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EDITORIAL



India's wind energy sector is experiencing significant growth, driven by both offshore and onshore developments. As of August 2024, India has installed 47,192 MW of wind power capacity, positioning it as the

fourth-largest wind energy producer globally. With over 7,000 km of coastline, India has immense potential for offshore wind, estimated at more than 500 GW. States like Tamil Nadu and Gujarat are leading in offshore wind projects.

On the Offshore Energy front, NIWE has initiated the offshore wind resource assessment and geophysical & geotechnical investigation for development of offshore wind farm of 500 MW at sub zone 1 Gulf of Mannar off Tamil Nadu coast under Model A. NIWE invited tender for Supply of meteorological and oceanographic data for a continuous period of minimum one year by deploying Integrated Floating Buoy with offshore LiDAR, Meteorological and Oceanographic Sensors (Wave, Current etc.) on LEASE BASIS at Sub Zone-1 in Gulf of Mannar off Tamil Nadu Coast in India including Comprehensive Operation and Maintenance for a period of 12 months.

The Wind Resource Assessment Division carried out data collection and analysis in Leh and Andaman and Nicobar Islands. The division also began the process of establishing a hybrid project within NIWE's premises to enhance NIWE's organizational profile, demonstrate operational efficiency in renewable energy systems, serve basic electrical needs, and provide a real-world example of wind turbine technology for student industrial tour at NIWE. The division has successfully completed eight Energy Yield Assessment projects and one Verification Procedure project, showcasing its expertise in critical areas of wind energy analysis and currently engaged in eleven ongoing consultancy projects.

Through our participation in Research tasks, NIWE is making a valuable contribution to the global wind energy community. As the official Country Member NIWE's Participation and its active soliciting & enabling key research partners

from India to participate in IEA Wind TCP's Research Tasks helps to drive innovation, improve efficiency, and address the challenges associated with large-scale wind power deployment.

The certification division of NIWE has signed an Agreement with M/s. Inox Wind Limited for Certification process for the Wind Turbine model "Inox DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 V2 (T-Bolt) Hub Height 100m IEC WT IIIB". The final stage of Certification process viz., Certification of 'PowerWind 56' Wind turbine model as per the scheme IS/IEC 61400-22:2010 has been completed and Type Certificate has been issued to M/s. Powerwind Limited.

The S&R division of NIWE has completed the Review of documentation for 05 numbers of RLMM applications of various wind turbine models submitted by wind turbine manufacturers for RLMM. Also the division has completed the review of documentation of two prototype wind turbine models.

The Skill Development and Training Division had conducted one National Training course with 46 participants and one Customised training for the officials of Gail (India) Ltd with 24 participants. NIWE was granted the status of an Awarding Body and Assessment Agency (Dual Recognition) by National Council for Vocational Education and Research (NCVET), Ministry of Skill Development and Entrepreneurship, Govt. of India. The division has also coordinated the student visit of 511 students to gain insights into Wind Energy. 27 students had completed internship at NIWE and six students are presently undergoing internship. The Vayumitra Skill Development project is progressing, to train 5010 participants and 690 trainers by March 2025.

As we wrap up this quarter, it's inspiring to see the rapid advancements in wind energy. These developments align with India's broader goals of achieving net-zero emissions by 2070. Together, we're making strides toward a cleaner, greener future for all. Let's keep the momentum going! We look forward to bringing you more exciting news in the next edition!

Dr. Rajesh Katyal, Director General

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Research and Development

NIWE's active contributions to IEA Wind TCP

NIWE continues its active participation in the International Energy Agency (IEA) Wind Technology Collaboration Program (TCP). Over the past three months, our researchers have been deeply involved in ideation for participation in several key research tasks with an aim to contributing significantly to the advancement of wind energy technology.

Key Research Tasks in focus are:

- Task 44-Flow Farm Control coordinates international research in the fields of wind farm flow control
- Task 51-Forecasting for the Weather Driven Energy System — Improving the value of renewable energy forecasts to the wind industry
- Task 52-Large-Scale Deployment of Wind Lidar
- Task 42-Wind Turbine Lifetime Extension

Through our participation in Research tasks, NIWE is making a valuable contribution to the global wind energy community. As the official Country Member NIWE's Participation and its active soliciting & enabling key research partners from India to participate in IEA Wind TCP's Research Tasks helps to drive innovation, improve efficiency, and address the challenges associated with large-scale wind power deployment.

