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EDITORIAL



The year 2010 has started with a big bang with not a single week passing by without an event of renewable energy in some part of India/World. Events in India have been training courses, workshops, green initiatives, seminars, conferences by C-WET, MNRE, WISE, IWTMA, IWPA, IPPAI,

IITs, IISc, CII and several institutions and engineering colleges. Apart from C-WET training courses, C-WET scientists have either exhibited their skills and expertise or participated in the events obviously in the most sought after fastest growing renewable energy, i.e. the Wind Power. Amazing it is to see the ever increasing awareness among all the stake holder's of wind power development. Yet it's worth re-looking into the trends of development. Since the late eighties wind power development in India is driven by profit to profit through property of prosperity (wind farms which are well maintained to keep up the generation). No wonder the State owned utilities are enjoying wind generated power with the "CAPEX" (Capital Expenditure) of nearly 65,000 crores so far has been met by private investors in India. However if the WEGs don't generate enough power to the GRID when there is wind the public money invested [in addition to the loss in tax collection (due to AD)] for evacuation, transmission, substations & distribution goes utter waste, even though wind farm land value appreciates always, for the owner. So, something drastically needs to be done to attract those early investors who seem to be contended with the old small capacity machines in their wind farms located at best windy sites in India. It is well known that the cost per kWh of wind generated electricity has come down by more than 8 times in the last 3 decades. The upgraded wind turbine technology with efficient machines at higher hub heights with larger mega watt class rotors, has made this cost reduction which is very closely comparable to gas based generations. I hope you guessed it right, we are at the right time to re-power those old best sites. This will naturally happen only when investors are consciously thinking on the climate, green powering their children's future environment. Re-powering will never take-off if the investors still follow the multiplier effect on their profits by the property of wind power plants. Not only repowering needs norms and guidelines, but also inter-cropping i.e., shorter hub smaller capacity wind turbines among taller hub with larger capacity wind turbines. Being an agricultural country inter-cropping is not unfamiliar to us, the Indians. It is certainly not enough to show the practical

viability by simple arithmetic calculations. Just like the demo-wind farms there is a definite need to highlight to the world of wind power developers that calculations are not mere arithmetic and they are truly achievable in the field/wind farms. C-WET/MNRE is keen in partnering with anyone to conduct relevant experimental measurements both on re-powering as well as inter cropping of wind turbines in wind farms to come out with guidelines for implementation.

C-WET's R&D Wind farm is all set to commission a 2MW wind turbine which will go operational in this wind season. Three R&D projects selected through rigorous scrutiny have been in progress with multiple institutional co-operation under C-WET's co-ordination and monitoring. The long awaited Indian Wind Atlas is out of the press waiting to be officially released soon.

The WRA Unit has completed 2 new installations and 15 procedure certification projects and a few site validation projects.

The Testing Unit has been able to attract a few international certifying bodies to accept C-WET's type-testing in Indian sites for Indian manufacturers. The team has discussed with certifying bodies in Germany and MEASNET executives. Blade testing centre for India, in India is also on the cards with positive developments.

The Standards and Certification has been on a busy schedule as usual to meet the demands of several manufacturers having a variety of models. For the release of next RLMM listing after the due meeting all the relevant information and documentation submitted by Indian Wind Turbine Manufacturers is under review. The revised guidelines issued by MNRE/GOI with amendments to allow signing of certification & testing with foreign bodies has kept the S&C Scientists on the toes all the time.

The ITCS Unit was very busy with many activities during this period. It successfully conducted the first ever ITEC (International Techno Economic Co-operation of Ministry of External Affairs) programme as the 5th International training programme for personnel from 14 developing Countries. Demonstration of new technical capabilities by Meteodyn are co-ordinated with IWTMA which need special mention.

C-WET is certainly thankful to the Wind Industry and MNRE for their involvement and support to nurture our technical activities. Your valuable feed back to our PAVAN would go a long way to serve you sincerely even better.

S. Gomathinayagam
Executive Director

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Developments in R&D UNIT

Small Wind Turbine Type Testing

The unit had undertaken testing of small wind turbine, which is the first of its kind in India, at its test bed at WTTS, Kayathar. The testing activity is done to improve the prospects of the marketability of small wind turbine as well as to boost the confidence level of laymen investing in the rooftop Aero-generators.

