

EDITORIAL



India overtaking Spain in installed capacity of wind turbines stands fourth in installed capacity with over 24 GW, next only to China, USA and Germany. There is considerable optimism in the matured Wind Industry in India inspite of the issues of cash flow. This has been partly due to

revival and sustaining the policy of both Generation Based Incentive (GBI) and Accelerated Depreciation (AD). Again, against sharply declining unit cost of power from solar the matured wind industry is strained by short of orders for execution while manufacturing of over 8000 to 9000 MW per year is possible by over 20 manufacturers with more than 50 models. However, several departments including Railways have given keen interest to seek alternative sources of energy like wind and solar to reduce their fossil fuel consumption in day today operations.

There has been interest by the wind generators in carrying out scientific and reliable forecasting and scheduling of wind power while earlier they had resorted to legal measures not to do the forecasting as mandated by the Central Electricity Regulatory Commission (CERC). The industry has realized the importance of renewable energy forecasting, bringing visibility to their power system operators to effectively manage the various sources of electricity generation and evacuate more wind and solar power into the grid. This mindset change by the wind generators has not been so easy without several meetings with the State distribution companies together with load dispatch centre officials and Joint Secretary (Wind Energy) Ms. Varsha Joshi, IAS., MNRE along with NIWE forecasting team. In an effort by NIWE, TANGEDCO Chairman & Managing Director, Shri Saikumar, IAS., and the then Principal Secretary -Energy Shri Rajesh Lakhoni, IAS who have made convincing decisions to allow NIWE-Vortex to have access to all the sub-stations under TANGEDCO to prepare and carry out operational forecast as per CERC norms. The project would not have been successful except for the wind generators of the Tamil Nadu represented by IWPA join hands with NIWE and TANGEDCO to finance the project of Wind Power Forecasting of over 7200 MW grid connected capacity.

NIWE has risen upto the expectations of SLDC, TANGEDCO & IWPA with their smart technology aligning in collaboration with Vortex, Spain and facilitated about 20% more evacuation into the grid. The project also won a coveted Skoch Award 2015. With wind power forecasting it could be demonstrated that the other sources of electricity generators could be efficiently managed.

NIWE in this quarter has several training programmes offshore and small wind turbine initiatives apart from several novel projects in wind resource assessment, wind turbine testing and standards and certification. Remote monitoring of wind turbines of Kayathar (WTRS) and integration with energy management system has been initiated with Central Scientific Instruments Organisation (CSIO). Special purpose training for Engineers of Tamil Nadu Energy Development Agency (TEDA) and a special one day meeting with Power Grid Corporation of India took NIWE's services to the field engineers. Today, NIWE operates more than 107 wind monitoring stations in 15 States and in 1 Union Territory successfully mastered and built capacity for effective wind power forecasting. WRA training was also imparted to North East State Nodal Agencies. Wind Turbine Testing for Inox has been initiated and a power curve measurement for ReGen 1000 kW machine has also begun.

Certification of wind turbines has always been a nightmare for the Indian manufacturers as most of the IPRs are held abroad and the Internationally accredited certification companies are also from the Western World.

This quarter marks an occasion of successful partnership between TUV Rheinland Industrie Services, Germany, TUV Rheinland (India) with NIWE to offer Internationally accredited certification services for wind turbines in India for which an International Workshop of Stakeholders was held.

Several student visitors and polytechnic teachers visited the premises of NIWE, Chennai as well as WTRS, Kayathar.

After the devastating deluge at Chennai during 1st week of December, NIWE quickly sprang back to normal operations within a short time by the quick action of the Engineering Service Division (ESD) and active coordination of all the Staff. Praying for the health and rehabilitation of families of NIWE post flood, NIWE staff acknowledge with profound gratitude for the helping hands and minds of NISE, NIWE to mitigate damage to deprived families.

Four short training courses have been arranged by SRRA, NIWE and several invited lectures, Keynote speeches and presentations of papers have been carried out by Scientists of NIWE. This quarter also marks 4 Institutional Awards and 2 Individual Awards.

With offshore wind power policy notified by Government of India, NIWE has formed a separate Unit to handle developments in that Sector along with Small Wind and Hybrid Systems. Your constructive criticism will make us serve you better in future forever.

Dr. S. Gomathinayagam, Director General

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Offshore, Small Wind Hybrid System & Industrial Business

Testing of Small Wind Turbines

An agreement has been signed for testing a model NALWIN 600 during the windy season of 2016. The erection of test turbine is expected during January 2016. Presently 2 nos. of small wind turbines are under test in WTRS, Kayathar and 3 more are proposed to be tested during the windy season of 2016.

Remote monitoring of Wind Turbines and integration with Energy Management System

NIWE in association with Central Scientific Instruments Organisation (CSIO) has initiated a project for remote monitoring of the wind turbines owned at WTRS, Kayathar. Additionally, energy monitoring at NIWE campus is proposed and will be integrated into the Energy Management system. The Energy Management System (EMS) will achieve the following objectives:

- The remote on line monitoring data will help in monitoring the performance of the turbines at NIWE, Chennai by collection, collation and timely analysis of data.



Electrical nodes identified for Energy Management System

- The EMS system installed at NIWE office, Chennai will also have measurement nodes which will help in monitoring the energy consumption and initiate energy conservation in NIWE, Chennai. As on date, no system for periodic on line monitoring of energy consumption in NIWE, Chennai is in place.

Offshore Geotechnical investigations

NIWE intends to establish a platform for assessing the offshore wind by LiDAR measurement near Tuticorin, Tamil

Nadu. For the purpose, NIWE has initiated work on Offshore Geotechnical investigations near Tuticorin. The objective of this investigation will be to ascertain the nature and properties of soil available at the proposed site at recommended depths for design of foundation of the proposed structure.



Map showing LiDAR Location at Tuticorin in Tamil Nadu

Special Training for field / inspection engineers

A special training course for field engineers of Tamil Nadu Energy Development Agency (TEDA) was conducted, which addressed the issues the field engineers faced in implementing the Small Wind Energy and Hybrid Systems. The training covered topics ranging from site selection criteria in lines with the present MNRE policy, O&M issues wind-solar hybrid technology and testing of small wind generators. The lectures were delivered by NIWE staff and external experts.



TEDA Training Participants during NIWE Facilities visit

Wind Resource Assessment

During the period of October to December 2015, 1 Wind Monitoring Station (WMS) in Tamil Nadu has been commissioned. Presently, 107 WMS are operational in 15 States and 1 Union Territory under various wind monitoring projects funded by the Ministry of New and Renewable Energy (MNRE) as well as various entrepreneurs.

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

- Verification of procedure of wind monitoring for 7 sites
- Technical Due Diligence for the proposed 58 MW wind farm
- Measure Correlate Predict (MCP) analysis & Verification of procedure of wind monitoring for 1 site
- Micrositing & Annual Energy production for the proposed 50 MW wind farm

Wind Power Forecasting services

- Continuous coordination is being extended to Indian Wind Power Association (IWPA), Tamil Nadu Electricity Board (TNEB) and other stake holders to get real time generation data for executing the project Wind Power Forecasting Services successfully.

The following activities have been done for the project;

- Error Analysis for the past 2 month has been carried out.
- Automation system has been created to refine the forecast results based on real time generation data.
- Another automation system has been created to send the refined forecast results to Energy Secretary, Tamil Nadu, Chief Executive, National Center for Education Statistics, Chief Managing Director, Tamil Nadu Generation and Distribution Corporation, Director-Operation, Chief Executive, Operation and Chairman, Indian Wind Power Association via mail.
- Finetuning of automation system has been carried out to send the long term forecast.
- General forecast brochure has been prepared.

