pavan

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EDITORIAL

The global wind power installed capacity has reached about 94,000 MW by the close of 2007, registering growth rate of 26.6% of more than the growth rate of 25.6% in the year 2006. A new record of adding about 19,700 MW has been achieved during the year, surpassing the previous year's growth of 15,120 MW. India is still in the 4^{th} position in the world with a total installed capacity of 7,850 MW as compared to 4,430 MW by the end of 2006, matching almost the global growth rate. The progress achieved during the 10^{th} five year plan period of 2002-2007 has given confidence to set higher target of about 10,500 MW during 11^{th} five year plan period starting from 2007. Wind power development is picking up in states other than Tamil Nadu, Karnataka and Maharashtra. States of Gujarat and Madhya Pradesh are showing strong signals for higher growth. While the indirect fiscal incentives are still driving the private sector investment in the sector, progressive policies recently adopted by some of the states are increasing the confidence of investors in the wind energy sector. Wind turbines which are more suitable to the wind regimes in the country are now available for deployment. Manufacturing facilities for wind turbine components, such as gear boxes, blades, yaw components, etc. have come up in the country to cater to the requirement of new and large wind turbines. As has been happening globally, wind turbines are increasingly contributing to the power supply, noticeably in the states of Tamil Nadu, Karnataka and Madhya Pradesh.

Centre for Wind Energy Technology (C-WET) is continuing to play a useful role in the development of wind power sector in the country. The Wind Resources Assessment (WRA) unit is continuing selection and identification of more sites for exploration. A number of major public and private sector undertakings are taking assistance of C-WET in preparation of project reports, micro-siting and due-diligence reports. The Testing unit has taken up Provisional Type Testing (PTT) of a few new wind turbines. The Testing and Certification unit have completed re-certification audits as per requirement of ISO 9001:2000. The fifth National Training Course on "Wind Farm Development and Related Issues" was organized by ITCS Unit in December 2007 for participants drawn from academic institutions, industries, various states, developers and consultants. This current issue has also an article on load measurement of wind turbine by the scientists of Testing unit of C-WET.

C-WET is looking forward to make more contribution to the wind power sector by completing Indian Wind Atlas, launching of coordinated and multi institutional research and development programme, assessment of the wind power potential for off-shore wind farms and establishing test facility for small wind turbines at Wind Turbine Test Station (WTTS), Kayathar. This would be possible only through increased interaction and involvement of all stake holders including Wind industries, State Governments, Investors, O&M providers etc.

We seek your valuable suggestions on these issues and also for further improvement of Pavan.

K.P. Sukumaran
Executive Director

Contents

Editorial Board

Developments in R&D UNIT

Wind - Solar - Battery – Diesel Hybrid System

The unit is in the process of installing a 5 kW wind-solar-battery-diesel hybrid system with microprocessor control and remote monitoring through GPRS / internet at C-WET campus to serve as a pilot cum demonstration plant. The automated hybrid power system will consist of 1.8 kWp solar photovoltaic panels and 3.2 kW aero generator optimized based on best windy / sunny months with lean periods taken care of by controlled diesel power injection. The system can supply no-break power supply at remote locations to critical installations like meteorological stations, mobile / telephone towers etc. Salient features are the master controller for unmanned control of the system and the remote monitoring system for monitoring power generation, battery health etc. at remote locations.

Schematic Layout of the Proposed Hybrid System

One-Day Awareness Programme on Renewable Energy Devices

The Unit conducted a one-day awareness programme for Renewable Energy Agency of Pondicherry on wind and solar energy programmes implemented at C-WET. The visit was planned to facilitate implementation of Renewable Energy Programme in Puduchery

Move on in WRA UNIT

Presently, sixty four wind monitoring stations are operational under various wind monitoring projects like Wind Resource Assessment in uncovered / new areas, Wind Resource Assessment in North East Region and Consultancy projects etc.

Verification of procedure of Wind Monitoring of Akal site, Jaisalmer in Rajasthan, has been taken up for M/s. Vestas RRB India Ltd, Chennai and three Verification of Procedure of Wind Monitoring has been completed for various developers viz. M/s. Enercon India Ltd, Mumbai, M/s. Vestas Wind Technology India Pvt. Ltd, Chennai and M/s. Dahivel Energy Project (P) Ltd, Mumbai.

