Development Accompanying Assessment

Title: **Development Accompanying Assessment**
An Established Approach for Development and Certification
Update 2010

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Summary and Conclusion

Certification of wind turbines or components is state-of-the-art and a must in most places around the world. Furthermore certification to harmonised requirements is an active support of export. Therefore it is important for manufacturers, banks and insurances of wind turbines and components to know the different certification processes as well as guidelines.

This paper puts focus on an approach of combined design and certification of wind turbines. An intense collaboration between the turbine designer or manufacturer and the certification body is proposed at an early stage of the turbine development. The benefits of this approach termed Development Accompanying Assessment (DAA) are among others reduced time-to-market and improved product quality.

The service of DAA was introduced in 2007 by GL and is well received in many certification projects. This paper is an update on former information for DAA.

Introduction

Certification of wind turbines has a history of thirty years. It has been applied differently in scope, requirements and depth in countries like Denmark or Germany and each on the basis of their own rules. These countries are still leading in the development and application of certification rules but during recent years a number of other countries as well as many banks realised the necessity of a thorough evaluation and certification of wind turbines and their proposed installation. Among these countries are Canada, China, Greece, India, Japan, Spain, Sweden and the USA.

Certification provides a significant contribution to the development and design of a wind turbine. The scope is on the examination of the structural integrity, safety and compliance with applicable guidelines and standards. Moreover, it adds value to the wind turbine from the marketing point of view: A reputable certificate reflects the high level of a wind turbine. For owners, banks and insurers the risk of technical and economical breakdown is obviously minimised and therewith the marketing of the wind turbine supported. Due to the complexity of modern wind turbines and their design, manufacturers who are comparatively new in the business often underestimate the extent in time and effort for certification. But even the certification of new wind turbines of experienced manufacturers takes usually no less than a year. The present article proposes a new approach for a more effective procedure for certification of wind turbines with GL.

Development and Certification

Common Practice

According to the international standard ISO/IEC 17000, certification is the confirmation that a product or a service complies with defined requirements (e.g. guidelines, codes and standards). The certification procedure for a Type Certificate is commonly based on e.g. GL onshore or offshore Guidelines [1], [2], [3] or IEC standards [4], [5].

The certification procedures for Type Certificates indicated therein can be divided into the following modules:

- Design Assessment
- Implementation of the design-related requirements in Production and Erection (IPE)
- Evaluation of QM System
- Prototype Testing

The most important part of the Type Certification is the assessment of the design documentation, a thorough review of the wind turbine (WT) design.

The task of the certification body is to verify if the design is in compliance with the applicable guidelines and standards. The assessment activity comprises communication between the WT designer and the certification body in order to achieve a proper level of understanding of the design calculations and documentation. Furthermore, remarks on the examination are posed by the certification body if deviations from the applicable standards and guidelines appear. Here, it is common practise in certification that the WT designer does not address the certification body until an advanced stage of the design phase is reached. The design concept is set, even design details were elaborated; verification calculations were performed and documented. After the finalisation of these efforts the WT designer submits the documentation to the certification body initiating the certification activity. The certification body assesses the documentation. If necessary, it submits remarks on examination and requires a revision of the documentation. The WT designer replies. Due to this 'question–answer' series, the procedure is characterised as 'serial'.

Room for Optimisation

A WT designer, who requests this 'serial' procedure, is supported by GL, as it is the typical approach for certifications and it works well. However, the 'serial' procedure may slow down the whole process. The reason is that in case of remarks the WT designer is urged to go backwards to the design step, the certification body is just working on. A necessary design modification may lead to a delay in finishing the design phase, and consequently, the launch of the product. This is often not welcome although it would improve the product technically or economically. Structural components of the wind turbine may already be in the manufacturing process, so that modifications are not possible any more.

The aim should be instead to finish a design step with the clarification of all certification related issues.

