

MEASNET: Network of European Measuring Institutes

J. P. Molly, DEWI

Summary

For much of the last decade, national wind test centres in Europe have been involved in developing measurement standards to ensure that measurements are performed to a high quality. In spite of this work and the existing standards of IEC and IEA the practical application of the methods in the commercial wind energy business showed the necessity of further harmonisation of test methods and interpretation of measurement recommendations. To improve the unsatisfactory situation the well known test centers CIEMAT (Spain), CRES (Greece), DEWI (Germany), ECN (The Netherlands), RISØ (Denmark) and WINDTEST (Germany) worked together in the project "European Wind Turbine Standards I and II" [1, 2], cofinanced by the European Commission, DG XII, and agreed to form a grouping called "MEASNET, Network of European Measuring Institutes". The objective of this project was to arrive at the situation where the measuring institutes are able to perform measurements of equal quality which are sufficient for the mutual comparison and acceptance that is necessary in an open European market. Mid 1997 the participants officially signed the Terms of Agreement which describes the internal structure and requirements of MEASNET. The project partners agreed on harmonised anemometer calibration, power performance, noise and power quality measurement procedures which take into account the existing standards supplemented by MEASNET recommendations. Regularly quality checks and compliance with the MEASNET measurement procedures by obtaining and maintaining EN 45001 accreditation ensure high quality for the customer. MEASNET is now operative and the institutes are allowed to offer their MEASNET approved high quality measurements from October 1997 on.

1. Introduction

More than four years ago the seven European institutes CIEMAT, CRES, DEWI, ECN, NEL, RISØ and WINDTEST decided to jointly improve their measurement quality to avoid any problems of future mutual recognition. Measurements performed by the institutes, even applying the existing IEA, IEC and other standards and recommendations, showed remarkable differences in their results, a situation which is unacceptable in an open international market. To improve this unsatisfactory situation the above mentioned test centres worked together in the projects "European Wind Turbine Standards I and II" [1, 2], cofinanced by the European Commission and agreed to form a grouping called "MEASNET, Network of European Measuring Institutes".

During the two projects special attention was given to the anemometer calibration procedure. Due to the third power dependence of power from wind speed, the main emphasis had to be concentrated on a accurate anemometer calibration. Especially the problem of the use of different wind tunnels for anemometer calibration had to be solved. Basis for all performed harmonisation and quality evaluation work were round robin tests and agreed quality evaluation procedures.

Within the two above mentioned projects, the project team was tasked with the goals of creating an organisational structure and of establishing rules and requirements which will guarantee that high quality measurements are carried out by the participants. In effect, the objective of this project was to arrive at the situation where the measuring institutes are able to perform measurements of equal quality which are sufficient for the mutual comparison and acceptance.

MEASNET is not restricted to the actual founding members but also open for other institutions as long as they are independent of industry and fulfil the membership requirements set up by MEASNET. All member institutes ensure compliance with the agreed measurement procedures by obtaining and maintaining EN 45001 accreditation. Measurements will not be done by "MEASNET" but by each participating institute. Customers therefore have the advantage to contract that MEASNET member for a measurement, which offers the best commercial conditions.

2. Internal Structure and Requirements of MEASNET

2.1 Structure of MEASNET

To ensure high quality measurements, uniform interpretation of standards and recommendations as well as interchangeability of results, the members established an organisational structure for MEASNET (Fig. 1) and perform mutual periodical quality procedures for measurements and evaluations. The highest tier is the Council of Members. An Executive Board, composed of three representatives from different member institutes executes the tasks delegated by the Council of Members. One or more Expert Groups, specialising in certain measurement tasks, advise and support the Executive Board and the Council of Members on the definition of the measurement procedures. Assessment Teams are established to perform assessments for the admission of new members and for quality confirmation of MEASNET members. MEASNET members must be accredited to EN 45001 for the MEASNET approved measurements.

