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R&D Vision

(1)	**Introduction:** National Institute of Wind Energy (NIWE) has been established by Ministry of New and Renewable Energy (MNRE), Government of India as an autonomous R&D institution in Chennai in the year 1998. It serves as technical focal point for wind power development in India. In the last two decades, NIWE as a knowledge based institution provided technical services to Indian Wind Energy Stakeholders starting from Wind resource assessment (onshore & offshore), Wind Farm design (micro siting), Type Certification, Type Testing, Wind Turbine Inspection services and etc., NIWE has a Wind Turbine Test Station (WTTS) at Kayathar for Type testing of wind turbines.
(2)	**Vision:** To act as a technical focal point and provide total solutions in the area of wind energy technologies to all stake-holders in the wind sector.
(3)	**Mission:** NIWE, a knowledge based institution of high quality and dedication, offer services and seeks to find total solutions for the major stakeholders across the entire spectrum of the wind energy sector. It will support the wind turbine industry in achieving and sustaining quality such that products of the highest quality and the reliability are installed, harnessing maximum energy available in wind. NIWE will strongly support the wind energy industry in developing the know-how and know-why and promoting export of products and services.
(4)	**Objectives:** a) To serve as the technical focal point for wind power development in India; for promoting and accelerating the pace of utilization of wind energy; and, support the growing wind power sector in the country. b) To develop and strengthen the facilities and capabilities, evolve strategies, promote, conduct, co-ordinate and support research and development programs to achieve and maintain reliable and cost effective technology in wind power systems. c) To analyze and assess wind resources based on the data available from various sources and prepare wind energy density maps/wind atlas/reference wind data. d) To prepare and establish standards including guidelines, procedures, protocols for design, testing and certification of wind power systems, sub-systems and components, taking into consideration the Indian conditions, and in line with internationally recommended practices and standards, and update the same based on the feedback. e) To establish world class facilities, conduct and/or co-ordinate testing of complete wind power systems, sub-systems and components according to internationally accepted test procedures and criteria, whereby the total performance such as the power performance, power quality, noise level, dynamics, operation and safety systems are tested according to agreed protocols. To accord type approval/type certification which verifies conformity with safety related requirements as per standards, guidelines and other rules for design, operation and maintenance, as well as adequate documentation of quality issues such as power performance, noise, life expectancy and reliability. f) To monitor the field performance of wind power systems, sub-systems and components; effectively utilize this feedback for fulfillment of the above objectives and review of certification; establish and update the data bank on a continuous basis and serve as information Centre for selective dissemination. g) To undertake Human Resource Development programs for the personnel working in the wind energy sector in collaboration / tie-up with other academic institutions, Universities as a Centre of Excellence in India or abroad. Also, to conduct short term / long term courses in the field of Renewable Energy in collaboration / tie-up with other renewable energy related academic institutions, Universities as a Centre of Excellence. h) To promote commercial exploitation of know-how, know-why results, and offer various consultancy services to the customers. i) To promote the development and commercialization of any other wind energy systems, including stand-alone systems, hybrid systems or combination of Wind-Solar-Bio-mass and Hybrids.

(5) **Research & Development Thrust Areas:**

India ranks fourth globally in wind power installation and achieved significant success in the Onshore wind power development with about 45 GW of installed wind energy capacity.

Growth in wind energy has been spurred by policy supports in different locations around the world. However, as global installations have grown, innovation driven by technology scaling has led to a corresponding drop in the levelized cost of energy (LCOE). The main drivers for LCOE reduction have been technology scaling to larger wind turbines coupled with innovation in several areas of wind turbine and plant design, operations, and reliability.

Over three decades' modern wind power development is characterised by huge advancements in turbine scaling, drivetrain technology, switching rotor fixed-speed to variable-speed operation, advanced load-control and grid integration. Larger rotors per megawatt aims at much lower cost of energy (CoE) and achieving accelerated cost parity with conventional power plants.

