Sustainable Installation of XXL Monopiles

Publieke samenvatting / Public summary

Aanleiding

Monopiles are by far the most commonly used foundations for offshore wind turbines in the North Sea and it is expected to remain so in the future. Monopiles are straightforward to fabricate, relatively inexpensive to manufacture, use less space on transport vessels, and are reliable. The dominant method used now to drive monopiles into the seabed is the hydraulic impact piling (hammering). The big disadvantage of the impact driving method is the generation of underwater noise that can be detrimental to fauna and that the method is not suitable for extracting piles again at the end of the lifetime. Alternative installation technologies are being researched, developed, and tested at various Technology Readiness Levels (TRLs). However, none of these technologies has reached a TRL that makes it a preferred/ready solution for the installation of future XXL monopiles under a broad range of soil conditions. With a better understanding of their performance and a validation of the underlying models, the development of these technologies can be enabled, which should ensure that offshore wind remains one of the lowest-cost, electricity generation options for the North Sea.

Doelstelling

The SIMOX consortium will develop new and necessary technical and environmental knowledge with the target to ensure that within 5 years one or more qualified and validated next-generation installation technologies will be available. Such technologies should enable the installation (and decommissioning) of XXL monopiles for offshore wind turbines with large (>10 MW) energy yield in a

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Publicaties en materialen / Publications and attachments

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sustainable, cost-effective, societally and environmentally acceptable manner. SIMOX will research and test the following installation technologies with different TRLs and different gaps in knowledge: • Vibro: Vibratory driving with a purely vertical excitation; • GDP: The Gentle Driving of Piles concept, which is an emerging technology that combines a vertical vibratory excitation with a high-frequency torsional shaking; • JET: Aiding vibratory techniques by fluidising the internal soil column in the pile; • BP: Modifications to the conventional impact driving which reduces noise (blue piling principle); and • DECOM: Pile extraction technologies that make use of vibration or pressure.

Korte omschrijving

The project starts with identifying a set of criteria to – as much as possible – objectively characterise the various innovative installation techniques subject to research in SIMOX. All partners, with support from NGOs, RWS and a certification body, will provide input to the criteria. Based on this information and a desktop study, we will make an inventory of the state of the art with respect to science and engineering, to identify the gaps in data and models for the new technologies. Thereafter, we will perform a series of laboratory and field-tests at intermediate scale and generate the data sets that are needed to gain new insights and knowledge, to support model development and validation, and draw conclusions for the design practice. This will also serve as input for further improvement of the technologies. Finally, we will analyse, integrate, and implement the results in prediction models in close cooperation with stakeholders, i.e. clients, designers, certification bodies, NGOs and regulatory bodies. The activities will be carried out in three substantive WPs.

Resultaat

The SIMOX project should lead to the following results: a. High-quality experimental data set and validated pile driving model(s) with as new element the refusal depth prediction in dense sands, stiff clays and layered soils. b. Noise prediction model(s) that are able to provide noise levels and frequencies

at 750 m from the source. An assessment of the noise mitigation potential / effort for the different technologies and recommendations for implementation of the results in future guidance to be developed by regulators. c. High-quality experimental data set from laboratory and scaled field tests and model(s) for predicting the lateral bearing capacity for piles installed by Vibro and GDP concepts, compared to Impact driven piles. d. Proof of concept and experimental data for extraction of monopiles with the aid of static forces combined with vibrating force/jetting. e. For each installation technology: a concept specification of the future installation tool for the XXL monopile combined with an indication of the area of application and limitations. f. Alignment for technology qualification of the technology/ies.

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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