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EXPERIENCE OF WIND TURBINE MANUFACTURERS WITH WIND TURBINE CERTIFICATION

Report of Subtask A1 of project EWTC

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SUMMARY

The report describes the findings of subtask A1 of the project European Wind Turbine Certification (EWTC, JOR3-CT98-0265). The main objective of the EWTC project is to come to a uniform harmonised wind turbine certification in the European Union, in order to remove trade barriers, speed up implementation and further reduce wind energy costs. The harmonised certification should be adjusted to the needs of the wind energy industry and the requirements of the European legislation. The objective of the subtask A is to collect viewpoints of the manufacturing industry on wind turbine certification. A questionnaire has been distributed to the European wind turbine manufacturing industry, asking for experience with the present certification systems and for specific wishes for improvement within harmonised certification.
Responses have been received from 13 companies. Their answers on the various questions are presented in this report. Wind turbine type certification is experienced as quite useful, but in view of the time involved and the high costs, wind turbine manufacturers put forward various suggestions for an improved certification system which is harmonised on the world-wide level.

1. INTRODUCTION

This report gives the findings of the subtask A of the EWTC project, with respect to the opinions of manufacturers with wind turbine certification. The results should make it possible to take the viewpoints of the manufacturers into account when making recommendations for harmonised certification procedures. However, in the present report the viewpoints and opinions of the interviewed companies are given as such and do not necessarily reflect the views of the authors of the report.

2. METHOD FOLLOWED

The wind turbine manufacturers have been approached with a questionnaire. The questions on the questionnaire were drafted such that the respondents could give their view both on past experiences as on specific wishes for an improved certification system.
In contacting the manufacturers, the tasks in the project team were distributed such that every participating Certifying Body would contact its own "customers".
In principle it was the purpose to ask the opinion both from a commercial person and a technical person in each company.

3. QUESTIONS ASKED TO MANUFACTURERS

1. What are the main arguments for your company to be involved in wind turbine certification/approval/examination? (mark box, multiple answers possible)
   - ρ because of legal requirements
   - ρ technical benefits
   - ρ on request of customer
   - ρ insurance
   - ρ financing

2. What are your present experiences with and opinion on the validity / acceptance of wind turbine certificates (type approvals, type examinations, type certificates) in various countries. If relevant make distinction between inside / outside Europe?

3. Please comment on your experience with time involved in certification/approval/ examination. What is the (typical) additional time to market because of multiple certifications/approvals/examinations required? How do you estimate the expected improvement from a European harmonisation (in terms of time and cost)?

4. Comment on differences between certification/approval/examination systems (Denmark, Germany, The Netherlands etc.). Do these differences result in modifications of the design in order to meet different requirements? (please give examples of general differences, specific technical differences).

5. There are several possible forms of certification/approval/examination. Presently, type certification - consisting of design evaluation, type testing and manufacturing evaluation - is used for wind turbines in many countries. Please comment on the advantages -

6. Are you aware of the forthcoming IEC standard on wind turbine certification? (IEC 61400-22)? If yes do you in principle agree with the certification systems proposed in IEC?
7. Do you have specific wishes/requirements for a European harmonised certification system: with respect to the certification system / technical criteria used / procedures / suggestions on the organisational structure.....

4. CONTACTED MANUFACTURERS AND RESPONSE

The questionnaires have been sent to and collected from the manufacturers by their respective "parent" certification institutes.

Manufacturer	**country**	**contacted by**	**response**
Aerodyn Energiesysteme	D	GL	no
Aerolaminates.	UK	DNV	no
Bonus	DK	DNV	yes
Desarollos Eólicos, S.A.	ES	GL	yes
DeWind Technik GmbH	D	GL	no
Ecotècnia, coop.	ES	GL	yes
Enercon GmbH	D	GL	yes
Enercon GmbH, Export	D	GL	yes
Husumer Schiffswerft GmbH & Co. KG	D	GL	yes
Jacobs Energie GmbH	D	GL	yes
Jeumont Industrie	F	GL	yes
MADE, Tecnologias Renovables, S. A.	ES	GL	no
Mitsubishi Heavy Industries Ltd.	JP	GL	no
NEG MICON UK Limited	UK	GL	no
NEG Micon,	DK	DNV	yes
NEG MICON, Deutschland	D	GL	no
Nordex GmbH	D	GL	yes
Nordic Wind Power	S	DNV	no
Renewable Energy Systems Ltd.	UK	GL	yes
Südwind Energiesysteme GmbH	D	GL	no
Tacke Windenergie GmbH	D	GL	yes
Theo Fuhrländer Umwelttechnik GmbH	D	GL	yes
VESTAS Wind Systems A/S	DK	GL	yes
Windpower & Co. (UK) Otd.	UK	GL	no
Windtec GmbH	AUS	GL	no
Windtechnik Nord GmbH	D	GL	no
Zond Systems Inc.	USA	GL	no

