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INSPIRED BY NATURE

Technology for offshore infrastructure that provides biological benefits

STORMWATER ATTENUATION

Assessment reveals upfront carbon footprint of concrete pipe tanks

GLASS AGGREGATES

Sustainable ways to improve concrete durability using recycled product

A NATURE-INSPIRED APPROACH TO OFFSHORE CONCRETE SOLUTIONS FOR UK NET ZERO

Andrew Rella of **ECOncrete** looks at concrete technology for offshore infrastructure that complies with industry standards and provides biological, environmental and financial benefits.

MAIN IMAGE:
Marine Mattress Neptune installed at Shark River Island, New Jersey, USA.

The UK Government published its *Net Zero Strategy: Build Back Greener*[1] approximately six months ago. The strategy sets out how the UK will strive to be emissions free by 2050. When it comes to efforts to reduce our reliance on fossil fuels by boosting clean energy production, offshore wind has taken the centre stage due to its massive potential on a global scale.

Offshore wind's role in the strategy has been regarded by many as a 'no brainer'. It makes sense given the UK's island coastline, ambitions to 'level up' nationwide and to bring post-Brexit manufacturing jobs back to the UK, while decarbonising our energy transition.

Offshore windfarms can be built quickly, close to key markets, with ever-developing technology allowing turbines to continually scale-up in size and power capacity. We are all aware of the performance and cost improvements this poses.

January's announcement of £60 million in public- and industry-matched funding for floating wind investment warrants further optimism for the future of the UK's coastline. But are bigger blades and nacelle component recycling studies the best we can do to offset environmental impact? Or do we need to tackle this problem from the ground up?

NATURE-INSPIRED DESIGN

The concrete foundations anchoring our ever-upscaling offshore turbines can become landmark installations for innovation, improvement and the environment.

Substrate degradation and changes to hydrodynamic flow regimes due to poorly designed foundations can lead to local ecosystem destruction and the proliferation of invasive and nuisance species. This can be significantly damaging to marine life, not only for general biodiversity but also for vital local industry, not least fisheries.

If UK offshore wind is to be truly sustainable and we are to meet our long-term net-zero goals, ecological materials and nature-inspired design need to come as standard. That is more likely to happen if those materials rival the cost and performance of existing solutions.

To tackle the issues that beleaguer offshore turbine foundations, forward-thinking engineers and regulators continue to work hard to re-evaluate how concrete and steel are being used in marine environments, at both structural and chemical levels. By seriously addressing the way marine flora and fauna interact with foundation surfaces, these engineers aim to cultivate the growth of strong ecosystems for cost-competitive, optimal performing structures as soon as possible.

At the leading edge of ecological engineering are positive feedback solutions created between concrete that enhance biological processes and in turn protect and strengthen the concrete itself. This in turn can significantly reduce maintenance requirements, increase structural lifespan and strengthen the argument for leaving foundations and accompanying scour protection in place after the decommissioning of the turbine; avoiding the significant costs and efforts associated with full removal.

By incorporating ecological concrete for all anchoring and maintenance procedures, instead of (or alongside) ordinary concrete, UK offshore wind can significantly reduce its overall environmental impact.

SCALING UP BUILD BACK GREENER

High-performance ecological concrete technologies can be applied to any concrete marine infrastructure to increase strength and durability, while simultaneously transforming them into bases for a thriving marine ecosystem and an active carbon sink.

These technologies are also scalable and cost-effective. They are already enhancing marine life in breakwaters, ports and offshore infrastructure – including water-retaining armour units, which ECOncrete provided to the Portsmouth City Council-led Southsea Coastal Scheme – and larger CAPEX offshore project developers are paying attention.