Micrositing for wind farms in Tirumala hills has been taken up for T. T. Devasthanams., Tirupati.

Six numbers of due diligence studies of 50.4 MW, 50 MW, 5 MW, 45 MW, 38.75 MW & 15 MW wind farm projects have been taken up for viz. M/s. Roaring 40s Wind Farm Private Limited., Mumbai, M/s. NTPC, Limited., Noida, M/s. Bharat Petroleum Corporation Ltd., Mumbai, M/s. Reliance Innoventures Private Limited., Mumbai, M/s. Tata Power Company Ltd., Mumbai and M/s. Theolia Wind Power Private Limited., New Delhi respectively during these period.

Commissioning of one Wind Monitoring Station at Sukhpur in the Amreli district of Gujarat state has been taken up for M/s. Jyoti Limited, Vadodara.

Two Scientists, one Meteorologist and one Junior Engineer of the unit have undergone a course on the layout of the structure of the Wind Atlas publication as a part of the preparation of numerical Wind Atlas of the country.

Steps forward in TESTING UNIT

The measurements for Provisional Type Testing (PTT) of Suzlon 1500 kW wind turbine at Moti Sindhodi and Enercon 800 kW wind turbine at Jodhpar in Gujarat were closed and the equipment has been withdrawn.

The measurements for PTT of IWPL 250 kW wind turbine and PTT of Siva 250 kW wind turbine are expected to be closed soon since low wind and standstill measurements are under progress.

Provisional Type Testing of Suzlon 350 kW wind turbine at Gujarat is expected to start in windy season of the year 2008.

Provisional Type Testing of Chettinad 600 kW wind turbine at Thirumangalakurchi, Tamilnadu for M/s. Chettinad Energy Pvt. Ltd., Tamilnadu is expected to be started in April 2008. Test plan preparation for instrumentation and tests are underway.

The Re-certification by DNV as per the requirements of ISO 9001:2000 for the unit has been successfully completed.

The unit has taken over 9 No's of 200 kW Micon make wind turbines at Kayathar from Tamil Nadu Electricity Board (TNEB). The developmental works for improving the performance of these turbines are underway.

Marching ahead in
S&C UNIT

Quality Management System (QMS) Re-certification Audit has been successfully conducted by DNV as per ISO 9001:2000 and issued the renewed certificate.

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

The continual improvement and maintaining the Quality Management System are on going.

Advisor, MNRE & ED,
C-WET Distributing Course Certificate

Highlights from
ITCS UNIT

Fifth National Training Course

Information, Training and Commercial Services Unit had successfully organized the Fifth National Training Course on "Wind Farm Development and Related Issues" on 6th & 7th December 2007 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 72 participants from academic Institutions, Industries, State Nodal Agencies, Developers and Consultants from various parts of the country. The training course was inaugurated by Shri. V. Subramanian, Secretary, MNRE.

Secretary, MNRE delivering Inaugural Address

The course content for the training was a carefully thought out syllabus with specific subject experts giving lectures. The training course addressed the following aspects:

- Wind Resources Assessment
- Design and Layout of Wind Farms
- Wind Turbine Technology
- Grid Integration of Wind Turbines
- Certification of Wind Turbines
- Testing of Wind Turbines
- O&M Aspects of Wind Farms

Farewell

Shri. M.P. Ramesh was given a warm farewell on **12.10.2007** His work span lasted from 15-04-2002 to 12-10-2007 as the Executive Director of C-WET. His dedicated contributions and remarkable services towards making this organisation a **'Centre of Excellence'** will always be remembered.

C-WET Annual Report 2006-2007

C-WET Annual Report 2006-2007 has been prepared, printed and submitted to MNRE to place on the table of Parliament.

'India's renewable energy capacity to grow eight-fold'

India's renewable energy capacity will grow eight-fold to touch 80,000 MW by 2032 and will account for 10 percent of the country's total electricity generation capacity, Renewable Energy Minister Vilas Muttemwar said Thursday.

'We are working for facilitating the implementation of a broad spectrum programme covering the entire range of new and renewable sources,' the minister said in a paper submitted at a seminar on renewable energy organised by PHD Chamber of Commerce and Industry here.