By actively engaging in the IEA Wind TCP as the Country Member NIWE is positioning as a lead enabler in wind energy research and development in the Indian subcontinent.

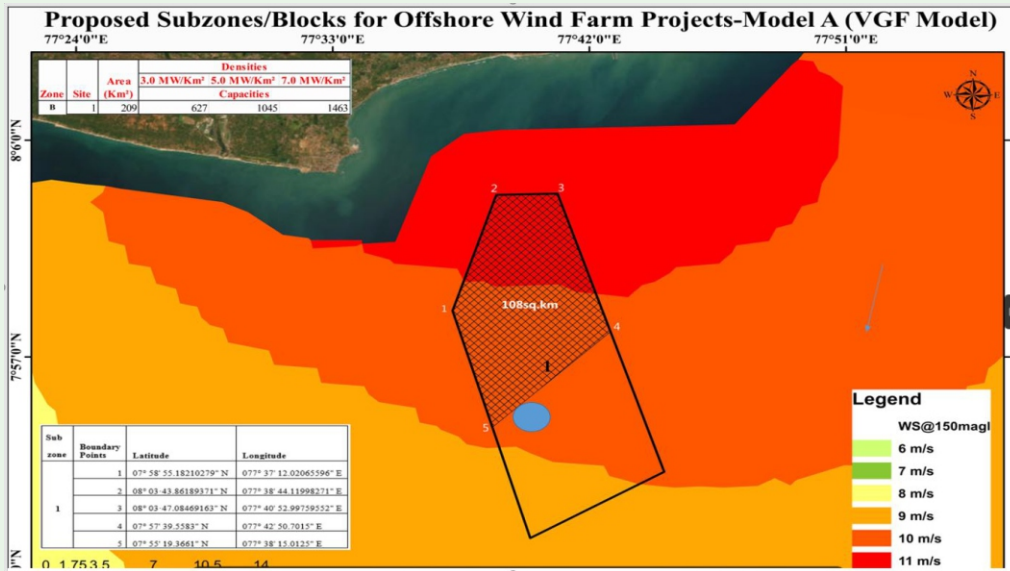
Offshore Wind Development

NIWE has initiated the offshore wind resource assessment and geophysical & geotechnical investigation for development of offshore wind farm of 500 MW at sub zone 1 Gulf of Mannar off Tamil Nadu coast under Model A. A latest progress on studies and surveys of Tamil Nadu coast is given below

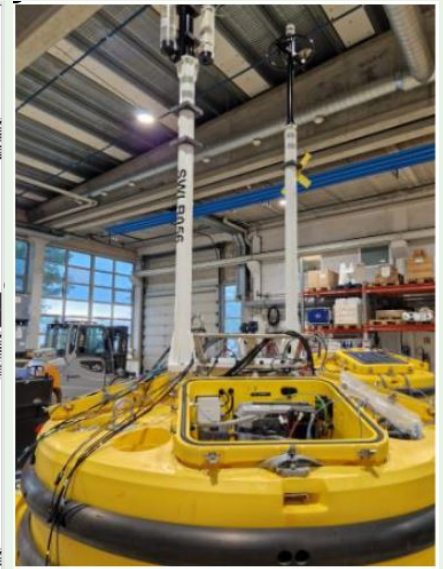
Offshore Wind Resource Assessment using Floating Buoy LiDAR system:

NIWE invited tender for Supply of meteorological and oceanographic data for a continuous period of minimum one year by deploying Integrated Floating Buoy with offshore LiDAR, Meteorological and Oceanographic Sensors (Wave, Current etc..) on LEASE BASIS at Sub Zone-1 in Gulf of Mannar off Tamil Nadu Coast in India including Comprehensive Operation and Maintenance for a period of 12 months. A Floating LiDAR buoy shall be deployed in the sub-zone 1 area of the Gulf of Mannar and shall measure wind speed and wind direction together with oceanographic data (waves, sea current, water level).

