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Shipping Guidance Notice – 174

Offshore renewable energy installations: impact on shipping

To: Mariners and Operators

1. Introduction

1.1. Globally, there is an increasing number of Offshore Renewable Energy Installations (OREIs) including wind farms, and wave and tidal energy devices. This forms part of the global commitment to reducing carbon footprints and tackling climate change.

1.2. The location, size and irregular shape of OREIs present new challenges to the safe navigation and communication of shipping and emergency rescue. These difficulties could contribute to a marine casualty leading to injury, death or loss of property, either at sea or among the population ashore.

1.3. This Shipping Guidance Notice (SGN) provides guidance on the impact of OREIs on navigational safety and emergency response. It also provides information on navigation and voyage planning to help mariners assess risks and plan safe passage. Finally, this guide includes research on the impact of OREIs on marine radar, communications and positioning systems and search and rescue helicopter operations.

2. Offshore Renewable Energy Installation impact on navigational safety and emergency response

2.1. OREIs have the potential to affect marine navigation and safety, and may require ships deviating from normal routes and recreational or fishing vessels entering shipping routes in order to avoid OREI sites.

2.2. OREIs can include:

- offshore wind farms
- marine current turbines
- wave generators
- any other installation

3. Navigation and voyage planning around Offshore Renewable Energy Installations

3.1. OREI's may be close to shipping routes.

3.2. Mariners should be aware that there is no right of access to any type of OREI. They are private property and appropriate warning signs are displayed. Access to an OREI requires skill and is limited by the state of the sea, and should only be undertaken in controlled circumstances by trained personnel.

3.3. The visibility of offshore wind, wave and tidal energy installations will depend on the device type as some installations are totally submerged while others may only protrude slightly above the sea surface. The marking of offshore wave and tidal energy installations will be based on recommendations of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), accessible via: https://www.iala.int/

4. Wind Farms

4.1. When planning a voyage, mariners should assess all hazards and associated risks, including the proximity of wind farms and turbines, for example:

- spacing - wind farm turbines are usually spaced 500 metres or more apart depending on the size of the turbine
- depth of water - most wind turbines operate in relatively shallow water though new generations of wind farm will be constructed in deeper water, possibly restricting navigable channels
- seabed changes - wind farm structures could, over time, affect the depth of water in their vicinity through scouring of the seabed making depth information unreliable
- tidal streams - wind farm structures may obstruct tidal streams locally, creating eddies nearby
- small craft - vessels involved in turbine maintenance and safety duties may be encountered or obscured within or around a wind farm - fishing vessels may also operate and be obscured in the area
- shore marks - in coastal areas shore marks may also be obscured by wind farm structures
- electrical transformer stations - can be found in or adjacent to larger wind farms
- rotor effects - can change the flow of the wind and impact on a vessel

5. Offshore wave and tidal energy installations

5.1. Unlike wind farms, you may have difficulty seeing systems using wave or tidal energy as they are likely to be located at or near the surface, for example:

- attenuators
- point absorbers
- oscillating wave surge converters
- oscillating water columns
- overtopping devices
- submerged pressure differentials

5.2. There are also many other devices that may have unique and very different designs to the more well-established types of technology, for example:

- tidal energy convertors (TECs)
- horizontal axis turbines
- horizontal axis turbines (enclosed blade tips)
- vertical axis turbines
- oscillating hydrofoils

5.3. The visibility of offshore wave and tidal energy installations will depend on the device type as some installations are totally submerged while others may only protrude slightly above the sea surface. The marking of offshore wave and tidal energy installations will be based on recommendations of the IALA (https://www.iala.int/).

6. Safety Zones

6.1. Safety zones should be in place around offshore wind farms under construction, all of which should be monitored and policed.

6.2. A temporary safety zone may be established during the construction, major maintenance and decommissioning of OREIs and therefore should be avoided. Notices to mariners and radio navigation warning broadcasts may be used to inform people of such a zone, and chart and hydrographic publications will be used. These zones will be monitored by support craft which may include fishing vessels employed by developers as guard vessels.

6.3. Permanent safety zones are not always established around entire wind farm groups, though single installations may be.