'India has one of the largest programmes in renewable energy in the world,' the minister said, adding the government has identified alternate fuels, namely hydrogen, synthetic fuels and bio-fuels, as thrust areas.

In wind power alone, the government proposes a capacity addition of 10,500 MW during the 11th plan period (2007-08 to 2011-12).

K.P. Sukumaran, advisor in the ministry, told the seminar that the growth in wind power generation in the country in recent years was a reflection of the investors' growing confidence in this clean energy source.

He said that generation capacity in wind power was currently being added at the rate of 1,700 MW every year compared to just 200 MW a year four years ago. 'This reflects the dramatic turnaround in investors' confidence in the wind power.'

He said this had also put to rest the debate on whether wind power generation was viable or not. 'Instead, the debate has moved on to how capacity addition in wind power can be accelerated,' he maintained.

Speaking earlier, Rakesh Bakshi, managing director, Vestas RRB India Ltd, a key player in wind power, said the share of renewable power in the energy mix must be raised to 20-25 percent if the country's long-term energy security is to be ensured.

It will help fight the growing threat of greenhouse gas emissions, he said, adding that wind energy, which is clean and environment-friendly, is not just an option but a need of the hour.

He appreciated the support being provided by the government to developers of wind power projects. However, he added that wind power was still at a disadvantage vis-a-vis hydrocarbon fuels.

'The government should impose environment protection cess on fossil fuel-generated power in order to level the playing field for renewable power project developers,' said Bakshi.

Wind power is emerging as a key factor in India's quest for energy security as fossil fuel-based power generation has failed to keep pace with growing electricity requirement of a surging economy.

Source: http://www.earthtimes.org

Total generation from wind power Projects (MU)

S. No.	Name of the State	Generation upto 2005-06	Generation during 06-07	Upto 2006-07
1	Andhra Pradesh	1041.30	149.18	1190.48
2	Gujarat	1461.31	454.91	1916.22
3	Karnataka	2342.34	1397.66	3740.00
4	Kerala	15.86	0.00	15.86
5	Madhya Pradesh	234.13	70.43	304.56
6	Maharashtra	3440.11	1691.50	5131.61
7	Rajasthan	922.72	532.60	1455.32
8	Tamil Nadu	15413.30	5268.84	20682.14
9	West Bengal	3.00	0.00	3.00
	Total	24874.07	9565.12	34439.19

Source: http://mnes.nic.in

India's wind power increase world's third largest

India was the world's top third country in terms of added wind power capacity last year with the global annual investment in renewable energy expected to exceed $100 billion by end-2007, says Ren21, a renewable energy policy network for the 21st century.

"India was number three globally in added wind power capacity in 2006," Virginia Sonntag-O'Brien of Ren21 told IANS on the sidelines of the UN conference on climate change here.

About a month before the publication of the Ren21 global status report on renewable energy, Sonntag-O'Brien praised Indian states that had mandated blending biofuels with conventional vehicle fuels.

Worldwide, annual biofuel production will exceed 50 billion litres this year, about three percent of the global petrol and diesel consumption.

Wind power has continued to grow at 25-30 percent per year since 2000 and now receives the largest share of annual investments among renewable sources of energy, she added. 'It will reach at least 93 GW cumulative capacity in 2007, up from just 7.5 GW in 1997.'

Among the various renewable sources of energy being promoted to replace the use of fossil fuels that lead to the emission of greenhouse gases such as carbon dioxide and global warming, small hydropower, biomass power and geothermal power are still relatively minor contributors, Sonntag-O'Brien said.

Rooftop solar energy collectors now provide hot water to over 50 million households worldwide, China accounts for 80 percent of the global market for solar hot water collectors. Sonntag-O'Brien said solar water heating and biofuels are growing at 15-20 percent annual rates.

In terms of adding wind power capacity, India's third position is behind that of the US and Germany.

China has focused on small hydroelectric projects and the country now accounts for more than half the world's power generation from this source.

Sonntag-O'Brien predicted that these trends are set to continue, 'as the costs of renewable energy technologies continue to decline and as the renewable energy industry continues to diversify production and technology development.

'With over 2.5 million jobs in the renewable energy industry and strong rural development benefits as well, they contribute to economic development, energy security and improving the local environment on top of helping mitigate climate change.

