For very large offshore rotors, achieving high performance is mandatory but reduction in loads and mass is also attractive to reduce the costs. The performance of the airfoils installed along the blades have a direct impact on the wind turbine performance. New airfoils tailored on specific requirements can help to obtain outstanding performance, while reducing loads and mass.

This research has been performed in collaboration with Blade Dynamics Ltd. with multiple goals:

- Design an ECN family of new airfoils (named ECN-G1-XX)
- Assess the accuracy of the predictions by wind tunnel measurements on one of the new airfoils
- Evaluate the impact of the new airfoils on the performance of very large offshore wind turbine rotor

An ECN family of new airfoils has been designed by adopting and advanced design methodology based on numerical optimization scheme coupled with ECN solver RFOIL. The result is a set of airfoils with consistent geometrical and aerodynamic characteristics.

In order to evaluate the impact of the airfoils on the rotor performance and the new blade has been designed with the ECN airfoils. The 10MW reference wind turbine of the European project INNWIND.EU has been used for comparisons.

Conclusions

- The results show that ECN airfoils contribute reliably to decrease the loads along the blade, while the annual energy production is kept.
- Wind tunnel tests show that the stall behavior is still a crucial area where further improvements are needed.