

EDITORIAL



Centenary Birthday Commemoration of Prof. Anna Mani, a renowned Scientist and researcher, a physicist and meteorologist of impeccable credentials in the field of Wind and Solar

Radiation Assessment was held at NIWE on 30th August 2018. The event was organized and coordinated by the R & D unit and was celebrated as SWURJADIWAS.

WRA & O Unit, during this period has commissioned 4 sites using 4 Airtel Telecom Towers in NE States. The Unit had completed 2 consultancy projects on verification of Procedure of wind monitoring and Energy Yield Assessment.

NIWE is creating a centralised database of existing and proposed installations in the country for Geo-Tagging of Wind Turbines Installed Across the Country. The detailed SRS for the portal development has been prepared. The vendor for web portal development has been identified and its development is initiated. A request for Expression of Interest of First offshore wind farm in India at Gulf of Khambhat, off Gujarat Coast has been uploaded in the NIWE website for development of first 1000MW commercial offshore wind farm in India, off the coast of Gujarat. NIWE had conducted presentation meeting by stake holders chaired by Joint Secretary, MNRE and the Comments/inputs on draft bid documents received from prospective bidders are sent to MNRE and is under process with SECI.

Testing & Forecasting Unit has carried out Type Testing and Power Curve Measurements for projects and signed two agreements. The Unit carried out Forecast Analysis, data management, error analysis report for the clients. During this period, the unit has initiated Wind power Forecasting services to the RE rich states. Testing of Small Wind Turbines for the clients are progressing.

Standards & Certification Unit has organized the committee meeting on Installation of Prototype wind turbine models and as decided by the .Committee, issued letter to the clients. Also completed the review / verification of documentation of five prototype wind turbine models received from the manufacturers.

It is note worthy to mention that NIWE QMS has got ISO 9001:2015 Certificate based on the audit by DNV GL.

Information, Training and Customized Services Unit, during the period, had conducted two International training courses, sponsored by MEA for ITEC partnering countries.

NIWE under the sponsorship of Ministry of New and Renewable Energy, GoI, India, is preparing to organize an International Workshop and Conference on "Small Wind Turbine" for knowledge sharing and technical know-how for energy access, in association with MinVayu, Aurore Systems / WE and Skill Council for Green Jobs and scheduled during 30th November to 12th December of 2018 which is unique and first of its kind in the country. These events are open to Indian entrepreneurs, scientists and rural development champions along with international participants. This global effort in technology transfer and collaboration wants to include a broad assortment of players in the rural development, educational, entrepreneurial and research areas to come under same platform for expanding and scaling up small wind turbine deployment all over India and the world.

NIWE took part and put up Exhibition Stall in the 'Government Achievements & Schemes Expo 2018' held during 27th to 29th July 2018 at New Delhi.

The Unit has organised and coordinated the visits and explanation / demonstration about the facilities of NIWE and 545 visitors had visited NIWE during this period.

Dr. K. Balaraman, Director General

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Wind Resource Assessment & Offshore

Wind Resource Assessment (Uncovered / New Areas)

During the period 4 sites have been commissioned using 4 Airtel Telecom Towers in NE states namely Mizoram & Tripura. Presently 73 wind monitoring stations & Telecom towers are operational in 12 states under various wind monitoring projects funded by the Ministry of New and Renewable Energy (MNRE) as well as various entrepreneurs.

Consultancy Projects

The following consultancy projects have been completed and reports have been submitted for promotion of onshore wind farm development in the country.

- Verification of Procedure of wind monitoring for 5 sites.
- Energy Yield Assessment for 3 sites.

Geo-Tagging of Wind Turbines Installed Across the Country

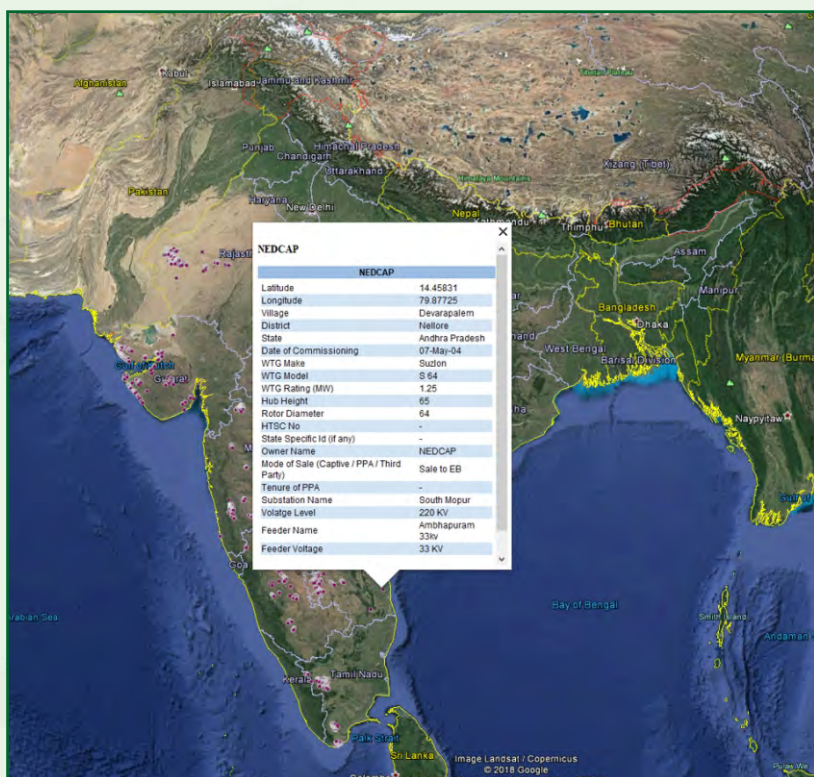
NIWE is creating a centralised database of existing and proposed installations in the country. NIWE has initiated data collection from SNAs and other Stakeholders. As on date out of about 34 GW installed capacity in the country, the data from various stakeholders / SNA Manufacturers of about 20 GW have been collected and the verification process is underway.