Source : www.windenergynews.com

Requirement of Load Measurements on Wind Turbines

Shri. S. A. Mathew (Unit Chief-Testing & Scientist) and
Shri. R. Kumaravel (Scientist-Testing) Centre for Wind Energy Technology, Chennai

In order to understand the effects of the loads on a wind turbine it will be first necessary to mention conventional design procedure. The wind turbine industry like any other manufacturing industry has a set design procedure. Mechanical load measurements is used both as the basis for design as well as certification. This technical note introduces the various mechanical loads that act on the wind turbine, the importance of measuring these loads and methodology to achieve the end results.

1. Importance of Measurement of Loads

The importance for measuring the mechanical loads can best be explained by the flow chart in Figure 1.1

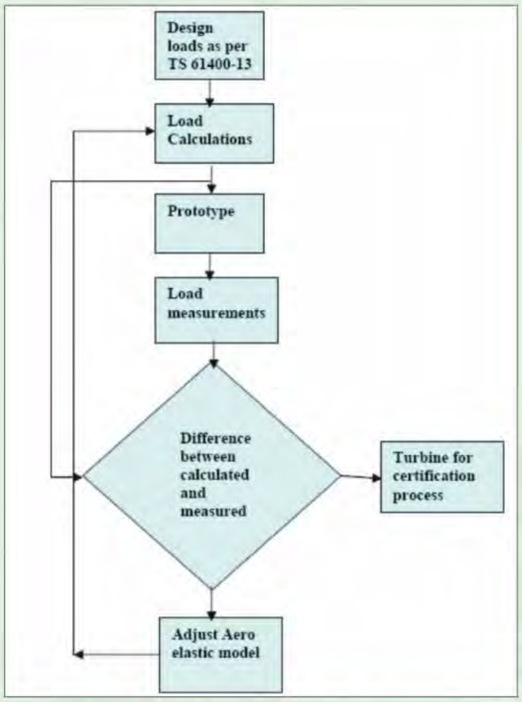

Figure 1.1: Flow Chart for design procedure.

2. Introduction to Mechanical Loads

The mechanical loads which affect the wind turbine during its operational, transient and stand still conditions are required to be quantified. These loads are mainly from the rotor (the unit which constitutes three blades), nacelle (the unit which constitutes the main rotor shaft) and tower (the unit that holds the whole rotor and nacelle unit). The Measurement Load Cases (MLCs) are defined in relation to Design Load Cases (DLCs) described in 61400-1. Hence all DLCs cannot be reasonably verified by measurements. The following are the mechanical loads in general which are related to specific DLCs and MLCs in the relevant IEC standards.

Blade loads

1. Edge-wise bending moment
2. Flap-wise bending moment

Rotor loads

1. Tilt moment
2. Yaw moment

Shaft loads

1. Shaft torque
2. Shaft bending moment in XX axis
3. Shaft bending moment in YY axis

Tower loads

1. Bending moments in XX axis at tower bottom
2. Bending moments in YY axis at tower bottom
3. Torsion at tower top

3. Guidelines / Method used for Measurement of Loads

The reference adopted for measurement of wind turbine loads is "Technical Specification: IEC TS 61400-13, Wind turbine generator systems-Part 13: Measurement of mechanical loads"

4. The Measurement Technique

The measurement techniques for the various types of quantities in load measurements include

1. Instrumentation

2, Calibration

3. Signal Conditioning (where relevant)

Load measurements are used to determine the natural frequencies and equivalent loads on wind turbine components. The equivalent loads are evaluated using rain flow counting technique. The concept of the equivalent load is a convenient, short handed description of the fatigue impact of a given load measurement time history. The equivalent load is conceptually the single load equivalent that when applied with the total number of cycles in a given time history appearing at a given frequency does the same fatigue damage as the sum of all the different rain-flow counted load amplitudes in the measured load spectrum. The advantage of the equivalent load is that it provides a single descriptor of the fatigue damaging potential of a particular loading during a given time period. The equivalent loads are calculated for different wind speeds.

