

EDITORIAL



The past year was one of reckonable growth for the Indian Wind industry. The industry with an addition of 5400 MW exceeded the target of 4000 MW has surpassed the previous highest capacity addition of 3423 MW

achieved in 2015. MNRE eyeing 60 GW of wind power capacity by 2022 set the pace by announcing several policy initiatives in this direction, such as reverse bidding in the wind power sector and a wind – solar hybrid policy. The scheme for setting up of 1000 MW ISTS connected Wind power projects by a competitive bidding process is a step in this direction, which will also help non –windy states to meet their RPO obligations. The wind power tariff at the auction fell to a record low at Rs 3.46/ kWh, which may lead to a short term slowing of the market. Competitive bidding will positively force manufacturers to innovate solutions to reduce cost, which will largely expand the market and benefit all. However this has to be accompanied with reinforcements in the transmission infrastructure to support the capacity addition.

Offshore wind is another sector where India can aim at harnessing reasonable potential of renewable power, based on preliminary estimates of potential along the coastline. NIWE will play a pivotal role in realising this in the coming years. Installation of the first Offshore Wind Monitoring platform at Gulf of Khambhat, 22 km from the Gujarat coastline was a milestone activity. The LiDAR based measurements will provide an estimate of the offshore potential in the zone. NIWE is also in the process of finalising guidelines to enable private participation for Offshore studies and surveys, which will be a further boost to the sector. German experiment of offshore wind blocks auction has enthused industry. India has a way forward looking at it.

The year also saw concerted efforts by our Scientists to provide reliable forecast services to the wind power industry. Remote terminal units to provide real time monitoring of the wind power from the wind turbines during the 2017 windy season have been put in place by SLDC and will be

used as inputs to better our forecasts. The service will be expanded to other windy states of the country. The capacity building in solar power forecasting in technical collaboration with GIZ Germany is another important activity planned for this year.

A unique hybrid concept that NIWE is working on is the integration of 75 kWp SPV system with its old 200 kW wind turbine at WTRS Kayathar. This will enhance the CUF of the existing plant by maximising the utilization of full load capacity of the WEG during the windy season and off season periods. Two new research projects focused on hybrid system and energy storage were also initiated in association with academic institutions.

NIWE hosted several training programmes during the quarter, drawing experts from academia and industry. Notable among them were the specialised courses on “Wind resource assessment, small Wind Energy & hybrid system and Solar radiation Assessment” for SNAs and Capacity Building training programme on Small Wind turbines. These training programmes were designed with focus on Wind & Solar resource assessment and Small Wind Energy & Hybrid Systems, schemes which are run by MNRE with active support from NIWE.

The wind resource assessment programme funded by MNRE has helped in establishment of wind farms across the length and breadth of the country. In order to lay further impetus on the 60 GW target, NIWE as per MNRE guidelines is providing free access to the data measured under the wind monitoring programme through the WRA web portal. Another activity in the pipeline for the benefit of stakeholders is the development of an online registry of wind turbines installed across the country in line with European efforts, which will require active support from the industry and stakeholders. This is the only way of establishing long-term generation data from wind farms to understand their performance, and also an important input for repowering. I request all stakeholders to extend their support to NIWE.

Let us all hope that the coming year will see the sector beats its record again!

Dr. Rajesh Katyal, Director General (AC)



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Contents

- ◆ NIWE at work - 2
- ◆ Indian Wind Energy Growth - an Overview - 17

Editorial Board

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Offshore Wind & Industrial Business

National Institute of Wind Energy has achieved its first milestone in offshore wind energy sector in the country by installing its first Structure (Monopile & Platform) for mounting LiDAR to carry out Wind Resource Assessment studies at Gulf of Khambhat off Gujarat Coast. The installation of LiDAR is underway and is likely to be commissioned by end of April 2017, thereafter the offshore wind data measurements will commence.

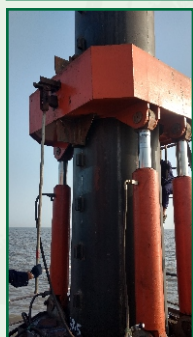
By this, NIWE has paved way for the development of offshore wind in our country. For a relatively young industry relying on considerable investment, research and development activity is spurring progress in leaps and bounds, leading to ever better economic prospects and improving the energy security of the coastal States of India. The mark of this milestone has been a remarkable achievement in the history of offshore wind power in India.

I. Installation of First Offshore Wind Monitoring Station at Gulf of Khambhat, Gujarat

The Monopile and Support Platform of 47.5m long with 1.2m diameter and allied components namely Boat Landing, Fender, Ladder and Hand Rails etc., has been fabricated and the same was transported to the proposed location with Jack up Barge MV- Ocean Pride. The Installation activities were carried out during 14th to 22nd March 2017.



Jack up Barge Holding Structure



Hydraulic Pile driving mechanism

The Monopile driving was carried out using customised mechanisms based on estimated site conditions. Hydraulic pile driving mechanism has been chosen to drive the monopile and hammering is done to increase the stability of the monopile after driving to sufficient depth.

The Boat Landing, Ladder fenders and other accessories of the platform has been



Hammering Monopile for Stability

Completion of Monopile Installation

Mounting Ladders

welded to the monopile for technicians to climb on the platform for carrying out the health monitoring of the wind sensors installed.

The Platform of 5m diameter was fixed to the monopile with nuts and bolts for mounting LiDAR and its ancillaries. Thereafter LiDAR, solar panels, batteries, data loggers and other sensors were fixed on the platform.



Platform Mounting in progress

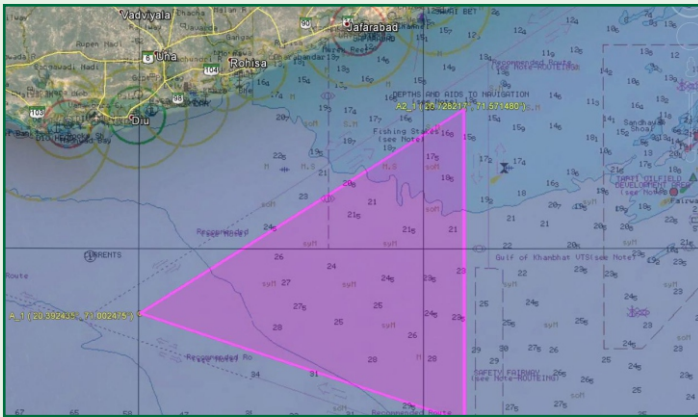


Fixing Boat Landing and Resting Platform

Completed Monopile and Platform

II. Geophysical and Geotechnical investigations off Gujarat and Tamil Nadu Coasts

NIWE proposes to conduct geophysical and geotechnical surveys and studies both off Gujarat and Tamil Nadu coasts to better understand the subsea profiles. The geophysical and geotechnical studies will cover the entire Zone A as per the FOWIND report both for Gujarat and Tamil Nadu coasts. The data obtained from the study will provide useful pointers in design of offshore foundations/Structures.



Bathymetry of Gujarat Location



Bathymetry of Tamil Nadu location

Wind Resource Assessment

During the period from January to March 2017, two Wind Monitoring Stations have been commissioned in Tamil Nadu and 13 Wind Monitoring Stations (WMS) have been closed down (5 in Gujarat, 1 in Rajasthan, 2 in Tamil Nadu, 2 in Maharashtra, 1 in Odisha, 1 in Karnataka & 1 in Madhya Pradesh). Presently, 19 WMS are operational in 6 States under various wind monitoring projects funded by the Ministry of New and Renewable Energy (MNRE) as well as various entrepreneurs.

