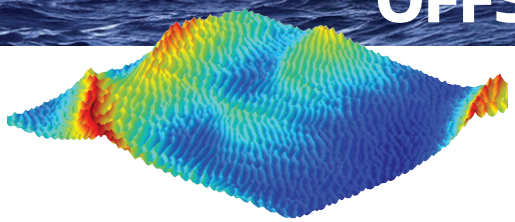
RAPID FALL IN THE COST OF OFFSHORE WIND ENERGY



Sand-wave fields on top of sand banks in the Borssele wind farm area

In 2016, the Netherlands launched a campaign to raise its offshore wind power capacity by 3,500 MW before the end of 2023, boosting the country's cumulative total capacity to 4,500 MW. An important precondition for the achievement of this goal is the lowering of the Levelised Cost of Energy from offshore wind by providing a stable market framework to reduce risks and costs for developers of wind farms.

To help RVO.nl, Deltares has performed numerous studies of the morphodynamics, metocean conditions, geology and scour at the planned wind farms. The results of the site studies relating to obstructions, soil and wind and water conditions at new wind farms are available to the public on https://offshorewind.rvo.nl/.

Our main contributions involved the assessment of seabed dynamics in the Borssele and Hollandse Kust wind farms using state-of-the-art analysis techniques with high spatial detail. In both sites, there is an abundance of migrating bed forms, such as sand waves, which can threaten the stability of foundations and the burial depth of electricity cables. The direction of sand-wave migration was determined by extracting the steepest slope orientations from the isolated and differentiated sand wave field. Migration rates were determined using an optimised 1D cross-correlation technique applied on transects extracted from distinct bathymetrical surveys. Analysis results were supplemented by the detailed numerical modelling of net sediment transport rates, which confirmed the directions found and which had a relative spatial distribution of magnitudes that was comparable with the migration rates. When studying the wind and water conditions ('metocean conditions'), we considered local variations in the Borssele Wind Farm Zone by using a dedicated numerical model that includes the influence of sand banks and sand waves. We also helped with metocean measurement campaigns for Hollandse Kust by validating the buoy data on the basis of nearby measurement stations and operational numerical models.

The main outcomes of these studies were the expected lowest and highest seabed levels over the design lifetime of the wind farm, which were validated on the basis of geological information about non-erodible layers. These expected levels were used to provide general recommendations about how to deal with scour development and mitigation strategies for a range of potential foundation types. High-fidelity seabed levels can be used to determine the layout of the wind farm and the electrical infrastructure using tools recently developed for the optimisation of cable routes and the result is a significant reduction in the risk of cable failure caused by seabed dynamics.

The expectation at the start of the five-year programme was that the price per kWh offered in tenders would fall to 10.75 euro cents. Quite remarkably, this expectation was surpassed: the price per kWh fell rapidly to 7.27 and 5.45 cents as early as the first Borssele tenders. The Hollandse Kust (zuid) wind farm will actually be built without subsidies. Open access to research results has significantly contributed to the rapid decline in the Levelised Cost of Energy for offshore wind energy.

Contact
Tom Roetert, tom.roetert@deltares.nl,
t +31 (0)6 1522 3195
Tim Raaijmakers, tim.raaijmakers@deltares.nl,
t +31 (0)6 4691 1177

Further reading:

Roetert et al. (2017) http://www.isope.org/publications/proceedings/ISOPE/ISOPE%202017/data/64789-isope-vol1-1.3616074/t002-1.3617324/f010-1.3617344/a084-1.3617351.html