Bolt and Beautiful

Publieke samenvatting / Public summary

Aanleiding

Wind turbines will continue to strongly grow in capacity and size. This will in turn increase the size of the ring flange connections and the number and size of bolts. With current application methods, the industry is reaching the practical limit of using M72 bolts and there is a reluctance to increase the bolt size to M80 or higher. The industry is facing limits in terms of handling installation of large bolts in practice and has to deal with strict tolerances. At the same time, misalignments in the ring flanges cause increased stress ranges in the bolts. There have been bolt damage cases in existing structures that led to costly repairs and very strict inspection regimes. The use of bolted ring flanges is a key solution. Multiple steps can be made to optimise the use of material (bolts, flanges) in new monopiles and to optimise inspection intervals for existing monopiles to arrive at a cost-effective application of bolted ring flanges, which requires an innovative set of measures. The industry has a strong need to improve assessment methods for ring flange connections that consider design, manufacturing and maintenance aspects.

Doelstelling

Ensure the bolted connection can be cost effective and a safe solution for turbine support structures. For this, installation procedures should be in line with design and production to improve quality and significantly reduce the manufacturing, installation and maintenance costs of ring flange connections. The project develops an innovative set of measures that lead to an optimized use of material (bolts, flanges) in new monopiles and optimized inspection

Projectinformatie / Project information

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Algemene informatie / General information

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intervals for existing monopiles and through this keep current technology cost-effective for larger wind turbines. • Provide a calibrated probabilistic model for determining the fatigue strength (and required partial, effects of preloading of bolts, as well as effects of hydrogen embrittlement on crack initiation and crack propagation in the context of the application and manufacturing processes. • Provide a calibrated probabilistic model for new and existing ring flange connections that incorporates tolerance limits for new design and improved life prediction for maintenance of existing structures. • Improve installation+maintenance procedures for the bolted connections with innovative stress measurement techniques.

Korte omschrijving

The project consists of 5 work packages and 13 activities. • WP1 works towards deterministic modelling of the ring flange and bolt fatigue. • WP2 develops sensors for (pre-)stress measurements. Two investigated methods are particularly interesting for measuring bolt load in existing connections. • WP3 contains calibration experiments at various scale levels: individual bolt, bolt and segment, medium-scale ring flange in lab and field test data validation. • WP4 develops a method for a structural safety evaluation through a probabilistic framework. The structural safety evaluation are integrated with the stress measurement system developed in the other work packages.

Resultaat

The project will provide calibrated models and procedures to effectively (re)design and maintain ring flanges of existing and future monopile foundations, with an optimal use of material and labour resources, . The innovation will offer faster installation, less maintenance costs and safer connections, and allow bolted connections to be used for large turbine sizes.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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