Consultancy Services

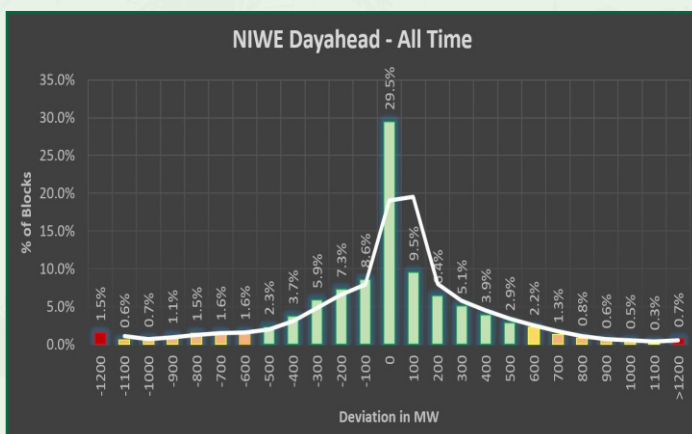
The following consultancy projects have been completed and reports submitted during this period:

- Verification of procedure of wind monitoring for 26 sites
- Consultancy services for 4 MW wind farm projects

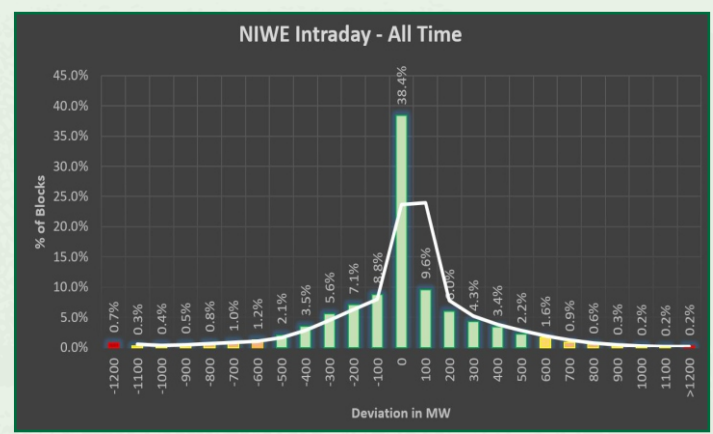
- Extrapolation of Wind Speed & WPD at various levels for 2 sites
- Technical Due Diligence of the proposed 154.50 MW wind farm
- Final report for 6 sites in Kerala for M/s. ANERT, Kerala was prepared.

Web Portal Updation

- Installation and commissioning of 4 sites in Assam for M/s. Oil India has been completed.
- Wind Monitoring data webportal created successfully and monthly data updated in WRA web portal.
- Development of web portal for "Online registry of Wind Turbines installed across the country" is under progress.



Forecast Graph



Wind Power Forecasting Services

- Dynamic power curve system has been created for NCMRWF data.
- Final report on wind power forecasting for year 2015-16 has been sent to IWPA.
- Static power curve has been created for 25 km, 4 km resolution for 50m, 10m & custom hub height data.
- Rectification of Ayyanaruthu substation data transfer has been completed.
- Ayyanaruthu historical data analysis has been carried out.
- Coordination with ISRO-SAC in connection with Numerical Weather Prediction (NWP) model output for wind power forecasting project in the State of Tamil Nadu has been carried out.
- Created dedicated FTP for Numerical Weather Prediction (NWP) data transfer between ISRO-SAC and NIWE.
- Forecasting error analysis has been done upto March 2017.

WRA in Uncovered / New Areas 2016-17

Site selection work has been carried out for establishment of 100m level Wind monitoring stations and identified 9 sites in Telangana & 4 sites in Kerala.

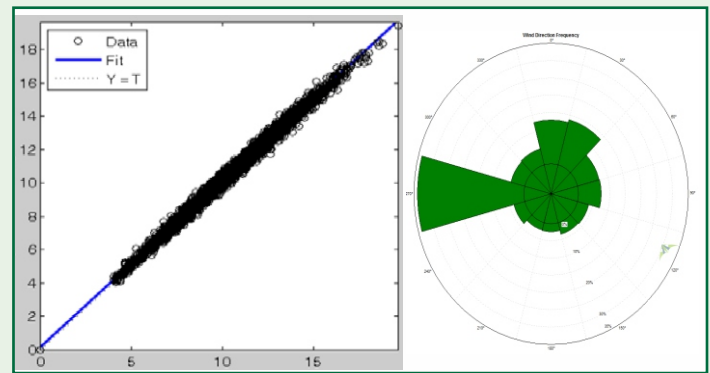
WRA in uncovered / New Areas 2016-17 (NE)

Site selection work has been carried out for establishment of 50m level Wind monitoring stations and identified 10 sites in Mizoram, 10 sites in Arunachal Pradesh, 3 sites in Assam & 2 sites in Meghalaya.

Estimation and Validation of WPP at 100m level of 7 States in India

NIWE has established 75 nos. (10 in Andhra Pradesh, 12 in Gujarat, 12 in Rajasthan, 13 in Karnataka, 8 in Maharashtra, 8 in Madhya Pradesh and 12 in Tamil Nadu) of WMS under the project 'Estimation & Validation of Wind Power Potential at 100m level in 7 States of India' and the data acquisition is in progress.

- Three year continuous data acquisition from 8 nos. of WMS (3 in Andhra Pradesh, 1 in Gujarat, 2 in Maharashtra & 2 in Karnataka), two year continuous data from 46 nos. of WMS (9 in Karnataka, 3 in Madhya Pradesh, 7 in Gujarat, 11 in Tamil Nadu, 2 in Maharashtra, 6 in Andhra Pradesh & 8 in Rajasthan) and one year continuous data acquisition from 15 nos. of WMS (1 in Andhra Pradesh, 4 in Gujarat, 2 in Madhya Pradesh, 3 in



Monthly Data Analysis

Maharashtra, 2 in Karnataka, 2 in Rajasthan and 1 in Tamil Nadu) has been completed successfully.

- Continuously monitoring and receiving real time wind data from 2 stations in 2 States.
- Monthly Data Analysis, Verification and preparation of Interim reports are under progress.
- Dismantling of Sensors and Mast from 73 WMS are under progress.

Other Programmes

- Offshore Guidelines Committee meeting for finalization of draft guidelines for Offshore studies and surveys by private sectors was convened at NIWE, Chennai on 3rd January 2017.
- Training programme on Wind Resource Assessment for the Project Assistants to be posted in NE region has been organized at NIWE, Chennai during 18th to 31st January 2017.
- Two days special training on "WRA, SWES & SRRA for SNA officials has been organized at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.

Two days Training Course

A two-day training course on "Wind Resource Assessment, Small Wind Energy & Hybrid system and Solar Radiation Assessment for SNA (State Nodal Agencies) officials was organised at Itanagar on 16th and 17th of February, 2017. The training course was focused to help the SNA Officials with the assessment of Wind in their respective State, Installation of Wind Mast, Maintenance of existing solar, wind farms, and explain the working of small wind turbines. Forty-eight SNA officials from eleven States across the country (Assam, Arunachal Pradesh, Karnataka, Manipur, Kerala, Andhra Pradesh, Rajasthan, Sikkim, Himachal Pradesh, Mizoram & Tripura) have attended the said training course and the course was highly appreciated by the participants for its intellectual level and the way of organization.

The Inaugural function started with a welcome address by Mr. K. Boopathi, Addl. Director & Head, WRA, NIWE and Mr. J.P. Singh, Former Director, WE, MNRE and NIWE Co-ordinator for the North-East briefed about the purpose and the objective of the workshop. Shri. Bhanu Pradap Singh, CEO Himachal Pradesh Nodal Agency stressed the need of Renewable energy and highlighted the success story of Renewable energy development in Himachal Pradesh. Shri. Marki Loya, Director, Arunachal Pradesh State Nodal Agency has briefed the status of Renewable energy implementation in the State and need of further assistance from the Government.

The Honourable Chief Secretary of Arunachal Pradesh, Smt. Shakuntala Gamlin, IAS delivered the Inaugural Address where she stressed on the need for development of Renewable energy in the North-East region. She also welcomed the drastic fall in the prices of equipment needed for the generation of renewable energy. She promised extent her help for ease of access on setting up of renewable energy plant in the State.



Smt. Shakuntala Gamlin, IAS inaugurating the Course

The training programme was addressed the following aspects:

- An overview on Small Wind Turbine, its testing and design relevance
- The Outcome of the study carried out by CECL towards the installation and commissioning of SWES systems in NE regions including J&K & Leh-Ladakh
- Small Wind Turbines & Hybrid systems for Telecom towers
- Small Wind Turbines & Hybrid systems for complex terrain From manufacturer perspective
- O&M issues of SWT/Hybrid and Batteries
- Large & Small Wind Turbine – Global & Indian Scenario
- Wind Resource Assessment and its technique
- A brief on 20m Indian Wind Speed map & 100m India Wind Atlas
- An overview on using Google Earth Effectively for site selection
- Optimum Utilization of Small Wind Turbines
- Solar Radiation Resource Assessment & details on the application of the SRRA data for various technologies

The intellectual level of the course was rated as Excellent based on the feedback received from the participants. The range of the technical presentation for the training programme was well appreciated and the participants had rated it good. The participants were very much satisfied by the quality of lectures and hospitality they found and the feedback from the participant's reflected the need for more number of training courses like this frequently including site visit and more details of every topics.

Wind Turbine Testing

Type Testing of XYRON 1000 kW wind turbine at Richadewda, Ratlam District, Madhya Pradesh of M/s. Xyron Technologies Limited is underway. The instrumentation work has been completed.

Standards and Certification

- Based on the Agreement signed with M/s. Southern Wind Farms Limited, review / verification of documentation in connection with renewal of certificate of "GWL 225" wind turbine model as per TAPS-2000 (amended) has been completed and renewed certificate has been issued to M/s. Southern Wind Farms Limited.
- Initiated renewal of Certificate of "V 39-500 kW with 47m rotor diameter" wind turbine model of M/s. RRB Energy Limited.