The work has been initiated, Pre-Deployment Validation has been completed at Froya, Norway. The site acceptance test has been completed and the buoy will be deployed soon at the Site



Location of floating buoy with offshore LiDAR



Integrated Floating Wind Lidar

Wind Resource Assessment

Wind Resource Assessment

Data Collection and Analysis

- Conducted data collection and analysis for the Pang site in Leh
- Performed rectification, data collection, and analysis for the Debring site in Leh
- Carried out rectification, data collection, and analysis for Manglutan, Bharatpur, and Sigmundera sites in the Andaman & Nicobar Islands; prepared a summary report

Site Identification and Surveys

- Associated with HIMURJA officials to conduct joint site identification and mapping of potential locations for wind monitoring studies in the Lahaul and Spiti districts of Himachal Pradesh
- Performed site surveys to identify suitable locations for establishing 150m meteorological masts for wind measurement in:
 - The state of Rajasthan
 - The state of Tamil Nadu

Research Activities

Maintenance and Repair Strategy for Wind Energy Development

- Participated in monthly meetings with collaborating institutions organized by DTU, Denmark
- Presented progress and plans for Work Package 1 (Wp1)
- Initiated the process of organizing a stakeholder workshop as part of Work Package 6.

The wind farm SCADA control system

- Conducted meetings with developers regarding Phase II activities for implementing the SCADA system at other pooling substations in Bhuj
- Performed maintenance activities through NIWE/Contractor
- Began the process of extending the SCADA control system to Jaisalmer, Rajasthan.

DST – TARE Research Project

- NIWE had taken up a collaboration research project with SRM Institute of Science and Technology (SRMIST) titled “Development of Fault-tolerant Reconfigured Power Converter for Enhancing Resilience of DC Microgrid” funding from the Department of Science and Technology (DST) under the Teachers Associateship for Research Excellence (TARE) scheme. This project aligns with India's current growth trajectory in the renewable energy sector, particularly in the implementation of hybrid projects nationwide.
- Began the process of establishing a hybrid project within NIWE's premises to enhance NIWE's organizational profile, demonstrate operational efficiency in renewable energy systems, serve basic electrical needs, provide a real-world example of wind turbine technology for student industrial tour at NIWE.

Data Analytics

Consultancy projects

The WRA Division has made significant strides in its consultancy services, demonstrating its commitment to supporting various stakeholders within the wind industry. The division has successfully completed eight Energy Yield Assessment projects and one Verification Procedure project, showcasing its expertise in critical areas of wind energy analysis. In addition to these completed projects, the WRA Division is currently engaged in eleven ongoing consultancy projects. Through these efforts, the WRA Division continues to play a crucial role in advancing the understanding and development of wind energy resources.

RE Projects

2 MWp Ground Mounted Grid Connected Solar Power Plant at Indian Institute of Management (IIM)-Trichy and 1 MW (AC) Ground Mounted Grid Connected Solar Power Plant at Madurai Kamaraj University (MKU), Madurai

- The division is actively managing two significant solar power projects at prominent educational institutions. These include a 2 MWp ground-mounted, grid-connected solar PV power plant at the Indian Institute of Management (IIM) Trichy campus and a 1 MW (AC) ground-mounted, grid-connected solar power plant at Madurai Kamaraj University (MKU), Madurai.
- The management process involves daily reviews of solar power generation data, complemented by periodic site visits to inspect critical components such as solar arrays, inverters, and transformers. Additionally, there is close oversight of Operation and Maintenance (O&M) activities, including module cleaning, string checks, and equipment testing.

- These activities are meticulously conducted in accordance with established operational and maintenance agreements. The primary objectives of this proactive approach are to ensure proper maintenance of the solar assets, optimize their performance, and maximize clean power generation from these grid-connected plants. This rigorous management strategy underscores the organization's commitment to maintaining the efficiency and sustainability of these renewable energy installations, contributing significantly to the green energy initiatives of these educational institutions.

Other Works

The Division Head and Engineer conducted a site feasibility study in Leh and Ladakh, along with SECI officials and manufacturers, for the establishment of a wind farm in the Leh and Ladakh region from 15.07.2024 to 20.07.2024.