Analysis was completed based on the measurements acquired from the testing of the 1 kW & 5 kW models supplied by their manufacturers and the reports of Power Performance, Safety & Function and Duration Test were prepared in accordance with the internationally accepted standards of IEC 61400-12-1 & 2.



1 kW & 5 kW Models at the Test Bed of WTTS

R&D / Experimental Wind Farm

The unit as its part of contribution for the sectors upliftment has been partaking projects that would provide useful value addition to the wind turbine technology. One of them has been to work for the improvement of the functionality & efficiency of different components that form the Wind Turbine. As a pursuit of this ideal a 2MW wind turbine is being installed in WTTS on which R&D works of multi-discipline are being proposed to be carried out and the knowledge base generated would be shared with the stakeholders of the wind sectors.



Foundation of the 2 MW R&D / Experimental Wind Turbine

The foundation laying for the 2 MW experimental wind turbine at CWET's Kayathar WTTS facility was completed in February 2010. The wind mill of 2.0 MW is likely to be fully operational during this windy season starting from May 2010.

R&D Projects Initiated in this Quarter

The unit has initiated three projects in this quarter whose end results would enable better understanding the peculiarities of the Indian Electric Grid in context of Wind Turbines Grid Tie-up & the power Quality issues that plague them and also result in a mode for the emancipation of rural populace from the perennial problems of power shortages & outages.

The project "Power Evacuation Studies for Grid Integrated Wind Energy Conversion System" would strive to identify the weak points in the power system & conduct power evacuation studies using load flow analysis and short circuit analysis based on the model generated containing the wind turbines and its grid tie.

The next project which is also in the same genre and named "Study on Power Quality Issues in Grid Connected Wind Farms and identification of remedial measures" would work to identify the power quality issues faced by a Grid-tied wind turbine & enumerate the remedial measures to overcome the shortcomings.

The third project is to design construct an "Everybody's Battery Charger" Savonius Rotor capable of powering a small hamlet's needs and the unique selling point of the work would be to construct the entire configuration from locally available material so that the design can be easily off-loaded for rural fabrication & installation.

Move on in WRA UNIT

During the period of January to March 2010, 5 new wind monitoring stations 2 in Goa and 3 in Madhya Pradesh have been established with 50 m tall masts. Presently, 100 wind-monitoring stations are operational in 20 states and one union territory under various wind monitoring projects funded by the Ministry as well as various entrepreneurs.

Projects on verification of procedure of wind monitoring have been done for the following sites.

- 1) 10 sites in Maharashtra for Maharashtra Energy Development Agency (MEDA), Pune.
- 2) Basavanapatna in Karnataka for M/s. RRB Energy Limited, Chennai and
- 3) Lalpur-1 & Lalpur-2 in Gujarat for M/s. Enercon India Limited, Mumbai.

WRA unit has also completed the following projects and submitted reports during this period.

- 1) Site Validation & Generation Estimate of proposed wind farm projects at Gandamanur, Theni District in Tamilnadu for M/s. Gamesa Wind Turbines Private Limited, Chennai.
- 2) Wind Resource Assessment study at Kombhalane, Ahmed Nagar District, Maharashtra – (Extension) for M/s. D. J. Malpani, Sangamner.
- 3) Site assessment for wind monitoring in Karnataka for M/s. Karnataka Power Corporation Ltd, Bangalore.

Indian Wind Atlas:

Indian Wind Atlas gives an updated overview of the wind climatological situations of India based on reliable measured wind data and using contemporary numerical mesoscale models. It also seeks to provide an up to date methodology for applying to primary data and results of mesoscale model for the purpose of wind resource assessment. Numerical wind atlas methodologies have been used to prepare Indian wind Atlas and it is devised to solve the issue of insufficient wind measurements. The methodology adopted to prepare the Indian Wind Atlas is Meso – Micro scale models combination (Karlsruhe Atmospheric Mesoscale Model [KAMM]/Wind Atlas Analysis and Application Programme [WASP]) developed at Riso DTU National Laboratory for Sustainable Energy, Roskilde, Denmark. In this methodology an approach called statistical-dynamical downscaling is used. The basis for the method is that there is a robust relationship between meteorological situations at the large-scale and meteorological situations at the small-scale. The Indian Wind Atlas is a result of combined effort of Centre for Wind Energy Technology (C-WET), Chennai, India and Riso DTU National Laboratory for Sustainable Energy, Roskilde, Denmark on the investigation of Indian Wind Climatology with a specific focus on wind resource assessment for harnessing wind energy. The book will be released shortly by the Honorable Minister of New and Renewable Energy, Government of India.



