pavan

C-WET
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A News Bulletin from CENTRE FOR WIND ENERGY TECHNOLOGY, Chennai

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EDITORIAL

A recent global update by International Energy Agency (IEA) for Clean Energy-RD&D indicates an expenditure of (240 Million US dollars) 1,080 Crores of Indian Rupees for Research, Development and Deployment in Wind Energy.

However, the research gap in funding RD&D in Wind Energy is estimated to be US $ 1.6 Billion to 3.4 Billion. The gap for wind energy research is largely due to need for improvement in (i) offshore wind technologies covering development of stronger-lighter blades to enable larger rotor with the improved tensile strengths, (ii) design to dedicated offshore wind turbines specially redesigned for offshore environment, (iii) advanced sub-surface structures and (iv) use of super conductor wires to reduce transmission loss. In addition development of advanced wind forecasting models would also be needed to overcome the onshore wind's strong market pull and competitiveness.

The main initiative for wind energy technology platform is taking place in Europe with multi-billion euro. Wind research also is highlighted by a very strong German, Danish, Swedish co-operation with a special focus on offshore RD&D.

The recent Husum energy proceedings have also shown the starting of construction activities of the first offshore commercial wind power project of Germany in the Baltic sea, with 21 numbers of 2.3MW Wind Turbines. India is ambitious to jump into the seas for wind energy but the cost and technology crunch is quite high apart from the lack of development of a policy frame work for a single window clearance of offshore wind energy projects. While there is a serious research gaps even in continents with well proven technologies, it may be appropriate that world would look at the vast technical manpower who are deployed for global RD&D needs by several multinational companies in India.

In India a significant Research funding has been made by MNRE, through C-WET in mostly non-IPR related areas of wind energy developments with effective networking of Educational Institutions and State utility providers. Some of the projects co-ordinated by C-WET have multi-institutional partnership including IWTMA to initiate systematic human resource development which are vital for the technology deployment in the wind energy sector in India.

There are possibilities of specific certificate courses and master degree programmes which are financially supported by MNRE as part of the R&D and educational support.

The R&D unit of C-WET is spear heading the developments in India with enhanced RD&D infrastructure at the Wind Turbine Research Station (WTRS) at Kayathar. Recently a 2.0 MW variable speed wind turbine with active pitch controls and additional GRID friendly features has been installed and commissioned for experimental investigations. The unit is testing at a very low cost, the aerogenerators for the Indian manufacturers to enable them get empanelled for GOI's incentive initiatives to give a strong boost to the current small market demand of Small Wind Energy Systems (SWES) in India.

WRA unit of C-WET is as usual quite fast in executing multi pronged projects starting from establishing new Wind Monitoring Stations (WMS) maintaining and operating about 94 WMS in nineteen states. Several verification of procedure of private wind monitoring have been completed by the division. Micro-siting, production estimates, tendering and technical evaluation are some of the other value added services which the division is actively involved. The unit has also upgraded their skill set by the training in other industry standard softwares like MeteoDyn, Windsim which have advanced numerical tools for wind power resource estimates in complex terrains.

Testing unit of C-WET has been very busy going through the preparations and execution of signed agreements for SEPC 250-T wind turbine testing. The unit's activities at site execution was audited by the expert team for recertification / re-assessment for the purpose of the NABL accreditation. The audit was completed successfully by the entire team. A senior experienced member of team Mr.Kumaravel formally got relieved from C-WET for good. The team C-WET will slog and fill up his gap soon.

S&C unit of C-WET has timely release of the RLMM Addendum list for the first time, after the Main list of models of manufacturers. The unit also carry out in parallel the renewal of provisional certificates for M/s.RRB Energy Limited. The unit is also planning development of a web portal for issuing RLMM application to improve transparency.

The ITCS unit of C-WET successfully completed 9th National Training Course amidst their routine duties of hosting C-WET's website, C-WET-IWTMA event and managing visitors to the campus.

We invite very fruitful constructive criticisms to make this Newsletter "Pavan" more interactively communicative as well as practically useful.

Thanking you for your early feedbacks.

S. Gomathinayagam
Executive Director

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Developments in R&D UNIT

Empanelment of Small Wind Turbines

The Unit in accordance with the Modified Scheme for the Programme on "Small Wind Energy and Hybrid Systems (SWES)" released by MNRE and by the recommendations of the Committee to review the status of various manufacturers of Small Wind Energy Systems had released the 1st and 2nd List for Empanelment / Provisional Empanelment on 24th June & 04th August 2010 respectively with a total of seven models and one model accorded provisional empanelment and empanelment respectively.