Publications

“Repair of Wind Turbine blades: Experience and observations from India – A Review” - Published in Wind Energy Science (European Academy of Wind Energy). Authors: Refugine Nirmal Ignacy Muthu, Leon Mishnaevsky, Saravanakumar Savadaiyan, Thamodharan Krishnaraj, Anthonyraj Premkumar, Mohammed Farook, Kadirvel Boopathi DOI: <https://doi.org/10.5194/wes-2024-55>.

Certification & Information Technology

- The final stage of Certification process viz., Certification of 'PowerWind 56' Wind turbine model as per the scheme IS/IEC 61400-22:2010 has been completed successfully and Type Certificate has been issued to M/s. Powerwind Limited.
- NIWE has signed an Agreement with M/s. Inox Wind Limited for the first stage of Certification process viz., Pre-evaluation of “Inox DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 V2 (T-Bolt) Hub Height 100m IEC WT IIIB” wind turbine model in connection with Type Certification. The Pre-Evaluation (First Stage) of Type Certification has been completed.
- NIWE has signed an Agreement with M/s. Inox Wind Limited for the second stage of Certification process viz., Evaluation of “Inox DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 V2 (T-Bolt) Hub Height 100m IEC WT IIIB” Wind turbine model in connection with Type Certification.

Visits made by Division Staff

- Division Head visited Rohika Village, Bavla Taluk in Ahmedabad district of Gujarat to carryout manufacturing evaluation of rotor blades in the factory.
- Visited Sandur site, Karnataka to inspect the wind turbine failure as per the directives of MNRE along with KREDEL officials
- Visited Rajpimpri site in Beed District of Maharashtra to carryout wind turbine failure analysis along with MEDA officials.
- Visited Parathodu Village, Pushpakandam Post, Kerala to conduct the Periodic Surveillance of the 'Siva 250/50' wind turbine model in connection with the maintenance of the Type Certificate issued to M/s. Siva Windturbine India Private Limited

INFORMATION TECHNOLOGY

- Continued to maintain the IT infrastructure to keep servers, storage, systems, and software up and running.
- Continued to provide IT support for users at NIWE and its stakeholders.
- Prepared tender documents for the procurement of new hardware, software, and AMC services.
- Completed Restructuring of CCTV infrastructure in NIWE, Chennai.

Web Portals

Design and development of the NIWE website in line with GIGW guidelines is in progress.



Testing, Standards and Regulation

TESTING

- Power Performance Measurements as per IEC Standard (IEC 61400-12-1:2017) for “INOX DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 (T-Bolt), Hub Height 100 m IEC WT Class IIIB” wind turbine with 3.3 MW capacity under Power Booster mode are ongoing at Rajkot, Gujarat for M/s. Inox Wind Limited.
- In addition, a Service agreement has been signed on 12.06.2024 to carry out Load Measurements, Safety & Function testing for “INOX DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 (T-Bolt), Hub Height 100 m IEC WT Class IIIB” wind turbine with 3.3 MW capacity under Power Booster mode and Measurements are ongoing at Rajkot, Gujarat for M/s. Inox Wind Limited.



Onsite reassessment audit by NABL (for renewal of accreditation) at WTTS, Kayathar



Onsite reassessment audit by NABL (for renewal of accreditation) at WTTS, Kayathar



Safety and Function Test of (INOX DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 (T-Bolt), Hub Height 100 m IEC WT Class IIIB” wind turbine with 3.3 MW capacity under Power Booster mode at Rajkot, Gujarat)



- Conducted Safety and Function Test for “INOX DF/3000/145 3.0 MW Power Booster Mode 3.3 MW Rotor Blade Type SR71 (T-Bolt), Hub Height 100 m IEC WT Class IIIB” wind turbine with 3.3 MW capacity under Power Booster mode at Rajkot, Gujarat for M/s. Inox Wind Limited.
- Dr. Rajesh Katyal, Director General, NIWE, Shri. A. Senthil Kumar; Director & Division Head (T, S&R), Shri. N.Rajkumar, Additional Director and Shri. A. Hari Bhaskaran, Deputy Director (Technical) along with MPIDC official attended a hybrid meeting on 05.07.2024 with global players in the field of calibration wind tunnels to discuss and understand the requirements for establishing the proposed Calibration Wind Tunnel facility in the industrial area Mohasa Babai at Narmadapuram.

