

## Aerodynamic Blade Design



### EWIS

Being one of the leading institutes on wind energy research, ECN established the EWIS (ECN Wind Industrial Support) group in 2009 to better bring the R&D results to the market. During the last three decades, ECN has developed expertise on aerodynamics, structural analyses, turbine control, offshore operation and maintenance, and grid connection. With the growing wind industry, ECN received more requests for assistance and EWIS has become the vehicle to support the wind energy industry in their product developments.

EWIS's focus is on the high end of the market which means that we will make use of tools and knowledge that have been developed in-house and include the latest R&D results!

The EWIS team is a mixture of young professionals and experienced researchers which ensures a fast response and high quality.

#### More information

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### Description of service

#### The service

Aerodynamic design of a wind turbine rotor is the start of the wind turbine design process. The integrated wind turbine design is an iterative process aiming to have the best power production possible considering several fields at the same time, such as costs and mechanical loads. ECN Wind Energy delivers aerodynamic blade designs that promise the highest possible aerodynamic performance by working in close cooperation with the customers by taking into account all the requirements and restrictions according to the customers' particular needs.

#### The Blade Design Approach

Experienced researchers of ECN use the sophisticated, validated, and highly accurate design and optimisation tools BOT (Blade Optimisation Tool) and ATG (Aerodynamic Table Generator) for the aerodynamic blade design; the tools have been developed by ECN. The design process starts with obtaining the initial requirements and restrictions of the wind turbine from the customer. According to the inputs, a smooth thickness distribution is defined and the airfoils are selected. The chord, twist, and thickness distributions are optimised to give the maximum annual power production by again considering the requirements and restrictions. The next step is to modify the airfoil distribution to match the relative thickness distribution. Optimisation continues until excellent and optimal results are obtained.

The design process includes iterations and discussions with the customer and several aerodynamic blade designs are discussed. The feedback is used in the iterative design process to develop the best aerodynamic design fitted to the requirements of the customer.

#### The results

At the end of the design process, the twist, chord and thickness distributions, and the coordinates of the airfoils that are used in the blade span are delivered to the customer. In addition to those, the performance of the designed wind turbine at the design and off-design conditions is also delivered. Optionally, additional noise analyses are performed for the designed wind turbine to report the noise levels of the design.

## **Additional Services**

After the aerodynamic design, the customers are advised to perform aeroelastic analyses on their designs to check the aeroelastic stability of their rotors right after the aerodynamic design stage. By doing so, minor modifications to the blades can be incorporated which can have large effects on the structural blade design. ECN also offers various aeroelastic stability analyses for every stage in the design process. Especially the software packages BladMode and TURBU are commonly used for these purposes. These services can be offered separately.

In addition, a unique feature of the ECN aerodynamic design process is that some of the software packages used in the process can be acquired. This enables the in-house analyses of the effect of changes to the delivered aerodynamic design. Please check [www.ewis.nl](http://www.ewis.nl) for more details about software packages and other services.

## **The Experience**

Over the last years ECN has delivered quite a few aerodynamic blade designs to various wind turbine manufacturers. These blades are designed for turbines ranging up to 10 MW, with rotor diameters up to 150 meters. Coming from years of experience, ECN's blade designs are highly competitive.

*Ask ECN for a competitive offer for the aerodynamic design of your blades.  
EWIS will provide the results using the state-of-the-art design tools  
developed at ECN Wind Energy delivered by experienced researchers.*

For more information about this service,  
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