Small Wind Turbine from different manufacturers have been installed at WTRS for Testing.

The unit is presently in the process of type testing three Small Wind Turbines of 3.2 kW, 3.5 kW and 5 kW rating at the Wind Turbine Research Station (WTRS), Kayathar as per the requirements of IEC-61400-2. The measurements would be continued to the next windy season since the windy season of 2010 has neared its end.

3.2 kW Model 3.5 kW model 5 kW model
at Wind Turbine Research Station, Kayathar

R&D Experimental 2 MW Wind Turbine Commissioning at WTRS facility, Kayathar

The 2 MW Experimental/Research Wind Turbine at CWET's Kayathar WTRS facility has been successfully commissioned. A slew of R&D activities have been planned on the Wind Turbine, as a first measure, work on the establishment of a Health/Condition Monitoring System. This excercise would help the industry to move away from a diagnostic approach of maintaining wind turbines to a Prognosis method of turbine maintenance.

2 MW Experimental / Research Wind Turbine

Move on in WRA UNIT

During the period of July to September 2010, two new wind monitoring stations, one at Jogimatti in Karnataka with 120 meter tall mast for the study of wind shear and other at Purakad in Kerala with 50 meter mast have been established. Presently, ninety four Wind Monitoring Stations are operational in nineteen states and two union territories 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. Gadaria and Makhale in Maharashtra for Maharashtra Energy Development Agency, Pune.
2. Kitawade, Suleran in Maharashtra for M/s. Enercon India Limited, Mumbai Jungi, Manabha, Kitawade, Golay, Karamtha, Barki, Gulumb, Amdhapuram for M/s. Suzlon Infrastructure Services Limited, Pune.
3. Machind in Rajasthan for M/s. Marut-Shakti Energy India Limited, Bhopal.
4. Girishankarwadi in Maharashtra for M/s. Kenersys India Pvt. Limited, Pune.
5. Avandi in Maharashtra for M/s. Sarvodaya Properties Pvt. Limited, Mumbai have been completed.

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

1. Micrositing of wind farm project at Kappatagudda, Gadag district in Karnataka for M/s. Karnataka Power Corporation Limited, Bangalore.

2. Technical evaluation of the proposed 50 MW wind farm projects in Tamil Nadu for M/s. Neyveli Lignite Corporation Limited, Neyveli.
3. Production estimate of 44 MW wind farm projects at Visapur and Adjacent Hills in Satara district, Maharashtra for M/s. Tata Power Company Limited, Mumbai.
4. Wind Resource Assessment at Sukhpur, Amreli district, Gujarat for M/s. Jyoti Limited, Vadodara.
5. Wind Monitoring at TB Dam-I & II, Hospet district, Karnataka for M/s. MSPL Limited, Hospet.

Steps forward in TESTING UNIT

An agreement was signed between C-WET and M/s. Shriram EPC Ltd. for Type Testing SEPC 250-T kW wind turbine at Pavoor Chathiram near Tenkasi.

NABL Re-certification / Re-assessment Audit as per the requirements of ISO / IEC 17025-2005 was completed successfully on 28th & 29th August, 2010 at WTTS, Kayathar.

Marching ahead in S&C UNIT

Agreement has been signed with M/s. RRB Energy Limited for renewal of Provisional Type Certificate of Pawan Shakthi 600 kW wind turbine model under category–II as per TAPS-2000 (amended). Upon successful review of documentation, the renewed PTC has been issued to M/s. RRB Energy Limited, Chennai.

Documentation / information have been obtained from various wind turbine manufacturers for the issue of Revised List of Models and Manufacturers of Wind Turbines (RLMM), Addendum – I list to the Main List dated 18.05.2010. Review of the documentation has been completed. Organized the meeting for issue of RLMM Addendum-I List. The updated RLMM Addendum-I List has been issued on 27.09.2010.

Preliminary activities for development of web portal for issuing RLMM Application Form online with the support of a software consultant have been carried out.

The certification projects, taken up as per TAPS-2000 (amended) are under progress.

The continual improvement and maintaining the Quality Management System are ongoing.