Performance Enhancement by DAA

New Concept

The Development Accompanying Assessment (DAA) introduced some years ago is a step forward to a more effective approach of integrated development, design and certification of wind turbines. The concept of DAA focuses on an assessment 'parallel' to the design process rather than 'serial' to it at its end as described above, see Figure 1. The DAA approach can enhance the certification performance through early compliance checks of the WT design by the certification body GL. In order to achieve this goal, the WT designer supplies GL with concept and design studies, calculations and documentation. This is done at any design stage where the WT designer needs feedback on the functionality of the concept and design as well as confirmation about coherence with applicable guidelines and standards.

Figure 1 (top) illustrates a classic certification process in a simplified way. After the development phase indicated by the first block, the WT designer submits verification documentation to GL. There, the assessment indicated by the second block might lead to remarks or questions posed to the WT designer. Upon clarification of these remarks or questions, the WT designer revises the documentation and resubmits it to GL. In case the documentation standard for certification is not yet attained, further resubmissions follow as indicated by the sequence of blocks. The process is finalised by the issue of the respective Certificate. In contrary to this, Figure 1 (bottom) illustrates the concept of DAA proposed by GL, showing the parallel feature of the certification process. Here, the assessment process at GL may already start in the development phase of the product initiating early correspondence by exchanging calculation results and assessment outcome. The advantage here is that remarks or feedback by GL can already be taken care of within the development phase to improve the product.

The involvement of GL by accompanying the WT designer in the development phase allows a more or less constant assessment activity resulting in a final assessment phase which is straightforward. Therefore, the entire process of certification is reduced significantly in time compared to the classic procedure.

The common goal of both parties is to assess and certify a technically mature wind turbine which endures on the market. GL assigns wind turbine experts for the project who assess the WT on the basis of their detailed knowledge and practical experience of a special area of expertise. New ideas are discussed and developed to innovative solutions. The WT expert of GL reflects the present design by either confirming it or by requesting improvements of the concept. Own concept studies and calculations can be elaborated by GL outside the scope of certification to add value to the project. Questions which arise in the daily work can be clarified at short notice. Communication between the WT designer and GL may be performed in a large variety of possibilities, such as telephone or email communication, meetings in customer offices, tele- or video conferences. The extent of DAA activities can be requested by the WT designer depending on his needs. During the course of the DAA a competitive design is elaborated.

DAA, in contrast to the classic 'serial' certification, does not lead to remarks on assessment of the kind, which necessarily have to be followed at once. DAA remarks lead to feedback which shall help to evaluate a new product that in the end is prepared to fulfil the requirements of certification and the market. The actual certification phase is reduced to the minimum time necessary, since all technical issues have been clarified during the DAA phase.

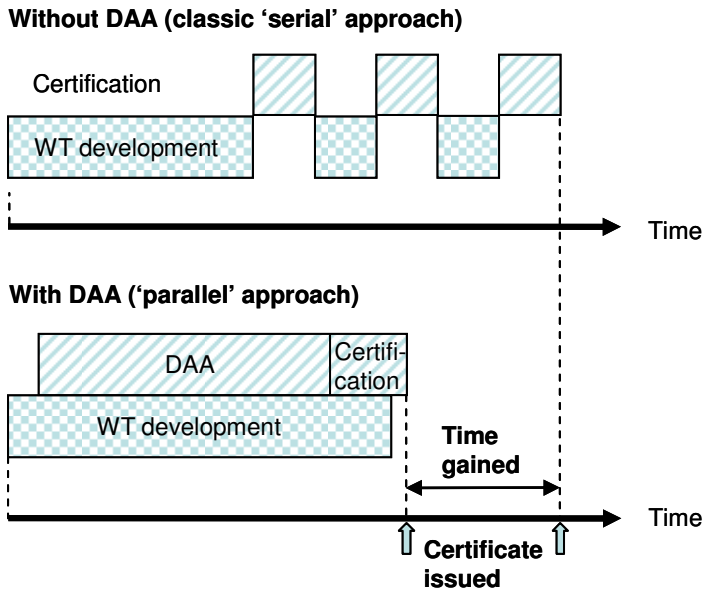

Fig. 1 Efforts for basic certification procedure without/with DAA

Fields of Application for DAA

The wind energy industry with its large diversity of manufacturers, developers and their projects requires different procedures to develop a wind turbine. The associated certification process can proceed in connection with a DAA as described above and help to optimise the whole procedure. In the following, possible fields of application are listed. They are meant to help the WT designer to identify situations where he could significantly profit from DAA within the design process or the re-design of a wind turbine.