R&D Projects progress in WRA

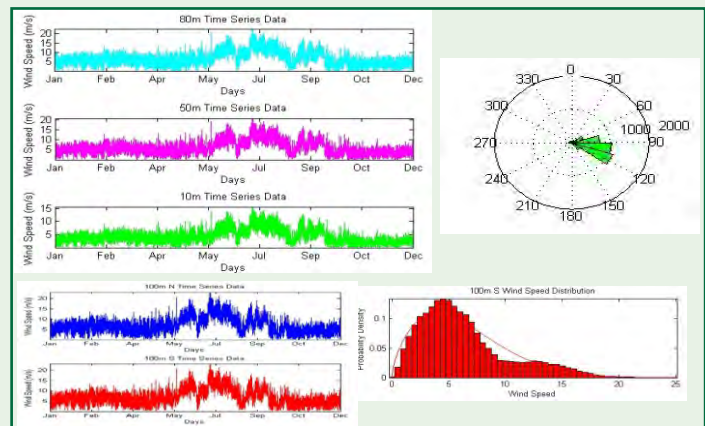
A 50 m tubular wind monitoring station has been commissioned at Gandhigram Rural Institute, Gandhigram, Tamil Nadu to understand the wind flow pattern in the region.

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

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 100 m WMS under the project 'Estimation & Validation of Wind Power Potential at 100 m level in 7 States of India' and the data acquisition is in progress.

- One year continuous data acquisition from 60 nos of WMS located in various part of the country (9 in Andhra Pradesh, 10 in Gujarat, 2 in Madhya Pradesh, 5 in Maharashtra, 13 in Karnataka, 10 in Rajasthan and 11 in Tamilnadu) and two year continuous data from 32 WMS has been collected successfully.
- Continuously monitoring and receiving real time wind data from 70 stations in 7 States.
- Monthly Data Analysis, Verification and preparation of Interim reports are under progress.



Monthly Data Analysis

The following works carried out for Wind Resource Assessment Studies;

- Closedown of Yarada hills for Gangavaram Port Trust
- Closedown of Billigere site for M/s.NSL
- Draft report for Ennore Port
- Draft report of Billigere site for M/s.NSL
- Draft report for 4 sites in Kerala for M/s. ANERT
- Draft report for Gangavaram Port Trust

Other Programmes

- Transported mast & its accessories from NIWE to Aarupadai Veedu Institute of Technology for Installation & Commissioning of WMS.
- A Meeting was organized at NIWE on 4th November 2015 to provide adequate inputs to Power Grid Corporation of India Limited for creating necessary grid infrastructure to develop Wind Power Projects across the Country.

- Technical committee Meeting was organized at NIWE on 6th November 2015 to evaluate the technical bids received and to finalize the supplier/vendor.
- Technical committee Meeting at NIWE on 27th November 2015 to evaluate the technical bids received and to finalize the vendor towards design, fabrication, transportation, civil work and installation of 50 m mast has been convened.

Special Training Course

In order to create awareness among the NE region State Nodal Agency officials regarding the different facets of Wind Resource Assessment and small wind energy and hybrid systems, a two day special Training Course on "Wind Resource Assessment and Small Wind Energy & Hybrid Systems" exclusively for North-Eastern State Nodal Agency Officials" was successfully organized during 18th & 19th November 2015 at Guwahati, Assam.

The prime objective of this training course was to transfer knowledge and needed skills to the officials from State Nodal Agencies / departments for effectively implementing the wind monitoring stations and small wind energy & hybrid systems in their respective States. During the training, a brief insight was also provided to the SNA officials on the concepts such as smart grid, Mini-grid, design aspects of wind turbines, SWES systems for telecom towers etc.

The training course was inaugurated jointly by senior officials of MNRE and NE regional State Nodal Agencies.



Participants with NIWE & MNRE officials

During the training, the GPS systems were bequeathed to each of the NE region SNA's which would be useful for them while doing the field survey and collecting the geographical coordinates. The training was attended by 24 participants from 8 States (Assam, Manipur, Meghalaya, Mizoram, Arunachal Pradesh, Sikkim, Tripura and Nagaland). As part

of the training, practical training was also provided on handling the GPS systems, Google Earth etc. The participants were very much satisfied and requested NIWE / MNRE to conduct more number of training course like this at on regular intervals.

Wind Power Forecasting Services / 42nd SKOCH Award

Wind power producers in Tamil Nadu, the state with the largest installed capacity 7.5 GW of green power every day, are dreading a reprisal of the 2014 wind season, when nearly 2.5 billion units of power produced was lost to frequency-induced back-downs and measures to rationalize wind power procurement with other sources. The losses due to back-downs totalled 245 million units in 2014, translating into a monetary loss of Rs. 500 to 700 crore. In order to overcome this issue Indian Wind Power Association had approached NIWE.

The project was launched on 13th May 2015 by Ms.Varsha Joshi, Joint Secretary, Wind Energy, MNRE, New Delhi and NIWE has been providing WPF (Wind Power Forecasting) service to SLDC which is helping Tamil Nadu's state-owned electricity generation and distribution utility, TANGEDCO, better manage the fluctuations in wind power output in the region in collaboration with M/s. Vortex S.L, Spain.

As latest state of the art forecasting technologies, NIWE uses a hybrid of physical and statistical schemes along with machine learning algorithms. Both models are used worldwide on an operative basis and have been intensively validated. NIWE generates forecast information by calibrating physical input from global and mesoscale numerical weather prediction models against historical wind farm observations (real or synthetic time histories generated by NIWE) with the use of advanced statistical techniques. The NIWE's 10 days' forecast is being shared with SLDC, RLDC, IWPA and all other stake holders to utilize green power effectively since August 2015. Tamil Nadu's state-owned electricity generation and distribution utility, TANGEDCO, very much benefited from the forecast provided by NIWE. The use of wind power forecasting system established by NIWE has helped to increase wind power evacuation by 20% (additional Rs.100-200 Crores profit to Indian wind generators) on a daily basis during this windy season. NIWE-Vortex forecast is first largest single regional forecast with 7.4 GW of Wind by any forecast service provider in the world. This project is one of the successful industry relevant deliverable from an International Co-operation between India and Spain, and was adjudged as one of top 50 smart technology by the eminent jury of 42nd SKOCH Award 2015.

Meeting on “Identification of Wind Potential Sites Across the Country in Collaboration with Power Grid Corporation of India Limited (PGCIL)”

The committee constituted by MNRE held on 4th November 2015 under the Chairmanship of Dr. S. Gomathinayagam, Director General, and NIWE, is to gather adequate inputs for planning necessary grid infrastructure for the potential sites. Dr. S. Gomathinayagam, discussed about the current and future plans of power evacuation in India. He initiated that PGCIL must develop infrastructure in solar / wind potential area. Presentation on wind and solar resources available in the country were discussed. Then the committee, discussed on the possibilities of Power Evacuation from the various potential sites and certain issues related with strengthening of power grid facilities and the commercial viabilities for substation commissioning, etc. IWPA

suggested that all the issues should have to be discussed in National level rather than Regional level. NLDC, POSOCO official explained the importance of LTA (Long Term Access) and requested PGCIL to consider wind farms starting from 50 MW to 100 MW, and small wind farms should be grouped together for common substations.

Based on the detailed discussion, committee concluded that power evacuation can be achieved in two phases;

Phase I: Developer should approach the State utility Centers and State Utility Centers should take responsibilities in getting LTA approval from PGCIL.

Phase II: Developer along with State Utility Centers should approach MNRE and MNRE should identify the required sub stations to fulfill the country power requirement with MNRE suggestion, sub stations can be approved from PGCIL.