Steps forward in TESTING UNIT

- A revised site feasibility report has been prepared as a part of the planning for testing the 2000 kW wind turbine of M/s. Inox Wind Ltd.
- An agreement was signed between C-WET and M/s. WinWind Power Energy Pvt. Ltd. on 10th March, 2010 for load measurement analysis and reporting of 1000 kW wind turbine at Ayyanaruthu, Kayathar, Tamilnadu. The load measurements analysis and reporting has been completed.
- Software development for remote monitoring of selected data from various field sites through Internet is under progress.

Marching ahead in S&C UNIT

- Technical note on "Guidelines on technical requirements to be fulfilled by a wind turbine manufacturer, prior to signing the agreement for "Provisional Type Certification with C-WET" has been published.
- Initiated actions to obtain documentation / information from the wind turbine manufacturers for updating the "Revised List of Models and Manufacturers of Wind Turbines".
- Agreement has been signed with M/s. Suzlon Energy Limited for Provisional Type Certification of Suzlon S.52/600 kW Wind Turbine model under category -I as per TAPS-2000 (amended).
- The certification projects, taken up as per TAPS-2000 (amended) are under progress.
- The continual improvement and maintaining the Quality Management System (QMS) are ongoing.

Highlights from ITCS UNIT

International Training Program

The ITCS unit had successfully organized the fifth International Training Course on 'Wind Turbine Technology and applications' during 3rd and 19th of February 2010. Over 21 participants from 14 countries attended the training programme. The participants were from Liberia, Guyana, Morocco, Egypt, Peru, Sudan, Nigeria, Tanzania, Mauritius, Fiji Islands, Afghanistan, Eritrea and Yemen.

The course content for the training was a very comprehensive syllabus with experts in various fields giving lectures and specific case studies. Practical training with wind resource assessment instrumentation, Testing equipment, R&D equipment was made available and factory visits to M/s. Suzlon Energy Limited at Pondicherry, M/s. RRB Energy Limited at K. K. Nagar, Chennai, M/s. Gamesa Wind Turbines Private Limited at Redhills, Chennai

and M/s. ReGen Powertech Pvt. Ltd at Tada were arranged. The participants also travelled down to the southern tip of India to visit wind farms and C-WET's own Wind Turbine Test Station (WTTS), Kayathar. The participants were very much satisfied by the quality of lectures and hospitality they found in India. The course topics covered were

- Wind energy technology and wind resource assessment
- Wind energy development in India and abroad
- Government policies and supportive schemes & programme
- Human resource development aspects of wind energy
- Operations and maintenance of wind farms
- Design of carefully vetted wind farming projects
- Improved performance of wind farms through the use of newly acquired knowledge
- Investment techniques and economic viability of wind technology
- Integration of wind energy to grid
- Clean development mechanism



Participants with C-WET team



Participants during factory visit

Participants during wind farm visit

To create awareness among the public and industries, C-WET established a stall at the "Wind Energy Expo 2010" at Chennai Trade Centre, Nandambakkam, Chennai during 26th - 28th February 2010. The stall was well attracted by the public and people from industries. The visitors were very appreciative of the services rendered by the MNRE, especially the role of C-WET. The various private industries participated and expressed their appreciation for the support offered by C-WET in conducting their business in India. Many students were inspired and expressed keen interest of their career in wind energy industry.

C-WET and IWTMA as a joint effort organized a guest lecture on "Wind Resource Assessment" using CFD (METODYN) at C-WET on 2nd March 2010.