The process of development of web portal initiated and the work plan for the same was prepared. The vendor for web portal development has been identified. The work for web portal development is initiated.

Expression of Interest of First offshore wind farm in India at Gulf of Khambhat, off Gujarat Coast

The request for 'Expression of interest (EoI)' has been uploaded in the NIWE website for development of first 1000 MW commercial offshore wind farm in India, off the coast of Gujarat.

NIWE has received 35 EOI proposals from various stakeholders and conducted presentation meeting by stake holders chaired by JS, MNRE. Comments/inputs on draft bid documents received from prospective bidders are sent to MNRE and it is under process with SECI. The requisite clearance have been obtained from MoD, MHA, MEA, DoS and GMB and awaiting for clearance from GCZMA.



Wind turbine static information on geo-spatial platform

Integrated Wind and Solar Resource Assessment through Mapping and Measurements

The project team has carried out multi criteria suitability analysis based on the available data sets and identified 25 Nos. of suitable locations for the installation of integrated measurement stations. The criteria considered for the site selection of the 25 locations as detailed below

- The windy states are given preference in the site selection criteria under Phase I.
- Uncovered area Exploration - The sites that are indicated as potential zones in the existing Indian wind & solar potential maps, but not covered in the previous potential assessment campaigns are given preference. If the potential is proven, these

regions will be emerged as the new wind and solar farmable sites in the country. Further, such uncovered measurements will be very much helpful for the validation of the potential maps.

- Some of the locations have been selected towards representing the existing wind farms, wherein the integrated measurement will be useful for Hybridization of the existing farms with solar power and will also be useful in repowering of old wind farms.
- The sites have been selected to represent various terrain conditions like homogeneous terrain, Complex terrain, Coastal Region, etc., to better understand the wind profile with respect to terrain conditions.

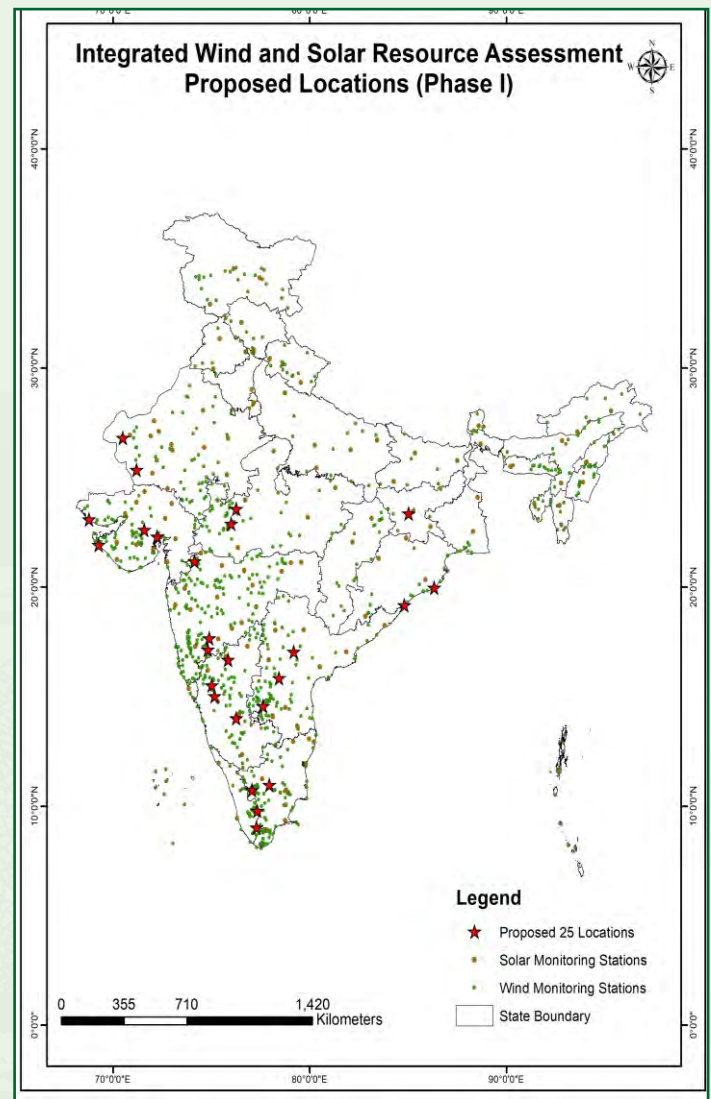
In addition to this, with regard to the placement of the Pyranometer at the met. mast, Shadow Analysis by using the PVsyst software has been carried out by the project team. Based on the results of PVsyst software and various siting criteria analysis, it is inferred that;