Wind Turbine Testing

- Removal of equipment for calibration has been done for the Type Testing of XYRON 1000 kW wind turbine at Richadewda, Ratlam District, Madhya Pradesh of M/s. Xyron Technologies Limited.
- The measurements are completed and Draft Test Reports sent to the Customer for the Type Testing of GVSL 1700 kW wind turbine at Kampaneari Pudhukudi Village, Tenkasi Taluk, Tirunelveli District, Tamil Nadu of M/s. Garuda Vaayu Shakti Limited.
- The blade instrumentation work at the site is on-going for the Type Testing of INOX 2000 kW wind turbine at Kidi village, Babra Taluk, Amreli District, Gujarat of M/s. INOX Wind Limited.
- The measurements shall be started during the windy season of 2016 for the Power Curve Measurement of REGEN 1500 kW wind turbine at Vagarai Village, Dindigul District, Tamil Nadu near Dharapuram of M/s. Regen Powertech Private Limited.



Ph.D WORK AT NIWE

Mr. P. Kanagavel, Additional Director and Head, ITCS has been notified eligible for the award of Degree of Doctor of Philosophy (Ph.D.) in Library and Information Science, based on the acceptance of his thesis entitled “Mapping of Research in Wind Energy: A Scientometric Study” from Bharathiar University of Coimbatore, Tamil Nadu.

NATIONAL TRAINING

19th National Training Course on “WIND ENERGY TECHNOLOGY”

during 14th - 18th March 2016

Detailed information is made available in NIWE website (<http://niwe.res.in>)

Standards and Certification

- Completed review / verification of documentation of a prototype wind turbine model received from the wind turbine manufacturer in connection with installation of prototype wind turbines in India as per MNRE guidelines.
- Organized a Committee meeting on Prototype Wind Turbine models.
- A letter has been issued in connection with grid synchronization of one prototype wind turbine of "DF/2000/113 (INOX DF/2000/113/50/90WB552/IIIA/HCV)" wind turbine model of M/s. Inox Wind Limited to the concerned State Nodal Agency, as decided by the Prototype Committee.
- Organized the Working Group meeting on standards to discuss following two draft Indian Standards viz., "Wind turbines – Part 12-1: Power performance measurements of electricity producing wind turbines" and "Wind turbines – Part 12-2: Power performance of electricity - producing wind turbines based on nacelle anemometry". Based on the discussions, Working Group decided to recommend for adoption of "IEC 61400-12-1:2005, First Edition, Wind Turbines – Part 12-1: Power Performance measurements of electricity producing wind turbines" as Indian Standard and communicated the said decision to BIS along with the comments on National Foreword, prepared by NIWE. In addition, Working Group sought time extension to BIS to discuss in detail on various issues related to draft Indian Standard on "Wind turbines – Part 12-2: Power performance of electricity - producing wind turbines based on nacelle anemometry".
- Co-ordination works with Bureau of Indian Standards (BIS) and members of working group on standards in connection with preparation of draft Indian standards on wind turbine related activities are ongoing.
- Officials from M/s. TUV Rheinland Industrie Service GmbH, Germany (TUV Germany) & M/s. TUV Rheinland (India) Private Limited (TUV India) had detailed discussions at NIWE, Chennai with DG, NIWE & S&C unit officials in connection with organizing the workshop on "Certification of Wind Turbines in India – Trends, Challenges and solutions"
- Jointly organized workshop on "Certification of Wind Turbines in India – Trends, Challenges & Solutions" on 1st December 2015 at GRT Radisson Blu, Chennai with TUV Germany & TUV India.
- Prepared consolidated list of wind turbine models and manufacturers marketed in India with Type Certificate as on September 2015 and the same has been hosted in NIWE website.
- Documentation / information have been obtained from various wind turbine manufacturers for more than 50 wind turbine models in connection with Revised List of Models and Manufacturers of wind turbines Addendum – I List to Main List dated 28.09.2015. Review/ verification of documentation is under progress.
- An agreement has been signed with M/s. Southern Wind farms Limited to take up the project on renewal of Certificate of "GWL 225" wind turbine model as per TAPS-2000 (amended). Review / verification of documentation in connection with renewal of Certificate of "GWL 225" wind turbine model is initiated.
- The continual improvement and maintaining the quality management system are ongoing.



Workshop on "Certification of Wind Turbines in India – Trends, Challenges and solutions"



Discussion during NIWE's Working Group Meeting on Standards

Wind Turbine Research Station

Preventive and Regular continuous Operation and Maintenance activities like preparation of 9 nos of 11kV / 400V transformers of 200 kW MICON Wind Electric Generators including transformer yards are being carried out as a part of preparation of the machines for uninterrupted operation during the windy season 2016.

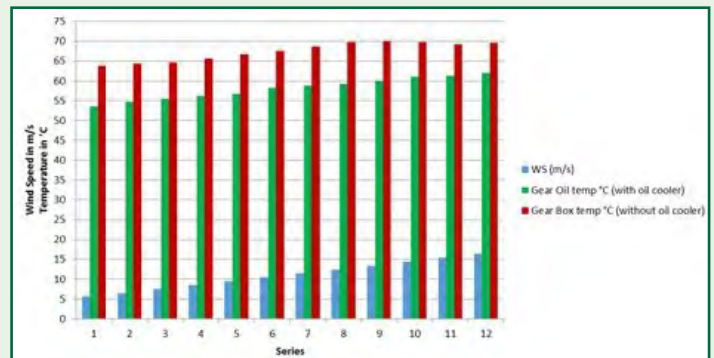
Comparative study on the reduction of gear oil temperature with and without gear oil cooler experimented in two 200 kW MICON Wind Electric Generators during windy season 2015 and encouraging results in reduction of gear oil temperature obtained as illustrated in bar graph using data collected during the windy season 2015.

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

- 57 students and 2 staff of KLN college of Information Technology, Pottapalayam, Sivaganga District, Tamil Nadu on 23rd September 2015.
- 5 students of M.Tech (Energy) and head from Centre for Energy & Environment, Rajasthan Technical University, Kota on 16th December 2015.



Exposure of R&D Facilities for College Students



Comparison of Gear Oil Temperature with and without Oil Cooler

Information, Training and Customized Services

18th National Training Course

Successfully organized the 18th National Training Course on "Wind Energy Technology" during 26th to 30th October 2015 to address all aspects of Wind Power starting from Wind Resource Assessment to project implementation and Operations & Maintenance in a focussed manner.



18th NTC Participants in front of the NIWE Campus

Student visits

To motivate 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 October to December 2015, the following visits were coordinated by the unit.

- 56 students & 2 staff from Tamil Nadu Agricultural University, Coimbatore on 1st October 2015.
- 63 students & 6 staff from KRM Public School, Chennai on 9th October 2015.
- 43 newly recruited Assistant Directors of National Productivity Council, Chennai on 9th October 2015.
- 40 students & 1 faculty from Department of Mechanical Engineering, Anna University, Chennai on 9th October 2015.
- 30 polytechnical teachers as part of training course conducted by NITTTR, Taramani, Chennai on 15th October 2015.



- 70 students & 4 staff from Good Word Public School, Chennai on 20th October 2015.
- 80 students & 5 staff from T.I. Matriculation Higher Secondary School, Chennai on 20th October 2015.

- 5 students from Lalaji Memorial Omega International School, Chennai on 29th October 2015.
- 7 International participants and staff from Central Scientific Instruments Organization, Chennai on 12th November 2015.

Exhibition

NIWE has been established and disseminated the information about the activities and services of the Institute along with the wind energy awareness in the 3rd India-Africa Forum Summit at New Delhi during 27th & 29th October 2015.



Engineering Services Division

- **Video conferencing:** The Audio – Video conferencing work has been completed and the set up is ready for usage.
- **380 kVA Diesel Generator and 62.5 kVA Diesel Generator:** i) CEA inspection for 62.5 kVA has been completed during this quarter. ii) New Generator 400 kVA Diesel Generator works were completed in the month of October 2015. iii) The Generator has been commissioned during the quarter and the request has been placed to TNEB for CEA inspection.
- **30 kW SPV power plant:** i) The structural work for procurement of 30 kW SPV power plant at the roof Top has been completed on 07.10.2015. ii) The Generation power is under monitoring.
- **CPWD civil works:** i) The Entrance main Gate and front side compound wall CPWD work has been completed. ii) The construction of ITCS cabin and new compound wall work has been approved and the CPWD work is yet to be done. iii) Construction of Security Guard room near entrance main gate and iv) The back side new compound wall file work has been started during the quarter by M/s Deccan Construction Pvt Ltd and it is under progress.
- **LAN networking :** i) LAN restructuring work such as documentation, configuration and testing has been completed.

