

MIDAS (Monopile Improved Design through Advanced cyclic Soil modelling).

Publieke samenvatting / Public summary

The renewable energy sector is skyrocketing worldwide, particularly in the field of offshore wind energy. Larger and more powerful offshore wind turbines (OWTs) are being installed, owing to impressive technological progress and cost reduction. Planned installations in deeper waters and harsher environments are posing extreme technical challenges, also concerning the design of support structures and foundations. About 80% of all OWTs installed in Europe are founded on monopiles, tubular steel piles of large diameter. Bigger OWTs require larger monopiles, depending on soil conditions and the severity of repeated ('cyclic') loading from wind and waves. Monopiles of 8-10 m diameter for 30 m water depth can easily require more than 1000 tonnes of steel. Since foundations mobilise approximately 20% of the capital expenditure, existing uncertainties about cyclic loading effects in current foundation design are no longer acceptable in future offshore wind projects.

Objective

The project title, MIDAS – Monopile Improved Design through Advanced cyclic Soil modelling, defines its mission. MIDAS targets deeper fundamental understanding of monopile-soil interaction under cyclic loading – particularly, for the relevant case of sandy soils. Advanced experimental and computational studies – 'physical' and 'numerical' modelling – will be combined to optimise foundation design in relation to cyclic loading conditions. A

Projectinformatie / Project information

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Algemene informatie / General information

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novel design method will be developed and incorporated by industry partners into their in-house practice. These advances will support better use of steel and will lead to significant cost reduction.

Short description

Existing knowledge gaps in the analysis of cyclic monopile-soil interaction will be filled by combining physical and numerical modelling. Small-scale, state-of-the-art tests on monopiles will be performed at TU Delft and Deltares to (i) investigate the physics of monopile-sand interaction; (ii) produce additional novel data in support to numerical modelling and, ultimately, monopile design. In parallel, computer modelling will help to conceive experimental set-ups, and generate numerical results relevant to defining new design concepts. High-fidelity experimental/numerical results will enable to describe cyclic loading effects in simpler engineering models – based on the well-known p-y approach. Industry partners will test the soundness of the research outcomes against previous design cases and data from the field. These activities will enable critical assessment of MIDAS' findings, and boost confidence about their use in future projects – with resulting lower costs and improved safety.

Result

The project will deliver: (i) high-quality experimental data about the cyclic behaviour of monopiles in sand (lateral stiffness and permanent tilt); (ii) a unique numerical dataset about cyclic monopile-soil interaction, as resulting from advanced computer simulations and relevant parametric studies; (iii) an enhanced method for designing monopiles in sand, based on new cyclic p-y curves; (iv) a method reviewed by a certification body to increase confidence of acceptance and utilisation in the industry; (v) implementation of the new method into in-house software at partner companies. MIDAS is anticipated to enable monopiles fabricated with approximately 5% less steel when design is driven by cyclic loading. Overall, a cost saving potential of 37.5 M€ is estimated for Dutch offshore wind farming from 2023 to 2030.

Website

More information on the MIDAS project can found [on the GROW website](#).

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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