quarter, 27th April, 2021

Power Ministry Urges States to Organise Vaccination Camps for Electricity Sector Employees

The functioning of hospitals and testing laboratories is largely dependent on round-the-clock electricity supply, and power engineers and the technical staff of discoms play a major role in the fight against COVID-19. The Ministry of Power has urged states to organise mass COVID-19 vaccination camps for power sector employees on priority in coordination with electricity utilities and their health departments, industry body AIPEF said.

Source: PTI, April 28, 2021

MNRE Announces Guidelines for PLI Scheme for Solar PV Modules

The Ministry of New and Renewable Energy (MNRE) has released guidelines for the production-linked incentive (PLI) scheme to promote manufacturing of high efficiency solar PV modules in India and Rs 4,500 crore has been approved and allocated under the scheme to be spent over a period of five years. Indian Renewable Energy Development Agency (IREDA) will be the implementing agency and beneficiaries would be selected through a transparent bidding process. Preference will be given to manufacturers who set up higher capacity plants. However, in order to qualify for the bid, the applicant manufacturer will have to undertake to set up a manufacturing plant of minimum 1,000 MW capacity.

+The scheme is also aimed at promoting the setting up of integrated plants for better quality control and competitiveness, to develop an ecosystem for sourcing of local material in solar manufacturing, generate employment, and reducing import dependence. The guidelines further said that greenfield new solar PV module manufacturing units would be eligible for PLI and brownfield projects will also be allowed to participate under the eligibility criteria.

Source: ET Energy World, Updated: April 29, 2021

Texas Icing Event Led to Over $4 Billion Financial Loss for Wind Farms - Study

ArcVera Renewables has published its report "ERCOT Market Cold Weather Failure 10-19 February 2021: Wind Energy Financial Losses and Corrective Actions". The study set out to quantify the lost energy production and calculate the financial impact of the rare Texas winter weather event. It is focused on wind farm outages reported by the Electric Reliability Council of Texas (ERCOT) grid operator for the period 14-19 February 2021, when the grid experienced extensive wind farm downtime, lost energy production, and high hub-settled electricity prices. Three repricing scenarios are evaluated using market pricing before the imposition of $9000/MWh prices by ERCOT.

The icy weather conditions and an unprecedented period of below-freezing temperatures caused extensive wind farm downtime. The study analyzes the outage periods documented by ERCOT for 191 wind farm units, with a nominal capacity of 21,888 MW, of which 57% (12,495 MW) is subject to a hedged financial structure. The findings of the study show the lost energy production from wind farms, aggregating individual wind farm results, was 629,700 MWh with a financial impact of this lost production, whether the financial loss to the owner or gain by others, estimated at $4.18B. This represents an average financial impact on any project of $44.4M. For hedged projects, the financial impact of this lost proxy production is even greater, with an average financial impact of $45.4M.

Source: Arcvera, 26th April 2021

Wind Energy Industry Set to Create 3.3 Million Jobs Globally By 2025

The global wind energy industry is set to grow at a 4 per cent Compounded Annual Growth Rate (CAGR) through 2025, with additional 470GW of capacity creation, helping create 3.3 million jobs in onshore and offshore wind over the period, according to a new report by the Global Wind Energy Council (GWEC). A historic 93 GW of new wind capacity was installed in 2020 despite the impacts of COVID-19, making last year a record year for onshore wind growth and the second-best year for offshore wind growth, demonstrating the resilience of the wind industry and a signal that the industry and global supply chain can continue to deliver. By 2025, GWEC expects more than 1,210 GW of installed onshore and offshore wind capacity around the world.

Source: ET Energy World, April 29, 2021

India Needs $401 bn CapEx to Fight Climate Change

India needs over USD 400 billion in capital investment which could save over 100 GW of energy and 1.1 billion tonne of greenhouse gasses between 2015 and 2030, if it goes ahead with the measures to control pollution under the Paris climate agreement, says a report. Since the country is set to far exceed most of its 2015 Paris Agreement targets on climate change, analysts are keenly watching whether India raises its pollution curtailment targets or signals a 'net carbon neutrality' deadline at the two-day Climate Summit that began on 22nd April 2021.