INTERNATIONAL TRAINING

17th International Training Course on
“WIND TURBINE TECHNOLOGY AND APPLICATIONS”
 during 3rd February - 1st March 2016

Detailed information is made available in NIWE website (<http://niwe.res.in>)

TRIBUTE to MARUTHANAYAGAM



Mr. S. Maruthanayagam, Driver, National Institute of Wind Energy & his Wife passed away in the recent Chennai deluge in December 2015. We are grieved that we have had a precious person's loss and pray the Almighty to enable the wards to come out of the sudden demise of their parents.

Knowledge Sharing and Management

Knowledge Management is fundamentally about making the right knowledge resources available to the working groups at the right time. Knowledge sharing is therefore perhaps the single most important aspect in this process. Knowledge sharing depends on the habit and willingness of the knowledge worker to seek out and/or be receptive to these knowledge sources. The right culture, incentives, and so on must therefore be present. KS&M strives to create this culture through its prime initiative, the Technology Think Tank.

Technology Think Tank



Technology Think Tank (TTT) lecture in progress

An open platform for ideation and cerebration inside NIWE. The following technical presentations were made and discussed in this platform during the reported quarter:

Sl. No.	Date	Sharing Unit	Resource personnel	Topic of the Presentation
1	01-10-15	ITCS	S.Saravana Kumar	Energy Management & Audit
2	15-10-15	SRRA	S.Arunkumar	Photovoltaic Principles and Basics of Solar
3	05-11-15	WRA	Arnald Sweshnekhar	Overview of Wake models used in Wind Flow Modelling Tools.
4	12-11-15	OSWH & IB	P.Prithivi Rajan	Trends in Wind Energy Technology

Sl. No.	Date	Sharing Unit	Resource personnel	Topic of the Presentation
5	19-11-15	WTT	M.Saravanan	HVDC Transmission for Off-shore Wind Energy
6	26-11-15	S&C	K.Parasaran	Wind Turbine System Materials and their corrosive effects & prevention
7	31-12-15	ESD	M.Anvar Ali	Wind Electric Generators and Types

Forework for Smart Grid Establishment

KS&M unit has initiated the preliminary process of analysis for implementation of smart grid at NIWE. The objective of the project is to setup a test platform for exploring the potential for actively controlling the buildings as an intelligent power grid and potential economic benefits with

controllable electrical units. Initial stage of the study is underway with survey of the NIWE electrical infrastructure with specific attention on the renewable energy assets like SWT & SPV systems in the campus. Field visit in Kayathar and Palladam for study of the SWT, testing process and manufacture of the wind turbines, generators and operation of grid were conducted. Possible research activities would be on:

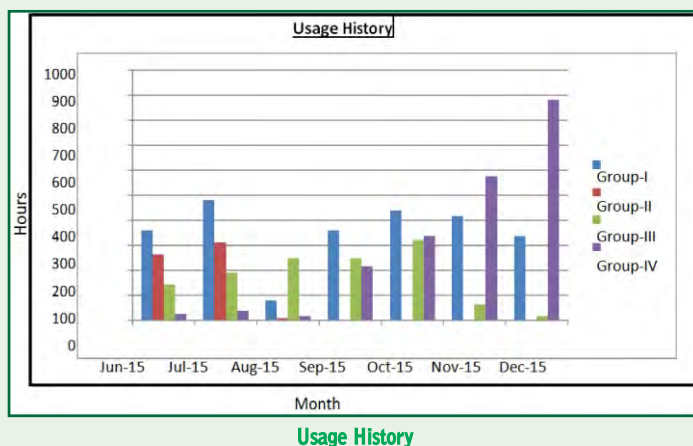
- Consumer impact studies
- Control strategies and portfolio coordination
- Grid impact and system efficiency
- User simulation

Work Group Usage

The work group facility opened for the use of engineers and students to hone their skills in various latest renewable software has found a very large patronage from both within and outside NIWE. Industry has availed the resources at the facility in this quarter to explore the WRA related softwares. The patronage for various software groups are shown below:

Software Group

Group-I Wind Turbine - Aero Mechanical Design



Group-II Wind Resource Assessment & Wind Farm Planning

Group-III Electrical & Electronics and Grid Power Quality

Group-IV Computational Analysis and Simulation

Internship & Projects for Students

About 10 students are currently pursuing their final year PG project at the unit mentored by various resource personnel drawn from various units of NIWE. We expect a few more students to join the program in the coming Quarter.

Solar Radiation Resource Assessment

- Quality Controlled data of 30 SRRA stations were supplied under SDSAP policy.
- Calibration of 8 pyranometers and 4 pyrhemometers were carried out under SRRA project.
- Calibration of 3 pyranometers were carried out under commercial mode.
- Project report on 4 MEDA SRRA stations for the period April-September 2015 sent to MEDA.
- A "Solar Technician Training Program" under PPP mode with M/s. Ultimate Energy, Hyderabad at Hyderabad during 17th August to 16th September 2015.
- A site visit carried out on 16th October 2015 at CCBF, Alamadhi for evaluating the feasibility of installing SPV systems in the campus and submitted a report.
- Project report on the "Solar Resource Assessment at Kharaghoda" was submitted to M/s. SJVN, New Delhi on 30th October 2015.
- SRRA officials visited Greyhound Police Training Centre at Timmapur, Vishakapatam, on

14th November 2015 to collect the ground truth information in connection with the feasibility study on solar energy systems and submitted a feasibility report.

- A training program on "Standalone and Rooftop PV Systems Design and Installation" conducted at NIWE, Chennai under PPP mode with M/s. GSES, New Delhi during 16th to 20th November 2015.



Training Participants with NIWE officials

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

Dr. S. Gomathinayagam, Director General

- Visit to Vestas Chennai Office on 9th October 2015.
- MoU signed & lecture delivered at PSG College of Technology, Coimbatore on 12th October 2015.
- Chaired-Working Session on Renewable Energy in the Seminar "Towards A Sustainable and Affordable Power Sector" at Hyderabad 13th October 2015.
- Attended Meetings on (1) Renewable Watch (Magazine) Conference (2) Governing Council Meeting of NISE and (3) High Level Meeting on Offshore wind in India and Repowering at MNRE, New Delhi on 15th October 2015.
- Attended Standing Committee on Energy Meeting at Parliament House, New Delhi on 16th October 2015.
- Attended Awards Committee Meeting of Science & Technology at DOTE Campus, Chennai on 26th October 2015.
- Attended Joint Committee on Offices of Profit – Oral evidence by the representative of MNRE at Parliament House, New Delhi on 27th October 2015.
- Attended Governing Council Meeting of NIBE at MNRE, New Delhi on 28th October 2015.
- Attended – Vigilance Awareness Talk by Dr A. Muthukrishnan, Sr.CoA, CSIR-CLRI at NIWE, Chennai on 29th October 2015.
- Attended Operational Review Meeting at MNRE New Delhi on 3rd November 2015.
- Attended 65th Governing Body Meeting of TEDA 5th November 2015.
- Attended 22nd Foundation Day of NIOT, Chennai on 6th November 2015.
- Attended Global Energy Technology Summit at New Delhi on 9th November 2015.
- Attended a meeting regarding NREL- MoU on 16th November 2015 alongwith Heads of different Unit NIWE.
- Attended SKOCH Smart Technology Award 2015 – Presentation at New Delhi on 18th November 2015.
- Presentation made and participated in panel discussion in the "International Seminar on Wind Energy – Opportunities in Rail Sector" at Western Railway, Mumbai on 20th November 2015.