Figure 2 gives an overview over these fields of application for DAA. In the following a more detailed description is given.

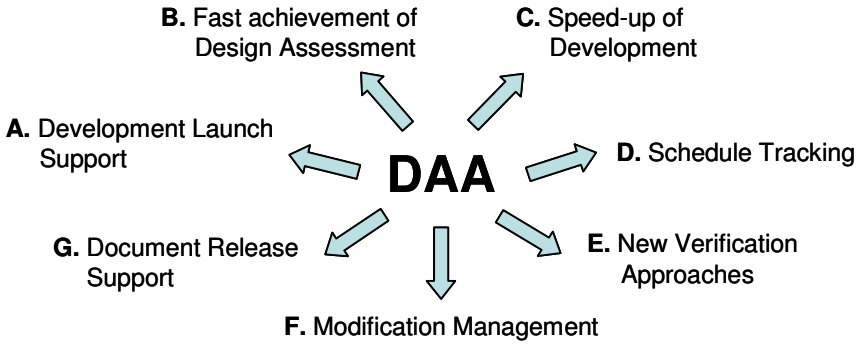

Fig. 2 Fields of application for DAA

A. Support of development launch for wind turbine

At the very start of the development process GL can support the manufacturer with market and preliminary design studies.

B. Support of fast achievement of a Design Assessment

Suitable for manufacturers who are comparatively new in the business and appreciate support to learn and profit of externals' experience. GL can support the build-up and check of the necessary design tools, verification documents and procedures.

C. Speed-up of development process and improvement of design

Suitable for manufacturers who need a competent, fast feedback on e.g. an internal ongoing discussion about different design solutions, on negotiations with component suppliers or on the application of guidelines and standards for verifications or tests.

D. Keep project within its schedule

Suitable for manufacturers who have to handle time-critical projects where the observance of the time schedule is most important. This would be the case when the development of the product has to be finished at a specified point in time due to marketing reasons or – as for offshore projects – the erection of a wind farm is only possible within a short time frame restricted by weather conditions.

E. Develop new verification approaches

If an experienced designer is developing advanced high-technology solutions for wind turbines, applicable guidelines/standards may reach their limits since they are set up to meet broad requirements. Within DAA, the designer and GL can discuss the interpretation of the guideline/standard and find new verification approaches together to verify the product.

F. Manage design modifications

Suitable for manufacturers who have to modify or improve an already built wind turbine design to a significant extent, e.g. after a severe damage. GL can support the team to reveal causes and to search the optimal technical solution with a following certification of the improved approach.

G. Improve product and documentation quality management

Suitable for manufacturers who wish to receive feedback on new verification documentation before internal or external release.

Case Study

To illustrate the certification process with DAA, it is described in more detail in the following based on the basic procedure of a load certification process. Figure 3 shows the chronological sequence of a showcase load certification including DAA, as it is normally performed at GL. The WT designer starts the process with an internal project kick-off and the search for an appropriate WT concept. In this early stage, GL is included in the project and is requested to accompany the development with market and design studies giving feedback on the feasibility and proposals for improvement. If a feasible concept has been worked out together, the WT designer documents this model outline and simulates an initial set of load assumptions.