Highlights from ITCS UNIT

Ninth National Training Course

ITCS unit had successfully organized the Ninth National Training course on "WIND ENERGY TECHNOLOGY" during 21st - 23rd July 2010 to address all aspects of Wind Power starting from Wind Resource Assessment to project implementation and operations & maintenance in a focused manner. The course was attended by 91 participants from academic institutes, industry, State Nodal Agencies, developers and consultants from various part of the country. The training course was inaugurated by **Prof. Dr. V. G. Idichandi, Deputy Director,** Indian Institute of Technology (IIT), Madras.

Prof. Dr. V. G. Idichandi delivering inaugural address

The course structure and organization of training was highly appreciated by the participants. It was appraised as an useful course for students who wish to start their career on wind energy and a refresher course for the wind industry professionals. The programme also highlighted the need for human resource development and entrepreneurship for wind energy sector. The feedback from the participants reflected the need for more number of training programmes like this frequently.

Er. S. Sukumar Solomon, Chief Engineer (NCES), TNEB was the Chief Guest of the valedictory function and he distributed the course certificate to all the participants after his valedictory address.

Er. S. Sukumar Solomon distributing the course certificate

C-WET website

ITCS unit had successfully installed the new server to foster state-of-the-art research environment inside C-WET and the same has been used to host C-WET website. The C-WET official website can be accessed @ http://cwet.res.in and also www.cwet.tn.nic.in.

C-WET – IWTMA Event

C-WET and IWTMA jointly organized a one-day workshop on WindSim Software for Wind Resource Assessment on 23rd August 2010. Professionals from wind industry, C-WET Scientists & Engineers have attended the programme.

Visitors to the campus

To motivate the students towards research on wind energy achieving the indigenization and also to create awareness about the activities and services of C-WET, we encourage school and college students visit to the campus. The ITCS unit has organized the following student visits during July to September 2010. A brief presentation on basic wind energy and about C-WET were made and the campus facilities were demonstrated.

- Students of EEE department along with their faculties from Vel Tech High Tech Dr. Rangarajan, Dr. Sakunthala Engineering College, Chennai on 27th July 2010.
- Students of EEE department along with their faculties from SRM University, Chennai on 29th July 2010.
- Students of EEE department along with their faculties from Vel Tech High Tech Dr. Rangarajan, Dr. Sakunthala Engineering College, Chennai on 30th July 2010.
- Students of ME Power System Engineering along with their faculties from Velammal Engineering College, Chennai on 2nd August 2010.
- Students of EEE department along with their faculties from Velammal College of Engineering, Chennai on 3rd August 2010.
- School children of 3rd to 6th Standard along with their teachers from Sharanalaya Public School, Chennai on 16th August 2010.
- Students of EEE department along with their faculties from Dr. M. G. R. University, Chennai on 19th August 2010.
- Students of EEE department along with their faculties from Mohammad Sathaq College of Engineering, Chennai on 24th August 2010.
- Students of EEE department along with their faculties from S. R. M. University, Chennai on 25th August 2010.
- Students of EEE department along with their faculties from S. R. M. University, Chennai on 26th August 2010.
- Students of EEE department along with their faculties from Dr. M. G. R. University, Chennai on 14th September 2010.

Visitors during the campus visit

Apart from the student visits, the ITCS unit had also organized visit for the 18 members of Thai Delegation headed by Prof. Dr. Virulh Sayakanit, Chairman of the Board of the National Research Council of Thailand (NRCT). The delegates visited the C-WET on 22nd September 2010 to meet and exchange of views of the matter with relevant officials / scientists concerning wind energy, which India has advance technology and know-how. The delegates have also visited the Wind Turbine Research Station (WTRS) and nearby wind farms on 23rd September 2010.

Display hall facilities is being explained

MANUFACTURING OF WIND TURBINE BLADES

Shri. G. RAVI, Asst. Vice President, WinWinD Power Energy Private Limited

1. Introduction

In the current day and age, burgeoning energy demand is a global reality so is the increased switch to the fastest growing source of green energy – the wind. Increased tapping of wind power comes with an escalating interest in configuring larger wind turbines with humungous rotor blades.

The task of developing competent rotor blade designs and perfect execution of the manufacturing process is as critical as it is challenging. From the wooden compositions of yore to present day designs where reinforcement with sandwich composites has become predominant, the intrinsic design and manufacturing process of rotor blades for wind turbines has come a long way, even by the standards of this nascent industry.