The response was about 55 %. In only two of the cases, for a specific company answers were obtained both from a commercial and from a technical person.
Some details about the responding manufacturers are mentioned in the Annex:

- since when is the company involved in wind turbine certification;
- how many wind turbine types are approved: per year, in total;
- which certification bodies have been involved;
- position of respondent in the company.

5. RESULTS

The answers from the various respondents are given in the Annex. In this chapter a summary is given of the opinions, per question asked.

5.1 Question 1. Main arguments for company to be involved in certification.

Several possibilities could be given. Almost all manufacturers have certification carried out because of request of customers. Legal requirement is mentioned less, probably because it does not apply (yet) in every country, and as such is dependent strongly on the market where the company operates mostly. Furthermore certification seems to be required for insurance and financing purposes in 50 % of the responding companies. Finally a good majority of the companies (66 %) sees technical benefits in the process of certification.

5.2 Question 2. Experience with validity and acceptance of specific certificates

The interviewed companies in generally did not mention acceptance as being a problem. Several companies consider certification as something that cannot be avoided. It was also mentioned in a number of cases that there are too many different types of certificates, which is confusing for customers in different countries.
Outside Europe and in countries that not yet have own approval criteria, the certificates from GL and DNV/Risø are - with one exception - reported to be generally well accepted.

5.3 Question 3. Experience with time involved in certification and problem of multiple certification

Full type certification takes 6 months to 2 years. The time needed for partial certification, notably type approval, takes 2 to 6 months. Multiple certification adds approximately 3 months.
Manufacturers - especially in Germany and Spain - express the feeling that the process is (sometimes unnecessarily) time consuming and delays commercialisation. It is suggested to introduce partial / preliminary approvals which enable the export to offer partially certified systems. One Danish manufacturer reports about a systematic approach that allows to pass through the “certification system” in a predictable time. An essential element of this approach is to spend sufficient attention in preparing the documentation in advance, and such that it fulfils the requirements for DK, NL and Germany. Another advantageous factor are the different approval classes in Denmark. This manufacturer expects that time and costs can be reduced if European harmonisation results in a type approval graduation such as in the Danish system (C, B and A class).
One company expects the biggest impact from harmonisation on the Danish, German and Dutch markets where local (restrictive) legislation already exists.

5.4 Question 4. How do manufacturers experience differences between approval systems?

Not many differences seem to be encountered in practice. Some specific aspects where specific differences are encountered:

- requirements in NL for personnel safety and lightning protection;
- tower and earthing systems;
- different requirements in NL for safety system;
- different requirements in Germany for loads and structural strength;
- impossibility in NL to erect 0-series (DK C-class certified);
- complicated process in Germany to have tower and foundation approved.

5.5 Question 5. Comment on advantages and disadvantages of type certification

Many comments were given to the present form of certification. Disadvantages mentioned:

- Rigidity of the present system obstructs product improvement / maintenance (technical improvements are not implemented by manufacturers because certification of these is tedious)
- lengthiness of the process hampers innovation and technical development;
- high costs of certification put smaller manufacturers at a disadvantage with respect to larger manufacturers;
- requirements for quality management are too expensive for smaller companies;
- Limited availability of testing facilities in some countries (F), lengthiness and costs of test procedures;
- Non-conformity of turbines with certified type;

Advantages mentioned:

- technical benefits from design evaluation
- combination of design evaluation and practical test covers all wind turbine aspects and as such is very useful
- type certification improves the quality;
- improves the acceptance of the technology, notably for investors;

Suggested improvements

- more focus on service, maintenance and operational experience;
- more easy procedure for certification (in supplements) of technical modifications (e.g. hub height change, alternative component supplier, 60 Hz adaptation)
- site specific certification;

5.6 Question 6. Opinion about IEC 61400-22?

Most of the interviewed companies did not yet know this document in detail and have no specific opinion. One large manufacturer thinks the document is not sufficiently written from a manufacturers point of view.