The government's push towards blending ethanol up to 25 per cent and move towards green hydrogen are encouraging, Bank of America Securities said in a note on Thursday-- which is the Earth Day and also the opening day of the two-day climate summit being pushed by US President Joe Biden.

"Over 2015-30, India could drive USD401 billion in capex, which could lead to over 106 gw in energy savings, and 1.1 billion tonne per annum reduction in Co2 and impacting 99 stocks with a market capitalisation of USD 1.4 trillion," Bank of America said in a note. The report expects India to step up its emission curtailment targets by 2047 and announce the same at the summit. Several large global economies have committed to be carbon neutral by 2050; and China has set a 2060 target. The BofA has identified two more new themes in India's fight against pollution-- blending ethanol, and green hydrogen-- adding to the seven themes already identified.

The government had ramped up ethanol blending within petrol ratio from 1.4 per cent in 2014 to 5 per cent in 2020, 10 per cent by 2022 and to 25 per cent by 2025.

However, achieving 25 per cent ethanol blending by 2025 could be a challenge as it will require 10 billion litres of ethanol per annum vs current production of only 3 billion litres. On the green hydrogen drive, the report expects India to gain traction for green hydrogen sometime soon as the government is finalizing the National Hydrogen Energy Mission which would require fertilizers, steel and petrochemicals industries to shift to green hydrogen.

The government has indicated plans to blend hydrogen with CNG and leverage the CNG pipeline infra to reduce hydrogen transportation costs. A pilot project with 50 buses running on hydrogen-CNG fuel is currently underway in New Delhi.

Another pilot on hydrogen vehicles is being planned by NTPC, which could set up 1 mw electrolyzers in New Delhi and Leh, as a part of the project. Besides, Reliance has also indicated plans to use green hydrogen.

The Wall Street brokerage feels that these nine climate/pollution control themes can impact 99 stocks with cumulative market cap of USD 1.3 trillion.

It can be noted that the Railways which has set 100 per cent electrification target by FY23, has already recorded its highest ever route electrification in FY21 at 6000 km, which is 14 per cent higher than the previous best in FY19, taking the electrified route to 71 per cent of the total. Also, 23 per cent or 657 km of the mega rail project, DFC or the dedicated freight corridor is already live from December last and another 12 per cent will go live by April end.

On the renewable energy front driven by one of the largest RE programmes globally (175GW/450GW target by 2022/2030), share of non-fossil fuel-based energy in installed power capacity of has already reached 38 per cent as against the Paris Agreement target to achieve 40 per cent by 2030.

To further support this, the government has approved a Rs 4,500-crore production linked incentive scheme to create 10GW solar PV manufacturing capacity vs the current capacity of just 3GW for solar cells and 5GW for modules.

Courtesy: PTI, April 23, 2021

Snippets

Google-Four Years of 100% RE

Google said that it is proud to announce that in 2020 Google again matched 100% of its global electricity use with purchases of renewable energy. It has signed agreements to buy power from more than 50 renewable energy projects, with a combined capacity of 5.5GW.

It was the first company of its size to achieve this milestone back in 2017, and it has repeated the accomplishment in every year since. So what's next? It is now building to target an even larger ambition: by 2030, Google aims to run on entirely 24/7 carbon-free energy, everywhere it operates.

Source: Google.com, April 21, 2021

CORRIGENDUM

Indian Wind Power, Dec. 2020- Jan. 2021 issue

Page 3. Para 1.6.

'Again the draft Electricity (Amendment) bill 2000 is..

' Please read 2000 as **2020.**

Summary Action Plan for Achievement of 175 GW Renewable Energy Target

In March 2021, the Standing Committee on Energy (Chair: Mr. Rajiv Ranjan Singh) submitted its report on the action plan for achieving 175GW of renewable energy by 2022. As part of its climate pledge, India set a target to install 175 GW of renewable energy capacity by 2022. This includes 100 GW of solar energy, 60 GW of wind energy, 10 GW of biomass power, and 5 GW of small hydro power.