- Placement of the Pyranometer at 20m against the regular practice of placing at 1.5m is recommended for safety and security purpose.
- The Pyranometer shall be placed in the southern side of the mast to reduce the influence of shadow.
- Wherever required, two Pyranometers be installed with one on the least shaded side (South) and other on 180 degree opposite side (North) to obtain one complete year shadow free data.

The list of proposed Wind/Solar Monitoring Stations are enclosed in the below Table while the map showing the proposed wind solar monitoring stations are shown in following Figure. These details were sent to MNRE for their concurrence and the approval has been obtained vide email dated 19.09.2018.

S.No.	Site ID	Latitude	Longitude	State
1	IWS OD1	19.16	84.79	Odisha
2	IWS TN 2	9.02	77.30	Tamil Nadu
3	IWS TN 3	9.78	77.33	Tamil Nadu
4	IWS TN 4	10.73	77.06	Tamil Nadu
5	IWS TN 5	10.97	77.94	Tamil Nadu
6	IWSF KA6	14.01	76.26	Karnataka
7	IWS KA7	15.01	75.16	Karnataka
8	IWS KA8	15.50	75.01	Karnataka
9	IWS KA9	16.68	75.84	Karnataka
10	IWS JH10	23.35	85.01	Jharkhand

S.No.	Site ID	Latitude	Longitude	State
11	IWS AP 11	15.83	78.44	Andhra Pradesh
12	IWS TE12	17.04	79.17	Telangana
13	IWS MH13	17.14	74.81	Maharashtra
14	IWS OD14	19.96	86.32	Odisha
15	IWF AP15	14.57	77.63	Andhra Pradesh
16	IWS MH16	17.66	74.89	Maharashtra
17	IWS MP17	22.88	76.01	Madhya Pradesh
18	IWS MH18	21.17	74.14	Maharashtra
19	IWS GJ19	22.29	72.24	Gujarat
20	IWS GJ20	21.91	69.27	Gujarat
21	IWS GJ21	23.08	68.78	Gujarat
22	IWS GJ22	22.60	71.59	Gujarat
23	IWS RJ23	26.79	70.49	Rajasthan
24	IWS RJ24	25.34	71.20	Rajasthan
25	IWS MP25	23.56	76.26	Madhya Pradesh



Testing & Forecasting

LARGE WIND TURBINE TESTING

The measurements have been completed as per the signed agreement for the Type Testing of XYRON 1000 kW wind turbine at Richadewda, Ratlam District, Madhya Pradesh of M/s. XYRON TECHNOLOGIES LTD. Final Test Reports issued to the customer and project has been closed.

The continuous measurement is on-going for the Power Curve Measurements of INOX 2000 kW wind turbine with 113 meter rotor diameter at Ranipat Village, Muli Taluk, Surendranagar (Dist), Gujarat of M/s. INOX Wind Ltd.

The continuous measurement is under progress for the Power Curve Measurements & Special Measurements for Loads of Pioneer 750 kW wind turbine W49-HH60 a wind turbine with 49 meter rotor diameter at HTSC no. 2988, SF.No. 95/4, 5&6B Part, Poigai Village, Tenkasi Taluk, Tirunelveli District, Tamil Nadu of M/s PARA Enterprises Pvt. Ltd.

An agreement has been signed between NIWE & M/s. Inox Wind Ltd dated 20.07.2018 for Power Curve Measurements of Inox 2000 kW wind turbine with 100 rotor diameter at Rojmal, Rajkot District, Gujarat. The continuous measurement is on-going.

FORECASTING

NIWE Indigenous Wind Power forecast model

Tamil Nadu

- Created an automated script for delivering substation level forecast for the whole state of Tamil Nadu to IWPA/TNSLDC.
- Updated the existing data management system of Tamil Nadu to process the feederwise generation data more efficiently.
- Retraining of the indigenous model for the whole state of Tamil Nadu with the updated model configuration has been carried out.
- Vortex aggregated forecast analysis from 17-04-2018 to 15-07-2018 has been carried out and sent the feedback to Vortex for further improvement.

- Detailed analysis of 84 numbers of different configuration forecast output has been completed for the state of Tamil Nadu.
- Error analysis report has been prepared from July, 2018 to September, 2018 for the State of Tamil Nadu.
- Initiating Wind Power Forecasting Services to the RE rich States

Gujarat

- Development of Aggregated Forecasting model for the state of Gujarat using Machine Learning Algorithm is under progress.
- Retraining of Gujarat forecast model with historical ABT meter data is under progress.
- Error analysis report has been prepared from July, 2018 to September, 2018 for the State of Gujarat.

