LOADS AND DYNAMICS IN LATTICE TOWER SUPPORT STRUCTURES FOR OFFSHORE WIND TURBINES

BACKGROUND
The extremely ambitious political goals concerning extensive use of offshore wind energy result in an intense demand of research and development in this field. As an example, round 3 in UK could mean a need to install several thousands of offshore wind turbines within the next ten years. To be able to fulfill this goal, components for offshore wind farms has to be produced by mass production techniques and within reasonably short fabrication time. New node concepts might be of interest for more automated production of lattice towers. As a basis for such an investigation, loading and dynamic response by focusing on design of the nodes has been analysed with HAWC2 in this study.

SUPPORT STRUCTURE CONCEPTS
Where offshore wind turbines are planned to be installed in the intermediate water depths of 30-70m, bottom-fixed support structures might be used. One promising concept is the lattice tower type, due to less material use compared to other concepts like monopile or tripod structures. A lattice topology could be used for the entire support structure between sea bottom and turbine nacelle or for the lower part of the tower only.

LATTICE TOWERS
Lattice towers are assembled from steel tubes, where legs and bracings are welded together in tubular joints. Legs and bracings are connected in K-joints, while bracings in the planes between the legs are connected in X-joints.

NODE ANALYSIS WITH HAWC2
A lattice tower support structure with 84 beam elements was modelled and analysed with HAWC2. Wind turbine and rotor configuration were taken from the NREL 5MW baseline turbine.

OBJECTIVES
- lower total production costs
- faster production, towards mass production
- more automated production
- more reliable welding results
- prefabrication of components

If the complex fabrication of lattice towers can be solved in an effective way, this type might be a preferred solution for support structures in the future.