7. The effect on navigation and communication systems of OREIs

7.1. OREIs can be large and there could be several of them within a particular area. As a result, OREIs that cover large areas of open water can present potential hazards to navigation. This is particularly dangerous if there are a number of OREIs close to or encroaching into waters where there is a high density of shipping movements, fishing vessels and recreational craft usage.

7.2. Because of their nature, OREI positions are exposed to weather conditions and are often in shallow water, which could affect the navigation of vessels, particularly small craft and inshore shipping, gaining access to ports or to waters that provide a more sheltered passage required in bad weather and sea conditions. Also, tidal streams of varying sets and rates pass through all wind farm sites and some sites are within port limits or lie within Vessel Traffic Services (VTS) operational limits.

8. Maritime Communication

8.1. Mariners and organisations require consistent and effective radio communications systems.

8.2. If within close range of an OREI, mariners should be able to rely on marine navigation systems as much as if in open sea. However, when requiring line of sight promulgation, same may be affected by wind turbines.

8.3. Mariners should have means to detect other craft in the area and to take appropriate avoiding action.

8.4. Port authorities and VTS operators require effective detection, identification and tracking of vessels navigating in their areas to:

- organise traffic
- provide traffic information
- provide navigational assistance services to vessels operating within port approaches
- prescribe routing schemes to meet their statutory responsibilities in respect of the safety of navigation

8.5. Emergency services require the ability to rapidly detect and react to maritime casualties. If there is a failure of any radar, navigation or communication system it could:

- reduce safety levels
- lead to marine casualties
- reduce the effectiveness of emergency service operations

8.6. If an incident involves a passenger vessel, or a vessel carrying dangerous and polluting cargo, it could have serious consequences for the public and the environment, both at sea and ashore.

9. Theoretical studies into the impact of OREIs on radio systems

9.1. Experiments in the United Kingdom North Hoyle wind farm, off the North Wales coast were carried out to test the theoretical results from an earlier study that predicted the impact on marine radio systems.

9.2. In the theoretical study, results showed that wind turbines have very large radar cross-sections, which scatter a large proportion of any incident electromagnetic energy. The turbines also cast shadows behind themselves, looking from the direction of the transmitter.

9.3. The study suggested that small vessels within the North Hoyle wind farm would be detectable with marine radar - both 3 gigahertz and 9 gigahertz - if they were not in the shadow of a turbine. However, detection of the vessel could be compromised if it was very close and directly behind a turbine. The effect of the shadow at 3 gigahertz was found to be much less severe than at 9 gigahertz.

9.4. The impact on Global Positioning Systems (GPS) was found to be minimal, with any interference very rarely causing any corruption to the GPS data. Unless a GPS receiver was within 70 metres (based on a signal-to-noise ratio of 15 decibels) of a wind turbine then any interference would be insignificant.

9.5. The study looked at very high frequency (VHF) communications and concluded that due to the wavelength of the VHF systems, any interference caused by wind turbines would be negligible.

10. Scientific and practical research

10.1. The North Hoyle wind farm research tried to obtain scientific and practical operational data on the performance of various navigation and communications systems within and in the vicinity of offshore wind farms. The research focused on how the performance of systems would be adversely affected, with cost effective solutions recommended.

10.2. Four different trials were designed to test the validity of the results from the theoretical study and indicated that there is minimal impact on:

- VHF radio
- GPS receivers
- cellular telephones
- automated identification system

10.3. Ultra high frequency and other microwave systems suffered from the normal masking effect when turbines were in the line of the transmissions.

10.4. The turbines produced strong radar echoes giving early warning of their presence.

10.5. At close range, turbines may produce multiple reflected and side lobe echoes that can mask real targets. These develop at about 1.5 nautical miles, with radar displays becoming worse as the range closes.

10.6. Where a shipping lane passes within this range, considerable interference may be expected along a line of turbines.

10.7. The target size of the turbine echo increases close to the turbine, with target definition and bearing discrimination becoming worse on both 3 and 10 centimetre radars.

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For & on behalf of the Maritime Administrator

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