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Introduction

In recent years there has been a significant increase in the number of offshore wind farms installed across many North Sea regions. Although these offshore wind farms are located within the same region, disparities exist between the marking and lighting concepts required within the respective Exclusive Economic Zones (EEZs).



Fig. 1: Borkum Riffgrund 1 wind farm in Germany

Concepts in Denmark and Netherlands

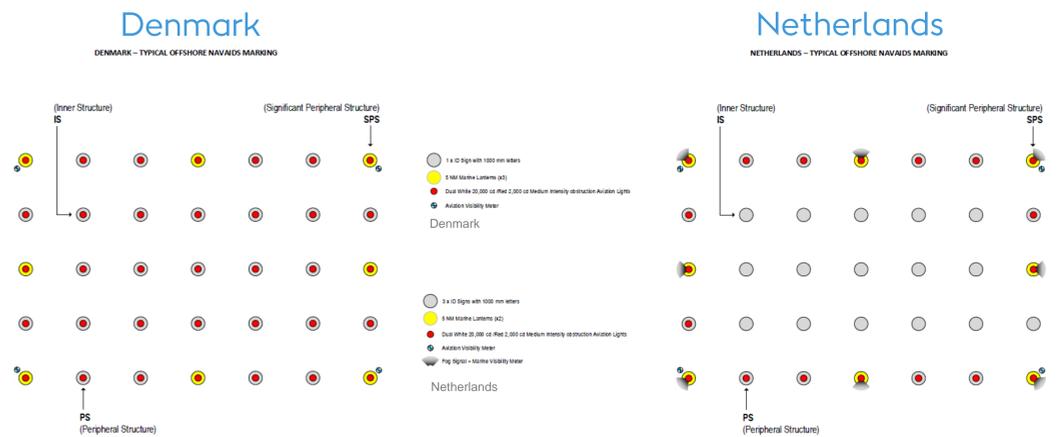


Fig. 4: Indicative operational-phase marking / lighting schemes in Denmark and The Netherlands (Source: Sabik Offshore)

The above schematics illustrate the typical Danish and Dutch aviation / navigation marking and lighting schemes, and highlight the significant differences that exist between them.

Concepts in Germany and the UK

Marking and lighting requirements in German waters can be characterised as rule-based, and relatively prescriptive. Compliance mechanisms are also well developed, which provides a high degree of certainty.



Fig. 2: German operational-phase marking and lighting scheme (Source: Sabik Offshore)

Marking and lighting requirements in UK waters are principally derived from a range of guidance documents, including [1] and [2]. The relatively non-prescriptive approach adopted in the UK can facilitate the evolution of existing requirements and the rapid adoption of new techniques. At the same time, the somewhat flexible UK approach can introduce uncertainty into design and procurement processes.



Fig. 3: UK operational-phase marking and lighting scheme (Source: Sabik Offshore)

More widely across Europe, including within the EEZ's of France and Belgium, there are inconsistent requirements for: colouring of offshore wind turbine transition pieces, towers and blades; banding/markings of blades, nacelles and towers; and lit helicopter corridors (leading to offshore substations). Requirements are currently being formulated for the nascent offshore wind markets that are emerging in Taiwanese and US waters.

Harmonisation in the future?

Inconsistent marking and lighting requirements have implications for offshore wind farm developers and their suppliers. These same inconsistencies also have implications for those using the navigation systems. International mariners and aviators may, for example, perceive a cluster of two or more wind farms as a single group of turbines, and so expect to observe consistent marking and lighting.

WIND Europe have proposed areas for harmonization, including:

- Only the transition piece to be marked in yellow (not the tower).
- No marking of tower and nacelle with a red/orange stripe.
- Blades to be marked with red/orange stripes.
- Consistent inspection method, and interval (e.g. initial inspection, 4 years and then every 2 years).
- Consistent format, typeface, and size for the alphanumeric characters used to identify individual turbines.

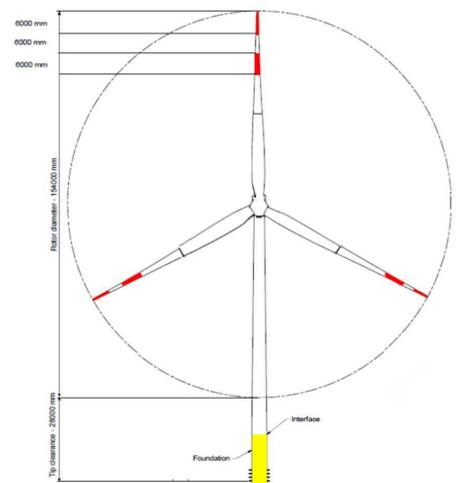


Fig. 5: Indicative offshore wind turbine colouring scheme

References

- [1] The Convention on International Civil Aviation (Annex 14) released by the International Civil Aviation Organisation (ICAO).
- [2] IALA Recommendation O-139 On the Marking of Man-Made Offshore Structures released by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).
- [3] CAA Policy and Guidelines on Wind Turbines, CAP 764, Sixth Edition Feb. 2016.
- [4] Marine Guidance Note 543, Safety of Navigation: Offshore Renewable Energy Installations, January 2016.