Solar Energy

National Solar Mission was launched in 2010 to promote solar power in the country. Under this, the central government aims to achieve 100 GW of grid-connected solar energy by 2022. The Committee noted that in over a decade since the launch, only 39 GW of solar energy capacity has been installed in the country. 36 GW of solar energy projects are under implementation. It recommended the central government to formulate strategic plans for expediting the process to achieve the target within the deadline.

- The rooftop solar programme was launched in February 2019. It was aimed at achieving 40,000 megawatts (MW) from rooftop solar projects by the year 2022. The Committee noted that in 2019-20, only 472 MW of the capacity was achieved against the target of 3,000 MW. The Committee stated that the target of 40 GW of solar energy capacity by 2022 is highly unlikely to be achieved. The Committee further stated that the lack of awareness of the programme among the people is one of the major reasons behind the slow progress of the programme. It recommended that the central government: (i) should widely advertise the benefits of having a rooftop solar power system and related incentives from the government, (ii) should set-up single window systems at the district level to facilitate the customer in installing the rooftop solar system, and (iii) may offer a higher subsidy for customers in lower income group.
- The Committee further recommended that the Ministry should formulate a long-term policy for developing and facilitating domestic solar manufacturing capabilities in the country. This will reduce the dependency on the import of equipment from other countries and generate employment.

Wind Energy

The Committee observed that since 2017-18, the Ministry has not been able to achieve its annual wind energy target. The Committee noted that 36 GW and 32 GW of offshore wind power potential exists off the coast of Gujarat and Tamil Nadu. It recommended that the Ministry should explore wind power potential in other coastal states.

Renewable Purchase Obligation

The Electricity Act, 2003 mandates licensees to produce or purchase a certain minimum quantity of their power requirement from renewable sources. This is called renewable power obligation (RPO). The Committee noted that the RPO compliance across India varies from 3.7% in Manipur to 250% in Karnataka. The Committee recommended that state regulatory commissions should ensure RPO compliance by enforcing penalties against defaulting entities. It also recommended that the carry forwarding or waiver of RPO must not be permitted.

Green Energy Corridor

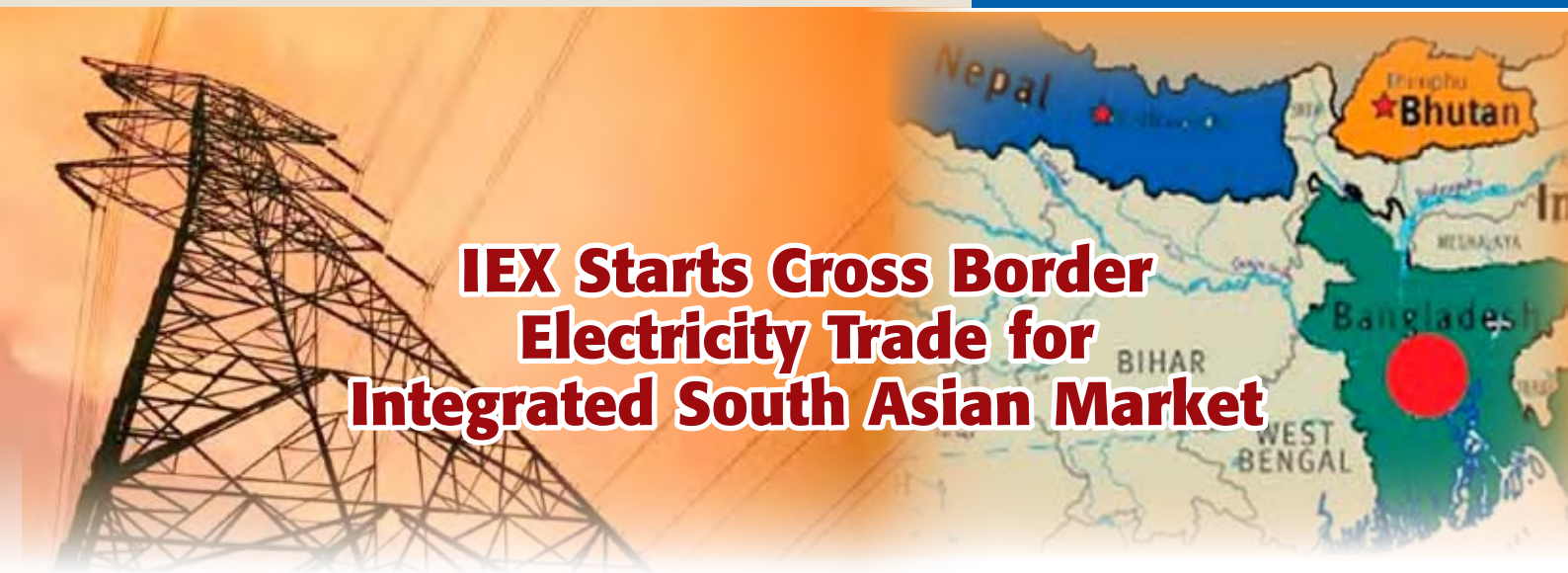
The green energy corridor project aims to synchronise electricity from renewable sources with conventional power stations in the grid. Since the launch of the project in 2015-16, transmission lines of length 7,365 circuit kilometres (ckm) have been constructed and substations of capacity 9,976 MVA have been commissioned (till December 31, 2020). The Committee observed that this is lower than the target of 9,700 ckm of transmission lines and 22,600 MVA sub-station capacity. The Committee stated that the main reasons for the low achievement of targets include inadequate monitoring by the Ministry of New and Renewable Energy and lack of priority to the project. The Committee recommended that the Ministry should work towards the timely achievement of targets under the green energy corridor project.