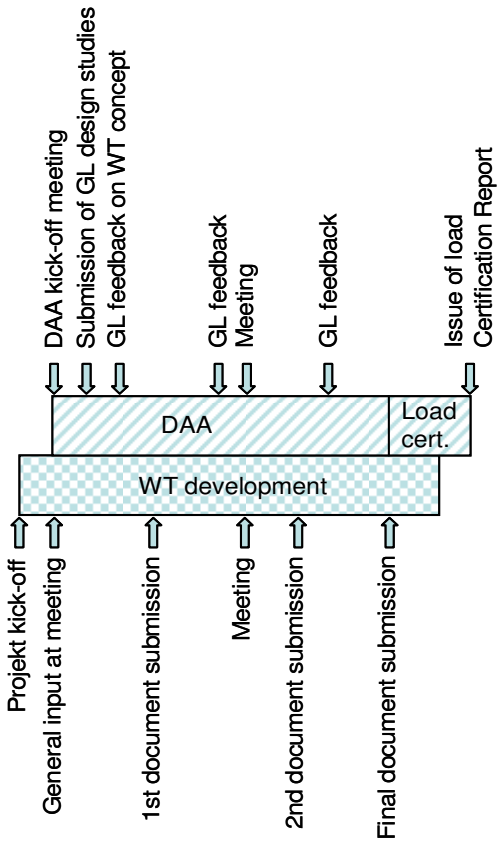

Fig. 3 Load certification with DAA (principle sketch)

This first set of load documentations containing also relevant information on the safety system is submitted to GL. Based on this documentation, GL reviews the design concept and the load assumptions. Feedback is given to the extent required by the WT designer in written form and within a meeting. The WT designer uses this feedback to improve the concept and the documentation for compliance with standards and guidelines in order to submit a second set of documentation. GL again reviews the documentation performing spot checks by parallel calculations.

During the proceeding development process with DAA, the final design has meanwhile become clear so that the WT designer now is able to produce the final load document. This is assessed by GL including parallel calculations leading to the issue of the Certification Report.

As indicated in Figure 3, GL is continuously accompanying the project being available for inquiries of the WT designer. Experience within previous certifications showed that the time required for certification of a component can be reduced to up to 50% of the time required for certification in a process without DAA (see Figure 1).

In reality, the design process is naturally more complex than sketched in figure 3, as e.g. in parallel to the load assumptions both the controller and the safety system has to be developed and checked. For these components a DAA can be performed as well as for the rotor blade, machinery components, tower or foundation certification.

The Certification Body

Germanischer Lloyd Industrial Services GmbH, Renewables Certification (GL) is an internationally operating certification body for wind turbines and leads the world in this field. GL carries out examinations, certifications and expertises and is actively involved in the development of national and international standards (e.g. IEC TC 88). GL offers the complete range of services for certifying wind energy products and projects. Certification of wind turbines and wind farms is carried out on the basis of the GL *Guideline for the Certification of Wind Turbines* (Edition 2003 with Supplement 2004 as well as the Edition 2010) and the GL *Guideline for the Certification of Offshore Wind Turbines* (Edition 2005). Furthermore, GL is accredited to carry out certification in accordance with all relevant standards in the field of wind energy (e.g. IEC 61400-series, national and international standards, guidelines and regulations) and marine energy.

Benefits and Conclusion

Within this paper DAA, an approach of certification performance is presented. Depending on the field of application of DAA, the most essential advantage of this concept is a significantly reduced time to market of a new wind turbine or its redesign. Delays and an increase of costs from certification requirements within a late stage of the project are prevented, since hidden problems of design or certification issues are already detected and addressed during the DAA. The time saved is of high value to (re-)launch the wind turbine and gain advantage in time. The final product quality is improved by the inclusion of certification feedback through GL experts. Wind turbine designers, who realise they may need support within one of the fields of application as described above should consider DAA to support their development and certification. It is GL's basic business practice that confidentiality of any kind of information is guaranteed.

References

[1] Germanischer Lloyd: Guideline for the Certification of Wind Turbines, Edition 2003 with Supplement 2004

[2] Germanischer Lloyd: Guideline for the Certification of Offshore Wind Turbines, Edition 2005

[3] Germanischer Lloyd: Guideline for the Certification of Wind Turbines, Edition 2010

[4] IEC WT 01: IEC System for Conformity Testing and Certification of Wind Turbines, Rules and Procedures 2001-04

[5] IEC 61400-22: Conformity Testing and Certification, Edition 1, 2010

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