Karnataka

- MoU, NDA has been signed between NIWE and Karnataka SLDC on 07th May, 2018 in connection with pilot wind power forecasting project for the entire state of Karnataka.
- Processed the static data received from Karnataka SLDC as per forecasting system requirements.
- Based on the static / historical generation data, trained the indigenous wind power forecasting model.
- Detailed analysis of 84 numbers of different configuration forecast output has been carried out for the state of Karnataka. Based on the Analysis, final forecast configuration has been selected for the state of Karnataka.

SMALL WIND TURBINE TESTING

Type testing of SM2 (1kW) at Wind Turbine Research Station, Kayathar, Tuticorin District, Tamil Nadu of M/s. Windstream Energy Technologies India Pvt. Ltd. The measurement is under progress.

Type Testing of model Vaata Smart, Vertical Axis WT (5.5 kW) at Wind Turbine Research Station (WTRS),

Kayathar of M/s. Vaata Smart Ltd. The measurement is under progress.

An agreement signed

An agreement has been signed between NIWE & SRLDC for initiating pilot wind & solar power forecasting model for specific wind & solar power plants connected in ISTS of Southern Region on 14th September, 2018 at SRLDC, Bangalore.



Standards and Certification

- Completed review / verification of documentation of five prototype wind turbine models received from the wind turbine manufacturers in connection with installation of prototype wind turbines in India as per MNRE guidelines.
- Organized the committee meeting on Installation of Prototype wind turbine models.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of “Suzlon S120 DFIG 2.1 MW, (50Hz)” model of M/s. Suzlon Energy Limited to the concerned State Nodal Agency, as decided by the Prototype Committee.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of “Suzlon S111 DFIG 2.1 MW, (50Hz)-STT” model of M/s. Suzlon Energy Limited to the concerned State Electricity Board, as decided by the Prototype Committee.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of “Suzlon S111 DFIG 2.1 MW, 50Hz-HCT” model of M/s. Suzlon Energy Limited to the concerned State Nodal Agency, as decided by the Prototype Committee.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of “Suzlon S120 DFIG 2.1 MW, 50Hz-HCT” model of M/s. Suzlon Energy Limited to the concerned State Electricity Board, as decided by the Prototype Committee.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of “GE 2.5-132, GE64.5, HH 94 & 130m, 50 Hz” model of M/s. GE India Industrial Private Limited to the concerned State Electricity Board, as decided by the Prototype Committee.



Issuing Renewed Certificate to M/s. RRB Energy Limited

- A technical due - diligence project with IREDA is under progress.
- An agreement has been signed with M/s. RRB Energy Limited to take up the project on revision of certificate of 'V 39-500 kW with 47m Rotor diameter' wind turbine model as per TAPS-2000 (amended). Review / verification of documentation in connection with revision of certificate of 'V 39-500 kW with 47m Rotor diameter' wind turbine model as per TAPS-2000 (amended) has been completed and revised certificate has been issued to M/s. RRB Energy Limited.
- An agreement has been signed with M/s. RRB Energy Limited to take up the project on renewal of certificate of 'Pawan Shakthi - 600kW' wind turbine model as per



Issuing Revised Certificate to M/s. RRB Energy Limited

TAPS-2000 (amended). Review / verification of documentation in connection with renewal of certificate of 'Pawan Shakthi - 600kW' wind turbine model as per TAPS-2000 (amended) has been completed and renewed certificate has been issued to M/s. RRB Energy Limited.

- An agreement has been signed with M/s. Southern Wind Farms Limited to take up the project on revision of certificate of 'GWL 225' wind turbine model as per TAPS-2000 (amended). Review / verification of documentation in connection with revision of certificate of 'GWL 225' wind turbine model as per TAPS-2000 (amended) has been completed and revised certificate has been issued to M/s. Southern Wind Farms Limited.



Issuing Revised Certificate to M/s. Southern Wind Farms Limited

- Organized 21st Management Review meeting of Quality Management System as per 9001:2008 at NIWE, Chennai.
- Shri.A.Senthil Kumar, Director & Group Head, S&C as Management Representative (MR) provided the support for DNV-GL Second Periodic Audit of QMS as per ISO 9001:2015 held at Kayathar on 14.08.2018.
- DNV-GL has conducted Transition and Second Periodic Audit of Quality Management System as per ISO 9001:2015 for NIWE. Based on the audit conducted, DNV GL recommended for upgradation of NIWE QMS as per ISO 9001:2015. Accordingly, DNV GL has issued the Quality Management System certificate as per ISO 9001:2015 for NIWE.
- The continual improvement and maintaining the quality management system are ongoing.
- Director & Group Head, S&C along with Director General, NIWE has attended the meeting of Electrotechnical Division Council (ETDC) and Sectional Committee chairs with DG, Bureau of Indian Standards (BIS) on 07.09.2018 held at BIS Head Quarters, New Delhi.
- Co-ordination with Bureau of Indian Standards (BIS) in connection with standards related works are ongoing.
- The continuous technical supports are being provided to MNRE for their various queries related to Type Certification documentation in connection with Revised List of Models and Manufacturers of wind turbines.