Achievement

- Undergone onsite reassessment audit held on 27.07.2024 and 28.07.2024 at WTTS, Kayathar conducted by NABL for renewal of accreditation of Testing services as per ISO / IEC 17025:2017 successfully. Further, NABL has granted certificate of Accreditation dated 03.08.2024 for the scope of Testing services (Power Performance, Load Measurements, Yaw efficiency, Safety and Function Testing and Duration Testing) for Permanent (WTTS, Kayathar) and site facility which is valid till 02.08.2026.

Publications

- Shri A. Hari Bhaskaran, Deputy Director (Technical) published a paper on 'Optimization of India's offshore wind farm capacity density - a case study'. Environment Devevelopment and Sustainability (2024), Springer Nature. <https://doi.org/10.1007/s10668-024-05278-x>
- Shri A. Hari Bhaskaran, Deputy Director (Technical) published a paper on 'Towards sustainable energy: integrating ERA5 data for offshore wind farm

planning in India', Engineering Research Express, IOPScience. <https://doi.org/10.1088/2631-8695/ad7938>

STANDARDS AND REGULATION

- Review of documentation has been completed for 05 numbers of RLMM applications of various wind turbine models submitted by wind turbine manufacturers for RLMM. Further, technical support has been provided to MNRE for implementation of Revised Lists of Models and Manufacturers of wind turbines (RLMM) process.
- Organized the first meeting of the Committee for “Ramping Up Domestic Wind Manufacturing Capacity 2024” under the Chairman of DG, NIWE, held on 07.08.2024 at NIWE, Chennai. The meeting was attended by committee members, Director & Division Head, S&R and Division engineer.
- Organized the Prototype committee meeting Chaired by DG, NIWE held on 08.08.2024 through Video Conference.
- Completed the review of documentation of two prototype wind turbine models. Subsequently, a letter has been issued in connection with grid synchronization for one prototype wind turbine model, as decided by the Prototype Committee.
- Shri. A. Senthil Kumar, Director & Division Head, S&R, as Management Representative (MR) and the division engineer as Deputy Management Representative (DMR) carried out various activities for DNV Second Periodic Audit of QMS as per ISO 9001:2015, which was held on 04.07.2024 & 08.07.2024 at Kayathar and Chennai respectively.
- Based on successful completion of Second Periodic Audit of Quality Management System of NIWE as per ISO 9001:2015, DNV recommended for continuation of Certification as per ISO 9001:2015 for NIWE.
- The continual improvement and maintaining the quality management system are ongoing.

Skill Development and Training

TRAINING PROGRAMMES

Special Training Course for the officials of Gail (India) Ltd.

The Skill Development and Training Division of NIWE had successfully conducted the special training course on "WIND ENERGY TECHNOLOGY" for the officials of Gail (India) Ltd held during 24.07.2024 to 26.07.2024. The course addressed all aspects of Wind Power starting from what is wind to wind resources assessment, project implementation and operations & maintenance aspects in a focused manner along with offshore wind aspects towards going for economically viable wind farm projects. A total of 24 participants working in different facets of projects have participated in the course. The Programme Director, Dr. P. Kanagavel, Director & Head, SDT Division, NIWE inaugurated the course along with few participants.



Lighting the lamp during inauguration of the course

During the 3 days course, 11 classroom lectures were scheduled apart from visit to wind turbine training facility. The course content of the training was handled by Scientists and Engineers of NIWE, who have years of experience in the field.



Glimpses of lecture Sessions



Participants at the Vestas Training Facility

The participants were taken to the training facility of M/s. Vestas Wind Technology India Pvt. Ltd., Ammapettai, Chennai which provided valuable insights into the various components and its finer points in the installation and maintenance of wind turbine. The simulator method which also was supported by having a close look of even the smallest component by means of a Virtual Reality demonstration gave a comprehensive view of the layout and equipment positioning of a wind turbine. The visit to the prototype installation, which had all the components of a wind turbine was equally impressive. The participants also had a bird's eye view of the Blade repair centre of Vestas.

Dr. P. Kanagavel, Programme Director had distributed the Course Certificates to all the participants. Some of the participants shared their feedback and stated that the training had encouraged a positive learning environment and found it very beneficial. The factory visit of Vestas was well appreciated and helped them to gain good and practical knowledge of what they have studied in classroom lectures. They also expressed their appreciation to NIWE for organizing the training course.