5.7 Question 7. Specific wishes towards European harmonised certification system

The following aspects were mentioned

- Changes in the certification system should be avoided;
- System should be world wide (not only European);
- System should be implemented fast;
- System should be mandatory for all countries;
- Modifications of turbines should be incorporated into existing certificates;
- Partial approvals should be recognised by other approvers;
- The system should be transparent;
- The system should not require quality management according to ISO 900x
- Costs for certification should be harmonised and reduced, more competition between certification bodies (sufficient number of certification bodies);
- Certification procedure should not become more extensive;
- System should include options for classes of type approvals such as in Denmark

6. CONCLUSIONS

Most of the manufacturers have experience with certification, and many of them have strong opinions on the advantages and disadvantages of certification. In the present market, manufacturers are forced to go through the process of certification, very often on request of their customers. Although most of the manufacturers definitely see the advantage of type certification, the time needed for the process is felt as long, and the costs are high. There is a well defined need for improvement on the certification procedures and some advantages are expected from a harmonisation not only on the European, but rather on world wide level.

An improved system should be better adapted to the rapidly changing technology. For this purpose it should be more flexible and transparent and should incorporate the possibility for prototype certification as in Denmark.

APPENDIX: RESPONSES TO QUESTIONNAIRES

1. What are the main arguments for your company to be involved in wind turbine certification/approval/examination? (mark box, multiple answers possible)
   - ρ because of legal requirements
   - ρ technical benefits
   - ρ on request of customer
   - ρ insurance
   - ρ financing

	because of legal requirement	technical benefits	on request of customer	insurance	financing
Bonus					
Desarrollos Eolicos					
Ecotecnia					
Enercon					
Enercon export					
Fuhrländer					
Husumer Schiffswerft					
Jacobs					
Jeumont Industrie					
NEG Micon					
Nordex					
RES					
RES (2) [1]					
Tacke					
Vestas					

[1] Two responses have been received from RES: engineering director (1) and project manager 52/1000 prototype (2)

2. What are your present experiences with and opinion on the validity / acceptance of wind turbine certificates (type approvals, type examinations, type certificates, a. o) in various countries. If relevant make distinction between inside / outside Europe?	
Enercon: -The clients only want building permits - external approvers sometimes use existing certificates to fulfil additional requirements	Enercon Export: There are too many different certificates with different meanings. It is often unclear for clients abroad which certificate includes what. This often leads to unnecessary global requirement.
Husumer Schiffswerft Basically, certification cannot be avoided, but leads often to additional costs and time for incorporation of knowledge and improvements. Technical development is hampered. The advantage is an independent check, fault detection is improved. Damages in the sector are assessed and considered in certification. Manufacturers and certification institutes learn from each other. HSW was not involved in certification with foreign certification bodies.	Jacobs Certification is not mandatory for China and Japan (as far as we know). Type approval with certificate e.g. from GL has a very positive PR value. Certification creates confidence - very important for smaller and unknown manufacturers. A certificate from GL is highly valued. In Greece the GL certificate is necessary for permits. In India ISO 900x is required, i.e. requirements are put forward which we consider as meaningless and inefficient.
Jeumont Industrie No experience at this moment. We are manufacturing our first machine to be installed in France	Fuhrländer Outside Europe (Japan, Jemen) a German type approval with reports from GL is sufficient. For India we have a GL certificate. Europe needs an harmonised Type approval / certification which is limited to the essentials and practice oriented in the first place: - Machine safety - Personnel safety - Optimal service and maintenance - Periodic monitoring - Mandatory service
Nordex Until now only type approvals and type certifications in Germany have been applied. No experience in other countries.	Tacke Wind turbine certificates are a must in the international wind energy community (e.g. Greece, Turkey, India, China, Japan). Essential factors are the needs of the client. In Germany the legal framework is determining.
RES Certification by GL, Risø and DNV are generally acceptable to our company and our clients	RES2 No experience outside UK
Desarrollos Eolicos Answer unclear/ not to the point.	Ecotecnia In Spain there is a growing need but in some cases there is not a follow-up of the approvals and actual turbines are different to some extent from the original certified wind turbines. In non-European countries a type approval certificate is widely accepted and seems to be valid.
Vestas Within Europe there is a broad acceptance of the certification of wind turbines. Outside Europe the need or the request for certified turbines is growing.	Bonus Our experience with the validity and acceptance of wind turbine certificates are good. The certificates are very useful for Bonus. The Danish type approvals from either DNV or Risø are accepted in Scandinavia and in some countries in Europe that do not have their own type approval criteria. These countries include Sweden, UK, Greece, India and Spain.
NEG Micon There is a general acceptance of wind turbine certification both inside and outside of Europe.	