Financing of Projects

The Committee noted that Rs 2.6 lakh crore will be required over the next two years for the installation of 58 GW of renewable projects. It stated that attracting this investment will not be easy. The Committee recommended that the Ministry of New and Renewable Energy should mobilise long-term loans for upcoming renewable projects.

Further, the Committee noted that 86 renewable projects financed by Indian Renewable Energy Development Authority (IREDA) have become nonperforming assets (NPAs) with a total outstanding loan of Rs 2,111 crore (as of March 31, 2020). The Committee recommends that IREDA should review its project appraisal process for disbursement of loans to avoid the creation of NPAs. In addition, outstanding loans must be recovered expeditiously by relevant legal ways (such as auctioning assets).

Courtesy: PRS Legislative Research



IEX Starts Cross Border Electricity Trade for Integrated South Asian Market

The Indian Energy Exchange (IEX) has announced starting of cross-border electricity trade on 19th April 2021 on its platform in first-of-its-kind initiative for exchanges to expand their power markets beyond India to the south Asia region towards building an integrated regional power market. This follows notification of cross-border trade electricity (CBET) regulations by the Central Electricity Regulatory Commission (CERC) in 2019 and the recent notification of CBET rules in March.

NTPC Vidyut Vyapar Nigam (NVVN) has secured approval from the Central Electricity Authority (CEA) for Nepal's participation in the day-ahead market on IEX. Currently, the cross-border trade with neighbouring countries for India stands at about 18 biliion units conducted through the medium to long term bilateral contracts.

As per the CEA and CERC, India imports 8.7 BU from Bhutan and exports 2.37 BU and 7 BU to Nepal and Bangladesh respectively. The power trade with these countries is expected to increase to about 40 BU by FY22 and 70 BU to FY27, according to a study by IRADe.

While the macro-economic growth in south Asia region have been one of the strongest in the world, the region has been confronting with challenges related to power demand-supply balance and the low per capita power consumption.

Mr. S N Goel, Chairman and Managing Director of IEX, said India is a power surplus country with a large installed power generation capacity base of 382 GW and peak demand of about 185 GW. "We have a unique opportunity to lead the regional power market development and make efforts towards enhancing the energy access and security among neighbouring nations in the region," he said in a statement. "We are immensely delighted to welcome Nepal as the first country to commence the cross-border electricity trade in our day ahead electricity market."

