The TFN Solution

Norfolk Marine Ltd developed the Tyre Filled Net or TFN to provide a sustainable solution to windfarm scour. The TFN's utilise recycled tyres to replace non renewable natural resources.

Each TFN consists of 50 recycled tyres held inside a robust marine grade net. The tyres are tied together inside the net with ropes that provide a back up method of securing and recovering the tyres from the seabed.

The tyres inside each net trap material which is suspended in the tidal water flow and prevent it escaping so the seabed is Reinstated with naturally Occurring sediment.

The fact that the TFN's are placed into the scour hole below the surrounding seabed level and the sediment is trapped within the tyres means that the problem of 'Secondary Scour' and the scour protection moving away from the turbine pile is eliminated.

The TFN system has been designed and tested, to provide a product, proven to withstand the effects of the marine environment.

Installation Plan

A typical installation plan consists of placing around 12 TFN units around each monopile, using 600 recycled tyres. The TFNs are secured to each other and around the turbine bases to ensure they remain in place. The exact installation procedure is developed to suit each site location.

The Numbers

To install scour remediation using Tyre Filled Nets around 30 turbines, as an example, when compared to conventional aggregate solutions:

TFN'S	Aggregates
• 360 TFN Units	• 5,000 Tonnes of non renewable natural resources
• 18,00 recycled tyres	• 240 Truck Deliveries or large capacity dredging vessels
• 1,800 m3 when filled with local sediment	• Large rock dumping or crane vessels
• 160 Tonnes of materials	• Temporary Solution Replaced Periodically (Typically 4 – 8 Years)
• 15 Truck deliveries	
• Small installation vessels	
• Permanent Solution	

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TYRE FILLED NET

Scour Remediation System

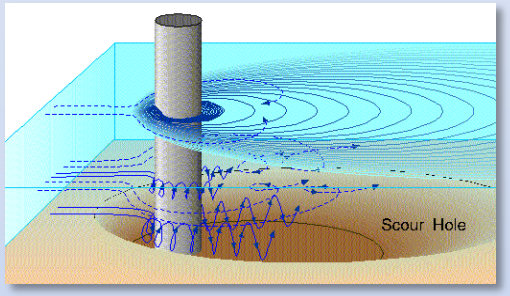
The Sustainable Solution

NM NORFOLK MARINE

The Problem

When an object, such as a wind turbine, protrudes from the seabed it causes 'Scour' around it. Scour occurs when the water flowing around the object increases speed and picks up the seabed material, creating a hole.

The Scour Effect

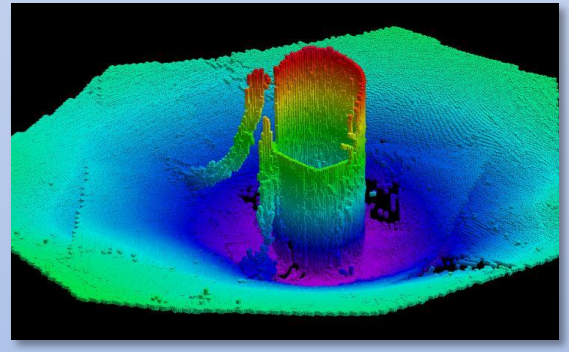


Offshore Windfarms

Offshore windfarms are particularly susceptible to this scouring effect, and it has been shown that large holes have developed around turbine structures in many locations.

Bathymetry Image

Showing a typical scour pit around a turbine pile



These holes around the turbines create a number of problems for the operation of the windfarm as there is a longer exposed length of the turbine piles and less penetration depth into the seabed.

Key problems include:

- Stability
- Vibration
- Fatigue
- Safety

Existing Scour Solutions

Current methods of filling the scour holes around wind turbines use non renewable aggregate resources which are either quarried and transported or dredged from the seabed and then deposited into the hole. These aggregate solutions can be either rock, which is dumped into place around the turbines or sand which is placed inside geotextile 'bags'.

Typical rock dumping and sandbag installation operations

Disadvantages

The impact of using natural aggregate resources includes:

- Dredging, Quarrying & Transport Costs
- Dredging activity on Benthic substrates
- Disturbance of marine organisms
- Non renewable use of natural resources
- Introduction of non indigenous species

The British Marine Aggregate Producers Association state that it can take 2 to 5 years for the seabed to recover from dredging activity.

The use of solid aggregates as scour protection around wind turbines is only a temporary measure as 'Secondary Scour' occurs around the edges of the material and draws it away from the turbine, therefore requiring periodic replacement.

Another consideration is, in order to access the power cables that exit from the base of the turbine, for maintenance or repair, the aggregate needs to be dredged out again with risk of damaging the cables.

The Use of Recycled Tyres

In order to responsibly manage our environment we need to recycle or re-use materials wherever possible.

According to government figures 55 million tyres are replaced, and enter the waste system, in the UK every year.

The EU Waste Framework Directive 'Waste Hierarchy' states that reuse of waste is preferable to the recovery of materials or energy from that product.

Recycled tyres have been used in the marine environment, in the form of artificial reefs and coastal erosion protection for many years.

Environmental concerns have been raised in the past, particularly after vast quantities of tyres became loose from an artificial reef project in Florida US. Reports conducted following this incident identified engineering failures in the construction of the reef rather than the tyres themselves as the cause.

The other significant environmental concerns regarding the use of tyres in the sea are the release of chemicals or leachates and degradation of the tyre composition.

A number of reviews and reports conducted or recognised by the 'Department for Environment, Food & Rural Affairs' and the 'Environment Agency' (Particularly the report 'Sustainable Re-use of Tyres in Port, Coastal and River Engineering) conclude the following:

- Leaching of chemicals in marine environments has been reported as low risk, generally due to large dilution of any contaminants released.
- Underwater, tyres are protected from ultraviolet degradation and are in a neutral, stable chemical environment.
- Test Results indicate that tyres do not leach volatile organic compounds. Detection levels are 10 to 100 times less than regulatory limits for drinking water.
- The US National Artificial Reef Plan includes tyres as a reef construction material noting that no toxic effects attributable to leaching or decomposition have been demonstrated.