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

- A Certification project viz., “Inspection for the Manufacturing Evaluation at a wind turbine tower production unit” has been taken up by NIWE - TUVR Certification Group and the project is under progress.
- The review of the three draft IEC standards sent by Bureau of Indian Standards (BIS) has been completed. Based on the review, voting recommendations for the said draft IEC Standards have been prepared and sent to BIS for further forwarding to IEC TC 88.
- Organized 7th meeting of Wind Turbine Sectional Committee (ET 42) of Bureau of Indian Standards (BIS) held on 24.03.2017 at NIWE, Chennai & provided the technical support to BIS.
- Shri. A. Senthil Kumar, Director & Head, S&C, participated in the said ET 42 Committee meeting and explained the status of various Standards related works carried out by NIWE.
- Reviewed the documentation received from a Indian wind turbine manufacturer in connection with installation of prototype wind turbine model in India for the purpose of developmental works, as per MNRE guidelines. Based on the review, a letter has been issued in connection with grid synchronization of Six prototype wind turbines for the purpose of development works of 'VENSYS 115' wind turbine model of M/s. Regen Powertech Private Limited to the concerned State Electricity Board upon approval of DG, NIWE.
- Director & Head, S&C, as a member of the Committee, attended the Project Evaluation Committee meeting for the project proposal on prototype development and certification, organized by Technology Development Board, Department of Science and Technology, Ministry

of Science and Technology, New Delhi held at company project site & manufacturing facility.

- Interactions with officials of M/s.TUV Rheinland (India) Private Limited & M/s. TUV Rheinland Industrie Service GmbH in connection with certification co-operation works are ongoing.
- The continual improvement and maintaining the quality management system are ongoing.
- Shri. A. Senthil Kumar, Director & Head, S&C participated in the 7th meeting of Wind Turbine Sectional Committee (ET 42) of Bureau of Indian Standards at NIWE, Chennai on 24th March 2017.



7th BIS ET 42 meeting held at NIWE, Chennai

- Director & Head, S&C and S&C Engineers attended meeting held with Team of Officials from Forum of Regulators from CERC, POSOCO, SRLDC, REMC (Tamil Nadu) at NIWE, Chennai on 27th March 2017.

Wind Turbine Research Station

- Complete Operation and Maintenance activities like Preparation of Transformer Yard, conditioning of Control Panels, Power Panels, Functionality checks of all the sensors, conditioning of transmission lines etc. carried out for the Wind Electric Generators at WTRS, Kayathar of capacity 6.4 MW for the uninterrupted operation of the machines during the windy season 2017.
- The works on displaying details of system configuration and data measured in NIWE web-page for Grid integration of 75 kWp Solar PV Power with existing one of the 27 years old 200 kW MICON WEG @ WTRS, Kayathar is under progress.

Visitors

The following visits were coordinated and facilities of Small

& Large Wind Turbine Testing, R&D and WRA showcased:

- Dr. Jagmohan Singh Raju, IAS, TEDA Chairman cum Managing Director visited along with Director General, NIWE on 5th January 2017.
- 59 Students and 4 staff from Thiyaagi Dharmakkan Amirtham College of Arts and Science of Physics and Chemistry Department, Tamil Nadu on 2nd February 2017.
- 26 delegates of Special African International Training Course on “Wind Turbine Technology and Applications” on 11th February 2017.
- 27 delegates of 19th International Training Course on “Wind Turbine Technology and Applications” on 17th February 2017.

Information, Training and Customized Services

Special African International Training Course

Successfully conducted the 24 days International Training Course on “Wind Turbine Technology and Applications” specially for African Countries held during 1st to 24th February 2017 addressing all aspects of Wind Power starting from introduction to wind and its technology, wind resource assessment, installation, operation and maintenance aspects of wind farm along with financial analysis and CDM benefits. This is a special training course for African Countries sponsored by the Ministry of External Affairs (MEA), Government of India under AIFS-III. The course was attended by 26 participants from 8 countries (Ghana, Ethiopia, Madagascar, Namibia, Seychelles, Tanzania, Tunisia & Uganda).

The training was inaugurated by Dr. Rajesh Katyal, Deputy Director General and Head, OW&IB, NIWE and Dr. G. Giridhar, Deputy Director General, SRRA and Head, NIWE.



Release of Course Material

During the 24 days training, 42 classroom lectures were handled to provide complete knowledge transfer, practical training at NIWE Laboratories, study visit to

i) M/s. Gamesa Wind Turbine manufacturing factory, Mamandur for large wind turbine manufacturing process (ii) WTTS/WTRS, Kayathar for large and small wind turbine testing facility (iii) M/s. Suzlon Wind Farms, Radhapuram for knowledge on various working wind turbines (iv) Leitwind Wind Farms, Alangulam to witness the physical material and operation activities and (v) to CSIR-Structural Engineering Research Centre, Chennai to see the Wind Tunnel facility and other facilities at Wind Engineering Laboratory.

Dr. Rajesh Katyal, Deputy Director General and Head, OW&IB, NIWE distributed the course certificates to all the participants.

19th International Training Course

Successfully conducted the 28 days 19th International Training Course on “Wind Turbine Technology and Applications” held during 1st to 28th February 2017 addressing all aspects of Wind Power starting from introduction to wind and its technology, wind resource assessment, installation, operation and maintenance aspects of wind farm along with financial analysis. This is a special training course for ITEC / SCAAP partner Countries sponsored by the Ministry of External Affairs (MEA), Government of India under ITEC / SCAAP programme. The course was attended by 27 participants from 18 countries (Bangladesh, Cameroon, Ethiopia, Iraq, Jamaica, Jordan, Liberia, Malawi, Mozambique, Myanmar, Nigeria, Panama, Philippines, Syria, Thailand, Tanzania, Sudan and Vietnam)

During the 28 days training, 42 classroom lectures were scheduled apart from practical training at NIWE Laboratories, study visit to i) M/s. Gamesa Wind Turbine Manufacturing facility, Mamandur for large wind turbine manufacturing process (ii) WTTS / WTRS, Kayathar for large and small wind turbine testing facility (iii) M/s. Suzlon



Dr Rajesh Katyal distributing the Course Certificate to the Participants



Dr. Rajesh Katyal inaugurating the Course

Wind Farms, Radhapuram for knowledge on various working wind turbines (iv) M/s. Leitwind Wind Farms, Alangulam to witness the operating wind turbines v) M/s. RS WindTech Engineers to know the operation and maintenance process (vi) M/s. Appollo Engineering Works to know the Controllers and Transformers used for Wind Turbines.

Dr. S. Gomathinayagam, Former Director General, NIWE was the Chief Guest for the valedictory function and distributed the course certificates to all the participants.

Capacity Building Training Programme

Successfully conducted the 10 days Capacity Building Training Programme on Design, Installation & Maintenance of Small Wind Turbine during 27th February to 8th March 2017 with the objective to build the capacity of participants on small wind energy technology and practically train them on how to design a small wind turbine. In addition to knowledge transfer, special skills was taught to the participants on designing of Small Wind Turbines, particularly Blade, Generator, O & M and installation and commissioning of small wind turbine.

This is a special training course sponsored by the Ministry of New & Renewable Energy, Government of India. The course was attended by 25 participants from 9 States (Andhra Pradesh, Chandigarh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Pondicherry, Tamil Nadu & Uttar Pradesh).



Group photo of Participants during RS Windtech Study visit



Designing and construction of SWT in progress



Distribution of certificate to the participant

TRAINING COURSES PROPOSED FOR 2017-18

INTERNATIONAL TRAINING COURSE

Sl.No.	Description	From	To	Duration
1.	20 th International Training Course on "Wind Turbine Technology and Applications" for ITEC / SCAAP Partner Countries	16.08.2017	08.09.2017	24 Days
2.	21 st International Training Course on "Wind Turbine Technology and Applications" for ITEC / SCAAP Partner Countries	31.01.2018	23.02.2018	24 Days

SPECIAL INTERNATIONAL TRAINING COURSE

Sl.No.	Description	From	To	Duration
1.	Special International Course on "Wind Resource Assessment and Wind Farm Planning"	05.07.2017	21.07.2017	17 Days
2.	Special International Course on "Design, Installation & Maintenance of Small Wind Turbine"	25.10.2017	10.11.2017	17 Days
3.	Special International Course on "Wind Turbine Technology and Applications" for African Countries under AIFS-III	22.11.2017	15.12.2017	24 Days

PROPOSED

Exhibition

NIWE had established and managed its Stall in the 104th Indian Science Congress and Exhibition” organized by Indian Science Congress Association at Sri Venkateswara University, Tirupati, Andhra Pradesh held during 3rd to 7th January 2017, wherein and disseminated the information about the activities and services of NIWE along with the wind energy awareness to the visitors in various capacities. Honourable Chief Minister of Andhra Pradesh Mr. Chandrababu Naidu inaugurated NIWE stall.