Dr. Gunjit Singh Bir, Senior Scientist from NREL visit to C-WET

Dr. Gunjit Singh Bir, Chief Scientist, Wind Turbine Test Centre, National Renewable Energy Laboratory (NREL) visited the C-WET during 18th to 23rd March, 2010 as part of the MoU signed between C-WET and NREL under Indo- US collaborative project initiated by Ministry of New and Renewable Energy.



To identify the possible collaborative area, he discussed with all the Unit Chiefs, Scientists, Junior Engineers and Technicians. For the purpose, all the Unit Chiefs made presentations highlighting their respective unit's activities and progress. He has also visited various infrastructure & facilities available in the campus.

Dr. Gunjit appreciated the C-WET contribution towards the wind power development in the country and also the efforts taken by C-WET for human resource development by conducting national and international training programmes and expressed his interest in going forward to undertake the collaborative project in the future.

Shri. Hari Kumar, Joint Secretary (Wind Energy), MNRE visited C-WET

The Joint Secretary (Wind Energy), MNRE, Shri. Hari Kumar visited C-WET on 23rd of March 2010 for the first time. He had a meeting with the Executive Director and all Unit Chiefs. All the Unit Chiefs made presentations highlighting their respective unit's activities and progress since the beginning of C-WET and later the Joint Secretary visited various infrastructure & facilities available in the campus. He has also visited Wind Turbine Test Station (WTTS), Kayathar and expressed his appreciation for C-WET's effort this far and offered his valuable suggestions towards the future development.



Dr. Gunjit Singh Bir, Chief Scientist, Wind Turbine Test Centre of National Renewable Energy Laboratory (NREL) was also present in the meeting and had a discussion with the Joint Secretary.

Human Resource Development for Wind Energy by C-WET

P. Kanagavel, Scientist & Unit Chief I/c, Information, Training and Commercial Services, C-WET

Indian Wind Scenario

In dealing with Climate Change, we are focusing more and more on renewable energy for sustainable development. Wind power has been one of the most promising options for a better life and greater independence from fossil fuels. India's present wind energy installed capacity is reaching 11000 MW, globally holding the fifth position. India has played an important role in world's wind energy market and has developed into the world's top five largest markets. India has a strong domestic manufacturing base with high potential for wind energy harnessing.

As wind power is being adapted the world over as the most efficient power generation source that does not cause greenhouse emissions, there is a huge demand for human resource to meet national and international business expansion. There are estimates that a target of 12% wind power for south Asia (India, Pakistan, Bangladesh, Sri Lanka and Nepal) will result in 50 GW wind power in the region by 2020 and most importantly providing employment to 2,66,400 people^[1].

World Scenario

Worldwide installed capacity is 1,59,213 MW as on December 2009. The wind sector had a turnover of 50 billion^[2]. Asia accounted for the largest share of new installations (40.4%), followed by North America (28.4%) and Europe at third place (27.3%). A total wind capacity of about 2,00,000 MW will be exceeded within the year 2010. Based on accelerated development and further improved policies, World Wind Energy Association increases its predictions and sees a global capacity of about 19,00,000 MW as possible by the year 2020. By the end of 2009, 5,50,000 persons were employed worldwide directly and indirectly in the various branches of the wind sector. Most of them are handling highly-skilled jobs.

Indian Wind Industry

There is currently about 10,950 MW^[3] of installed capacity as on January 2010 in India. India is ranked fifth in the world with installed capacity after USA, China, Germany, and Spain. The Global wind turbine industry is growing at a rate of about 28% a year^[4]. India is set to become a global manufacturing hub for wind turbines in next few years. India has about 16 large wind turbine manufacturers^[5] with wind turbines capacity ranging from 225 kW to 2000 kW and several small wind turbine manufacturers producing capacity ranging from 300 W to 50 kW. Some of the turbines produced in India are currently exported by several manufacturers and are expanding capacity to meet growing demand. To assure timely evolution of wind industry to meet India's demands and development of rural areas, human resource development is a matter of immense interest. Wind energy can serve as a growth engine to bring about development in many underdeveloped areas as most of the wind farms are located in rural areas.

