Paper for Consideration by NCWG

Offshore Solar Parks

Submitted by:	Netherlands Hydrographic Office
Executive Summary:	Development of offshore Solar Parks. Charting guidelines
Related Documents:	S4 chapter B-445.12
Related Projects:	None

Introduction / Background

A Dutch consortium wants to build a floating solar park on the North Sea. The plan is to float the first prototype at the end of this year

The consortium is a joint venture between six Dutch companies and research institutes. The biggest issue with sustainable energy using wind and solar power is the space they take up. But at sea there seems to be more than enough space. The floating solar parks could for instance be combined with off-shore wind farms.

A floating solar park at sea also has major benefits in terms of economies of scale. At sea you can build parks covering a scale of square kilometres, and there aren't the integration problems you face when building on land. Of course the cost of construction is far greater when working at sea.

A solar park at sea also has disadvantages: salt water is not good for electronics, it is deposited on the panels and waves can reach over ten metres in height. This has been studied for two years. All sorts of coatings have been tested on the solar panels lying in the salt water of the Oosterschelde estuary. And in one of the wave tanks of the maritime research institute Marin, various possible structures have been tested that can cope with 13m waves.

At sea there is also the interaction with nature. Investigation was done on the impact of solar panels on nature and vice versa. As with any infrastructure constructed at sea, they will attract marine life, with algae and barnacle growth, both of which then attract more sea life. What's more, fish will be attracted to the structures to shelter, eat and reproduce. The panels

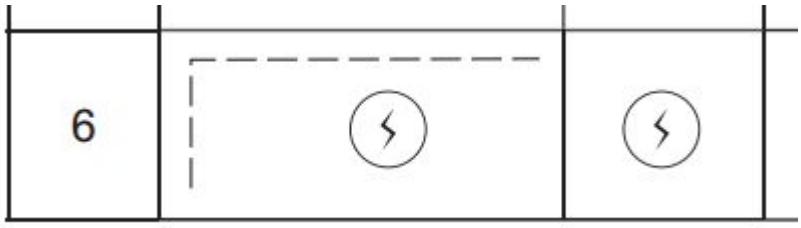
will possibly also form a refuge for birds, so bird droppings could be an issue. Research into the impact from nature is being carried out.

The solar panels are held in place using anchors, and are connected with cables that carry the power to land. Both are entirely feasible, and the off-shore world has plenty of experience with this.
The plan is to launch a prototype at sea by the end of this year . In the 3 years to come a pilot project is launched in an area 8 miles off the coast of Scheveningen. The area will cover around 2.500 square meter. There will be a similar field with solar panels on land in order to compare the yield. The expectation is that the yield on sea is higher: The panels are cooled more effectively at sea, there is more diffuse light, and there is an effect from the rocking motion caused by the waves.

Analysis / Discussion

There's quite a chance that this development will result in more offshore solar areas, either integrated in a wind farm or stand alone.

The S4 445.12, INT1 L6 has an appropriate symbol for this



The descriptive text in S4 chapter 445.12 doesn't cover the whole subject. The suggestion is to make the following change in S4 to make the use of this feature more general:

B-445.12 ~~**Wave energy devices; Wave farms**~~**Renewable energy devices and farms**. A wide variety of devices for harnessing ~~wave~~ renewable energy are being developed. Examples are wave farms and solar farms. These devices need protection and are also potentially dangerous to navigation.

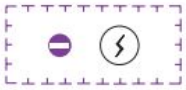
At the present stage of the industry, ~~wave~~ these farms should usually be treated as Development Areas (limit N1.2, N2.1 or N2.2 as appropriate, see B445.7); (that is: charted in magenta), as the actual obstructions will come and go or be moved as experiments progress. A legend such as 'Renewable Energy Devices - Development Area (see Note)' should be inserted in the area. Small areas may be simply labelled 'Development Area (see Note)' or 'Wave Farm (see Note)'. All cables, buoys, lights and permanent structures should be charted as normal.

A magenta note should be inserted warning of the potentially hazardous nature of the area, for example:

DEVELOPMENT AREA
Extensive testing of renewable energy devices, both above and below the surface, takes place in this area. Mariners should exercise caution if navigating in this area. For further information, see [eg associated publication].

Later, if such an area becomes established as a ~~wave~~ renewable energy farm, the symbol for a renewable energy device should be used. Usually, the renewable energy device symbol will be used in combination with an area symbol, although if necessary (for example because of scale or for a single device) it may be used as a point symbol, with the centre of the circle representing the position:

Symbol N1.1 (black maritime limit implying permanent physical obstructions) should normally be used for the limit of a ~~wave~~ renewable energy farm. However, if navigation is prohibited, N2.2 must be used:



If there are other restrictions, N2.1 may be used, noting the principles for portraying coincident limits at B-439.6.

Action required of NCWG

The NCWG is invited to take note of the developments in offshore solar farms and comment on the proposed changes in S4.