- Chaired R&D Meeting of Veltech Dr RR & Dr SR Technical University on 21st November 2015.
- Delivered a Lecture on "Small Wind Turbine Global & Indian Scenario" in the Training Course organized by NIWE for Field Inspection Engineers of TEDA on SWES at NIWE, Chennai on 30th November 2015.
- Attended NIWE & TUV Rheinland International Workshop on Type Certification of Wind Turbines at Chennai on 1st December 2015.
- Attended Wind Power Forecasting Workshop at New Delhi on 11th December 2015.
- Gave an Interview on "Energy Conservation" in Sun TV- Virunthinar Pakkam which was telecasted on 16th December 2015.

Dr. Rajesh Katal, Deputy Director General and Head, OSWH&IB

- As a panel speaker delivered a lecture on "Recent Developments regarding Offshore Projects in India" organized by Indian Wind Energy Forum (IEWF) at New Delhi on 25th November 2015.
- Delivered a lecture on "Wind Solar Hybrid System-Technology" in the Training Course organized by NIWE for Field Inspection Engineers of TEDA on SWES at NIWE, Chennai on 30th November 2015.
- Attended "Offshore / High level Industry Interaction Meeting" under the Chairmanship of Joint Secretary, MNRE at MNRE, New Delhi on 15th October 2015.
- Attended the "Regional Interactive Workshop on Wind Energy" organized by Confederation of Indian Industry at Bhopal on 2nd November 2015.
- Attended the "DFID / FCO sponsored Offshore Wind Energy Project (implemented by IT Power)" meeting under the Chairmanship of Joint Secretary, MNRE at New Delhi on 5th November 2015.
- Attended a Meeting regarding various stakeholders viz. FOWIND, NIWE, BHC, funding agencies and project developers under the chairmanship of Joint Secretary, MNRE, to discuss various issues related to offshore wind development at MNRE, New Delhi on 26th November 2015.
- Discussion meeting held with Scientist, NIOT to decide the base structure / mast configuration for typical water depth of 20 m for the States of Gujarat and Tamil Nadu at Chennai on 30th November 2015.

- Attended First meeting of the working group for recommending clearance procedure to be adopted for offshore wind energy in India at MNRE, New Delhi on 1st December 2015.

Deepa Kurup, Deputy Director (Technical), OSWH&IB

- Delivered a lecture on "Testing and Analysis of SWT" in the Training Course organized by NIWE for Field Inspection Engineers of TEDA on SWES at NIWE, Chennai on 30th November 2015.

R. Naveen Muthu, Junior Engineer, OSWH&IB

- Delivered a lecture on "Instrumentation on SWT" in the Training Course organized by NIWE for Field Inspection Engineers of TEDA on SWES at NIWE, Chennai on 30th November 2015.

K. Boopathi, Additional Director & Head, WRA

- Attended meeting of the Grid Integration Review Committee for Southern Regional Grid Integrational Study at Bangalore on 19th October 2015.
- Delivered a lecture on WRA during one day awareness programme on energy, environment and climate change for school students at Sathyabama University on 30th October 2015.
- Attended meeting of Working Group on Space Technology for Renewable Energy Resources Assessment (WGSTRERA) at Space Application Centre (SAC), Ahmedabad on 9th November 2015.
- Attended NCAOR Expert Committee meeting at Goa on 24th November 2015.

A. Haribhaskaran, Deputy Director (Technical), WRA

- Attended meeting/discussion on Small Wind Energy & Hybrid Systems & R&D activities at MNRE, New Delhi during 19th & 20th October 2015.

A.G. Rangaraj, Assistant Director (Technical)

- Attended meeting of the Grid Integration Review Committee for Southern Regional Grid Integrational Study at Bangalore on 19th October 2015.
- Attended evaluation conference on SKCOH Smart Technology Award 2015 at New Delhi on 18th November 2015.

S.A. Mathew, Director & Head, WTT

- chaired the R&D Meeting (Electrical & Electronics Engineering) and the idea of the meeting is to give

opportunity to professors to present their innovative research proposals held at Veltech Dr. RR & Dr. SR Technical University, Chennai on 1st November 2015.

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

- Attended meeting on "Bill of Material Evaluation / Approval Committee for issuance of Special Additional Duty (SAD) Certificate for additional items of wind operated electricity generator (WOEG)" at MNRE, New Delhi on 6th November 2015.
- Presentation on "Introduction of Local Competencies" during the workshop on "Certification of Wind Turbines in India – Trends, Challenges & Solutions", jointly organized by NIWE with TUV Rheinland at GRT Radisson Blu, Chennai on 1st December 2015.

S. Arulselvan, Assistant Engineer

- Attended meeting on "First Grid Integration Review" at Southern Regional Power Committee, Bangalore on 19th October 2015.

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

- Participated and managed the NIWE "Indo Africa Forum Summit III – Exhibition" at New Delhi held during 26th to 30th October 2015.
- Delivered a lecture on "Wind Turbine Technology and Applications" for International participants of ITEC programme organized by Central Scientific Instruments Organization (CSIO) at Chennai on 12th November 2015.
- Delivered a lecture on "An overview of Indian Wind Power Sector & Wind Energy – Government Policies & Schemes" in the Special Training Programme organized on WRA & SWES for SNA Officials of North East Regions at Guwahati held during 18th & 19th November 2015.
- Delivered a Keynote speech on Wind Energy in the International Conference on Climate Change & Sustainability at Tagore College of Science and Commerce, Mumbai held during 21st to 22nd December 2015.

M. Anvar Ali, Additional Director & Head, ESD

- Attended the "USAID – GRID Integration Review Committee Meeting at Bangalore on 19th October 2015.
- Participated and managed the NIWE "Indo Africa Forum Summit III – Exhibition" at New Delhi held during 26th to 30th October 2015.

J.C.David Solomon, Additional Director & Head, KS&M

- Participated and managed the NIWE “Indo Africa Forum Summit III – Exhibition” at New Delhi held during 26th to 30th October 2015.

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

- Delivered a lecture on Role of Educational Institutions in the promotion of Renewable Energy at NIT, Goa on 24th November 2015.
- Attended Expert Committee Meeting in connection with the establishment of solar energy systems in the NCAOR campus at NCAOR, Goa on 24th November 2015.

Prasun Kumar Das, Assistant Director (Technical) Contract, SRRA

- Delivered a lecture on Solar Resource Assessment for ME (Solar Energy) & ME (Energy Engineering) students of IES, Anna University on 13th October 2015.
- Delivered lecture on “Solar Potential in North-East India” at the Industry Academy Meet organized by Tezpur University, at Guwahati on 4th November 2015.
- Delivered lecture on Solar Resources in the North East region in the training program organized by NIWE for the SNA's of North East at Guwahati on 19th November 2015.
- Delivered a lecture on “Solar Resources Assessment in North-East India” at TEQIP 2015 organized by NIT, Patna on 27th November 2015.

Karthik.R, Assistant Director (Technical) Contract, SRRA

- Attended Technical Committee meeting on tender evaluation in Agricultural Engineering Department, Chennai on 30th September 2015.
- Delivered a lecture on Solar Radiation Assessment at VIT, Vellore on 16th October 2015.
- Attended the meeting of the Working Group on Space Technology for Renewable Energy Resources Assessment (WGSTRERA) at SAC, Ahmedabad on 9th November 2015.
- Presentation on Solar Radiation Measurements and Validation results of satellite derived solar radiation from ISRO Kalpana - I against MNRE/SRRA data for a limited period of October to December 2011 for the Working Group on Space Technology for Renewable Energy Resources Assessment (WGSTRERA) at SAC, Ahmedabad on 9th November 2015.
- Delivered a lecture on Solar Radiation Resource Assessment in the GSES training program on

“Standalone and Rooftop PV Systems Design and Installation” at NIWE on 17th November 2015.

Prasun Kumar Das and a **SRRA official** attended a meeting with NRSC/MNRE officials at Hyderabad on 1st October 2015.

