

The role of pile foundation engineering in the development of offshore wind

Authors:

Federico Pisanò, Norwegian Geotechnical Institute

Abstract ID: 131

Submitted: May 21, 2026

Call:: MRC 2026 Research & Technical Track – Call for Abstracts

What Theme Are You Submitting for?: Technology and Innovation

Presenter Name: Federico Pisanò

Focus Area: Offshore Wind

Keywords: R&D, foundation design, geo-technology, industry practice, optimization, soils

As offshore wind development expands into new regions and marine environments, pile foundation engineering is evolving rapidly to support safer, more cost-efficient, and scalable projects. The transition from conventional oil and gas foundations to modern offshore wind systems has introduced new design drivers associated with larger structures, tighter installation tolerances, aggressive cost targets, and increasingly demanding requirements for long-term performance monitoring and operational reliability.

This presentation discusses how offshore pile engineering is adapting to these challenges through advances in installation methods, cyclic design frameworks, and CPT-informed, data-driven approaches. The talk will highlight the evolution of offshore pile geometries and the differing performance demands associated with offshore wind compared to traditional energy infrastructure. Examples from recent industry and research projects will illustrate how new methodologies are being developed to address key offshore wind challenges, including cyclic loading, quiet installation requirements, and complex seabed conditions. Emerging technologies such as vibro-installation and monitoring-informed design approaches will also be discussed, together with the growing importance of managing uncertainty associated with highly variable seabed conditions and less familiar geomaterials, including glauconitic sands, which may be encountered in developing offshore wind markets such as Canada.

The overall message is to reaffirm the central role played by pile engineering — and, more broadly, by the geoscience and geoengineering disciplines on which it relies — in enabling the successful deployment of offshore wind infrastructure. Continued innovation through collaborative industry-academia research will be essential to achieving the levels of cost optimization, supply-chain feasibility, and infrastructure reliability required for large-scale offshore wind expansion worldwide.