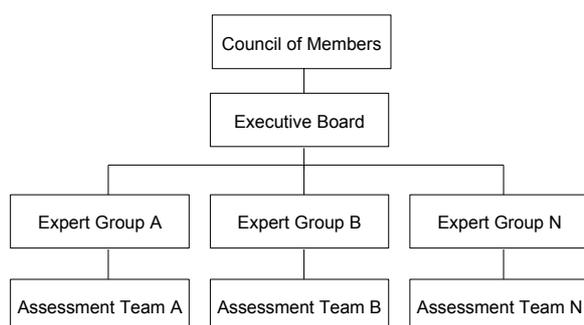


Fig. 1: Organisational structure of MEASNET

2.2 Requirements of MEASNET

In order to ensure generally acceptable, high quality measurements the member institutes shall fulfil the following requirements:

- legally independent from industry.
- adequate experience in the field of wind energy and wind energy related measurements.
- qualified and experienced measurement staff.
- carry out measurements according to the MEASNET rules and procedures, at least power performance measurements.
- EN 45001 accreditation of the agreed measurement procedures. If the EN 45000 accreditation system is not implemented in the home country of the organisation, the agreed alternative acceptance requirements will be applied.
- presentation of measurement results according to the MEASNET format.
- accept the policy of co-operation and exchange of information on measurement and evaluation procedures and on problems arising in measurement campaigns.
- MEASNET members will accept each others results as far as they are carried out according to the MEASNET procedures.
- MEASNET members will subject themselves to an internal MEASNET quality evaluation programme.

The seat of MEASNET is the address of the institute of the current Executive-Chairman of MEASNET. Actual address for 1997 and 1998 is DEWI in Germany. As this seat will change with the Executive-Chairman the formal contact address of MEASNET for initial contacts is the seat of the EUREC-Agency in Leuven.

MEASNET c/o EUREC-Agency

Kapeldreef 75

3001 Leuven - Heverlee, Belgium

Tel.: ++32-16-281-522

Fax.: ++32-16-281-510

Commercial contacts can be made directly with the desired member institutes.

3. MEASNET Recognised Measurements

During the course of the two projects, the members of MEASNET agreed on the following measurement and quality evaluation procedures to be performed under the MEASNET quality criteria:

- anemometer calibration
- power performance
- noise
- power quality.

The members can be approved by MEASNET for all measurements except power quality, which still is in the quality evaluation process. Approved institutes for power quality measurements will be available from March 1998 on.

Special attention was given to the calibration of anemometers as the most crucial part of a power curve measurement. As result of the round robin tests was agreed that not all MEASNET members are approved for absolute anemometer calibrations. Some are qualified to perform absolute anemometer calibrations for customers as a general commercial service. Others perform relative calibrations which allow for own power curve measurements only. All agreed measurement procedures except power quality, take into account the final and draft documents of international organisations, e.g. IEC, IEA and in addition requirements derived from results of related projects and measurement experiences. The agreed noise measurement procedure is an example for the necessity of additional MEASNET measurement requirements. The performed round robin evaluation of a measured data set led, after some necessary correction measures of the different institutes, to comparable results because the IEC recommendation concerning the evaluation of tonality was improved [3].

For the power quality measurement procedure an IEC standard is not yet existing. Therefore the members of MEASNET decided to use the respective German guidelines until IEC recommendations will be worked out. At the moment Germany is the only country, where such measurements are required by the utilities. In Germany these guidelines for power quality measurements had been worked out during the last two years by a group of experts coming from the involved measurement institutes, industry, utilities and state governments. They include two years of experience gained by the three German measurement institutes and therefore are already a good starting point for a future international harmonisation within MEASNET.

A MEASNET member must at least be approved for power performance measurements. This requirement was established to guarantee that MEASNET members have enough experience and understanding in wind energy related questions. In the actual status of the project not all founding members have finished yet the quality evaluation procedure for the different agreed measurements. A member must not be approved for all measurement types and can be approved for additional measurements at any time he performed successfully the quality evaluation procedure. The MEASNET measurement approval is valid for five years as far as the institute passes successfully all internal quality evaluation programmes during this time and maintains the accreditation to EN 45001. An official MEASNET acceptance document indicates the measurement types for which the MEASNET member is approved for. Customers should ask the institute of their choice to present this document.