4.1. Nomenclature / sign convention as per TS IEC 61400-13

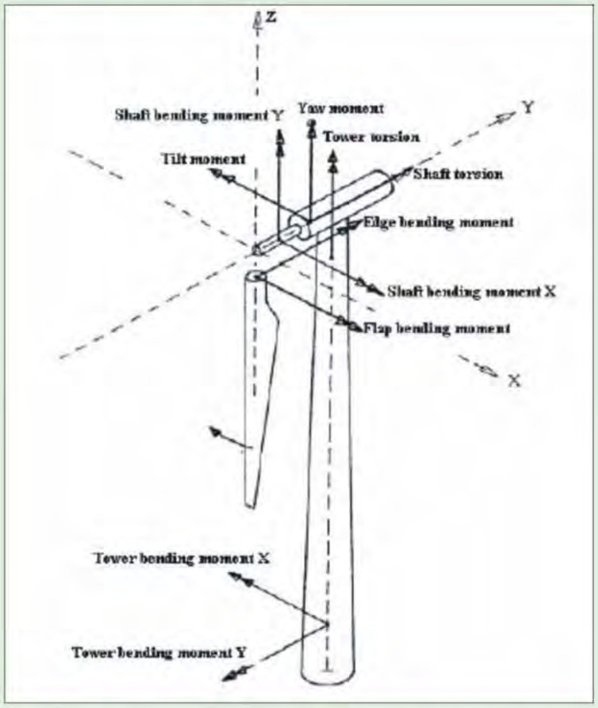

Figure 4.1.1 Nomenclature of Wind Turbine Loads

4.2 Parameters to be measured as a minimum required (Mandatory)

1.	Wind speed – hub height
2.	Wind direction
3.	Air temperature
4.	Rotor speed
5.	Rotor position / Rotor Azimuth
6.	Yaw position
7.	Edgewise bending moment – in any one blade
8.	Flapwise bending moment – in any one blade
9.	Shaft torsion
10.	Shaft bending moment XX direction
11.	Shaft bending moment YY direction
12.	Tower top torsion
13.	Tower bottom forces (in four legs - in case of lattice towers)Tower bending moments (in two directions in case of tubular towers)
14.	Active Power
15.	Reactive Power
16.	Frequency
17.	Generator status
18.	Brake status

4.3 Parameters measured normally apart from mandatory requirement

1.	Nacelle acceleration 1
2.	Nacelle acceleration 2
3.	Nacelle acceleration 3
4.	Nacelle acceleration 4
5.	Tower top bending moment XX direction
6.	Tower top bending moment YY direction

4.4 Measurement System

The Pentium III microprocessor-based system is connected with 4 DAUs (Data Acquisition Unit), P2858a fitted in various locations viz., metmast, rotor, nacelle and control room. Each DAU can handle 16 analog channels and 6 digital channels. The sampling frequency for this kind of continuous measurement normally used is 35Hz. All the analog signals connected to the DAU are transmitted within the range of ±5V DC. The wind speed signals are pulse/frequency based hence they are connected to the digital inputs of the metmast DAU. Similarly the generator and brake status signals are also connected to the digital inputs of the control room DAU. All outputs from various DAUs are routed to the terminal box, which combines all of them and routes the combined output to the MOXA communication port through which the signals enter the Industrial PC.

4.5 Overview of the Measurement Setup

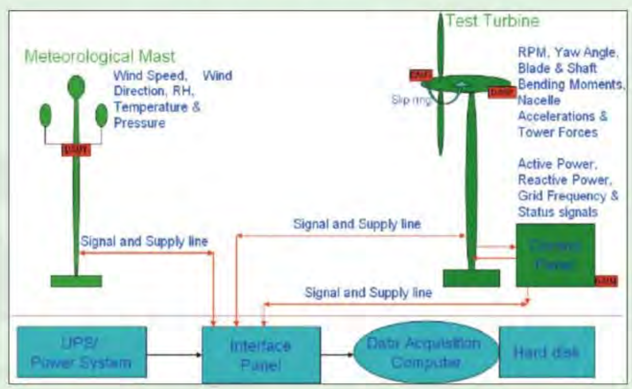

Figure 4.5.1 The Measurement Setup

4.6 Instrumentation used for the measuring the mechanical parameters

1.	Shaft torque	350 Ω, HBM 14 strain gage bridge
2.	Shaft bending moment XX	350 Ω, HBM 8 strain gage bridge
3.	Shaft bending moment YY	350 Ω, HBM 8 strain gage bridge
4.	Nacelle acceleration 1	Accelerometer
5.	Nacelle acceleration 2	Accelerometer