The company is steadfastly developing its technology to fit offshore infrastructure requirements. In the US, ECOncrete has joined forces through its R&D partnership with Holcim (US) to design and produce an ecologically beneficial concrete scour protection unit for offshore wind turbine foundations. This joint R&D project began in May 2021 and is funded by a grant from the Binational Industrial Research and Development (BIRD) Energy programme. The goal is to design and manufacture a fully structural concrete scour protection

unit with superior interlocking capabilities that facilitates the growth of marine organisms, while meeting all industry standards for stabilising the seabed. The next step will be a large-scale pilot project to evaluate the ecological and structural performance of the units in an offshore environment before implementing full-scale installations. The pilot project is planned to be installed by the end of 2022 offshore of New York, USA in the vicinity of, and in water depths similar to, the upcoming offshore installations.

It is our sincere hope that similar projects will follow suit. The UK is well-placed and well-timed to support them. In the near future, we should all be excited about using ecological concrete for foundations in the burgeoning floating wind industry as well.

A CONCRETE CALL TO ACTION

The UK is targeting offshore wind expansion towards a goal of 40GW in 2030 and 65–125GW by 2050. Reshoring manufacturing jobs and raw materials supply for concrete substructures will be crucial. Approaching these requirements with innovative structures using concrete technologies that deliver nature-inclusive design and lasting performance ought to become industry standard now.

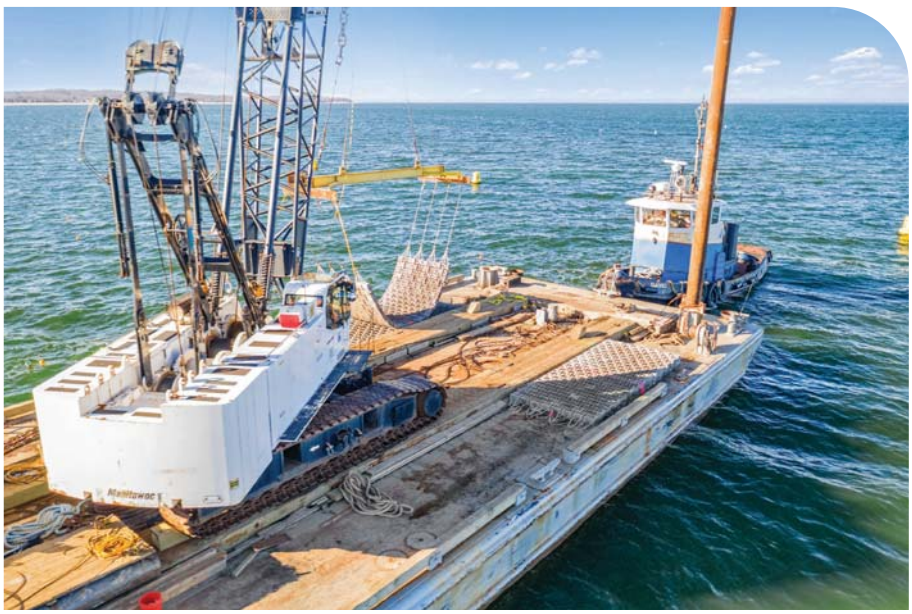
Carbon footprint penalties can be avoided, stable marine ecosystems established, maintenance costs reduced and the real ethos of UK net zero delivered alongside Government targets. The key to doing so is in ecological concretes.

Reference:

1. HM GOVERNMENT. *Net Zero Strategy: Build Back Greener*. HMSO, London, 2021, available at: https://bit.ly/37hfkEK.

Further reading:

THE NATURE CONSERVANCY. *Designing Offshore Wind Power to Improve Habitat for Marine Life*, 29 November 2021, available at: *https://bit.ly/3JbdPFl*.
HERMANS, A., BOS, O. and PRUSINA, I. *Nature-Inclusive Design: A Catalogue for Offshore Wind Infrastructure*. Witteveen+Bos/Wageningen Marine Research, The Netherlands, 17 March 2020.



ABOVE:
Southsea, Portsmouth – tide pools including water-retaining concrete armoured units.

LEFT:
Concrete Marine Mattress installation at Northport fishing and boat ramp, Fort Salonga, New York in 2019.