3. Please comment on your experience with time involved in certification/approval/ examination. What is the (typical) additional time to market because of multiple certifications/ approval/examination required? How do you estimate the expected improvement from a European harmonisation? (in terms of time and cost).	
Enercon Drafting of documents takes appr. 1 year. Not all markets are opened (e.g. NL, DK) because of requirement of local certifications.	Enercon Export: After submitting documents it takes ½ to 2 years to obtain a certificate. The export/trade doesn't need additional time, they loose the projects, if they cannot show certificates together with the offers. European harmonisation would be useful, time wise and cost wise. In view of the market for WE is Europe not sufficient : world wide. There should be partial approvals or preliminary approvals which enable the export to offer partially certified systems.
Husumer Schiffswerft Certification always involves more time to market and costs which is often hard to deal with under the present market conditions (fast development, "bad" prices). Until now HSW did not have to do multiple certifications. The requirements should also be feasible (financial, manpower, time) for SME's and should not be abused as instrument for market settlement in favour of large manufacturers. There should not be any demands which only can be fulfilled by large manufacturers.	Jacobs Basically the type approval of a wind turbine comes 8-12 weeks after submitting all necessary documents (which are submitted also in parts). The development process becomes appr. 4 weeks longer because of first submitting and approval of the loads. In general the flexibility in the development is being limited by the approval process. A project in Greece has been jeopardized in the meantime because certificate was necessary and only a type approval was available. Only because of this experience there is no doubt that harmonisation would be advantageous.
Jeumont Industrie We don't know exactly because for the J48 Aerodyn was a subcontractor in charge of documentation for certification.	Fuhrländer The time is being worn out (wasted?) by complicated demands and documents that are not praxis oriented. Essential things have to be worked on.
Nordex The duration of certification is between 6 months and 1 year, with a new type. If many components are identical, also shorter. Because the certificate (e.g. german type approval) is not accepted in other European and non-European countries, we expect big cost advantages from harmonisation.	Tacke Certification: 6 months Type approval: appr. 4 weeks multiple certification: appr. 3 months
RES We have no view at the present time of the effect, if any, on time or cost resulting from harmonisation but regard harmonisation as very important to prevent conflicting requirements and confusion voer the status of different certification authorities.	RES2 The time/cost for obtaining approval for a prototype turbine is high however, I would expect that with subsequent versions of the turbine this process would be quicker. To date we have no experience which would enable comments on the additional time to the market although I would add that many turbines installed in the UK are in the final stages of approval during installation. The harmonisation of European standard is likely to have the biggest impact on the Danish, German and Dutch markets where local legislation already exists. I would hope that it will make it easier to have a turbine certified in the UK which can then be sold in any European country.
Desarrollos Eolicos 6 months depending on type certification We expect more uniform criteria and more involvement of authorities in making design criteria more cost effective.	Ecotecnia Our experience is that the time to get the approval is too long an d in most cases serial production flows parallel to the certification process. If the market needs the certification, this will delay the commercial activities. It would be very positive to have a harmonisation on the certification; this will reduce the certification needs for different countries.

Vestas Additional time to market: approximately ½ year. Improvement due to harmonisation: appr. 1 quarter. Cost reduction: ??	Bonus The time used for the type approval depends on the class of the type approval (Danish A-class, B-class or C-class). Bonus normally begins with a B-class type approval for commercial use. The preparation of the necessary documentation is typically a 6-month process. It is carried out in parallel to turbine development and does not delay the development as such. The manpower required is on the order of a half man-year per turbine. The certification of the Danish B-class type approval is normally carried out over a 2-3 months dialogue period with DNV. The work for an A-class type approval will normally follow afterwards when the relevant measurements have been carried out. The A-certification process also has duration of 2-3 months. Bonus normally prepares the type approval documentation so it fulfils the requirements for Denmark, the Netherlands, and Germany. Therefore, the time for updating the documentation for the Danish A-class type-approval to a Dutch type approval is not significant. Bonus expects that the time and costs can be reduced if the European harmonisation result in a type-approval class graduation as the present Danish system of three classes, C-Class (prototype), B-class and A-class.
NEG Micon We have not seen any problem in time to market, in countries, where the certification must valid at installation of WTG. In markets where the certificate is required in order to obtain a building permit we see a delay of the market introduction. In general we see certification as an important part of our QA-system.	

