

## TECHNOLOGY PRESENTATION

### Structural Fuse for Wind Turbines

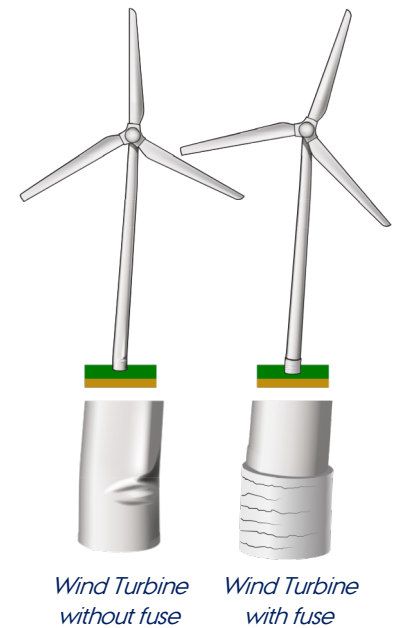
A sacrificial element with the primary task of significantly reducing extreme base moments, rendering the entire wind turbine and its foundation intact, thus allowing for significant cost-reductions for on- and offshore repowering and installations in areas with extreme natural hazards.

#### VALUE PROPOSITION

As we begin to approach the end the service life of existing wind turbine farms, a new wave of wind turbine installations within existing wind turbine parks is immanent. But, as the cost of foundation decommissioning is very high, the current cost of repowering leaves the wind turbines struggling to compete with alternative energy sources. Foundation decommissioning is only necessary though, if the base moments of new wind turbine installations is greater than the design moments of the existing foundations, as most foundations have adequate residual fatigue life. The structural fuse ensures that the base moments of the new wind turbines are kept at a similar level to those designed for previously, thus allowing us to use existing foundations for new turbine installations. This leads to large reduction in foundation costs when repowering. Furthermore, recent years have shown a rising tendency and interest in installing wind turbines in regions with more extreme natural hazards, such as e.g. earthquakes, tsunamis, and typhoons. In these regions, the design is often governed by the Ultimate Limit State (ULS) loading. A properly designed structural fuse will lower the structural demands of a wind turbine tower and the foundation in case of a critical natural event, leading to a reduction in material costs, and as a consequence, the cost of energy.

#### BUSINESS OPPORTUNITY

The market of both on- and off-shore wind turbines is rapidly growing and the need for repowering is rapidly approaching. This technology provides a favourable business



opportunity for companies in the wind industry to improve their competitiveness.

We are looking for:

- Investors and/or Partners to collaborate towards a spin-out company, bringing the technology to market

#### TECHNOLOGY SUMMARY

A fuse is normally associated with electrical circuits, acting as a safety component, activated only during critical events. The structural fuse utilizes the same conceptual idea as the electrical fuse. The structural fuse is implemented between the base of a wind turbine tower and its foundation. The purpose is to control and isolate potential damage within a specially designed element, which may need to be repaired or replaced after a critical event.

#### CURRENT STATE OF DEVELOPMENT

Proof-of-concept has been provided through scaled (1:10 and 1:20) pseudo-static and shake table tests followed by realistic analytical time-history simulations of a 5MW on- and off-shore wind turbine, exposed to wind and earthquake loading. Thus, a solid theoretical and experimental basis has been formed for further development of the technology.

#### INTELLECTUAL PROPERTY RIGHTS

European patent application, Applic. No. 20180100531, has been filed in November 2018 by Aarhus University and the Technical University of Denmark (DTU), who shares the rights. The patent has broad protection for the technology.

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