Optimization of the Lay-out of a Farm of Wave Dragon Wave Energy Converters in the North Sea

Charlotte Beels, Peter Troch and Julien De Rouck
Ghent University, Department of Civil Engineering
Technologiepark 904, B-9052 Zwijnaarde

Introduction
In the last decade many concepts for wave power conversion have intensively been studied and developed, a.o. the Wave Dragon Wave Energy Converter (WD-WEC).

Several WD-WECs need to be arranged in a geometric configuration or in a ‘farm’ to extract a substantial amount of wave power. Both the power production and cost of a farm are affected by the lay-out of the farm.

Objective
Optimization of the lay-out of a farm of WD-WECs to decrease the cost per produced kWh by studying the power production and cost of two farm lay-outs of 99 WD-WECs with a rated power of 198 MW in a near shore North Sea wave climate:

Power production
Power production assessment by calculating the wave power redistribution in and behind each lay-out in the time-dependent mild-slope equation model MILDwave.

Cost
Design of optimal (low cost) submarine cable network by minimizing the cable cost and capitalized cost of expected constrained energy from cable losses.

Conclusions
A single line of WD-WECs (lay-out A) results in the highest power production and lowest cost of energy. On the other hand this lay-out requires a wide sea area. Combining a line of WD-WECs with a farm of wind turbines facilitates the maintenance of the farm of wind turbines and reduces the overall grid connection cost.