6.	Nacelle acceleration 3	Accelerometer
7.	Nacelle acceleration 4	Accelerometer
8.	Edgewise bending moment – blade 1	350 Ω, HBM 11 strain gage bridge
9.	Flapwise bending moment – blade 1	350 Ω, HBM 11 strain gage bridge
10.	Edgewise bending moment – blade 2	350 Ω, HBM 11 strain gage bridge
11.	Flapwise bending moment – blade 2	350 Ω, HBM 11 strain gage bridge
12.	Edgewise bending moment – blade 3	350 Ω, HBM 11 strain gage bridge
13.	Flapwise bending moment – blade 3	350 Ω, HBM 11 strain gage bridge
14.	Tower top bending moment XX	350 Ω, HBM 11 strain gage bridge
15.	Tower top bending moment YY	350 Ω, HBM 11 strain gage bridge
16.	Tower top torsion	350 Ω, HBM 14 strain gage bridge
17.	Tower bottom axial force – leg 1	350 Ω, HBM 9 strain gage bridge
18.	Tower bottom axial force – leg 2	350 Ω, HBM 9 strain gage bridge
19.	Tower bottom axial force – keg 3	350 Ω, HBM 9 strain gage bridge
20.	Tower bottom axial force – leg 4	350 Ω, HBM 9 strain gage bridge

4.7 Analysis and Reporting

The analysis and reporting of the load measurements are carried out as per TS IEC 61400-13. Two different types of analysis are carried out.

1. Power Spectral Density (PSD) analysis from the time series data to obtain the natural frequencies for different components
2. Rain Flow Counting (RFC) analysis from the time series data to obtain the equivalent loads for determination of the fatigue loads with statistics of all load parameters. Examples of the above said two analysis are shown in the figures below.