Research and Development / Information Technology / Information, Training and Customized Services

RESEARCH AND DEVELOPMENT

Prof. Anna Mani Centenary Birthday Commemoration

Prof. Anna Mani Centenary Birthday Commemoration, was celebrated as SWURJA DIWAS on 30th August 2018 and the work and life of the doyen was remembered and reminisced by wind field experts at NIWE, Chennai. A press release has been made during the celebration: Prof Anna Mani was born on 23 August 1918 at Peerumed, located in the Western Ghats, in Kerala she was a renowned Woman Scientist and researcher, a physicist and meteorologist of impeccable credentials. She undertook pioneering work in instrumentation and solar radiation measurements at India Meteorological Department, Pune for about three decades and continued her work in this domain at Raman Research Institute, Bangalore. Prof. Mani took up



the preparation and publication of 'The Handbook for Solar Radiation Data for India', which was followed by a second volume on 'Solar Radiation over India' in early 1980's, based on data from IMD's meteorological stations. With her vast experience in this field and her organizing skills, Prof. Anna Mani led the task of augmenting the national power resources on

the invitation by the Ministry of Non-conventional Energy Sources and she ran the wind energy survey project from Bangalore. Her team brought out 4 volume of Wind Energy Resource Survey in India, and these volumes have now become the Bible for scientists and engineers involved with the conversion of wind energy to electrical energy and utilizing the information provided in these volumes a number of wind-farms have been successfully set up in various parts of the country.

For the commemoration of her dedicated work in the field of wind and solar radiation assessment, National Institute of Wind Energy, under MNRE, Government of India has celebrated the Centenary Birthday of Prof. Anna Mani, on 30th August 2018 at NIWE. Pioneers in the resource assessment had gathered and highlighted her contribution in the resource assessment. NIWE conducted this programme with keynote lecture and panel discussion with the industry experts on wind resource assessment. The discussion refreshed the memory of the gathered audience on the path traversed in onshore & offshore meteorology and its place of relevance in the future of the Country's ambitious target of achieving 175 GW by the year 2022.

INFORMATION, TRAINING AND CUSTOMIZED SERVICES

22nd International Training Course

NIWE had successfully conducted the 31 days International Training Course on "Wind Turbine Technology and Applications" held during 18th July to 17th August 2018, sponsored by the Ministry of External Affairs (MEA), Government of India under ITEC programmes. The course addressed 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 24 participants from 14 ITEC countries (Azerbaijan, Cambodia, DR Congo, Ethiopia, Malawi, Malaysia, Mauritius, Nigeria, South Sudan, Sri Lanka, Tanzania, Uganda, Venezuela and Vietnam).



Chief Guest lit the Kuthuvilakku to inaugurate the Course

The training course was inaugurated by Shri D.V. Giri, Secretary General, IWTMA, Chennai and had released the course material.

The course content of the training were handled by Scientists, Engineers of NIWE, Wind Turbine Industries and Academic Institutions, who have years of experience in the field. The syllabus of the training course had been taken under the following 7 modules to group the syllabus / topics and each module was evaluated.

Module 1: Introduction and Wind Turbine Components,

Module 2: Standards, Testing & Certification

Module 3: Resource Assessment

Module 4: Erection, Commissioning and Operation & Maintenance

Module 5: Electrical Systems & Grid Integration

Module 6: Energy Storage and Hybrid

Module 7: Policy and Financial / Economical Analysis

The practical training was arranged with Wind Resource Assessment, Instrumentation, Testing and R&D equipments apart from the Large Wind Turbine manufacturing factory visit to M/s. Siemens Gamesa Renewable Energy, Chennai, where, the participants had the opportunity of listening from the industry experts who are actually in the process of making wind turbines and also visited the manufacturing facilities with all major components and its process. As part of the study visit, all the participants were taken to southern part of Tamil Nadu to visit Wind Turbine Test / Research Station located at Kayathar, where they got exposure on small and large wind turbine testing process apart from visiting wind farms in and around Kanyakumari, where wind turbines are installed in large numbers like coconut trees.



Chief Guest distributing the Course Certificate to the participant

Shri. T.S. Tirumurti, Secretary (ER), Ministry of External Affairs was the Chief Guest. He had given the valedictory address and distributed the course certificates to all the participants during the Valedictory function.

Special International Training Course on Wind Resource Assessment & Wind Farm Planning

Successfully conducted the 24 days Special International Training Course on "Wind Resource Assessment and Wind Farm Planning" during 19th September to 12th October 2018, sponsored by the Ministry of External Affairs (MEA), Government of India under ITEC programmes.

The course provided an invaluable platform for hands on practical training on Introduction to Wind Resource Assessment, Wind Resource Assessment techniques, Site Selection for Wind Monitoring Stations (WMS), Wind Resource Mapping,

Installation, Instrumentation and Commissioning of WMS, Met Mast and Modern Measurement Techniques including measurement using remote sensing instruments (SODAR & LiDAR), Data Analytics and Processing, Software tools for Wind data Analysis, Design and Layout of Wind Farm, Forecasting and Wind Energy Production, Project Implementation and Operations & Maintenance aspects of Wind Farms in a focused manner.