Karthik and a **SRRA officials** attended GNSS user meet on “Towards Self-reliance in Satellite Navigation” at ISRO Satellite Centre, Bangalore on 8th October 2015.

SRRA official inspected VNIT, Nagpur on 26th November 2015 in connection with micro siting to establish SRRA station on commercial mode.

Visits Abroad

Dr. P. Kanagavel has attended Final Review workshop as part of the International Training Programme on “Wind Power Development & Use” at Arusha, Tanzania during 1st to 4th December 2015 and also visited Kenya and Ethiopia towards disseminating the training information for mobilizing more number of participants for the future training courses.

Publications

- S.Gomathinayagam**, “Offshore Wind Resource Potential Assessment in India and Turbine Deployment Challenges” INWEA Magazine.
- S. Gomathinayagam**, “Indian Wind Power” on “Wind Resource Assessment”, IWTMA Bi-monthly magazine October-November 2015 issue
- S. Gomathinayagam**, Article, Wind Insider Magazine issue 8, Nov.2015
- S.Gomathinayagam, K.Boopathi & J.Bastin**, " Wind Resource Assessment in India" Indian Wind Power, Bimonthly, IWTMA. Vol.1, Issue-6, Oct.-Nov. 2015, Pg.no.9-14
- S.Gomathinayagam & K.Boopathi**, “Offshore wind resource assessment and turbine deployment challenges”, InWind Chronicle – A wind industry international Bi-monthly journal, Volume 11, No.4, Aug – Sep 2015, pg.no.17-20
- News : “Indian Solar Radiation Atlas is Launched”, Current Science, Vol.109, No.10, 25 Nov.2015

18th National Training Course on “Wind Energy Technology” held during 26th to 30th October 2016

S.No.	Topic	Speaker
1	Wind Turbine Components	Mr. J. C. David Solomon
2	Introduction & Status of Wind Energy Technology	Dr. S. Gomathinayagam
	Wind Turbine Tower concepts	
3	Wind Electric Generators & Types	Mr. M. Anvar Ali
4	Wind Resources Assessment & Techniques	Mr. K. Boopathi
	Design and Layout of Wind farms	
	Forecasting of Wind and Energy Production	
5	Wind Data Measurement and Instrumentation	Mr. Hari Bhaskaran
6	Wind Turbine Foundation	Mr. Rajesh Katyal
	Small Wind Turbines and Hybrid Systems	
7	Control & Safety System of Wind Turbine System	Mr. S. Arulselvan
8	Grid Integration of Wind Turbines	Mrs. Deepa Kurup
9	Certification of Wind Turbine	Mr. A. Senthilkumar
10	Offshore Wind Energy : An overview	Mr. Joel Franklin Asaria
11	Wind Turbine Testing & Measurement Techniques	Mr. S. A. Mathew
12	Indian Wind Energy Development & Role of NIWE	Dr. P. Kanagavel

Special Training Programme on WRA & SWES to SNA Officials of NE Regions on 18th & 19th November 2015

S.No.	Topic	Speaker
1	Wind Resource Assessment & Techniques & a brief on GIS based Indian Wind Atlas at 100 m level	Mr. K. Boopathi
2	Wind Turbine Design & Engineering (Both small & large wind turbines)	Mr. J.C. David Solomon
3	Software tools for WRA including micrositting of wind farms	Mr. B. Krishnan
4	An overview of Indian wind power sector & wind energy - Government Policies & Schemes	Dr. P. Kanagavel
5	An overview on Smart Grid & Mini grid concept and its relevance to NE region	Mr. Anwar Ali
6	Hands on training on GPS, Datalogger, MMC card and its trouble shooting	Mr. R. Vinod Kumar & Mr. B. Krishnan
7	Solar Radiation Resource Assessment & An overview of SPV systems for off grid applications	Mr. Prasun Kumar Das

PARLIAMENTARY STANDING COMMITTEE ON ENERGY

Parliamentary Standing Committee on Energy (On-the-spot study visit) comprising of Hon'ble Member's of Parliament visited NIWE campus on 7th October, 2015 and reviewed the various activities carried out by the Institute.



Training / Conferences / Seminars attended by NIWE Officials

Wind Turbine Testing

- **S.A. Mathew, M. Saravanan and Bhukya Ramdas** attended the half a day Seminar on "Wind Energy Vs Power Quality" organized by M/s. ATALON Instruments Pte. Limited held at Hotel Satyam Grand, Sriperumbudur, Chennai on 27th October 2015.
- **S.A. Mathew and Bhukya Ramdas** attended the "Power Quality Instruments Demonstration" by M/s. Atalon Innovative Measurement Software held on 28th October 2015 at WTTS, Kayathar.
- **M. Saravanan & Bhukya Ramdas** participated in Webinar on the topic "Wind Turbine Power Performance Testing" organized by DNV GL Energy Academy at NIWE, Chennai on 17th November 2015.
- **Y. Packiyaraj** attended the training on "Laboratory Quality Management Systems and Internal Audit as per ISO 17025:2005" organized by Bureau of Indian Standards at Hyderabad during 17th to 20th November 2015.

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

- Attended One Day National Seminar on "Research Publication and Evaluation organized by Justice Basheer Ahmed Sayeed College at Chennai on 7th November 2015.

Workshop for Liaison Officers of SC/ST and OBC

K. Boopathi and J.C. David Solomon attended two days workshop on "Liaison officers of SC/ST and OBC" organized by Institute of Secretariat Training & Management at New Delhi during 12th & 13th October 2015.

MS Project 2013 Software Training

S.A. Mathew, M. Saravanan, Bhukya Ramdas, A.R. Hasan Ali and Y. Packiyaraj, S. Arulselvan and Gunasekaran.M.R. attended the training on "MS Project 2013 Software" organized by M/s. USAM Technology Limited held at NIWE, Chennai during 2nd to 4th November 2015.

Awards & Honors : Institutional - NIWE

42nd Skoch Award - NIWE - VORTEX



Final SKOCH Award

Order of Merit Award

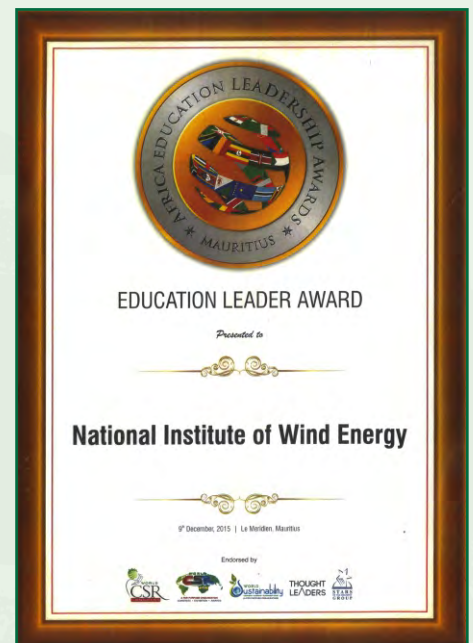
NIWE-Vortex has received the 42nd SKOCH Award for the Project "Wind Power Forecasting" on 11th December 2015 at India Habitat Centre, New Delhi. The Skoch Award is known to follow the most rigorous process of selection. The Skoch Awards celebrate human excellence and agents of change in Indian society. The Awards are based on the philosophy of spearheading positive socio-economic changes through recognizing persons who have contributed immensely to salutary transformations in society and governance by displaying exemplary leadership abilities. The Awards are conferred on the mighty and the ordinary alike.

Education Leadership Award - NIWE

NIWE has been awarded "Education Leadership Award" by Vijayavani, Karnataka's largest circulated Kannada daily on 12th September 2015 at Vivanta by Taj, Bangalore. The award is in recognition of leadership, development, marketing an institute and industry interface of an Educational Institute. Dr. P. Kanagavel, Additional Director & Head, ITCS received the Award on behalf of NIWE.