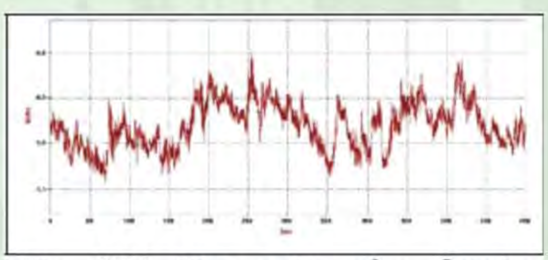

Fig: 4.7.1 Time series of a flapwise bending moment signal

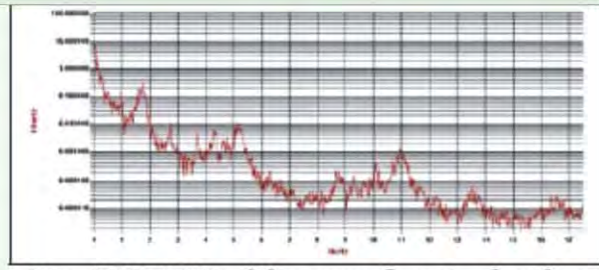

Fig: 4.7.2 PSD of the same flapwise bending moment signal

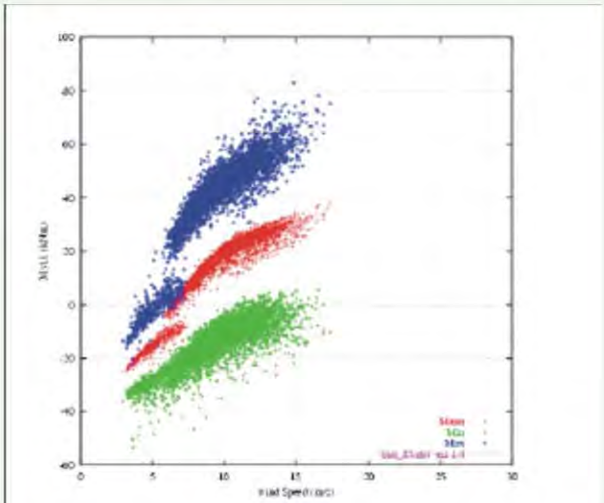

Fig: 4.7.3 Statistics of a flapwise bending moment signal

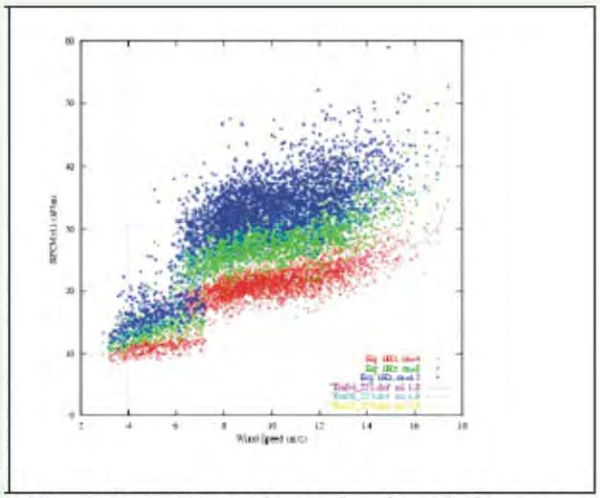

Fig: 4.7.4 Equivalents loads of the same flapwise bending moment signal

References

1. TS IEC 61400-13 Wind turbine generator systems-Part 13: Measurement of mechanical loads"

World wind energy award for Brazil

On the occasion of the 6th world wind energy conference 2007 in Mar del Plata, Argentina, the board of the World Wind Energy Association has decided to give the world wind energy award 2007 to Brazil for the successful creation and implementation of the renewable energy incentive programme Proinfa which boosted the development of wind energy utilisation in Brazil.

The Award has been given by WWEA President Dr Anil Kane to the following persons who have all contributed greatly to this achievement:

- The Honourable Ms Dilma Vana Rousseff, Chief of Staff Minister of Brazil and former Minister for Mines and Energy,
- Ms Laura Porto, Director of the Department of Renewable Energy of the Ministry of Mines and Energy,
- Mr Valter Luiz Cardeal, Director of Engineering and current President of Eletrobrás,
- Dr. Sebastião Florentino da Silva, Coordinator of the Unity of the Proinfa Programme at Eletrobrás.

Under the leadership and supervision of the named persons, the existing wind potential of Brazil has become exploited in a way which makes Brazil the leading wind energy country so far in Latin America. Since the introduction of the Proinfa programme, power purchase agreements with a total capacity of 1423 MW have been made which will all be operational by December 2008. Today Brazil has an installed wind energy capacity of 237 MW in total, out of which 208 MW were added in the year 2006, under the Proinfa programme.

WWEA sees the creation and implementation of the Proinfa programme as an excellent example how an emerging country can introduce wind energy on a large scale. A fixed feed-in tariff guaranteed for a fixed period of time has already helped especially several European countries such as Denmark, Germany and Spain to boost their national wind industry. Brazil is the first country in Latin America which has set up regulations that are following these successful principles, however, taking wisely into account the specific conditions in the country.

An important part of the Proinfa programme therefore is the requirement that wind farms must contain a minimum of 60 % of local content. This requirement has lead to the creation of a strong domestic wind industry, in cooperation with international wind turbine manufacturers.

The creation and implementation of Proinfa would never have been possible without the contribution and wise political decisions taken under the responsibility of Honorable Minister Dilma Vana Rousseff in her capacity as Minister for Mines and Energy, as well as Ms Laura Porto as Director of the Renewable Energy Department. Mr Valter Luiz Cardeal, as Director of Engineering of Eletrobrás and Dr. Sebastião Florentino da Silva, as Coordinator of the Unity of the Proinfa Programme at Eletrobrás, have been in charge of the successful and probably not always easy implementation of the programme. Of course the awarded persons are working with the support of big teams and many dedicated persons which unfortunately cannot all be mentioned and honoured in person but should see the award also as an appreciation of their work. WWEA hopes and expects that the World Wind Energy Award 2007 will encourage the Government of Brazil to continue its strong support for wind energy and hopes that other governments in the region and worldwide feel encouraged by the Brazilian progress and will set up similar frameworks, learning from the vast experiences already made.

Ms Silvia Suárez, Secretary for the Environment of the Province of Buenos Aires, received the World Wind Energy Honorary Award 2007 for the great support the Province gave to making WWEC 2007 a success with 600 participants from 40 countries.

Source : http://www.jeccomposites.com

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