Release of Course Material during Inaugural Function

The course was attended by 17 international participants from 11 countries (Azerbaijan, Bangladesh, DR Congo, Ethiopia, Malawi, Mauritius, Sri Lanka, Sudan, Tajikistan, Tunisia and Uganda) and 03 Indian participants nominated from IREDA, New Delhi.

The training course was inaugurated by Dr. K. Balaraman, Director General, NIWE and the course material was also released by him.

Practical training was arranged with the visits to Wind Resource Assessment Analysis Lab, Instrumentation & Commissioning of WMS, Wind Analysis - Data collection, Validation and Processing and Reporting. The participants were taken to southern part of Tamil Nadu to visit Wind Turbine Test Station / Wind Turbine Research Station at Kayathar, where they got exposure on small and large wind turbine testing process apart from visiting wind farms in and around Kanyakumari, where wind turbines are installed in large numbers like coconut trees. Also, the participants stayed at Kanyakumari during the study visit period and the experience at Cape Comorin (southern tip of India) were so exciting to the participants such as seeing the sunrise and sunset and cultural visits showcasing the spiritual heritage of India.



Participants at Kayathar Wind Farm during study visit

Shri C. Kannan, IFS, Under Secretary, MEA Branch Secretariat, Chennai attended the valedictory function, addressed the august gathering and distributed the course participation certificate to the participants.

Exhibition

NIWE took part and put Exhibition Stall in the 'Government Achievements & Schemes Expo 2018' held during 27th to 29th July 2018 at New Delhi and explained the activities and services of NIWE to the visitors of the exhibition and worked for the development of business promotion.

Visitors

During the period July to August 2018, ITCS, NIWE has organised and coordinated the following visits and explanation / demonstration about the facilities of NIWE along with the activities / services of NIWE to create awareness and to motivate towards research on wind energy, schools and college students are encouraged to visit the campus.



Certificate distributing to the participant by Chief Guest

06.07.2018	78 students of III Year, ECE and Faculty coordinators, Kingston Engineering College, Vellore
02.08.2018	20 Participants (Polytechnic teachers) of Short term course organised by NITTR, Chennai
03.08.2018	54 students of III Year, ECE and Faculty coordinators, Veltech Engineering College, Chennai
10,20 & 21.08.2018	170 students of III Year, ECE and Faculty Coordinators, S.A. Engineering College, Chennai
27.08.2018	30 Students, Solar Energy & Energy Engineering and Faculty Coordinators, Anna University, Chennai
29.08.2018	76 students of EEE, IV Year and Faculty Coordinators, Kingston Engineering College, Vellore
07.09.2018	25 Participants (Polytechnic teachers) of Short term course organised by NITTR, Chennai
10.09.2018	70 students of IV Year, EEE, Loyola ICAM College of Engineering & Technology, Chennai
08.10.2018	22 students of 12 th Standard and Teaching Coordinators, Royal Global School, Guwahati, Assam

Wind Turbine Research Station

For the windy season 2018, all the wind turbines of capacity of 6.4 MW installed at WTRS, Kayathar (1 no 2000 kW KENERSYS, 1 no 2000 kW INOX, 1 no 600 kW SUZLON, 9 nos of 200 kW MICON) were put in for un-interrupted operation, after successfully completion of Operation & Maintenance works, and the power generated is fed into the Grid during the windy season 2018.

Visitors :

The following visits were coordinated and facilities of Small & Large Wind Turbine Testing, R&D and WRA showcased:

- 38 Students and 3 staff from EEE Department of Pothigai Engineering College, Chennai, T.N. on 02.08.2018.
- 31 Students and 3 staff from EEE students Eshwar Engineering College, Chennai, T.N. on 03.08.2018
- 24 Delegates from 22nd International Training Programme on Wind Turbine Technology and Application on 03.08.2018.
- 149 Students and 6 staff from TIME School, Tirunelveli, T.N. on 29.08.2018



Solar Radiation Resource Assessment

Project Activities

- Calibration reading taken for 3 pyranometers and 3 Pyrliometers under SRRA mode.
- Calibration reading taken for 3 pyranometer under commercial mode.
- SRRA officials carried out micro-siting at Palakkad and Ramakkalmedu, Kerala in connection with SRRA station program during the period 08.07.2018-13.07.2018.
- Dr. G. Giridhar and Prasun Kumar Das with a team of officials from NIWE, Chennai met GETCO and PSDF officials regarding R&D Project on solar Power Forecasting through PSDF funding at Vadodara and New Delhi during the period 31.07.2018-03.08.2018.
- Dr. G. Giridhar & R. Sasi Kumar met ANERT and KSEB officials visited Trivandrum during the period 19.08.2018 to 21.08.2018 in connection with the implementation of VPP in Ponmudi, Kerala and the SRRA project at Palakkad, Ramakkalmedu.
- Prasun Kumar Das visited Coimbatore on 03.09.2018 in connection with ground truth verification of CPCL wind firm in connection with feasibility study.
- Karthik. R visited Bengaluru for discussions with SRLDC on solar forecasting on 06.09.2018 and with attended meeting with KPTCL on 07.09.2018 on the maintenance issues of SRRA stations and its extension up to March 2020.
- Dr. G. Giridhar with NIWE officials signed MoU with SRLDC, Karnataka on solar forecasting activities during 14.09.2018-15.09.2018.