Based on the recent advancements in technology, it is identified that research in following thrust areas would provide impetus to further development of wind energy in the country including offshore, large scale hybrid systems:

Wind Resource Characterization (Onshore & Offshore)	• Resource Assessment including remote sensing • Offshore Resource Assessment using floating LIDAR • RSD Calibration • Wind Flow Modeling (Micro siting) • Site Suitability analysis (Turbulence, Wind shear, extreme wind conditions)
Wind Turbine Design	• Rotor design (including Airfoil & Wind turbine aerodynamics) • Aero elastic load simulations • Type Certification (Design Assessment) • Type Testing (Power Performance, Loads) • Acoustic Noise Measurements • Drivetrain Technology innovation • Support Structure design (Onshore & Offshore)
Wind Energy Systems	• Distributed energy systems including hybrid system • Hybrid Power Plant design and operation • Wind Power Forecasting
Wind Turbine Materials & Components	• Structural design and full scale Testing (Blades) • Composites Analysis, manufacturing and Testing
Market & Policy	• Standards, guidelines, schemes preparation on above areas • Repowering • Life Time extension • Wind Farm economics including LCOE studies

Above Thrust areas align with existing RD&D focus of MNRE:

- Renewable Energy Resource Survey, Assessment and Mapping
- Technology Benchmarking
- Technology validation for scaling up/ demonstration/ commercialization
- Capacity building
- Technology development and demonstration, testing, and standardisation including through international collaboration
- Policy recommendations
- Feedback to manufacturers for upgrades
- Technology innovation
- Cost reduction of new and renewable energy products and service

(6) **R&D Vision:**

NIWE being technical focal point visualizes following targets could be achieved in short, Medium, Long Terms:

<table>
<tr><th>Short Term
(Up to 2 years)</th><th>Medium Term
(Up to 5 years)</th></tr>
<tr><td>Lifetime Extension Assessment studies</td><td rowspan="8">Test Station development for offshore wind turbines at Dhanuskodi

Blade Test Facility for large wind turbines)</td></tr>
<tr><td>Met ocean Studies</td></tr>
<tr><td>Mesoscale data validation using one year measurements</td></tr>
<tr><td>Offshore Resource Assessment using floating LIDAR</td></tr>
<tr><td>Inter decade variability in wind resources (to determine AEP uncertainty)</td></tr>
<tr><td>Acoustic Noise Measurements in different terrain conditions</td></tr>
<tr><td>Validation of Turbulence Normalization with measured data</td></tr>
<tr><td>Condition Monitoring using Artificial Intelligence</td></tr>
<tr><td colspan="2">Long Term (Up to 10 years)</td></tr>
<tr><td colspan="2">Renewable grid integration:
• Effect of including wind in electric grid specially in terms of offshore wind through power modelling to balance generation vs demand all through the year.
• Model study on incorporation of grid and stability of power from offshore wind.
• Model study on the integrated wind solar hybrid through enhanced coordination and flexible operation, regulating the power and thereby greening the energy
• Study on causes of degradation and improving life of stored energy</td></tr>
<tr><td colspan="2">Decarbonization:
• Policy of decarbonization through renewable energy as a part of large business plans that are to be met for regulatory requirements.
• Expanded modelling scenarios to understand role of offshore wind in decarbonizing India
• Technology for cutting down carbon emissions by 45% by 2030 and zero emissions by 2050 for the wind energy.
• Research on new and engineered materials that better withstand the wear and tear while offering exceptional performance.
• Aim to reduce waste from wind systems and preserve and re-use products, as a part, or whole.</td></tr>
<tr><td colspan="2">Biodiversity:
• Study on limiting effect of biodiversity by 80% in 2030 and to no effect by 2050.
• Study on re-use of wind turbine materials through recycling
• Study on materials utilized and its availability in futuristic scenarios</td></tr>
<tr><td colspan="2">Offshore Wind:
• Modelling study on types of foundations and its economical impact on wind turbines
• Feasibility of floating wind energy in Gulf of Mannar
• Atomistic examination of technology to reveal stressors and allow for the identification of weak points in the material or structure
• Securing funds and support for development in offshore wind through policies and contracts</td></tr>
</table>

Note:

The Vision document seeks proposals in the identified thrust areas from academic, R&D Institutions and Industry.