IEX is working closely with leading provider of power trading solutions PTC, NVVN and all other designated nodal agencies for cross-border electricity trade to facilitate inter-country power trade through the exchange market. The power prices discovered at IEX provide a competitive benchmark as well as provide valuable signals for the value chain, it said.

Source: ANI, April 19, 2021

Snippets

California and US Agree to Allow Big Offshore Wind Power Farms

California and the U.S. government announced an agreement to open up areas off the state's central and northern coasts to massive wind energy farms. The plan includes floating 380 windmills across a nearly 1,035-sq km area that is 32 km northwest of Morro Bay. The site could be finalized next month and could be put up for lease next year. The announcement is part of President Joe Biden's plan to create 30 Gw of offshore wind energy by 2030. California set a goal to produce all electricity by 2045 through renewable energy resources and zero-carbon generating facilities.

Source: AP, May 26, 2021

COP26 Last Chance for World to Limit Global Warming

The United Nations COP26 climate action summit scheduled in Glasgow in November is the last chance for the world to limit global warming and stay on track to keep global temperature rises well below 2 degrees, said Alok Sharma, the British Indian minister in charge of the meet. Sharma outlined the UK's presidency of the summit across four key areas of limiting global warming to 1.5 degrees, enabling communities and natural habitats to adapt to the impacts of climate change, mobilising climate finance, and working together to deliver action. “Having been born in India, a proud British citizen, and having spent time as Secretary of State for International Development, I am committed that this COP will deliver for the communities most vulnerable to climate change,” said Sharma, who holds a Cabinet Office ministerial post. “We are pushing for action in vital areas like power generation, clean transport and halting deforestation; because if we are serious about 1.5 degrees, Glasgow must be the COP that consigns coal power to history. The COP that signals the end of polluting vehicles. The COP that tackles methane emissions. And that calls time on deforestation, by making sustainable production pay,” he said.

Source: PTI, May 15, 2021

We regret to inform our readers the passing away of **Dr. Sarvesh Kumar, President and Chief Operating Officer of RRB Energy Limited on 1st June 2021.** Dr. Sarvesh Kumar championed the cause of Wind Energy in India for over three decades. He was an outstanding wind energy pioneer, who brought modern wind energy technology to India and show cased its successful operations. He was the Chairman of the Indian Wind Turbine Manufacturers Association (IWTMA) from the year 2000 to 2005 and 2016-18.

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 Dr. Sarvesh Kumar.

May his Soul Rest in Peace.

Snippets

IKEA Aims to Run India Stores on RE by 2025

Furniture retailer IKEA plans to power its stores, warehouses and shopping centres entirely on renewable energy by 2025, even as Ingka Investments -the investment arm of parent Ingka Group is considering India for investments in renewable energy plants, the company said on Tuesday. It currently has two stores in India.

Source: Mint, April 20, 2021

No Saving the Planet without Booming India

The world's third-biggest carbon emitter, already home to 1.3 billion people, is projected by the UN to become the planet's most populous nation by the middle of the decade. Crucially for its carbon footprint, its urban population is set to rise the size of Los Angeles each year, totalling 270 million people by 2040, according to IEA. To meet the associated electricity demand over the next 20 years, India could need to add a power system the size of the European Union's, the IEA believes. "All roads to successful global clean energy transitions go via India," it said in a recent report. "The stakes could not be higher, for India and the world." Unlike many other countries, India is on track to exceed its voluntary goals under the 2015 Paris climate agreement.

Source: AFP, April 20, 2021

Electricity at the Heart of Saving the Planet

"Climate change is no different to a pandemic," says Pat O'Doherty, chief executive of Irish state-owned utility ESB. "And we need the same kind of mobilization of governments – the same togetherness – in the response to climate change as we have seen against Covid."

He said that during the coronavirus crisis, the power sector "has stood up and been counted".

"For 100 years, electricity has been at the heart of societal well-being: it's been an enabler of economic well-being. This is now the second coming of electricity. It places electricity right at the heart of societal transformation in saving the planet." "We are going to have 50 million heat pumps and 70 million electric vehicles – we can see that shift taking place before our very eyes: we are living that change.

