

Paper for Consideration by CSPCWG

Floating wind turbines

| | |
|---------------------------|--|
| Submitted by: | Norway |
| Executive Summary: | A floating wind turbine has been towed out into the North Sea and placed in the ocean west of Norway. The structure has a height of 65 m above sea level, and extends downwards to a depth of 100 m below sea level. |
| Related Documents: | Possible new symbol in INT 1 and specification in S-4 INT 1 and S-4 |
| Related Projects: | Revision of S-4, New Editions of INT 1. TSMAD |

Introduction / Background

A floating wind turbine, HYWIND, is now in position in the ocean west of Norway. The three-bladed turbine has a height of approx. 65 m above sea level, 109 metres including the rotor blades, and a depth of 100 m below sea level.

This kind of floating wind turbine can be placed at ocean depths between 120 and 700 metres.

This is the world’s first full-scale floating wind turbine project.

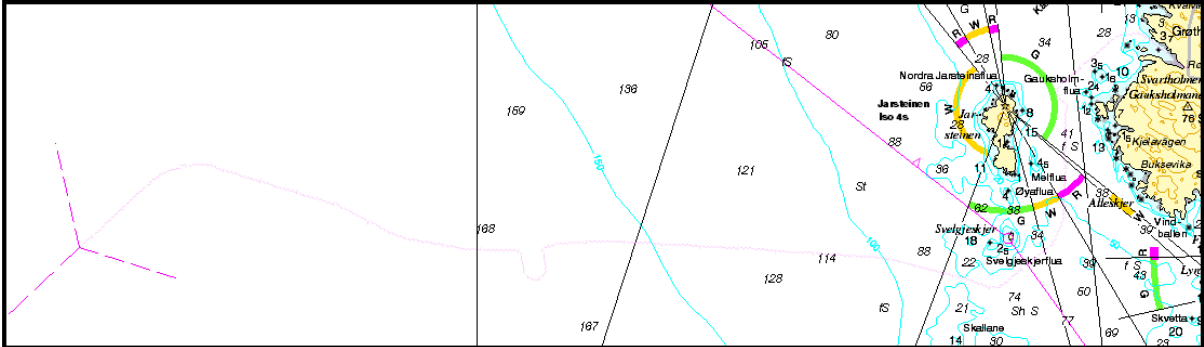
The only other floating wind turbine we have heard of except HYWIND is a very small two-bladed demo turbine located 12 nautical miles off the coast of southern Italy (Blue H) in 2007.

We think Floating wind turbines need a place in INT 1 and suitable specifications in S-4.

Analysis/Discussion

This wind turbine is a floating structure anchored to the sea floor, in much the same way as floating production units in the oil sector, by 3 anchor piles placed approx. 950 metres from the turbine position. The water depth in the area is 120 – 170 metres.

The position is 59° 08.42' N, 05° 01.78' E. WGS84 DATUM. This is 10 km southwest of the island of Karmøy, Norway.



Power from this 2.3 megawatt turbine is transported ashore and connected to the local electric network by a 13.000 metres long submarine power cable. (Efs 18-2009)
 The structure is painted yellow up to 15 m above sea level and fitted with a yellow retro-reflecting band.
 3 synchronous lights, character Oc Y 2s, are placed above the yellow painted area.
 The structure is floodlit.

PAPER CHARTS

The installation is not yet printed in any of the NO paper chart.
 The turbine itself is not affecting any 1:50 000 scale paper charts, but will be inserted in NO 306 and 307 in scale 1:350 000, and NO 559 in scale 1:800 000.
 The turbine is surrounded by a precautionary area with 50 m radius. Due to the scale of the paper charts covering the area, the precautionary area is too small to be visible as an area.
 Minimum clearance under the blades is 24 metres.

ENCs

The installation will be found in ENCs in the NO4 Approach Usage band.

In lack of suitable coding in S-57 the turbine is at the moment coded in S-57 as follows:

- Landmark.
- OBJNAM = Hywind demo
- CATLMK = 18 windmill
- STATUS = permanent
- Height = 60.0
- FUNCTION = unknown
- Colour = grey
- CONVIS = 1 visual conspicuous
- INFORM = flytende vindmølle

A code similar to an OFSPLF is perhaps closer to the actual kind of construction.
 Or may be a BOYSPP, but wind motor or wind turbine is not an available attribute for BOYSPP.

S-4:

Amending 445.8/445.9/445.10

Conclusions

Specifications in INT 1, S-4 and S-57 are not fully covering this object.

Recommendations

INT 1:

Suggestion 1: A new symbol in L, as a new L 5.1:

| | | | |
|-----|--|--|----------------|
| 5.1 | Vindmølle/vindgenerator, fast <i>Wind turbine, fixed</i> | | 445.8 445.9 |
| | Vindmølle/vindgenerator, flytende <i>Wind turbine, floating</i> | | |
| 5.2 | Vindmøllepark <i>Wind farm</i> | | |
| | Vindmøllepark med restriksjoner <i>Wind farm with restricted area</i> | | |

Suggestion 2: Use the existing upright wind turbine symbol 5.1, but italic characteristics.

Suggestion 3: Use the same principles as for buoyant beacon in S-4 B-459, or 'floating' platforms in B-445.2d with 'fixed' moorings (B-445.4).

This could be used if the installation is seen as a fixed object.

Position stability:

In normal weather conditions the Hywind is moving horizontally +/- 30 m, and vertically 0.5 m. In extreme weather the horizontal movement can be as much +/- 50 m horizontally and 1-2 m vertically.

S-4:

- One solution is to amend B-445.8 Wind turbines to include floating wind turbines.
- Another is to rewrite B-445.10 to embrace overwater turbines as well.
- Or use existing S-4 options.

Clarification:

In NHS we struggle when floating elements are treated as fixed.

These conditions may need further (better) explanations.

Justification and Impacts

S-57

TSMAD will have to be asked to find a way of coding this object in the ENC.

TSMAD will also have to be asked to discuss if this requires amendments in S-57 or if it can be solved in existing version by an Encoding Bulletin.



HYWIND, 8 June 2009