Dr. P. Kanagavel distributing the Course Certificate

26th National Training Course

The Skill Development and Training Division of NIWE organized the 26th National Training Course on "Wind Energy Technology" from 21.08.2024 to 23.08.2024 to address all aspects of Wind Power starting from introduction to wind and its technology, wind resource assessment, installation and commissioning, operation and maintenance aspects of wind farms in a focused manner along with financial and policy aspects. The course was attended by 46 participants from 9 States viz. Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Telangana and Uttar Pradesh and 2 Union Territories viz New Delhi and Pondicherry. There were 35 male and 11 female participants with diverse background attended the training course.

The training course was inaugurated by Dr. P. Kanagavel, Director & Head, SDT Division, NIWE with the training participants. The 11 presentations made during the training course were handled by nine Scientists / Engineers of NIWE.

The participants visited the Renewable Energy facilities available in NIWE campus for practical exposure, and had an opportunity to understand the Water Pumping Wind Mill, Vertical and Horizontal Axis Small Wind Turbines, Wind-Solar Hybrid System, Wind Turbine Nacelle, Wind Monitoring Station - Meteorological Mast, LiDAR, Solar Calibration Laboratory and Solar Radiation Resource Assessment (SRRA) Station.



Visit to Wind Turbine Nacelle



Visit to LiDAR while measuring the Wind parameters



Data Logger in the Met Mast being explained



Visit to Solar Calibration Laboratory

During the Valedictory Function, some of the participants shared their feedback. The participants stated that NIWE had provided a nice opportunity to gain knowledge on wind technology with very good presentation and neat explanations. They also expressed their appreciation to NIWE for organizing the training course. Thereafter, Dr. P. Kanagavel, Director & Head, SDT Division, NIWE thanked the participants for their appreciation and distributed the Course Certificates to all the participants.



Distribution of Certificate



Group Photo with Course Participants

Vayumitra Skill Development Programme (VSDP)

Ministry of New & Renewable Energy (MNRE), Government of India has sanctioned, “Vayumitra Skill Development Program (VSDP)” to create skilled workforce for the Indian wind energy sector especially the trained manpower for the operation & maintenance of wind farms in the country as per the industry demand/needs so as to achieve the Government of India targets and other future targets.

In this regard, the second EOI was floated, received responses from 18 Training Partners out of which 15 were shortlisted by the committee formed for the purpose. Physical Verification of these 15 Identified Institutes are being done and allocation of ToP Batches to new Training Partners will be done shortly.

National Council for Vocational Education and Training (NCVET)

NIWE was granted the status of an Awarding Body and Assessment Agency (Dual Recognition) by National Council for Vocational Education and Research (NCVET), Ministry of Skill Development and Entrepreneurship, Government of India and also developed a Qualification Pack titled “Wind Farm Engineer” which has been subsequently uploaded in the National Qualification Register (NQR). An Agreement to this effect was signed on 27.08.2024 between NCVET and NIWE for having obtained Dual Recognition as Awarding Body (AB) and Assessment Agency (AA).

Students & Training Participants Visit

To create awareness and to motivate towards research on wind energy, achieving the indigenization and also to create awareness about the activities and services of NIWE, schools and college students are encouraged to visit the campus.

During the period from July to September 2024, the following visits were coordinated and 511 students had attended the same.

S.No.	Name of Institution	No. of Students	No. of Staff	Visited on
1	Vestas, Chennai	38	1	03.07.2024
2	Veltech Hightech Rangarajan Dr Sagunthala Engg. College, Avadi	60	1	12.07.2024
3	Sathyabama Institute of Science & Tech., Chennai	53	1	13.08.2024
4	VIT, Bhopal	60	1	09.09.2024
5	VIT, Bhopal	60	1	11.09.2024
6	VIT, Bhopal	60	1	13.09.2024
7	VIT, Bhopal	60	1	17.09.2024
8	VIT, Bhopal	60	1	18.09.2024
9	VIT, Bhopal	60	1	20.09.2024

Internship Programme

The “NIWE-Academic Associate Programme” (NIWE-AAP) aims to encourage students and provide an opportunity to choose renewable energy as their career option. To create awareness and interest in the field of renewable energy research among the young talented Sciences, Management and Engineering students NIWE invites applications from the eligible candidates for the “NIWE-Academic Associate Programme” (NIWE-AAP).