Type Certification of Wind Turbine and Overview of Design Requirements as per IEC 61400 - 1

A. Senthilkumar, Director and Group Head, Standard and Certification, National Institute of Wind Energy, asenthilkumar.niwe@nic.in

Introduction

Efforts for the utilization of renewable energy sources are increased in order to meet the growing demand for the power and to reduce the dependence on fossil fuels. Wind energy is recognized as one of the key renewable energy sources in India. The number of wind turbine installations is continuously in the upward trend in India in line with the growth in various other countries. In the recent years, wind turbines are introduced with relatively newer technologies, increased rated capacity and with larger rotor diameter. Reliability and safety of the wind turbines have to be ensured for the sustained growth of the industry. Type Certification of wind turbines demonstrates that wind turbine models are meeting the specified standards and certification scheme requirements. Type Certification of wind turbine plays an important role to provide confidence among the various stakeholders including investors, utilities, financial institutions, insurance agencies Governmental authorities and such others.

Type Certification Scheme

Type Certification of wind turbine have a history of almost thirty years. The requirement of type certification is insisted in various parts of the world including in India. Most of the countries with the active wind energy programmes have their own certification and testing facilities for Type certification / Approval of wind turbines. In countries like Denmark, Germany and Netherlands type certification schemes for certification of wind turbines were in place much earlier. In India, certification scheme has been put in place after Centre for Wind Energy Technology (C-WET) was formed. Certification has been applied differently in

scope, requirements and depth depending upon the schemes. The present trend is moving towards harmonization of certification requirements. International Electro-technical Commission Standards (IEC) have been issued on certification requirements. IEC standards are widely accepted.

International Electrotechnical Commission Standards

The certification systems based on country specific requirements were followed in Europe in 1990s, which were mostly based on National standards. Subsequently, efforts have been made for harmonization of the requirements in order to overcome trade barriers and for mutual recognition.

The International Electrotechnical Commission is a worldwide organization for standardization. International standardization efforts on wind turbine certification procedures started in 1995 within the International Electrotechnical Commission (IEC) in the Technical Committee TC 88 and resulted in the by the Conformity Assessment Board (CAB) of the IEC in April 2001. Subsequently, IEC WT 01 was revised and issued as IEC 61400-22 ed 1.0. TC 88 started their efforts in 1987 and has so far published various standards, rules and technical specifications under the scope of the IEC 61400 series. The list of standards commonly used for type testing and certification are listed below:

S.No.	Standard	Title
1.	IEC 61400-22 ed 1.0	Wind Turbines – Part 22 : Conformity Testing and Certification

S.No.	Standard	Title
2.	IEC 61400 – 1	Wind turbines – Part 1 : Design requirements
3.	IEC 61400-12-1	Wind Turbines- Part 12-1: Power performance measurements of electricity producing wind turbines
4.	IEC/TS 61400-13	Wind turbine generator systems- Part 13 : Measurement of mechanical loads
5.	IEC 61400-21	Wind turbines- Part 21 : Measurement and assessment of power quality characteristics of grid connected wind turbines
6.	IEC/TS 61400-23	Wind turbine generator systems – Part 23 : Full-scale structural testing of rotor blades

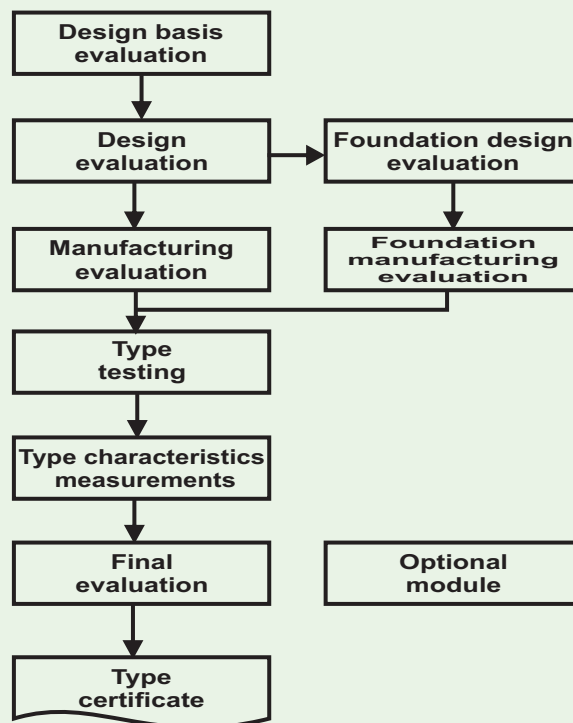
Type Certification

The purpose of the type certification is to confirm that the wind turbine type is designed, documented and manufactured in conformity with design assumptions, specific standards and other technical requirements. Type Certification applies to a series of wind turbines of common design and manufactured under the same design.