4. Comment on differences between certification/approval/examination systems (Denmark, Germany, The Netherlands etc.). Do these differences result in modifications of the design in order to meet different requirements (please give examples of general differences, specific technical differences).	
Enercon Export: Structural safety according NEN requires higher safety level. For personal safety and lightning protection partly changes required.	Enercon Differences not known.
Husumer Schiffswerft Until now HSW did not do any certifications according to regulations outside Germany.	Jacobs Differences only known from second hand, so no comment.
Jeumont Industrie No experiences on that. We expect from a European certification to design on the same basis as our competitors for all European countries.	Fuhrländer No comment.
Nordex See answer to question 2.	Tacke Tacke Windenergie GmbH has limited experience with international certification. Important points are tower and earthing. Here are new designs necessary for export, as well strengthened as reduced.
RES We are aware that there are differences but would not be in the position to detail these or comment on them.	RES2 RES only has direct experience with GL.
Desarrollos Eolicos We have no experience but Germany (GL). IEC 61400-1 may give different design requirements compared to GL (e.g. wind turbine classes).	Ecotecnia Not experienced. We are not delivering wind turbines in other countries. We know about the differences but we did not consider it into the design.
Vestas Vestas makes standard wind turbines, so in order to cope with the different systems we have to design the turbines according to the highest common denominator. The entrance of the tower and the foundations are different for each country.	Bonus For the earlier turbines as the Bonus 300 kW series and the Bonus 600 kW series, the safety system was designed after the Danish requirements, but to fulfil the Dutch requirements the safety system was modified for the turbines erected in the Netherlands. The current wind turbine types are designed to fulfil both the Danish and the Dutch requirements without modifications. The German type approval requirements are and have always been more lenient on the loading side. However, on the structural side the German system of “Gutachter” leaves much to be desired. The flexibility regarding rigid DIN codes is very small and this is a traditional problem issue.
NEG Micon The difference is very small: Denmark: The certification open up for different certification levels (C, B, and A) which makes it possible e.g. to build 0-series of WTGs rather quickly. The Dutch rules do not give us that possibility. Germany: The nacelle, the blades, and the control unit are covered by the "Machin-Gutachten" which more or less is like a safety approval. The tower and foundation must be approved by the building authorities or by TÜV, which is a very complicated process.	

5. There are several possible forms of certification/approval/examination. Presently, type certification - consisting of design evaluation, type testing and manufacturing evaluation - is used for wind turbines in many countries. Please comment on the advantages - disadvantages of type certification and possible suggestions for improvement.	
Enercon Export: Disadvantage of type certification: it obstructs the maintenance of the product. Changes to systems with type certificate are not applied partly in order not to jeopardize the validity of the certificate. Revisions to type certificates are hard to implement, because the regulations are changing regularly.	Enercon Disadvantage of type certification: realistically spoken a type certificate only can be obtained after 2 years (the measurement of the power curve alone takes 1 year). This is extremely hampering innovation. the technical development moves much faster, but theoretically every change requires a new certificate before the system can be sold. The requirement for certificate in this form should not be supported, because it only hampers the technical development of wind power. Also the clients do not have a technical advantage (see India 1998).
Husumer Schiffswerft Basically meaningful. The extent of the required tests and proofs should not increase further. The mentioning of component suppliers in the certificate is a problem. Change or selection of second suppliers theoretically involves linked to a new certificate. This causes loss of time and costs. As proof of quality management ISO 9000 without additional checks should suffice. Check of every system should not be required. In order not to hamper trade possibilities and further development, larger modifications such as hub height, component change, supplier change, 60 Hz adaptation, etc. should be easy to certify per supplement without bureaucracy as a variant an not as new system.	Jacobs The costs for a full type approval are much too high for small manufacturers. We consider ourselves put at a major disadvantage by these. The smaller manufacturers are pushed from the market by these regulations, whereas the small manufacturers have contributed most to the survival of windpower in the early 90s. MAN, MBB,Dornier, Boeing…stepped out because too expensive and too rigid. The flexibility of the small manufacturers has caused the development to be so fast and the specific costs of windpower to decrease so much. Too high demands and restrictions have hampered these developments. And we are not yet finished with the development. The introduction of quality management is much too expensive and too sumptuous. It is applied in a different way in different countries (unequal treatment, makes rigid.. The innovative development is hampered.
Jeumont Industrie The design evaluation is interesting because of the technical benefits. The type testing is for us difficult to achieve because there is no accredited company in France. Manufacturing evaluation is achieved through ISO 9001.	Fuhrländer The type certification should focus more intensively on system safety and the design data…(?) Robustness, life time, structural safety
Nordex The advantage of type certification versus type approval is the practical test. It results in higher safety both for manufacturer and operator. The disadvantage is the lengthiness of the procedure (because of measurements) and therefore higher costs compared to German type approval. The installation of the prototypes has to be financed by the manufacturer.	Tacke Tacke Windenergie has not much experience, only for TW600. The time required to obtain a certificate is a problem.
RES Design certification is important to us as purchaser of wind turbines. Type certification including manufacture is not a requirement, manufacture can be addressed by reference to QA/QC procedures. Certification of power curves + noise reports is important. Site specific certification, matching turbines to specific site conditions (topography, wind speed, turbulence etc.) is important to us.	RES2 RES only have experience with design approval and having only built one turbine it is a bit early to comment on the type approval process.