Need for Indigenization in India

Until the late 1990s, Indian wind turbine manufacturers relied upon European manufacturers and Technology for wind turbine components. We started indigenization of large items such as towers due to import complications along with other smaller fabricated parts. The main components like generator, shaft and other components were started to be manufactured in India with technical know-how or support from European technical partners. The cost of wind turbine goes high with increased usage of imported components which makes it economically not viable and difficult to survive in competitive conventional market. Indigenization will make wind a more viable renewable energy option to all the investors planning their investment in power sector. Further, Indigenization needs a pool of skilled human resource. C-WET has been acting as a pioneer in producing human

resource through its various orientation programmes which are discussed in this article.

If further indigenization of wind turbine technology, its components and other related services are achieved then the overall employment may increase three fold, which means there would be more jobs for Indians within the country^[6].

The country can become a major source of green jobs as many companies in wind sectors have started to diversify and indigenize the process and jobs are expected to increase in the manufacturing as well as O&M sector.

It is extremely important that the young talent pool of India be informed at the right time about the opportunities available to them in the Wind energy industry. Wind energy is a multidisciplinary industry. There are requirements for core engineers, mechanical, civil, electrical along with specialists in the aeronautical, electronics and instrumentation control. The needs also include associated skills like economists for developing the wind farms^[6].

Prospective Job Areas in Wind Engineering

The following are certainly prospective areas:

1. Turbine design, Manufacturing and Assembly:

Experts are needed in aerodynamics, Mechanical and electrical design, instrumentation and control, and simulation in design; Component manufacturing and sourcing, R&D in composite materials, components and systems, turbine optimization, inspection and audit in manufacturing; and finally in assembly experts in turbine blades, hub, casting, forging, fabrication, gear box, coupling, Generators, bearing control panels and towers.

2. Wind resource assessment and project development:

This includes acquisition of Land, wind resource mapping involving meteorologists, geologists and data collection and analysts. Micrositing in wind farm design and project planning, is another highly skilled expertise to get most out of a given area of land.

3. Building infrastructure:

This includes civil work relating to construction management, Turbine foundation, site development and electrical infrastructure and transformers.

4. Erection and commissioning:

This includes experts in crane services, logistics, tower, civil works and electrical grid connection.

5. Operation and maintenance:

This includes experts in basic engineering, trouble shooting, repair and other logistics services. There is a need for staff to operate and regularly service the installed wind turbines throughout a roughly estimated 20 years lifetime and this creates long term full time employment close to the wind farm. Logistics, employment related to Operation and Maintenance will increase with installed capacity.

Wind Industry HR Requirements

Many Indian companies have started to diversify and indigenize the process, with the targets for addition of higher installed capacities and larger wind



turbines incorporating latest technological features. In the last three years, more than 20,000 people were recruited in the Indian wind industry.

By the end of March 2006, according to estimates about 10,000 people were directly employed in the Indian wind industry^[6]. While 4 times as much, i.e. 40,000 indirect jobs were created, totaling the full-time employment to 50,000 personnel. This results in 5.7 direct jobs and 22.87 indirect jobs totaling to 22.6 jobs / MW installed in 2005-2006. Wind power industry may absorb 34,000 to 53,000 people directly in addition to the present strength upto 2015. Indirect employment generation would be three to four times of this anticipated direct generation. It means about 3,400 to 5,300 people on an average would be recruited by the Wind industry over the next 10 years. The rate of induction would be more in the near future and will then slow down gradually as the industry matures.

In India, close to 34,000 people would be employed by 2010, and more than 1, 36,500 by 2020 and 1, 42,000 by 2030. The advanced scenario would see the employment level rise to 57,700 by 2010, about 1, 77,000 by 2020 and 2, 13,500 by 2030^[6].

Deficit of Skilled Human Resource

Indian wind power sector experiences shortage of trained and skilled human resource despite having 1400 engineering colleges, 1000 management institutes, 15 Indian institutes of technology and 15 National Institutes of Technology existing in the country. Apart from this about 25 institutes run M.Tech Energy programmes in the country. A few of them cover wind power technology as one of the optional subjects in the renewable energy course. The total strength of students from all these post graduate programme put together does not exceed 250 to 300, out of which only a handful opt for wind energy as a career. At the graduate level, all those syllabi were developed with renewable energy technologies in the curriculum, trained faculty to teach this multidisciplinary subject are rarely available in most institutions. The reason may be the lack of information on sectoral developments and integrated efforts by the concerned authorities.