- 15 faculty members from Hindustan University, Chennai on 13th January 2017.
- 63 students & 2 staff from American International School, Chennai on 30th January 2017.
- 25 Government Polytechnic teachers from National Institute of Technical Teachers Training & Research (NITTTR), Taramani, Chennai on 22nd February 2017.
- 19 students & 2 staff from Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Amritanagar, Coimbatore on 25th February 2017.
- 70 students & staff from Vel Tech High Tech Dr. Rangarajan Dr. Sakunthala Engg. College, Chennai on 2nd March 2017.
- 29 students & 2 staff from Dr. Babasaheb Ambedkar College of Engineering & Research, Nagpur visited NIWE facilities on 7th March 2017.
- 67 students & 2 staff from Vel Tech Engineering College, Avadi, Chennai on 9th March 2017.
- 70 students & staff from Aarupadai Veedu Institute of Technology, Paiyanoor on 16th March 2017.

Student Visits

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 January to March 2017, the following visits were coordinated.

- 120 students & 10 staff from SRM University, Chennai on 9th & 10th January 2017.

Students Internship

- Foreign student training fellowship application has been processed under Research Training Fellowship for Developing Country Scientists (RTF-DCS) for a period of six months. - Mr. Tchodou Samah Bawong from Togo has joined NIWE for the research work on 10th January 2017 and Mr. Tinotenda Zwavashe from Zimbabwe has joined NIWE for the research work on 1st March 2017.



Mr. Lars Halten, Chairman, LIFE Academy, Sweden

AWARDS

Change Agent of the Year 2016

Dr. P. Kanagavel, Additional Director & Head, ITCS, NIWE has been Awarded the “Change Agent of the year 2016” by LIFE Academy, Sweden. He has been chosen among the one thousand trained Change Agents in 80 Countries all over the world and will receive \$1000 USD to use for a project to continue to develop the organization and country in a sustainable way. He is the Second Winner of this award, which was started in the year 2015.

Engineering Service Division

Solar 30 kW SPV Power Generation:

- The Power Generation of 30 kW SPV plant for January to March 2017 is 3684 KWh and the Cumulative generation is 43.40 MWh.

Civil Works

The following civil construction works have been completed:

- Platform for stores at the rear side of the SRRA office module.
- Sheet coverage for stores platform at the rear side of the SRRA container.
- Small Wind Turbine training facility with storage at the rear side of the Biogas plant.

- Colonnade 55 kW Demo nacelle for the usage of college students and visitors during seminar & conference is in progress.
- Cement concrete road at main entrance gate and inter locking paver block flooring for car parking at NIWE through CPWD department.

General Maintenance works post Vardah Cyclone

- The 15 kW and 20 kW SPV solar power plants repair work has been completed which were damaged during Vardah Cyclone.
- Due to Vardha Cyclone, the 5 kW rooftop wind - solar Hybrid system and SPV street lights were damaged and the repair work is in progress.



15 kW solar panels installed at car shed after Vardah Cyclone & repair



15 kW solar panels installed at rooftop after Vardah Cyclone & repair



Lightning Arrester before & after Vardah Cyclone & repair



20 kW solar panels installed at rooftop after Vardah Cyclone & repair

Solar Radiation Resource Assessment

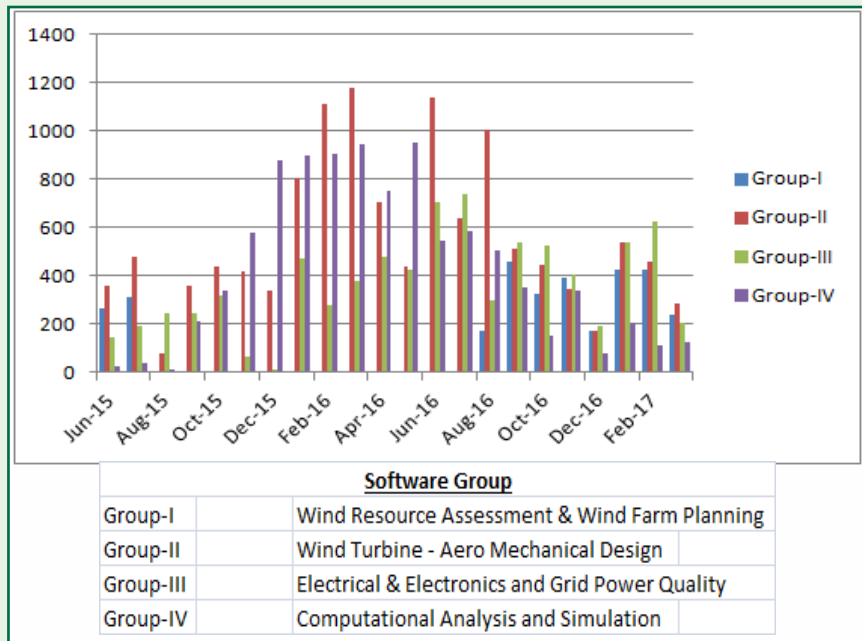
- Calibration of 30 pyranometers & 15 Pyrheliometers were carried out under SRRA project and calibration of 17 pyranometers were carried out under commercial mode.
- Quality Controlled data of 19 SRRA stations were provided to 6 clients under SDSAP policy.
- Draft MoU in connection with EOI on solar forecasting sent to the 4 SLDC's of Tamil Nadu, Kerala, Madhya Pradesh & Gujarat.
- Dr. G. Giridhar, along with Dr. Indradip Mitra, GIZ and Dr. R. D. Vashistha visited NISE, BSRN station and had discussions with MNRE/NISE officials on 23rd & 24th January 2017.
- Draft report in respect of the Solar Radiation Resource Assessment at Anas, H.P sent to M/s. SJVN in March 2017.

Knowledge Sharing Management & Small Wind Hybrid Energy System

Soft Skill training & TTT

Striving forward to meet the needs of internal staff training, the workgroup facility has placed consultancy grade software from different NIWE units at one platform and has seen extremely good patronage from the staff and research personnel attached with these units. Count of the footfall at the facility stands as a testimony to the benefit that the staff have accrued from its availability with in NIWE, and is shown below:

An open ideating platform provided by the Institute under the guise of TTT – Technology Think Tank has been reaping in high dividends. Started in January of 2014, the TTT stage has seen more than 90 speakers, every time a new and different topic, benefiting the hearers. Snap shots of the latest TTT sessions are provided for the benefit of the readers as follows:



Technology Think Tank (TTT) lecture in progress

Students Training Program

This HRD societal mission of NIWE to provide the needed technical skills to students has seen more than 60 students pass through the Institute as Interns and project students this year. The unit provides the needed coordination to the students to work under various scientists of NIWE who mentor them in new skills & knowledge. These students have brought in fresh ideas and in the process of being stewarded through have helped NIWE staff challenge & expand their horizon of knowledge on renewables.

Small Wind Energy & Hybrid program

The unit conducts testing and empanelment of small wind turbine models, which is a one of its kind facility in India and helps improve the quality of the turbines operating in the Indian Hemisphere. As an extension of its societal program the unit has come out with a Consumer label for these tested machines to edify the general user of the quality and performance of the turbines. The web uploaded consumer label will in addition to the nameplate details would contain a summary of the test report conducted at its test bed in WTRS, Kayathar.

In addition, the unit has supported the needs of MNRE by carrying out Physical Inspections of installed capacity of kW level wind and solar hybrid system at various locations in India. Based on these inspection reports, MNRE disburses its CFA subsidy assistance to its various beneficiaries.

Supporting the R&D programme of NIWE

The unit acts as the convenor for the R&D Council of NIWE and executes all the dictates of the council. The 24th R&D council Meeting had sponsored the following new projects:

- Control of Multi-Input Converter for Hybrid Wind Solar Battery Based System by NIT, Durgapur
- Wind Driven Air Storage System by KCG College of Technology, Chennai.

The unit coordinated the inking of the R&D agreements pertaining to the sponsored research and will now be tracking the progress through its established mechanism helped by Internal & external experts to provide course correction to the research carried out by the investigating agencies.

Establishment of Pan-India Wind related Research Network

Under the able Chairmanship of Shri S.K.Soonie, Former CEO, POSOCO the 24th meeting of R&D council of NIWE issued an directive to NIWE to establish a Pan-India Researcher's Network working in wind related science. This would bring all the researchers and institutions conducting work in wind engineering under NIWE's radar and a directory would be prepared & uploaded in NIWE webpage to help get the needed synergy & visibility to the wind related research in India. As a first step, details have been sought from premier technical institutions such as IITs, NITs, IISc, TIFR and State Central Universities (including the institutions to which MNRE had sponsored the R&D projects).