Desarrollos Eolicos *Answer was not to the point.*	Ecotecnia Examination/approval is easier but in markets where there is no requirement but a customers request, it is possible that well known manufacturers use a type certificate that does not match the turbines being installed.
Vestas Advantages: the whole turbine is covered. Disadvantage: time consuming process.	Bonus The present Danish form is very suitable and we have no desire for changes.
NEG Micon The advantages of type approval are: • Improved quality • Improved acceptance of the technology, which makes finding investors easier • Makes it easier for investors to compose products The disadvantages are: • Makes the development of WTGs more expensive • Makes it more difficult to introduce alternative technologies Improvements: I would suggest that service, maintenance and operational experience could be a more important part of the certification.	

6. Are you aware of the forthcoming IEC standard on wind turbine certification? (IEC 61400-22)? If yes do you in principle agree with the certification systems proposed there?	
Enercon Export: We are aware of it but no further experiences.	Enercon We are aware of it. Of course it makes sense to harmonise world-wide. Details are not known.
Husumer Schiffswerft Draft not known in detail Remarks see answers on question 3.	Jacobs We do not know the standard or the certification procedure. We do not have the time and means to permanently be actively involved in the many circles with all new regulations.
Jeumont Industrie Yes we are aware. Yes, we agree on the principle of having certification applicable in all European countries.	Fuhrländer No.
Nordex Yes	Tacke Yes, this certification procedure is OK as long as it won't become an additional requirement, but instead replaces the various national regulations/demands! See also the problem with IEC 61400-1, which doesn't have much value because of the various national concepts (Germany, Denmark, Netherlands etc.)
RES We are aware of this but not able to comment at the present time.	RES2 Yes, but I need to read the draft document !
Desarrollos Eolicos We are not aware. We are in the process of requesting this standard.	Ecotecnia No we are not aware.
Vestas The standard is not written from a manufacturer point of view. It is too complicated to understand for regular customers.	Bonus Concerning the new standard, we are in principle aware of it but in detail not. Therefore, we can not provide any justified answer.
NEG Micon I do not have detailed knowledge of the IEC standard.	