The factors that influence the number of jobs in wind energy are the technology, equipment and R & D and the location of the wind farm. The scale of production and the nature of technology deployed will affect HR requirements in the wind power sector. As the wind industry switches to more advanced rotor manufacturing by changing the design of blades and lowering O&M requirements, the quality of HR required also changes.

Jobs in manufacturing, services and O&M are expected to increase manifold. But if the Industry concentrates only on assembly of wind turbines, the kind of jobs that may arise will be in the semi-skilled or unskilled nature. Hence there may not be large number of jobs created unless there is a shift in technology, indigenization of components and R&D thrust.

Employment in Wind Energy Sector

The employment in wind energy sector can be divided into two broad categories, direct and indirect.

Direct Jobs

Direct employment activities will be

- Manufacturing of wind turbine generators • Delivery and logistics
- Assembly and erection • Infrastructure development
- Commissioning • Project management • Operations and maintenance

Indirect jobs

Construction of a wind generator will require cement and steel, electric and data communication cables, sensors, data loggers etc. A study conducted by WISE^[9] states that there are about 4 indirect jobs for one direct job. Indirect jobs are a multiplying factor on the direct.

In 2008, over \$52 billion were invested in wind energy worldwide, and the sector currently employs over 4,00,000 'green collar workers'. This number

includes associated fields such as technical and financial services and marketing^[7].

The annual value of global investment in wind energy would reach \$213 billion by 2020 and account for over 2.2 million jobs^[8].

Two factors that influence the number of jobs in wind energy sector are equipment used for construction and installation and R&D development done, in and around the area of the location of installation of the wind farm.

C-WET's Role

One of the key objectives behind the establishment of the C-WET by MNRE is the development of human resource to meet the increasing demand of workforce for the wind energy industry in the country. Wind Industry demands a substantial level of skilled and unskilled workforce and is therefore of considerable economic importance. As compared to other conventional power generation technology, wind power creates more jobs / MW of generation. In addition, wind power development enables rural uplift and empowers the poor. There is a constant search in India for talented fresh as well as experienced force to meet the growing demand.

C-WET has five specialized units contributing to different aspects of wind energy development.

1. Research and Development unit contributing to the evolution of efficient technology
2. Wind Resource Assessment unit conducting measurements in various locations in India to identify locations for wind power generation.
3. Testing unit that undertakes various kinds of safety, function and performance and efficiency tests to study the wind turbine, including its operational loads.
4. Standards and Certifications unit that evaluates the design and approves the quality of the wind electric generators.
5. Information, Training and Commercial Services unit provides quality updated information to industries, the government and the public about various developments in the wind energy sector, provides manpower training and promotes wind energy development in the country and abroad.

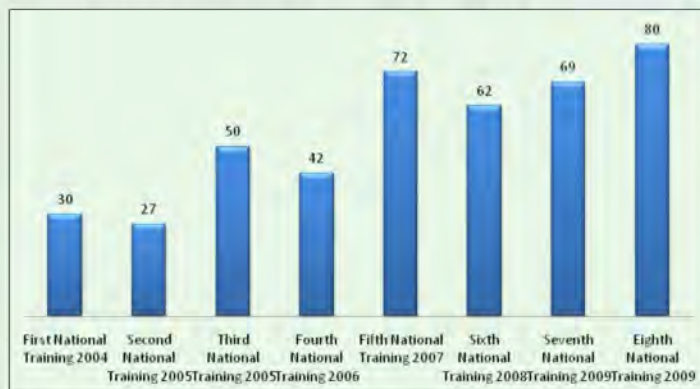
C-WET's exclusive unit for information dissemination called ITCS which is contributing the development of human resource in India and abroad by conducting training programmes on wind energy, publishing annual reports on the activities of C-WET and quarterly newsletters carrying the latest technological advancements in the wind energy sector. ITCS unit also has developed a informative website and maintains the same with continuous updates.