The duration of the Internship will be two weeks to six months. NIWE-AAP will provide opportunities for the students/post studies students/ Lecturers/Professors to work with scientists/engineers on NIWE's projects.

During the period from July to September 2024, 37 applications were received out of which 27 students got enrolled. 27 students were issued Internship Certificates and 6 are undergoing Internship.

From the commencement of the NIWE-Academic Associate Programme (NIWE-AAP), One hundred and sixty three (163) Internship Certificates were issued to the successfully completed Interns.

"Unleashing the Power of Mycelium: Lessons for India's Wind Energy"

Author : J.C. David Solomon, Director & Head, R&D Division, WTRS (Incharge) - Email : david@niwe.res.in

In the heart of India's forests, a hidden network thrives. Mycelium, the vegetative part of fungi, weaves an intricate web of connections, fostering symbiotic relationships and facilitating the exchange of nutrients. As India embraces wind energy, can we draw inspiration from the humble mycelium to revolutionize our approach?

Just as mycelium breaks down organic matter and distributes nutrients, wind energy can be taken to local communities to harness their own power. By installing smaller, community-owned turbines, India can mimic mycelium's distributed network, reducing reliance on conventional fuel based power plants. Mycelium's network allows it to thrive in diverse environments, adapting to local conditions and leveraging available resources. Similarly, India's wind energy sector can benefit from enabling local communities to harness their own wind resources. By installing smaller, community-owned turbines, India can reduce reliance on transmission infrastructure, promoting energy democracy and self-sufficiency. This way of community partnership in wind energy can also accelerate rural development, providing energy access to remote communities and stimulating local economies. By generating power locally, communities can reduce energy costs, enhance energy

security, and create new economic opportunities. It can also foster community engagement, education, and ownership, ensuring that benefits are shared equitably and projects are tailored to local needs. Furthermore, this novel way of reaching out to wind energy can help India achieve its renewable energy targets while minimizing the environmental impact. By dispersing wind turbines across the landscape, India can preserve natural habitats and promoting ecological balance. By embracing a rural community engagement India's wind energy sector can become more inclusive, sustainable, and resilient – much like mycelium's adaptable and decentralized network.

Mycelium's vast network allows for efficient resource sharing. Similarly, India has envisaged & achieved the development of one interconnected grids, enabling the seamless transfer of power across regions. This mycelium-inspired approach has enhanced energy security and reduce transmission losses. Mycelium's vast network of interconnected fungal threads allows for efficient resource sharing and mutual support. By linking wind farms to other renewable energy sources, energy storage systems, and demand centers, India can create a robust and resilient energy infrastructure. This

interconnectedness can help mitigate the intermittency of wind energy, ensuring a stable and reliable power supply. Interconnected grids presently has been achieved through the development of high-voltage transmission lines, grid-scale energy storage, and advanced smart grid technologies. By enabling higher level real-time monitoring and control, smart grids can optimize energy flow, predict energy demand, and detect potential grid disruptions. This can facilitate larger penetration of wind energy into the grid, reducing the strain on transmission infrastructure and minimizing energy losses. By fostering interconnectedness, India's wind energy sector can unlock the full potential of its renewable resources. Furthermore, interconnected grids have facilitate the sharing of excess energy between regions, reducing the need for backup power plants and promoting energy efficiency. By creating a unified national grid, India has enable the trade of renewable energy certificates (RECs) and carbon credits, incentivizing wind energy development and reducing greenhouse gas emissions. By embracing interconnected grids, India's wind energy sector has become a key player in a unified, efficient, and sustainable energy system – much like mycelium's interconnected network.