Source: Smart Energy International, 25 May 2021

Global Leaders Call for Concrete Plans for Clean Energy for all by 2030 and Net-Zero Emissions by 2050

Leaders from the United Nations (UN), the private sector, national and local governments, youth and other organisations issued a joint call on May 26, 2021 for countries, businesses, cities and civil society groups to put forward their 'Energy Compacts' to show how they will achieve the goal of clean energy for all by 2030 and net-zero emissions by 2050. The 'Global Champion' ministers from over 30 countries have joined the call for urgent energy action in advance of the high-level dialogue, along with senior UN officials, climate leaders including the Presidency of the COP26 conference, CEOs, Mayors and youth activists.

Mr. Liu Zhenmin, UN Under Secretary-General for Economic and Social Affairs and Secretary-General of the Dialogue added that Energy Compacts could also help to limit temperature rise to 1.5 degrees, avoiding the worst consequences of climate change. Urgent action is needed as global temperatures are already 1.2 degrees higher than they were in the late 1800s, with climate-related disasters displacing millions of people.

Source: ET Energy World, May 26, 2021

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Editor: Dr. Rishi Muni Dwivedi

Know Our Member

Kintech Synergy Private Limited

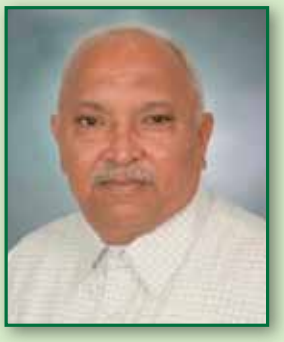
Kintech Synergy Private Limited is more than 25 year old Engineering, Procurement and Construction company established in 1995 by Mr. Jigar J Shah and Mr. A.C. Patel for harnessing the invisible power of Nature for human progress. Kintech Synergy is engaged in the business of turnkey wind and solar power solutions like land development, construction of substation and transmission line, wind turbine/solar panel installation and maintenance services.

Kintech is an ISO Certified Company which offers technical consultation and project execution in the field of wind power generation and distribution and is also a leading Service provider and has more than two decades of experience in wind turbine operation and Maintenance from a 55KW to 2MW Class WTG & BOP Maintenance. Kintech is the authorized service provider for Enercon wind turbines in India and is also engaged in the EPC business in the UK via its subsidiary company. Kintech is working across Gujarat, Rajasthan, MP, Maharashtra states in India and has 1300+ employees on pay roll.

Kintech provides a concept to commissioning solution for wind and solar farms and has an inhouse team for Designing, Construction, Testing & Commissioning of Power Evacuation System up to 400 kV and Transmission line up to 220 kV level for windfarm, Hydro & solar developer.

Since commencement with a meagre turnover of Rs. 10.43 lacs in the year 1995-96, Kintech has a group turnover of Rs. 250 Crores in 2019-20. Kintech is preparative from the beginning by endeavouring each client for their future and itself. Our dedication to offer absolute customer satisfaction and our valued relationship will persist the foundation for our next 25 years of success.

Mr. Jigar J Shah
Chairman and Managing Director



Mr. A.C. Patel
Technical Director

KINTECH WORK EXPERIENCE	UNITS
Power Evacuation	5745 MW
220 kV Transmission Line	289 km
132 kV Transmission Line	31 km
66 kV Transmission Line	50 km
33 kV Transmission Line	1256 km
Wind Turbine Unit Substation	967 Units
Wind Turbine Erection & Foundation	967 Units
Approach Road	696 km

Kintech has conception chronicle of Substation i.e., 220 kV Devikot, 220 kV Amrapur, 400 kV Asoj, 220 kV Virvav, 220 kV Motigop, 220 kV Babra, 220 kV Naranpar and 220 kV Vandhiya Substations and 132 kV Ludarva and Shikarpur and our upcoming projects is 'Design, Engineering, and Manufacturing & Construction of 220/66 kV GETCO Sevalia, 220 kV GETCO Metoda-GIS, and 220 kV Morjar Substation.'

220kV Ostro Sub-Station

Control Room

Erection of Wind Turbine

Ostro Line

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