C-WET Activities towards HRD

National Training Courses

C-WET has so far organized 8 national training courses, The programme cover all aspects of wind energy generation from technology, installation & commissioning, operations and maintenance, financing, wind resource assessments, Clean Development Mechanism etc. The course materials of these programs are well sought after by all the stake holders who intend to contribute to the wind energy sector. Till now about 700 Indian nationals from all part of the country were benefited by the courses. For activities such as risk assessment, in more employment and feasibility studies, talent with a background in finance and economics is necessary. C-WET includes topics of importance to such people in its training courses. In general the national training courses are intensive 2 to 3 days programme with most of the faculty drawn from C-WET and a few experts from Industry and Academia.

Sl.No	No. of Trainings	Title	Place	Date	No. of Participants
1.	First National Training	Wind Farm Development and Related Issues	C-WET, Chennai	14 th & 15 th October, 2004	30
2.	Second National Training	Fundamental of Wind turbine Technologies	C-WET, Chennai	10 th & 11 th March, 2005	27
3.	Third National Training	Wind Farm Development and Related Issues	C-WET, Chennai	1 st & 2 nd September, 2005	50
4.	Fourth National Training	Wind Farm Development and Related Issues	YASHADA, Pune	9 th & 10 th November, 2006	42
5.	Fifth National Training	Wind Farm Development and Related Issues	C-WET, Chennai	6 th & 7 th December, 2007	72
6.	Sixth National Training	Wind Farm Development and Related Issues	C-WET, Chennai	25 th & 26 th September, 2008	62
7.	Seventh National Training	Fundamentals of Wind Energy	C-WET, Chennai	28 th & 29 th May, 2009	69
8.	Eighth National Training	Wind Energy Technology	C-WET, Chennai	9 th to 11 th December, 2009	80



Participants Trained by C-WET



Participants by Sector-wise

International Training Courses

C-WET has organized six international training programs catering to international HR requirements. About 100 foreign engineers/scientists from countries around the world were trained in C-WET as a part of technical

collaboration and also on specific request. Most of the international participants trained by C-WET are from countries which are economically backward, we are proud to say that we have paved the way for their development.

Country	No. of Participants
China	8
Jordan	3
Iran	7
Indonesia	2
Malaysia	1
Saudi Arabia	3
Nepal	1
Sri Lanka	7
Cuba	23
Mauritius	4
Yemen	2
Uganda	2
Malawi	1
Bangladesh	3

Country	No. of Participants
Thailand	4
Maldives	1
Mozambique	2
Egypt	6
Guyana	1
Nigeria	2
Morocco	1
Sudan	2
Tanzania	2
Algeria	1
Eritrea	1
Afghanistan	4
Peru	1
Fiji	1
Liberia	1

The duration of the international courses are usually 2 to 3 weeks involving faculty from Industry & Academia and C-WET scientists. These courses are specialized in the sense, it features factory visits, wind farm visits, hands on tutorials and field demonstrations.

Sl.No	No. of Trainings	Title	Place	Date	No. of Participants	Countries
1.	First Training	Wind Turbine Technology and Applications	C-WET, Chennai	9th - 20th February 2004	15	7
2.	Second Training	Wind Turbine Technology and Applications	C-WET, Chennai	22nd February - 3rd March 2006	21	11
3.	Third Training	Wind Turbine Technology and Applications	C-WET, Chennai	8th - 17th August 2007	9	7
4.	Fourth Training	Wind Turbine Technology and Applications	C-WET, Chennai	11th - 24th February 2008	19	Cuba
5.	AOI Special Training	Wind Turbine Testing and Wind Farm Micrositing	C-WET, Chennai	19th - 28th October 2009	5	Egypt
6.	Fifth Training	Wind Turbine Technology	C-WET	03rd - 19th Feb 2010	21	14

Publications

So far, C-WET has published annual reports every year detailing all activities of C-WET during each financial year since 1998 and 23 quarterly newsletters since 2004 carrying the latest updates in wind energy development. These materials keep the industry and students and research and academic organizations updated about the progress in the industry. Other publications like Indian wind atlas, wind power density map of India and study material carrying the lectures held during the training programs were also disseminated frequently.