Today, most rotor blades in the market are built from Glassfiber-Reinforced-Plastic (GRP). Other materials that have been tried include wood and Carbon Filament-Reinforced-Plastic (CFRP). Increased rotor sizes on larger machines require a rampant switch to high strength, fatigue resistant materials. Attaining these physical attributes at optimized production cost is one major facet to futuristic rotor blade development.

With increased optimization in the manufacturing techniques, the capital cost of producing rotor blades have come down steadily over the past years. Replacing the Hand Lay-up method, Vaccum Assisted Resin Infusion Moulding (VARIM) has now become the most widely used technique in blade manufacturing, irrespective of the resin system in use.

In recent years, PREPREG - a next generation technique, has started gaining momentum among rotor blade manufacturing processes. However, the temperature and climatic conditions in countries like India have hindered the easy adoption of this advanced blade development process. A major obstacle to employing this process is presented by the higher temperatures that constitute the climatic conditions of the country.

Rotor blade manufacturing is still largely dependant upon the skill set of the people, since it is a labour intensive process. In the US and Europe, studies are on and steps are being taken to attain increased automation. The use of man power, though, still remains predominant in manufacturing rotor blades. India with its excellent skilled labour base is one of the preferred destinations for mass production of Rotor Blades.

2. Wind Turbine Blade – Configuration

The rotor blade is basically an interface between the raw mechanical force of wind energy and the mechanism that translates this energy into usable electricity. The competence of the rotor blade design hence depends on the efficiency of its aerodynamic area in harnessing the wind.

2.1. Rotor Blade Body

The rotor blade is divided into two sections namely, root area and aerodynamic area. The aerodynamic area is responsible for power production and root is joining the aerodynamic portion into hub of turbine.

2.2. Rotor Blade Nomenclature

Root End

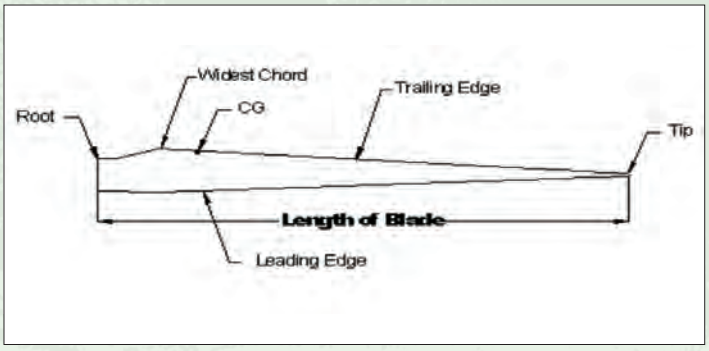
The Root End of the rotor blade is cylindrical in shape, fixed with Studs in a précised PCD to enable it to get connected to the Rotor Hub.

Tip End

As the name refers, it's the tip part of the rotor Blade, the profile of the tip is of very much importance because it is main part for turbine power production. The tip section of the blade is a sensitive area where the wind speed is attacking at high speed. The speed with which the tip of the rotor blades moves through the air is app. 64m/sec, while at the centre of the hub, it is zero. At the tip of the blades, the relative wind speed is app. 8 times higher than the speed of the wind, hitting the front of the turbine.

Widest Chord

Largest linear distance between the trailing and leading edge of the blade and which normally holds the CG point of the Rotor Blade.



Leading Edge / Nose Side

The LE / NS is the edge which leads the Rotor Blade revolution. It is also the first point where the wind attacks the blade. The nose side of the blade is the part, which faces the wind force. It is this side which pierces into the wind which is acting perpendicular to it. Hence this side is the very strongest sides, as it has to withstand the impact and variable load of the wind.

Trailing Edge / Tail Side

The trailing edge of the Blade follows the leading edge. Thickness of the blade in the trailing edge area is of very thin and should be very precise. The tail side of the blade is the essential in its own way because; the design of the aerodynamic profile of the blade lies in this side. It is this profile, which ensures us the efficiency in capturing the wind energy. It is the thinner part of the blade having a sharp edge towards the tip. The power efficiency depends on this profile of the blade .

3. Wind Turbine Blade Manufacturing

3.1. Materials

In the wind turbine blade manufacturing process, the material used is mainly the Glass fibre Reinforced Plastics (GRP). Within the FRP Product, the Materials used for making Rotor blade can be divided under various categories, irrespective of method of manufacturing.