Africa Education Leadership Award - NIWE

NIWE has been awarded "Africa Education Leadership Award" by World CSR Day & World Sustainability on 9th December 2015.



Awards & Honors : Institutional - NIWE

Hindi - Official Language Implementation



NIWE has received the Consolation Award for the best performance in the progressive use of Official Language Implementation during the year 2014-15 from the TOLIC Chairman & General Manager, Southern Railways during the Town Official Language Implementation Committee (TOLIC) meeting held at IIT-Madras, Chennai on 21st December 2015.

Awards & Honors : Individual

The following NIWE staff has been awarded in the India Sustainability Leadership Summit & Awards and Sustainable Maharashtra held on 26th November 2015 at Mumbai organized by the World Sustainability Congress in recognition of leadership, development, marketing an institute and industry interface of an Educational Institute.

1. Dr. S. Gomathinayagam, Director General, NIWE - "50 Most Influential Solar Energy Leadership Award"
2. Dr. P. Kanagavel, Additional Director & Head, ITCS, NIWE - "50 Most Influential Sustainability Leadership Award"



Dr. S. Gomathinayagam with "50 Most Influential Solar Energy Leaders" Award



Dr. P. Kanagavel receiving the "50 Most Influential Sustainability Leaders" Award

WIND POWER FORECASTING SERVICE OFFERED BY NIWE

Dr. S.Gomathinayagam, Director General, NIWE E-mail: dg.niwe@gov.in
K.Boopathi, Additional Director / Head (WRA), NIWE E-mail: boopathi.niwe@nic.in
A.G.Rangaraj, Assistant Director (Technical), NIWE E-mail : rangaraj.niwe@nic.in

1. Brief Overview of the project

The project was launched on 13 May 2015 and is helping Tamil Nadu's state-owned electricity generation and distribution utility, TANGEDCO, better manage the fluctuations in wind power output in the region. Wind power forecasting plays an important role in the allocation of balancing power. As a technical focal point of the entire spectrum of Indian wind Industry, NIWE has partnered with M/s. Vortex S.L, Spain to enhance wind forecasting initially in Tamil Nadu state. Indian Wind Power Association (IWPA) had approached NIWE to carryout forecasting of Wind power for the entire state of Tamil Nadu as per CERC norms in vogue. Wind Turbines in Tamil Nadu are connected in 106 no of Substations and the same is being considered under this project. NIWE / Vortex Forecast service is based on a 3rd generation forecasting approach. Pioneer 1st prediction schemes were based on downscale-modeling and 2nd generation ones on statistical training only. NIWE approach takes the better of the two worlds introducing a new combined schemes. With forecast, NIWE enters the very competitive forecast market with a new, fresh approach: making use of our massive cluster (in charge of heavy Wind & Site calculations delivered every day) and an extremely interactive, easy-to-use users Interface. NIWE has developed a new Forecasting service for the wind industry focusing its efforts on two main aspects: highly accurate results and highly customizable service. This is the first time the exercise is being attempted on a state-wide basis, allowing the grid operator in the state load dispatch center (SLDC) to exploit the forecast and real-time data on wind power generation at substation level to schedule evacuation of wind power.

2. The objectives of the implementation:

The main objectives of the implementation are as follows:

- To provide wind power forecasting service to all stakeholders in the country.
- To ensure higher level of wind energy deployment without affecting the stability of the grid and the security of the energy supply.
- To provide support to Load dispatch centers for scheduling and dispatching of electricity from wind farms for demand supply management with ease.
- To build capacity and to develop India specific forecasting model

3. Pre-deployment scenario:

Wind power producers in Tamil Nadu, the state with the largest

installed capacity churning out 7.5GW of green power every day, are dreading a reprisal of the 2014 wind season, when nearly 2.5 billion units of power produced was lost to frequency-induced back-downs and measures to rationalize wind power procurement with other sources. The losses due to back-downs totaled 245 million units in 2014, translating into a monetary loss of Rs. 1,470 crore. Tamil Nadu is sourcing anywhere between 26 and 46 million units of wind energy each day since the beginning of the wind season. Although agreements are signed with wind power producers on the power purchase, the generators are remunerated based purely on the power supplied, which means power generated during down-time is lost power. The Central Electricity Regulation Commission which had set a narrow frequency band for wind power in early 2014 for its national grid plan. Partly the narrow frequency band is the reason for the back-downs.

4. Present wind power Scenario in Tamil Nadu

As per the information provided by Indian Wind Power Association (IWPA), 11,393 Wind turbines with total rated capacity of 7,212.5 MW are under operational in the state of Tamil Nadu in 106 Substations across the state. Out of 106 Substations, 53 SS are 11 kV, 36 SS are 22 kV and 29 SS are 33 kV. Further these substations are located mainly in the 3 regions viz., Theni, Tirunelveli and Coimbatore.

4.1 Theni Region: In Theni region, there are about 395 WTG are under operational with rated capacity of 503.5 MW were connected in 11 substations.

4.2 Tirunelveli Region: In Tirunelveli region, there are about 6,262 WTG are under operational with rated capacity of 3,872.86 MW were connected in 57 substations.

4.3 Coimbatore Region: In Coimbatore region, there are about 4,736 WTG are under operational with rated capacity of 2,836.14 MW were connected in 38 substations.

5. Post- Deployment Scenario

As latest state of the art forecasting technologies, NIWE uses a hybrid of physical and statistical schemes along with machine learning algorithms. From the physical point of view, NIWE makes use of several global numerical weather prediction atmospheric models, among which the European Center of Weather for Medium Range (ECMWF) forecasting deterministic model (0.125 degree resolution) and the North American Global Forecasting System (GFS) constitute the two main inputs. Both models are used worldwide on an operative basis and have been intensively validated. NIWE generates

forecast information by calibrating physical input from global and mesoscale numerical weather prediction models against historical wind farm observations (real or synthetic time histories generated by NIWE) with the use of advanced statistical techniques. Besides the global models, NIWE / Vortex makes use of the WRF model in order to generate in-house mesoscale data that is also inputted our forecasting system. In addition, In-house developed refinement algorithm is used to calibrate the forecast with actuals to generate more accurate forecast as per CERC norms. The NIWE's 10 days' forecast is being shared with SLDC, RLDC, IWPA and all other stake holders to utilize green power effectively since August 2015.

Tamil Nadu's state-owned electricity generation and distribution utility, TANGEDCO, very much benefited from the forecast provided by NIWE. The use of wind power forecasting system established by NIWE has helped to increase wind power evacuation by 20% (additional Rs.100-200 Crores profit to Indian wind generators) on a daily basis during this windy season. Wind power being among the cheapest sources of power – at Rs 2.70 to 3.50 per unit (PPA dependant) – it would enable TNEB financially to use all the wind power being generated. This has been helping the SLDC to turn down or carry out maintenance schedule coal and other power plants for whose power it pays nearly Rs 5.50 and take in cheap non-polluting wind power instead. While in 2014, TNEB, on an average evacuated around 68MU (million units) every day, this season, the average evacuation per day has gone up to 81MU with NIWE-Vortex forecasting. In upcoming windy season, our improved forecast accuracies will certainly help TNEB to evacuate more wind power than this windy season. Higher Utilization of Green Power will drastically reduce the load shedding hours and mitigate climate change effects in a developing country like India.

NIWE-Vortex forecast is first largest single regional forecast with 7.4 GW of Wind by any forecast service provider in the world. This project is one of the successful industry relevant deliverable from an International Co-operation between India and Spain. Operational forecast capacity building in India provides sustainable solutions with big target of 175 GW Renewable by 2022. NIWE/Vortex's FORECAST uses real-time wind generation data to provide increasingly accurate forecasts at a competitive costing, and NIWE is sure that the outcome of the project is a blueprint for the rest of India. Thus the project helps the entire Indian society, using make in India with skilling India focus.