The second directive of the RC and as the logical follow up to this, NIWE will be very soon calling for Industry NIWE interaction to identify potential problem statements and connect the researchers in the network to work on them for feasible solutions.

NABL refresher Training at NIWE

A 4 days NABL training on "Requirements of ISO/IEC 17025-2005 and Internal Audit" was organised from 18th to 21st January 2017 at NIWE, Chennai. The training helped increase the internal pool of trained Internal Auditors and the details were updated with the Management Representative of NIWE looking after the Quality system in NIWE.



Staff Recruitment / Retirement



Recruitment

Mr. Tamada Sankara Rao
has been appointed as Junior Engineer in WRA&O Unit from 3rd March 2017 onwards.



Recruitment

Mr. B. Senthil Kumar
has been appointed as Technician in WRA&O Unit from 1st March 2017 onwards.



Recruitment

Mr. M. Nandakumar
has been appointed as Technician in ESD Unit from 16th February 2017 onwards.



Recruitment

Mr. B. Krishnan
has been appointed as Assistant Director (Technical) in S&C Unit from 9th February 2017 onwards.



Retirement

Dr. S. Gomathinayagam
Director General, NIWE has retired on superannuation on 31st January 2017.

Invited lecture delivered / meeting attended by NIWE Official in external forums

Dr. S. Gomathinayagam, Director General

- Windfarm visit alongwith CMD, TEDA at WTRS, Kayathar on 5th January 2017.
- Attended Review Meeting of RD&D programme on New & Renewable Energy on 25th January 2017.
- Attended “15th Arivukalanjiyam Awards 2017” at University of Madras, Chennai on 28th January 2017.

Dr. Rajesh Katyal, Deputy Director General and Head, OW&IB

- Delivered a lecture on “Offshore wind Farms” on 104th Indian Science Congress organized by Shri Venkateshwara University, Tirupati at Tirupati on 7th January 2017.
- Attended the meeting for consultation on the issues relating to offshore exploration and mining under the Chairmanship of Secretary, Mines at Royal Plaza, Ashoka Road, New Delhi on 10th January 2017.
- Attended the 165th meeting of Expert Appraisal Committee for projects related to infrastructure Development, Coastal Regulation Zone, Building/Construction, Industrial Estate and Miscellaneous projects at MoEF&CC, New Delhi on 16th & 17th January 2017.
- Delivered a lecture on “Offshore wind Farms” on one day workshop on Renewable Energy organized by Sri Sai Ram Engineering College, Chennai on 28th February 2017.
- Attended the meeting with MNRE officials and MoEF officials at New Delhi on 9th March 2017.
- Attended the National meeting on Lab policy for Testing, Standardization and Certificate at MNRE, New Delhi on 10th March 2017.

Dr. G. Giridhar, Deputy Director General & Head, SRRA

Dr. G. Giridhar made a presentation on “SRRA network & Wind Solar Hybridization” in the training program on Wind-Solar Hybrid Program organized by First View Group at New Delhi on 13th January 2017.

S.A. Mathew, Director & Head, WTT

Attended the meeting regarding National Lab Policy on Testing, Standardization and Certification in Renewable Energy Sector and Draft Modification for Quality Control of SPV Systems and Components at Ministry of New and Renewable Energy (MNRE), New Delhi on 10th March 2017.

A. Senthil Kumar, Director & Head, S&C

As a member of the Committee, attended the Project Evaluation Committee meeting for the project proposal on prototype development and certification, organized by Technology Development Board, Department of Science and Technology, Ministry of Science and Technology, New Delhi held at company project site & manufacturing facility on 11th & 12th January 2017.

M. Anvar Ali, Director & Head, ESD

- Delivered a lecture on “Wind Turbine Generators and Integration of wind power to Grid” at Gandhigram Rural Institute on 24th February 2017.
- Delivered a lecture on the “Optimum Utilisation of Small Wind Turbines” at 2 days special training for SNA officials of NE regions at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.

J.C. David Solomon, Additional Director & Head - KSM & SWES

Delivered lecture on the “Design Aspects of Small Wind Turbine” at the 2 days special training for SNA officials of NE regions at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.

K. Boopathi, Additional Director & Head, WRA

- Attended first Review Meeting of State Pr Secretaries and SNAs at New Delhi during 23rd & 24th January 2017.
- Attended Coordination Committee Meeting for Wind Power Forecasting on at Coimbatore 3rd February 2017.
- Attended Wind Evaluation Committee Meeting under the Chairmanship of Additional Chief Secretary to Government (Power), Kerala at Trivandrum on 7th February 2017.
- Attended meeting on forecasting of Wind and Solar Power Potential at MNRE on 10th February 2017.
- Delivered lecture on the “Wind Resource Assessment and its Technique”, “A brief on 20m Indian Wind Speed Map & 100m Indian Wind Atlas” and “An overview on using Google Earth effectively for Site Selection” at the 2 days special training for SNA officials of NE regions at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.
- Carried out site selection for establishment of WMS in the state of Arunachal Pradesh on 18th February 2017.

Dr. P. Kanagavel, Additional Director & Head, ITCS

- Delivered a lecture on “Large & Small Wind Turbine – Global & Indian Scenario” in the Special Training Programme on WRA & SWES To SNA Officials Of NE Regions and Other States at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.
- Delivered a lecture on “Power from Wind Resources” at National Institute of Technical Teachers Training & Research (NITTTR), Chennai on 21st February 2017.
- Delivered a lecture on “Wind Energy Technology and its status” in the All India Seminar on Renewable Energy – Present Scenario organized by The Institute of Engineers India, Chennai on 3rd March 2017.
- Delivered a lecture on “Wind Energy Technology and its status” at Murugappa Polytechnic College, Chennai on 6th March 2017.

- Delivered a lecture on “Wind Energy Technology and Applications” at Two day national seminar on "Grid connected solar-wind energy systems-Opportunities and challenges" at Bannari Amman Institute of Technology, Sathyamangalam, Erode on 27th & 28th March 2017.

Prasun Kumar Das, Assistant Director (Technical) Contract

- Visited SJVN office, New Delhi for discussion with officials on SRRA at Anas, H.P on 12th January 2017.
- Made a presentation on "SRRA network & Wind Solar Hybridization" in the training program on Wind-Solar Hybrid Program organized by First View Group at New Delhi on 13th January 2017.
- Delivered lecture on the “Solar Radiation Resource Assessment & details on the application of the SRRA Data for various technologies” at the 2 days special training for SNA officials of NE regions at Itanagar, Arunachal Pradesh on 16th & 17th February 2017.

R.Karthik, Assistant Director (Technical) Contract

Visited SJVN office, New Delhi for discussion with officials on SRRA at Anas, H.P on 12th January 2017.

R.Sasikumar, Consultant

- Made a presentation on “Solar resources and solar energy Applications” in Periyar University, Salem on 6th February 2017.
- Made a presentation on “Fundamentals of Solar Radiation in the short term training program on Advances in off grid

and grid tied solar PV systems” organized by Government College of Engineering, Kannur on 13th March 2017.

Publications

- Thi Thi Soe, B.Krishnan, K.Boopathi, S.Gomathinayagam**, Optimum Wind Farm Layout Considering Energy Yield And Wake Losses in Kyonkadun, Ayeyarwaddy Region, Myanmar, International Journal of Modern Engineering, Vol. 6, Issue 12 ISSN: 2249–6645, pp-73-80, December, 2016.
- Thi Thi Soe, K.Boopathi, J.Bastin, A.G.Rangaraj, S.Gomathinayagam**, Assessment of Technical Wind Power Potential in Myanmar, International Journal of Advance Engineering and Research Development, Vol. 4, Issue 1, pp-312-319, January, 2017.
- Thi Thi Soe, A. Hari Bhaskaran, K. Boopathi, S.Gomathinayagam**, Strategy for Wind Energy Development in Myanmar– An Overview, International Journal of Advance Engineering and Research Development, Vol. 4, Issue 2, pp-119-123, February, 2017.
- Thi Thi Soe, B.Krishnan, K.Boopathi, S. Gomathinayagam**, Social and Environmental Study on Wind Power Development in Ayeyarwaddy, Myanmar, International Journal of Advance Research, Ideas and Innovations, Vol. 3, Issue 1, pp-February, 2017.
- R Katyal**, et al, Optimal reactive power controller for wind-driven stand-alone doubly fed induction generators, Wind Engineering Journal 2017, Vol. 41(2) 124–143.