Academic Activities

C-WET had prepared syllabus for Master level course exclusively on wind energy and the same has been approved by MNRE and forwarded to All India Council for Technical Education (AICTE) for implementation. C-WET is also planning to organize exclusive national level training course for students from academic institutions. Realizing the importance of specialized training for operation and maintenance, C-WET has provided technical guidance to CAPE institute of Technology, Kanyakumari to formulate a practical syllabus and to conduct self supported 6-months course on O&M of wind turbines.

C-WET Library

C-WET has a state-of-art library named after "Prof. Anna Mani" as Information Centre. With more than 1500 books on renewable energy in general and wind energy in particular. It includes books on Energy and environment, sustainable development, all engineering disciplines, science and management. C-WET's Library has also subscribed to all major National and International Journals & Magazines (approximately 60 in count) on wind energy and other allied engineering disciplines. It is also having around 50 technical reports and 90 conference proceedings and other information resources like Wind Atlas and data books, Maps, manuals, souvenirs, Digital resources etc. The library has been computerized using library software for easy access and management. Online Public Access Catalogue (OPAC) is also available. It also has tie-up with leading libraries like IIT, Anna University and American Library for reference purposes. Interested public/students can access C-WET's library with prior permission.

C-WET's Bi-lingual Website

C-WET also maintains a bilingual website 'www.cwet.tn.nic.in' which carries all information about wind energy development in India and abroad. The website is continuously constructed for up-to-date information on wind energy and it also has wind energy related information resources like frequently asked questions and free quarterly newsletters carrying latest developments and technical updates in the wind industry. Includes internal academic and research information, services to the industry and individual, a technical glossary, updated policy information and statistics. It also contains information on Government institution, wind energy associations, apex institution of renewable energy, print resources mainly periodical pertinent to different research areas of wind energy, the corporate industry as large, medium and small wind turbine manufacturers, nodal agencies of states and union territories of India.

The information system also direct the user to the international council on wind energy, apex Government bodies, wind turbine associations, renewable energy research institutions at global level, the links and details on international primary periodicals on wind energy and global giants in wind energy market. A complete guide list to more than 300 potential information resources on wind energy systems. The website directs wind energy persons with news on trainings, conferences, exhibitions, workshops, seminars etc. An average of 200 visitors daily utilize the information from all over the world and benefit from the web enabled information system. Indirect contribution of C-WET website towards the human resource development is evident from the several contacts established so far with all stake holders of wind energy.

Related Activities

C-WET has also offered short term training on specialized topics as requested by the industries. Apart from this, students make use of a well stocked library and display projects within the campus and are welcome to interact with the scientists and engineers at C-WET to improve their knowledge. Students from schools and colleges are always welcome to visit the campus and see the demonstration projects available within the campus and to utilize the library.

C-WET establishes stalls in many exhibitions and industrial fairs with an objective to disseminate information to the people about the bright possibilities available in the wind energy sector.

C-WET also has good relationships with wind energy development organizations in other countries such as Egyptian wind energy association, Riso Laboratories, Denmark, and American Wind Energy Association. There are frequent training programmes conducted at C-WET for engineers and scientists from abroad and the same is being provided by other countries to the scientists of C-WET.

C-WET recruits project assistants who are provided excellent on-the-job training for a temporary period. These project assistants then contribute to the private wind energy industry or continue to serve the government as permanent employees.

Conclusion

According to GWEC report, cumulative installed capacity in India by 2015 will cross 30,000 MW with annual installations of about 5000MW annual installations. At this rate, 75000 employees will be required in the industry by 2015. For each of the direct job, 4 indirect jobs will be created. Operations and maintenance jobs are of an ongoing nature and more workforces will be required for every megawatt installed.

For every megawatt of installed capacity, 0.4 jobs are required. For 5000MW annual installations, 2000 trained persons are required every year for handling the O&M activities. With anticipated capacity of 30,000 MW by the year 2015, 12000 workers would be employed in the O&M activities.

There is an immediate need to improve the educational system in our country at undergraduate, graduate and post-graduate levels. Vocational training may also be given to unskilled people who would reduce the socio-economic problems that arise due to unemployment. Manpower export for serving global wind industry can also be thought of because India has the greatest strength and youngest English speaking population in the world. C-WET is constantly striving hard to provide quality knowledge training in focused areas of wind energy development in India as well as in the world at large.

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