Procedures and documentation requirements for obtaining the type certification are explained in the type certification scheme. The requirements may vary relatively depending upon the selection

scheme. The procedure to obtain Type Certificates as per IEC scheme is described in IEC 61400-22 ed 1.0. As per IEC

61400-22 ed 1.0, the Type Certification consists of the following mandatory modules:



Modules of Type Certification

- Design Basis Evaluation
- Wind Turbine Design Evaluation
- Type Testing
- Manufacturing Evaluation
- Final Evaluation and the optional modules
- Foundation Design Evaluation
- Foundation Manufacturing Evaluation and
- Type Characteristic Measurements.

Design Basis Evaluation

The purpose of design basis evaluation is to examine that the design basis is properly documented and sufficient for safe design of the wind turbine type. The design basis shall identify all

requirements, assumptions and methodologies which are essential for the design and the design documentation.

Wind Turbine Design Evaluation

The purpose of design evaluation is to examine whether the wind turbine type is designed and documented in conformity with design assumptions, specific standards and other technical requirements. The design evaluation is normally carried out as a review of the design documentation submitted by the manufacturers. In addition to the documentation review, independent analyses will usually be carried out, wherever required, including for critical parts of the wind turbine.

The Design Evaluation module comprises the following elements:

- Evaluation of Design Control
- Evaluation of Control and Protection System
- Evaluation of Loads and Load Cases
- Evaluation of rotor blades
- Evaluation of machine and structural components
- Evaluation of Electrical components
- Evaluation of housings
- Evaluation of foundation design requirements
- Evaluation of manufacturing process
- Evaluation of transportation process
- Evaluation of installation process
- Evaluation of maintenance process
- Evaluation of personnel safety
- Evaluation of component tests

Type Testing

- The purpose of type testing is to provide data needed to verify power performance and aspects which are vital to safety and need additional experimental verification and any other aspects that cannot be reliably evaluated by analysis. The Type Testing module normally

comprises the following element

- Safety and Function Tests
- Load Measurements
- Power Performance Measurements
- Blade Tests
- Other Tests

The type test reports, prepared based on the test results, are evaluated by the Type Certification body to ensure that the tests have been carried out in accordance with the approved detailed test program and that the test reports properly document the aspects required for certification.

Manufacturing Evaluation

The purpose of manufacturing evaluation is to assess if a specific wind turbine type is manufactured in conformity with the design documentation, verified during the design evaluation.

The Manufacturing Evaluation module comprises the following elements:

- Quality System Evaluation
- Manufacturing Inspection

As per IEC 61400-22 ed 1.0, the requirements for the Quality System Evaluation are satisfied if the quality system is certified by an accredited Certification Body as per ISO 9001. If the quality system is not certified, the Certification Body shall evaluate the system covering ten aspects listed in IEC 61400-22 ed 1.0.

In the Manufacturing Inspection, the Certification Body shall verify by inspection that atleast one representative specimen is manufactured according to the design under certification.

Foundation Design Evaluation

The purpose of the optional foundation design evaluation is to enable the inclusion of one or more foundation designs in the Type Certificate, as selected by the Applicant. The Foundation Design is

evaluated based on the design documentation and in accordance with the agreed applicable standards and codes.

Foundation Manufacturing Evaluation

The purpose of foundation manufacturing evaluation is to assess if a specific wind turbine foundation type is manufactured in conformity with design documentation, verified during the design evaluation.

The Foundation Manufacturing Evaluation module comprises the following elements:

- Quality System Evaluation
- Manufacturing Inspection

Type Characteristic Measurements

The purpose of type characteristics measurements is to establish performance related characteristics of the wind turbine type, other than measurement of power performance.

The Type Characteristic Measurements module comprises one or more of the following elements:

- Power Quality Tests
- Low voltage ride through tests
- Acoustic Noise Measurements

The test reports, prepared based on the test results, are evaluated by the Type Certification body to ensure that measurements have been carried out in accordance with the approved detailed test program and that the reports properly document the characteristics required for certification.

Final Evaluation

The Final Evaluation module summarizes evaluation findings of both mandatory and the

selected optional modules. Furthermore, it is evaluated whether the documentation is complete and whether the type test results confirm all the relevant requirements set out in the design documentation.

Type Certificate

The Certification Body shall issue a Type Certificate based on satisfactory evaluation for completeness and correctness of the Final Evaluation Report. The Type Certificate is valid for the wind turbine type specified in the certificate.

The Type Certificate shall have a reference of the standards / certification scheme used. The specifications of the certified wind turbine model are issued as a part of the Type Certificate. The make and model of components including allowable alternative suppliers are also mentioned in the Type Certificate.

Conclusion

With the rapid growth of the wind industry with increase in capacity and size of wind turbines, importance of type certification is increased. Type certification of wind turbines provides confidence to various stakeholders on the product. In order to ensure the quality of the wind turbines used in a wind farm project, availability of a type certificate is often included as a part of evaluation criterion by the developers, financial institutions and insurance companies in India. The type certification of wind turbines helps the industry to develop reliable wind farm projects.

References

IEC 61400-22 ed 1.0 : Wind Turbines – Part 22 : Conformity Testing and Certification.



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