Fig. 2: DEWI MEASNET stamp

Measurement reports performed under the quality criteria of MEASNET will be stamped by the measuring institute with a stamp which consists of the MEASNET logo and, written around the logo, the name of the institute. As an example the DEWI MEASNET stamp is shown in Fig. 2.

MEASNET is now operative and the institutes are allowed to offer their MEASNET approved, high quality measurements from October 1997 on. Depending on their interest in certain measurements, not all members are approved by MEASNET for all of the above mentioned harmonised measurements. Those who want to know, if an institute is approved by MEASNET for a certain measurement should ask the respective institute to provide the MEASNET approval document, in which the MEASNET approved measurements are listed. This information can be achieved also from the Executive Chairman, which for 1998 and 1999 is J. P. Molly of DEWI. DEWI is accredited to EN 45001 and approved by MEASNET for all of the above listed measurement types.

4. Performed Quality Evaluations

Several quality evaluations have been made during the two projects. The most intensive one was for anemometer calibration, because a procedure had to be found, how to judge the quality of the wind tunnel which should be used for the anemometer calibration. The standard anemometers in use by each institute were sent around for calibration to each of the MEASNET founding members. One of the evaluation difficulties was how to define the correct wind speed reference to which the calibration results of each institute had to be compared. After an additional evaluation of the influence of anemometers under skew wind flow conditions and after several correction measures a mutually agreed comparison base was found. As a result of this round robin the institutes decided to have the above mentioned two types of approved anemometer calibrations, the absolute and the relative anemometer calibration.

Other round robin evaluations had been performed for power performance and noise measurements. In both cases a set of measured data had been sent around for evaluation by the individual institutes. Differences in the evaluation results had been discussed and led to correction measures concerning the established measurement and quality evaluation procedures. All round robin tests showed, that the idea of MEASNET to harmonise the interpretation of standards and the applied measurement methods is of very high importance. Guidelines for evaluation, for example stated in the existing IEC standards, even when correctly applied led to different interpretations of requirements and consequently to deviations in the results.

5. Conclusion

MEASNET members are commercially interested in performing measurements in the field of wind energy. In spite of all difficulties encountered during the project the institutes always found a solution which at the end could be accepted by all members. It was of great advantage for the progress of the work that the experts of the founding members are used to work together in many other joint European research projects since more than a decade. As a result of their intensive and detailed work, MEASNET members now mutually accept their measurement results and guarantee high quality by regularly performed quality evaluation programmes. The advantages for the industry to contract a

MEASNET institute are that the measurements

- are accepted in other countries,
- are of high and comparable quality
- and can be ordered on the basis of competitive offers from the member institutes.

For the first time measurement institutes work together and were able to find agreed procedures with the goal to harmonise the interpretation of measurement procedures established in international standards and recommendations. The different performed quality evaluation tests during the course of the two projects showed the necessity of such a grouping, if measurements performed by different institutes shall be comparable to each other. The fact that all MEASNET members are also engaged in the different existing IEC, IEA and CENELEC working groups will help to integrate the gained MEASNET experience in the respective international measurement standards and recommendations.

6. Acknowledgement

The work was partially supported by the European Commission under DG XII Non-Nuclear Energy Programme, contract no. JOR3-CT95-0064

7. References

- [1] N.N. 'European Wind Turbine Standards' Project Results, Chapter 9, European Commission, Report EUR 16898 EN, ISSN 1018-5593.
 - [2] N.N. 'European Wind Turbine Standards II', subproject 6, European Commission, DG XII, Non-Nuclear Energy Programme, contract JOR3-CT95-0064.
 - [3] H. Klug: Noise from wind turbines or: How many Megawatts can you get for a 100 dB(A)?.
-