Women's Day Celebrations

Women's day was celebrated for the first time in NIWE on 8th March 2017. On the eve of Women's Day, competitions were conducted in NIWE, Prizes were distributed to the winners. The Chief Guest Dr. Yashodha Shanmugasundaram, Educationist & Ex. Vice, Chancellor, Mother Teresa Women's University has given talk on “Empowerment of Women”.



Glimpses of Women's Day Celebration

The following NIWE staff delivered lecture(s) in the 19th International Training Course on “Wind Turbine Technology and Applications” held during 1st to 28th February 2017 and Special International Training Course on “Wind Turbine Technology and Applications” Specially for African Countries held during 1st to 24th February 2017

S.No.	Topic	Speaker
1	Wind Energy Technology and its status	Dr. P. Kanagavel
	Wind Energy Development in India and Role of NIWE	
2	Overview of Wind Turbine Components	Shri. J. C. David Solomon
3	Wind Turbine Generators	Shri. M. Anvar Ali
4	Control and Protection System in Wind Turbine	Shri. S. Arulselvan
5	Wind Turbine Foundation	Dr. Rajesh Katyal
	Small Wind Turbine Testing and Hybrid Systems	
6	Wind Resource Assessment and Techniques	Shri. K. Boopathi
	Forecasting of Wind and Energy Production	
7	Wind Measurement and Instrumentation	Shri. B. Krishnan
8	Guidelines for Wind Measurements	Shri. A. G. Rangaraj
9	Wind Data Measurements and Analysis	Smt. G. Arivukkodi
10	Design and Layout of Wind Farms	Shri. J. Bastin
11	Type Certification of Wind Turbine and Overview of Design Requirements as per IEC 61400 – 1	Shri. A. Senthilkumar
12	Wind Turbine Testing & Measurement Techniques	Shri. S. A. Mathew
13	Instrumentation for Wind Turbine Testing	Shri. M. Saravanan
14	Power Curve Measurements and Safety & Function Testing	Shri. Bhukya Ram Das
15	Grid Integration of Wind Turbine	Smt. Deepa Kurup
16	Indian Government Policies and Schemes	Shri. Mohammed Hussain
17	Offshore Wind Energy	Shri. M. Joel Franklin Asaria
	Environmental Aspects of Wind Turbine Technology	
18	Solar Radiation Resource Assessment	Dr. G. Giridhar

The following NIWE staff delivered lecture(s) in the 21st National Training Course on “Wind Energy Technology” held during 20th to 24th March 2017

S.No.	Topic	Speaker
1	Wind Energy Technology and its Status	Dr. P. Kanagavel
	Wind Energy Development and Role of NIWE	
2	Wind Resources Assessment & Techniques	Shri. K. Boopathi
3	Wind Turbine Components	Shri. J. C. David Solomon
4	Certification of Wind Turbine	Shri. A. Senthilkumar
5	Indian Government Policies and Schemes	Shri. Mohammed Hussain
6	Wind Turbine Foundation	Dr. Rajesh Katyal
	Small Wind Turbines and Hybrid Systems	
7	Design and Layout of Wind farms	Shri. J. Bastin
8	Wind Electric Generators & Types	Shri. M. Anvar Ali
9	Wind Turbine Testing & Measurement Techniques	Shri. S. A. Mathew
10	Control and Safety System of Wind Turbine System	Shri. S. Arulselvan
11	Offshore Wind Energy : An overview	Shri. Joel Franklin Asaria
12	Forecasting of Wind and Energy Production	Shri. A. G. Rangaraj

19th Foundation Day Celebrations

NIWE's "Foundation Day", 19th Birthday was celebrated for the fifth consecutive year on 21st March 2017, with variety of programmes. 'Open Day' was announced for public to visit all the facilities of NIWE on 21st March 2017 between 9.30 am and 12.30 pm to create awareness about the Renewable Energy Sources and its applications. All the staff members of NIWE were presented with mementos in commemoration of the 19th Foundation Day of NIWE.

Dr. M.V. Ramana Murthy, Scientist G & Head, Ocean Structure & I-land desalination, National Institute of Ocean Technology, Chennai was the Chief Guest and delivered the Foundation Day Lecture at the Conference Hall of NIWE among NIWE staff.



Glimpses of Public visit during Open Day of NIWE's Foundation Day



Glimpses of NIWE's Foundation Day lecture and Prize distribution

INDIAN WIND ENERGY GROWTH - AN OVERVIEW

Dr. P. Kanagavel, Additional Director and Head, Information Training and Customized Services, NIWE pkanagavel.niwe@nic.in

INTRODUCTION

The initial step towards wind energy took place in 1986 with demonstration wind farms with private and government partnership. The Government has taken serious steps towards promoting renewable energy with lot of policies and supports as incentives, tax holidays, financial benefits and lot more through Ministry of New and Renewable Energy (MNRE), the nodal ministry for promotion of Renewable Energy (RE) in the country. Initially, the wind data with India Meteorological Department was used for the wind resource assessment and thereafter the National Institute of Wind Energy (NIWE) formerly Centre for Wind Energy Technology (C-WET) took the assessment and proved wind as possible energy source for India when people were telling India as tropical or sub-tropical country with not good potential for wind energy. Initial reports proved the potential to be 20,000MW and later it was revised to 49,130 MW at 50 m hub height, 102,788 MW at 80 m and 302 GW at 100m[4]. Now it's going to be still further with ongoing research on offshore wind energy. Currently, India holds very good status in installed capacity with more than 32 GW holding fourth place in the world and having global manufacturing base with ambitious target of 60 GW by the year 2022[5].

INDIAN POWER SECTOR

The total installed capacity of power in India is about 326 GW[6] from different sources of energy and the electricity demand is growing 8.9 per cent annually. Energy security and sustainable developments are the greatest challenges to face with the fossil fuel depletion and climate change issues. The power production from RE sources gaining momentum in India. Indian Electricity Act 2003 is supporting RE development with the provision to promote generation of electricity from RE sources by providing suitable measures for connectivity with

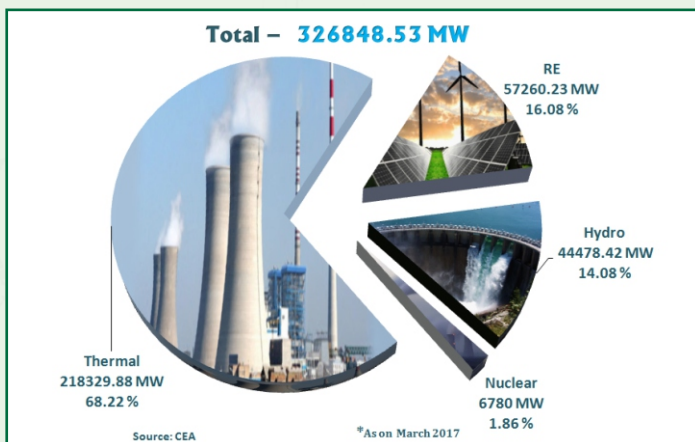


Figure 1. Indian Energy Mix^[6]

the grid and sale of electricity to any one desire to purchase. Further policies had mandated the purchase of renewable power by Renewable Purchase Obligation (RPO). MNRE has fixed a target of 175 GW from RE by the year 2022 which includes 60GW from Wind. Deployment of the renewable power during the 10th plan has made it as the second largest source after conventional power. Besides this, the Clean Development Mechanism (CDM) has accelerated the diffusion of RE and energy efficient technologies by mitigating some of the risk associated with the adaptation of new technologies.



Figure 2. Indian RE Installed Capacity^[1]

RE penetrates about 16 per cent of the total Indian energy installed capacity of 326848.53 MW as on March 2017 [6] in which wind energy contributes 8.9 per cent with installed capacity of 32279.77 MW[1].

INDIAN WIND POWER DEVELOPMENT

First effort to harness wind energy in India can be traced back to 1973 when attempts to develop water pumping wind mills by National Aerospace Laboratories (NAL), Bangalore. Prior to this, there is no evidence of wind power having been used in India, as in the case of Europe, where windmills have been in use for several hundred years. But today, Tamil Nadu and other windy states of India, the wind turbines are part of the landscape.

MNRE: To manage the oil price hike and to identify alternate energy sources, Government of India has formed a commission in 1980. The commission became Department of Non-Conventional Energy Sources (DNES) in 1982, which then became Ministry of Non-Conventional Energy Sources (MNES) in 1992 and now known as Ministry of New and Renewable Energy (MNRE), which promotes the deployment of RE sources in the country. Until 2015, India is the only country having a separate ministry for the promotion of New and Renewable Energy Sources. MNRE has launched dedicated programme on wind mapping and monitoring, and is one of the largest in the world and still continues. The development of wind power in India began in the 1986 with demonstration wind farms set up in the states of Gujarat and Tamil Nadu. The demonstration wind farms have created awareness about the new technologies and were helpful in establishing technical and economic viability of wind power technology in India. The development initiatives then on were pushed up and there are number of success stories about pace of development of wind power in the country. In spite of the interest evoked by success of demonstration wind farms, the progress of wind generation in India remained slow initially however gradually picked up due to many positive initiatives.