Mycelium forms mutually beneficial relationships with trees and microorganisms. Wind energy can follow suit by furthering vigorously the integration with other renewable sources, like solar and hydro power, to create hybrid systems. This harmonious coexistence would optimize energy production and reduce environmental impact. Mycelium's remarkable ability to form symbiotic relationships with trees and microorganisms offers a powerful lesson for India's wind energy sector. By embracing a similar approach, wind energy can be integrated with other renewable sources, such as solar, hydro, and biomass, to create hybrid systems that optimize energy production and reduce environmental impact. This symbiotic relationship can be achieved through innovative technologies to generate electricity. Symbiotic relationships can also be fostered between wind energy and other industries, such as agriculture and forestry. For instance, wind farms can be designed to accommodate agrivoltaics, where crops are grown between turbines, or agroforestry, where trees are

integrated into wind farm landscapes. These combinations can enhance biodiversity, improve soil health, and generate additional income streams for local communities. By exploring such synergies, wind energy can become a more holistic and regenerative part of the energy landscape, mirroring mycelium's mutually beneficial relationships.

Furthermore, symbiotic relationships can be extended to the grid level, where wind energy is integrated with energy storage, smart grids, and demand response systems. This can create a resilient and adaptive energy system, capable of responding to changing energy demands and renewable energy output. By embracing symbiotic relationships, India's wind energy sector can become a key player in a thriving, interconnected energy ecosystem – much like mycelium's integral role in forest ecosystems.

Mycelium regenerates forests by breaking down organic matter. Wind energy can adopt more regenerative practices by incorporating sustainable land-use strategies, preserving natural habitats, and promoting eco-friendly turbine designs. Mycelium's remarkable ability to regenerate forests by breaking down organic matter offers valuable lessons for wind energy. By adopting regenerative practices, wind farms can transition from being mere energy-generating facilities to thriving ecosystems. This approach involves designing wind farms that not only minimize environmental impact but also actively enhance local biodiversity.

Regenerative wind farm design can incorporate native plant species, pollinator-friendly habitats, and wildlife corridors, creating a haven for local flora and fauna. Additionally, more turbines can be equipped with bird-friendly features, such as slower rotor speeds or visual deterrents, to reduce avian collisions. By prioritizing ecological harmony, wind farms will become net-positive contributors to the environment, mirroring mycelium's regenerative prowess. Furthermore, regenerative practices can extend to the decommissioning phase of wind farms. Instead of simply dismantling turbines, operators can adopt "circular economy" strategies, repurposing materials and minimizing waste. This might involve upcycling turbine blades into sustainable products or utilizing decommissioned infrastructure as habitat



restoration tools. By embracing regenerative practices throughout their lifecycle, wind farms can embody the mycelium's spirit of renewal and regeneration.

Mycelium's vast network relies on intricate relationships. India's wind energy sector can increase the present level of engagement it has with local communities in the planning and maintenance of wind farms, fostering a sense of ownership and spreading benefits equitably.

By embracing the wisdom of mycelium, India's wind energy sector can transition to a community-driven model. Let us harness the power of mycelium's interconnected, symbiotic, and regenerative nature to create a more resilient and sustainable energy future. Mycelium's vast network relies on intricate relationships between individual fungal threads and their surroundings. This collaborative approach can lead to more effective project implementation, improved social acceptance, and enhanced overall sustainability.

Community engagement can take various forms, such as public consultations, workshops, and training programs.

By actively listening to local concerns and ideas, wind farm developers can address potential issues early on and incorporate community-friendly design elements. For instance, turbines can be sited to minimize visual impact or noise pollution, and Wind Farm owners can help community benefit fund that support local initiatives. By prioritizing community engagement, wind energy projects can become integral to the social fabric of the region, much like mycelium's integral role in forest ecosystems.

Empowering local communities to take an active role in wind energy development can also lead to innovative solutions and new economic opportunities. Community-owned wind cooperatives, for example, can provide members with a direct stake in the project's success, generating revenue and promoting energy independence. By embracing community engagement as a core principle, India's wind energy sector can unlock the full potential of mycelium-inspired collaboration, leading to more resilient, inclusive, and sustainable energy systems.

UPCOMING TRAINING COURSES

CUSTOMIZED TRAININGS

Special Training Course on “Wind Energy Technology”
for the officials of *Envision Wind Power Technologies India Pvt. Ltd.*
from 21st to 25th October 2024

Special Training Course on “Wind Energy Technology”
for the officials of *Renew Power Pvt. Ltd.*
from 11th to 16th November 2024

NATIONAL TRAINING

27th National Training Course on “Wind Energy Technology”
from 18th to 20th December 2024

Detailed information available in NIWE website.