7. Do you have specific wishes/requirements for a European harmonised certification system: with respect to the certification system / technical criteria used / procedures / suggestions on the organisational structure.....	
Enercon Export: Changes should be avoided, in order to guarantee continuous production. National special requirements (e.g. tower) are disturbing Changes on machines should be incorporated in existing certificates, without requiring new certification according to the often changed regulations Partial approvals should be recognized by other certifying bodies, in order to allow also individual points to be approved by various certifying bodies.	Enercon Not European but world-wide Fast implementation Mandatory for all countries : a uniform certification procedure makes only sense if all countries are bound to it. Otherwise the whole effort of harmonisation is useless.
Husumer Schiffswerft See answer to question 3. The system should be transparent and to the point. Requirements should be sensible minimum demands (personnel safety, protection of public safety/..) Wind energy should not be pushed by the regulations into a remote high-tech corner.	Jacobs The component quality can be secured and documented. However we are opposed to mandatory introduction of quality management systems according ISO 900x, because this hampers the flexibility of an enterprise, it stiffens the system and it has more disadvantages than advantages. A harmonised certification system surely is an advantage. The costs for the manufacturers should also be harmonised, i.e. reduced. Harmonisation may not be used by the certifying bodies to enhance the requirements and the costs. The costs are simply too high. The approving/certifying bodies are to high with costs and hourly tariffs. The competition among these institutes is too low. The requirements for proof only have been increased. This development should be halted, because wind energy in total and the individual companies should also remain competitive. The actual development may not be hampered by exaggerated approval costs.
Jeumont Industrie The certification must be done in such a way that the criteria have to run to competitive solutions compared to other countries (out of Europe). There must be some balance between actual European country certifications (GL, DNV).	Fuhrländer See before.
Nordex It is important to have enough certifying bodies in Europe. Mutual recognition is necessary.	Tacke Certification may not become more extensive or lengthier. A fast and un-bureaucratic modification for site specific characteristics should be possible. A possibly uniform interpretation of regulations is necessary -- recommendation for clearing office
RES No comment	RES2 No

Desarrollos Eolicos Certification system: see answer question 2 Technical criteria used: Some criteria are very conservative (e.g. turbulence isotropic model in IEC61400-1). While some others are not (Distance between blade tip and tower, GL). Some criteria depend on interpretation (strain verification in direction of fibres: a laminate has a lot of directions, GL). Procedures: Depending on interpretation. Safety margin for a dynamic blade test is 1.25 in IEC 61400-23 while in IEC 61400-1 is 1.15. We believe 1.15 is more realistic.	Ecotecnia ---
Vestas All aspects should be harmonised including partial coefficients.	Bonus It should preferably be a combination of the Danish and Dutch requirements, with the Danish option of three classes of type approvals, A-class, B-class and C-class.
NEG Micon My wish would be that in case of a European harmonised system, this system would be based on the Danish system, especially on the different levels of certification.	

General questions

Manufacturer	Since when is company involved in certification	How many wind turbines approved? - per year - in total	Which certification bodies?	Position of respondent in company?
Bonus	since beginning ?	Approximately 20 have been certified. Of these more than half with reference to more than one national system. Currently nine types hold valid certificates in one or more country.	DNV and Risø	Technical director and type-approval engineer
Desarrollos Eolicos	1998	1 per year 1 in total	GL	Technical Director
Ecotecnia	1995	none finished 1 ongoing, 1 planned	GL	Technical Director Engineer
Enercon	1987	6 in total	GL / ECN (TÜV)	production manager
Enercon export	1987	6 in total	GL / ECN (TÜV)	export manager
Fuhrländer	1991	6 in total	GL, TÜV	owner, technical director
Husumer Schiffswerft	1987	4 in total	GL	technical bureau
Jacobs	1993	5 in total	GL, TÜV	operation/design manager
Jeumont Industrie	1997	1 in total	GL	product manager
NEG Micon	1980		DNV and Risø	Director R&D Product Development
Nordex	1988	1 per year 5 in total	GL	production & development
RES	1994		GL, DNV	engineering director
RES2	1996	1 in total	GL	Project Manager
Tacke	1989	1 per year 10 in total	GL, TÜV , DNV	production manager
Vestas	1987	2-3 per year appr. 20-25 in total	Risø, GL, CIWI	Dep. Manager R&D

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Abstract

The report describes the findings of subtask A1 of the project European Wind Turbine Certification (EWTC, JOR3-CT98-0265). The main objective of the EWTC project is to come to a uniform harmonised wind turbine certification in the European Union, in order to remove trade barriers, speed up implementation and further reduce wind energy costs. The harmonised certification should be adjusted to the needs of the wind energy industry and the requirements of the European legislation. One of the objectives of the subtask A1 is to collect viewpoints of the manufacturing industry on wind turbine certification. A questionnaire has been distributed to the European wind turbine manufacturing industry, asking for experience with the present certification systems and for specific wishes for improvement within harmonised certification.
Responses have been received from 13 companies. Their answers on the various questions are presented in this report. Wind turbine type certification is experienced as quite useful, but in view of the time involved and the high costs, wind turbine manufacturers put forward various suggestions for an improved certification system which is harmonised on the world-wide level.

Key Words: Wind energy, certification, European harmonisation, manufacturers

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