IREDA and NIWE: MNRE has established Indian Renewable Energy Development Agency (IREDA) in 1987 to provide the policy framework and soft financing for the renewable energy projects which played a crucial role in attracting private sector investments. NIWE was established at Chennai in 1998 by MNRE as an Autonomous R&D institution to act as technical focal point for the development of wind energy in the country and to extend support to Indian Wind industry and

the stakeholders. NIWE has achieved several milestones in Indian wind energy development and its work towards wind resource assessment, development of Indian Wind Atlas, Indian certification scheme & testing facility, research & development and human resource development are the greatest achievements to note in the history of wind power development in India. NIWE supports to the orderly growth of wind energy in the country. The policy framework provided by MNRE, financial supports by IREDA and technical support by NIWE has been instrumental in encouraging private sector investments apart from the available potential land and manufacturing facilities with O&M support.

Private Sector Participation : It is very important to highlight few interesting aspects about wind power development in India. Wind energy is the only sector, which has more participation from private unlike all other power sector projects developed in India. More than 95 per cent of the investment is from the private sector. In the conventional power sector where most of the investment has been made by Governments. By 1990, the Government of India introduced a policy of 80 per cent Accelerated Depreciation (AD) for first year to encourage private sector investments in wind power. The Tamil Nadu Electricity Board (TNEB) came forward with a policy on banking and wheeling of electricity from wind farms. MNRE is continuously creating favorable environment for the private sector to invest in this green power projects with right policies and directions.

INDIAN WIND POWER POTENTIAL

India is the first country in Asia to develop wind power on a commercial scale. India is blessed with good wind resource and climatology. Wind of India is influenced by the strong south- west summer monsoon, which starts in May-June, when cool, humid air moves towards the land and the weaker north-east winter monsoon, which starts in October, when cool, dry air moves towards the ocean. India conducts one of the largest wind resource assessments in the world and has dedicated wind monitoring stations for resource assessment and the setup covers the entire length and breadth of the country. Wind resource assessment has so far been covered in 29 states and 3 Union Territories by establishing more than 800 dedicated wind monitoring stations. More stations are being added every year so as to study scientifically the uncovered areas in various states. Wind data is being collected from the monitoring stations for a minimum period of 1 to 2 years and periodically publishing the Wind Energy Resource Survey in India volumes to support the wind farms development. The collected data also serve as a data bank for the preparation of Wind Atlas and other research studies. India is consistently upgrading the Wind Atlas at various heights which itself acts as reliable source of information to attract better investments in the wind energy sector.

Initially, the wind potential at 50m height above ground level was estimated as 49,130 MW with a conservative consideration of 2 per cent land availability for all states except Himalayan states, North-Eastern states and Andaman & Nicobar Islands, where it is assumed as 0.5 per cent. The potential for 80m height was estimated as 102,788 MW[4].

Recently, NIWE has assessed potential for 100m height as 302,251 MW using advanced modelling techniques. The assessment has been carried out at a very high spatial resolution of 500m, using the advanced meso-micro coupled numerical wind flow model, and with the corroboration of almost 1300 actual measurements spread all over India. The study has been done with actual land availability estimation. Land features which are not suitable for wind farming has been excluded in addition, roads, railways, protected areas, airports, etc. The suitable land features have been grouped into 3 ranks (Rank I: Wasteland, Rank II: Cultivable Land and Rank III: Forest Land) and considerable weightage of 80 per cent to

Rank I, 30 per cent to Rank II and 5 per cent to Rank III has been assumed for the estimation[4].

GROWTH OF INDIAN WIND INSTALLATION

The Indian wind energy market grew by almost 68 per cent on a year-on-year basis with 3472.15 MW of new capacity installed in the financial year 2015-16[7]. This made India the third largest annual market after China and the USA. With more than 27 GW of total installed capacity at the end of July 2016. India ranks fourth in the world in terms of cumulative installed capacity after China, USA and Germany.

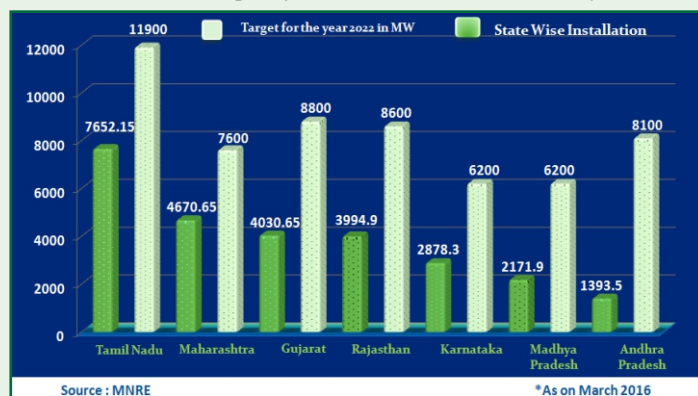


Figure 4. State wise Indian wind installation and Target for the year 2022 in MW^[6]

WIND TECHNOLOGY DEVELOPMENT IN INDIA

A large domestic manufacturing base has been established in the country for wind turbine. The technology is rapidly evolving in the country with global players in the field. The size of Wind turbines has gone up over a period of 30 years from 55-100 kW in the 1980s to 3 MW in 2016. The figure 5 shows the Wind Turbine Capacity growth in Indian market.

In the initial stages of wind technology development India received substantial assistance from Europe specially from Denmark. As mentioned above, the first commercial wind farm in India was set up during January 1986 at Mandvi, Gujarat, 1.15 MW project comprising 55 kW, 110 kW Micon and 33 kW DWT wind turbines. During August 1986, a 550 kW wind farm was set up with 55 kW wind turbines by RRB with Vestas in Tuticorin, Tamil Nadu. In 1988, DANIDA, the Danish

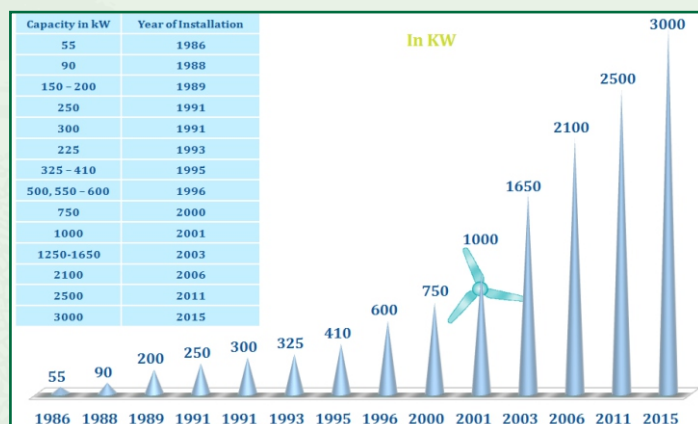


Figure 5. WT Capacity growth in Indian market^[3]

International Development Agency played a significant role for wind power development in India and during that time, nearly all the wind turbines set up in India were of Danish origin. Then, DANIDA has set up two 10 MW demonstration projects in Tamil Nadu and Gujarat.

Gujarat project comprised of 200 kW Vestas wind turbines and Tamil Nadu project comprised of 200 kW Micon make wind turbines. These demonstration wind farms.

- ◆ Created awareness about the new technology and provided useful operational experience.
- ◆ Established the technical and economic viability of wind power technology in India.
- ◆ Provided insights into various technical, operational and economic issues.
- ◆ Encouraged the private sector, in particular the energy-intensive industries, to invest in wind farms.

The Indian wind market has saw the new entrants in the year 1994 onwards, the Danish concept fixed speed wind turbines to Enercon's gearless wind turbine of 500kW gearless variable speed. As the 500 kW wind turbine was not suited to Indian wind regimes, logistics, grid etc., a new Enercon 30 (E-30) developed with the rating of 230 kW, with 50 m hub height and 30 m rotor diameter. Suzlon made entry in 1995 with technical collaboration of German company, Sudwind GmbH Windkraftanlagen, to source the latest technology for the production of wind turbine generators in India and agreement with Enron Wind Rotor Production BV for manufacturing of APX-60 type blades in India. Almost at the same time as that of Suzlon's entry, in 1996 NEG Micon also made a beginning in India with its base in Chennai. NEG Micon introduced large capacity machine NM48, A 750 kW turbine in 1999 followed by the largest and the tallest (NM82) 1650 kW turbine in 2004. NEG Micon rolled out more than 700 turbines during that point of time which was a world record for any wind turbine manufacturer at that time[9].