6. Status of Forecast Output

Firstly the historical data given to NIWE is formatted in a specific form and fed into the software model developed by NIWE in collaboration with Vortex Factoria de Calculs, S.L. a Spanish company who is specialised in Forecasting. NIWE has created an automated system to pick up and process the real-

time generation data which is received at 15 minute interval. This processed input is continuously fed into the forecast model and refinement took place.

In addition to the above inputs, the software model is configured to capture the current atmospheric data with the help of WTG co-ordinate information provided by IWPA and using the real-time generation data it refines the forecast result for the next 6 days for every one and half hour interval i.e., for Each day 16 forecast file are available and the above process is done for each sub-station. For each Substations, at every one and half hour interval these 16 forecast updates are consolidated into a single file. In addition, this process is now further consolidated into a single file giving a consolidated forecast for the entire State. NIWE developed an in house site specific algorithm to further fine tune the consolidated day ahead forecast result and send the consolidated forecast to all the stakeholders list provided by IWPA through e-mail on daily basis since September 2015.

The accuracy level purely depends upon the quality of input. If reliable input is given then the accuracy goes up otherwise there could deviations. Nevertheless with the passage of time the Forecasting model has an inbuilt correction mechanism. It can self-correct and over a period of continuous real time data the accuracy will improve.

Based on the present limited information, NIWE could provide the day ahead forecast with reasonable accuracy. However, for long term forecast i.e., more than 1 day, NIWE needs accurate 1 year historical generation data to train the forecast model. Unfortunately, the present accuracy level of the historical generation data is not adequate to deliver the stable long term forecast result to the stakeholders. Hence, it is anticipated that before the end of next wind season NIWE could deliver the long term forecast with reasonable accuracy.

7. Error Analysis

7.1 Error Calculation

NIWE ascertain the deviation between actual and forecast by using the following CERC recommended formula:

$$\text{Error \%} = 100 \times (\text{Abs} ([\text{Actual} - \text{Forecast}] / \text{Available Capacity}))$$

Since, NIWE does not have any data to ascertain block wise operational capacity. Hence, we assumes all the WTGs are under working condition i.e., Available Capacity = 7,212.5 MW.

7.2 Day ahead forecast

- Average Deviation between actual and forecast with respect to total Available capacity during August Month is 4.44%, September month is 3.16%, October month is 1.97%, November month is 1.06% and December month is 1.73%.
- In some days, for few blocks, the deviation is crossing beyond the 12%.
- Error level is considerably reduced in every month.

7.3 Longterm forecast

With respect to long term forecast i.e., more than 1 day the forecast values are continuously changing in every update and the absolute deviation is also more.

8. Achievement

Recently, NIWE has received a 42nd SKOCH Award for Wind Power Forecasting. Skoch Award is distinctive for its approach in selection of awardees. The Skoch Award is known to follow the most rigorous process of selection. The Skoch Awards celebrate human excellence and agents of change in Indian society. The Awards are based on the philosophy of spearheading positive socio-economic changes through recognising persons who have contributed immensely to salutary transformations in society and governance by displaying exemplary leadership abilities. They are the highest independently instituted civilian honours in India. Since 2003, when these were instituted, the Skoch Awards have become the only independent benchmark of best practices in India in

the fields of governance, finance, banking, technology, corporate citizenship, economics and inclusive growth. These salute individuals, highlight projects and focus institutions that go the extra mile to make India a better nation. The Awards are conferred on the mighty and the ordinary alike.

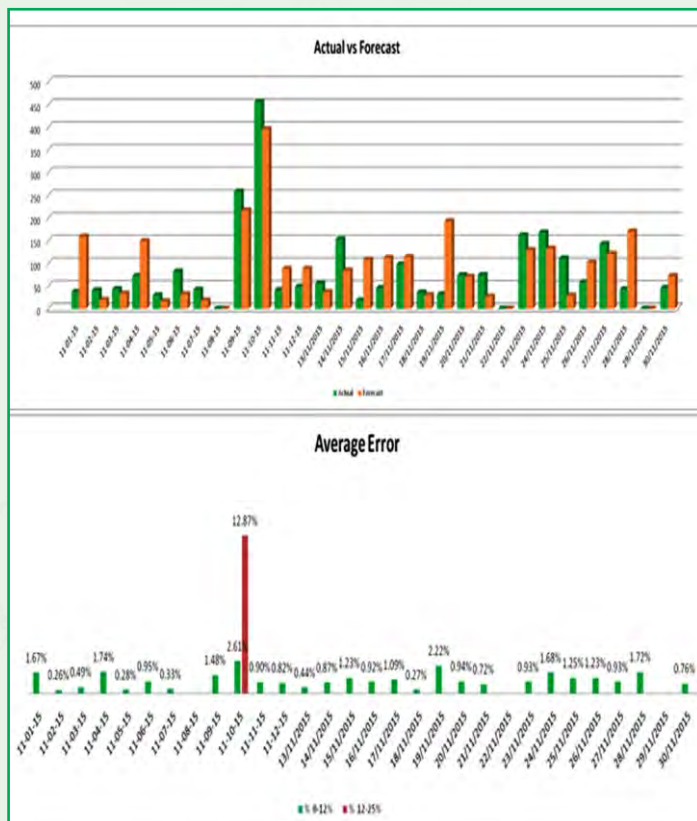
9. Future Road map of the project

NIWE will carry out necessary modification in the forecast system to offer reliable and cost effective 7-10 days ahead forecast. NIWE will retrain the forecast model once again after collection of 6 months of real time generation data in the state of Tamil Nadu. To carry out continuous improvement in both short term and long term forecast results. To offer stable 10 days ahead forecast as early as possible to all stake holders

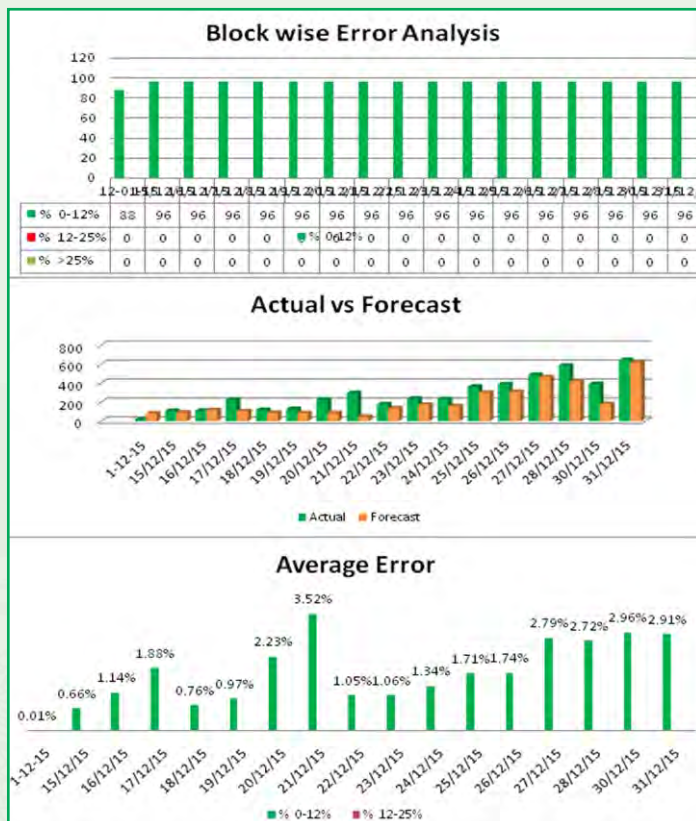
10. Conclusion

Based on the analysis of forecast and actual data received from all the substations, we could conclude that Substation wise forecasting is giving better results and could achieve the error level less than 10%.

November 2015



December 2015



नीवे NIWE

Published by :
NATIONAL INSTITUTE OF WIND ENERGY (NIWE)

An autonomous R&D Institution under the Ministry of New and Renewable Energy (MNRE), Government of India
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