MATERIAL

Binder- Resin: Epoxy, Polyseter	Resin is the liquid form of plastic known as Thermoset matrices. In the constituents of FRP, the thermoset matrices are an important factor.
Reinforcement – Fibre: Glass, Carbon	Uni-Directional Glass mat Bi-axial Glass mat Tri-axial Glass mat Quad axial Glass mat Combination Glass mat Continuous Glass mat Surface Mat
Structural Core – Foam: PVC, PS, SAN, PALSA Wood	The sandwich foam is rigid, closed cell foam with a tri-dimensional grid structure which gives high thermal stability and three-dimensional structural integrity. Sandwich foam provides structural strength and buckling strength to the blade. It also has excellent mechanical properties even in its lower densities.
Surface Protection – Coating: Polyester gel coat, PU paint	Polyester gel coats and PU paints protect the rotor blade from harsh weather conditions and make them last longer
Bonding - Adhesive : Epoxy, Polyester	Durable Epoxy and Polyester adhesives are utilized in Blade construction to ensure excellent bonding strength, longer up times and resistance to fatigue, ageing, stress and for gap filling.
Metal Components	T-Bolts and Hexagonal nuts Lightning Strip and Lightning Tip Lead shot "O" ring

3.2. Methods

There are more methods available. But three major methods are employed in the market to manufacture rotor blades. They are Hand Lay Up, VARIM and PREPREG methods. VARIM is the most widely used method across the globe.

3.2.1. Hand Lay Up - HLU

Hand Lay Up method is one of the oldest methods of blade fabrication. It is a labour intensive method in which glass / reinforcing mat / woven fabric / roving is positioned manually in the open mold, and resin is applied to the glass plies. Entrapped air is removed manually with squeegees or rollers to complete the

laminates structure. Room temperature curing polyesters and epoxies are the most commonly used matrix resins. Curing is initiated by a catalyst in the resin system, which hardens the fibre reinforced resin composite without external heat. For a high quality part surface, a pigmented gel coat is first applied to the mold surface. This process of open moulding is becoming history.

3.2.2. PREPREG

PREPREG is a more advanced technique of manufacturing rotor blades. However, it poses the following challenges:

- Difficult handling in large structures
- Higher production costs
- Raw Material Storage

