Lighting and marking concepts in the North Sea – one area and plenty of concepts

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Summary
In recent years there has been an increase in windfarm installation across many North Sea regions. As part of the rapid deployment of offshore wind energy, Ørsted is developing and constructing large wind farms in the Exclusive Economic Zones (EEZs) of the United Kingdom, Denmark, Germany and The Netherlands. Although these offshore wind farms are located within the same North Sea region, significant differences exist between the marking and lighting concepts required in the different EEZs. This means that, on a journey across different North Sea territories, either by sea or by air, one may encounter many different marking and lighting systems. Ørsted's experience will be used to discuss the main features of the different marking and lighting concepts utilised across European waters, both in terms of the underpinning legislation and guidance, and the implications this has for mariners and aviators.

1. Marking concepts

Ørsted presents the different marking and lighting concepts in place across the North Sea region and discusses the underlying requirements. Marking and lighting requirements apply to both offshore wind turbines and offshore sub-stations - features include identification boards, colour schemes, navigational aids (inc. buoys, lights and fog horns), aviation warning lights, and search and rescue lights. Different marking and lighting schemes are utilised during the construction and operational phases.

1.1 Concepts in Germany

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 in requirements.

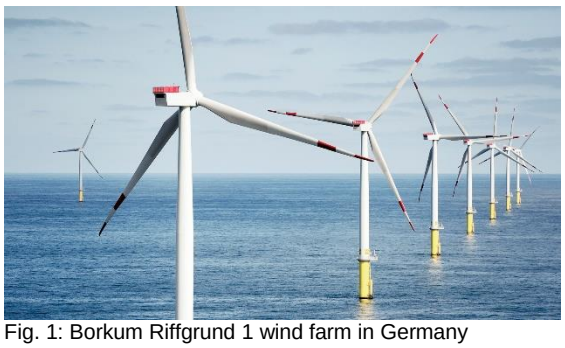

Fig. 1: Borkum Riffgrund 1 wind farm in Germany

1.2 Concepts in UK

Marking and lighting requirements in UK waters are principally derived from a range of guidance documents [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.

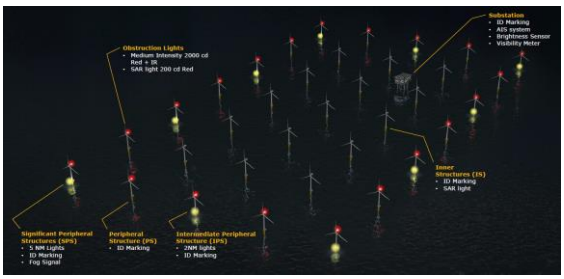

Fig. 2: UK marking and lighting scheme

2. Importance and challenges for mariners

Alongside the implications of the difference in systems for a wind farm developer, there are also implications for those using the navigation systems. 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. As marking and lighting requirements evolve over time, an expectation of synchronisation between wind farms can point to complex and often challenging modifications.

3. References

[1] CAA Policy and Guidelines on Wind Turbines, CAP 764, Sixth Edition Feb. 2016.
[2] Marine Guidance Note 543, Safety of Navigation: Offshore Renewable Energy Installations, January 2016.