Today, India has 20 wind turbine manufacturers with 53 models manufactured, capacity starting from 225 kW to 3 MW[3], mainly through joint ventures or under licensed production agreements. A few foreign companies have also set up their subsidiaries in India, while some companies are now manufacturing wind turbines without any foreign collaboration. The current annual production capacity of domestic wind turbine industry is around 9500 MW. The technology is continuously upgraded, keeping in view global developments in this area.

To harness the available wind energy, selection and use of efficient wind energy technologies like aerodynamic design of blades, variable speed rotors had become essential. These modern developments not only increase the efficiency but also bring down the cost of wind generated electricity to further lower levels. The technology is moving towards better aerodynamic design; use of lighter and larger blades; higher towers; direct drive to free from the gear issues; advanced control systems and Double Fed Induction Generators (DFIG) generator systems, Permanent Magnet technology and variable speed gearless operation using advanced power electronics. The industry has taken up indigenized production of blades, gear boxes, generators, yaw components and other critical components unlike during initial periods all the components was imported and installed. Wind Turbines and its components produced in India are exported to the US, Australia, Europe, Brazil, Asian Countries, etc.

OFFSHORE WIND POWER IN INDIA

India has a long coastline of over 7500 km and with promising offshore wind potential according to preliminary offshore assessments carried out by Scottish Development International which indicates offshore potential to establish around 1 GW wind power capacity each along the coast lines of Rameswaram and Kanyakumari in Tamil Nadu. A

mesoscale model of offshore potential was done by DNV GL under FOWIND project and Eight potential zones are identified at Gujarat and Tamil Nadu. Initial studies carried out by National Institute of Wind Energy indicates offshore wind energy potential in the coasts of Gujarat and Tamil Nadu. An EU funded study has also indicated potential for offshore wind energy in Tamil Nadu and Gujarat coasts. However, this requires validation by actual measurement as the investment is more the double when compared to onshore. Locations have been identified in Gujarat and Tamil Nadu Sea to establish LiDAR (Light Detection and Ranging) for measurement of offshore wind data. National Offshore Wind Energy Policy was released by MNRE in October 2015 to support and promote development of offshore wind power[1].

WIND POWER FORECASTING IN INDIA

The infirm and fluctuating nature of wind power has been an issue in general and particularly the utilities who are evacuating the wind power. It is therefore, forecasting of wind power is need of the hour. NIWE as a technical focal point for the wind power development in India, has started forecasting service initially in Tamil Nadu state and will extend to all other states and stakeholders in the country. NIWE is gathering wind generation data from various wind farms connected to substations across Tamil Nadu state through GPRS and analyse to arrive at wind power generation estimation for the following day up to 10 days ahead. NIWE has created an automated system to pick up and process the real-time generation data, which is received at 15-minute interval. NIWE is providing 10 days ahead wind power forecast since August 2015. The use of wind power forecasting system has helped to increase wind power evacuation by 20 per cent on a daily basis.

GOVERNMENT POLICIES AND INCENTIVES

Between 1990 and now, the policy environment, the industry, the technology, the institutional structures, the market, financing approaches have changed to a greater extent. On the policy and regulatory front, a series of strategic steps have been taken, starting with the Indian Electricity Act of 2003, followed by Tariff Policy of 2006, Integrated Energy Policy of 2006 and the National Action Plan on Climate Change (NAPCC) of 2008. The common single part tariff introduced by MNRE in early 90's has been replaced by feed-in-tariffs by the State Regulators in most states, and the Central Regulator has issued Guidelines in 2009 for fixation of such tariffs. 20 states have introduced Renewable Purchase Obligations (RPOs). This has been followed by introduction of a Generation Based Incentives (GBI) for new installations in lieu of Accelerated Depreciation. Accelerated Depreciation has been driving force for wind power development in India. MNRE has also announced GBI to enable investments from Non-tax liable investors but the scheme has taken by only few IPPs. Even though, several public sectors and Government undertakings own interest in investing in wind power having most of them seem to hang on to the Accelerated Depreciation clause of policy. The main driver should be the desire to decarbonize the economy and mitigate climate change. This approach would make India's hand upper in the green society. Renewable Energy Certificates (RECs) have also been introduced and it is slowly picking up to meet RPO obligation.

In 1990, the Government of India came out with a policy to encourage private sector investments in wind power and MNRE has taken sustained efforts towards promoting renewable energy with lot of policies and supports. The highlights of the policy initiatives at the central and state level were as follows,

- ◆ 80 per cent accelerated depreciation within the first year of commissioning
- ◆ Wheeling, banking, and third-party sale of electricity produced

from wind turbine

- ◆ Exception from customs and excise duty
- ◆ Tax holiday

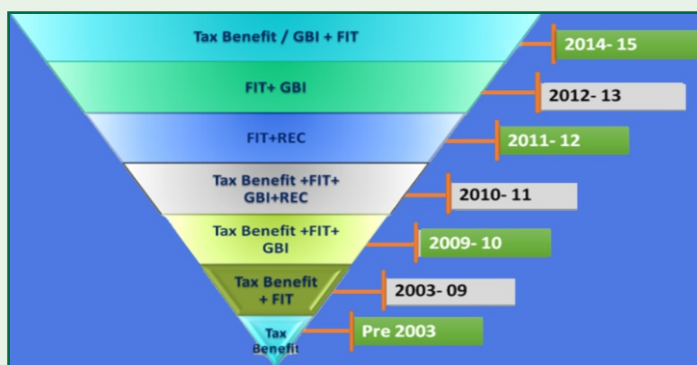


Figure 6. Indian Policy Highlights

Series of policies with generous incentives, soft financing facilities from international institutions and tax holidays gained good response from industries, entrepreneurs and businessmen and played significant role for the development of wind power sector in the country.

HRD IN INDIAN WIND ENERGY SECTOR

World Institute of Sustainable Energy (WISE) in the year 2006 conducted survey in Human Resource Development (HRD) concluded that there are 50,000 (10,000 Direct and 40000 Indirect) Jobs available in Wind Power Sector. They also forecasted that by the year

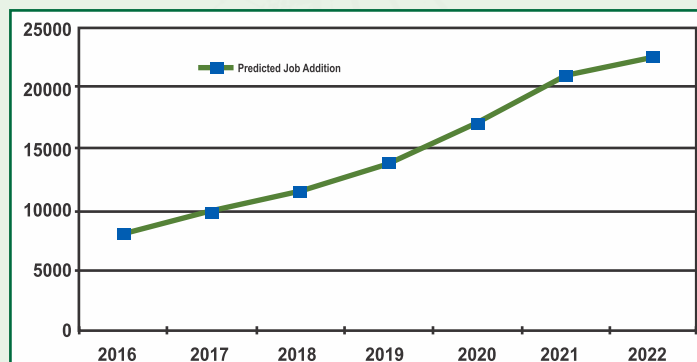


Figure 7. Forecasted Manpower addition^[1]

2015, 34000 to 53000 will be directly employed and the indirect employment will be 3-4 times of the Direct Employment. MNRE statistics says that the present job availability in the wind power sector is around 46000 to 48000 jobs which is higher than the reported prediction. By analyzing various reports, the future jobs in Indian wind power sector will be around 100,000 mainly in the technical and skilled category, Research & Development, Project Management and Development, Construction, O&M, Servicing and Maintenance etc. Because of the tremendous push by the government and the target fixed for the year

2022 there will be definite technology developments which lead to the increase in the installed capacity and investors to trust and rely on the wind sector. This will surely lead to increment in jobs opportunity in the future days. Analyzing different reports and predictions given by different institutions, organizations and future technology development in wind energy, the manpower addition in the wind sector for every year is derived and given.

CONCLUSION

The Government of India has been actively developing renewable energy and wind energy through right policies / schemes and development programs. Now, India occupies the fourth position in the world with a wind power installed capacity of 27 GW. Indian Electricity Act 2003 proved to be instrumental for Renewable Energy Development with the provision to promote generation of electricity from renewable sources. India conducts one of the largest wind resource assessments in the world and has wind monitoring stations for resource assessment setup to cover the entire length and breadth of the country. Initial studies carried out by National Institute of Wind Energy indicate offshore wind energy potential in the coasts of Gujarat and Tamil Nadu which evident the offshore installation in India within few years. NIWE has recently launched wind forecasting service to enhance the efficiency of wind power evacuation. India has committed that 40 per cent of its total power capacity by 2030 will be based on renewable sources. There has been an upward pressure on the overall cost of generation of power using fossil fuels. As a result, preferential tariffs offered to wind power plants in several states such as Tamil Nadu, Gujarat and Karnataka are competitive with the tariffs of new conventional power plants.

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Phone : +91-44-2246 3982, 2246 3983, 2246 3984 Fax : +91-44-2246 3980

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