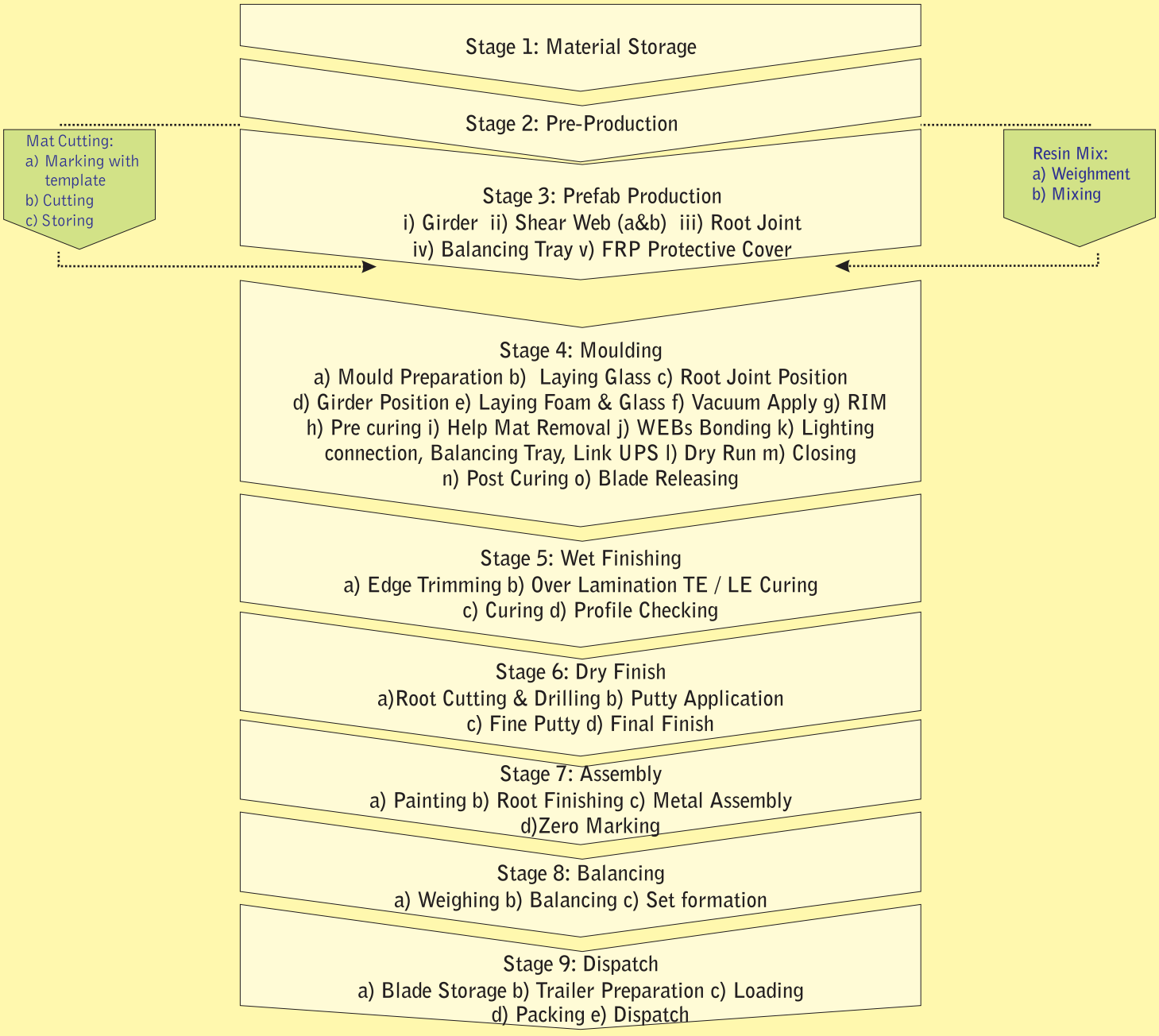
3.2.3. VARIM

VARIM is the commonly used method for rotor blade manufacture. The process has the following advantages:

- Excellent resin consolidation
- Excellent fiber impregnation with more fibre content
- Environmental free

4. Wind Turbine Blade – Stage wise Manufacturing

4.1. Flow Chart – Stage wise activities



4.2 Process Equipments

The power needed for manufacturing blades employing the process explained above requires a decent manufacturing facility. The blade manufacturing facility has the following equipments installed for the manufacturing of the blades:

Equipment list:
The list of process equipments is
Resin mixing Machine
Adhesive mixing Machine
Vacuum Pump
Hydraulic Turning Device
Root drilling and cutting machine

The list of inspection and laboratory equipment is
DSC Calorimeter
Brooke field Viscometer
Infra Red Camera
Laser Tracker
Barcol hardness Tester
Universal Testing Machine

5. Challenges in Rotor Blade Manufacturing

Technology Side :

1. Usage of PREPREG in hot climate countries like India.
2. Automation of rotor blade manufacturing.
3. 12 hours cycle time to increase productivity.
4. Usage of Carbon fibres has to be increased to reach less weight with more strength concept (Technically possible, but commercial ???)

Human Resource Side :

1. Availability of skilled manpower.
2. Insufficient degree courses, as of today.

Waste Management Side :

1. Development of a user-friendly wastage management system.
2. Support from Government agencies to have beneficial policies in handling the wastage.

RECRUITMENT / PROMOTION / RETIREMENT

New Recruitment

Name	Cadre	Unit
A.G. Rangaraj	Scientist – B	S&C unit

EVENTS

Hindi Day Celebrations

C-WET had celebrated Hindi Fortnight between 14th – 28th September 2010. The celebration started with the inauguration function on 14th September 2010 and inaugurated by the Chief Guest, Shri. Navanaath Kamble, Deputy Director (South), Hindi Teaching Scheme with the address by Dr. S. Gomathinayagam, Executive Director.

As part of the celebration, Paragraph Writing, Photo Theme, Singing, Elocution, Recitation, Caption Writing, Reading and Hand Writing competitions were conducted for the employees of C-WET.

The celebration was concluded on 28th September 2010 and Shri. B. B. Kothe, Assistant Director of Dakshin Bharat Hindi Prachar Sabha was the Chief Guest. He delivered keynote address and explained the importance of promotion of Hindi, the National Language. The Chief Guest distributed the prizes to the winners of the competitions.

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