Optimisation of vessel routing for offshore wind farm maintenance tasks

Toby Kingsman*†[1] and Burak Boyacı‡[2]

[1]STOR-i Centre for Doctoral Training, Lancaster University (STOR-i) – Lancaster, LA1 4YR, United Kingdom

[2]Lancaster University Management School, Department of Management Science, Centre for Transport and Logistics (CENTRAL) – Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom

Abstract

The rapid growth expected in the offshore wind sector means there is an increasing opportunity to find savings from conducting operations and maintenance activities more efficiently. The predicted increase in the size and quantity of offshore wind farms means mathematical tools for scheduling maintenance activities will be necessary to exploit economies of scale fully.

Maintenance tasks must be worked on by a specific combination of technicians, equipment and vessel support for a set duration of time. A heterogeneous fleet of vessels is responsible for transporting technicians around the wind farm and conducting personnel transfers. Vessel movements must satisfy any limitations in wind turbine accessibility imposed by offshore weather conditions and the need to return all resources back to port by the end of the shift. In this research, we propose a mathematical model capable of determining the most cost effective routes for vessel movements and the ideal times to undertake crew transfers. The model incorporates a one-to-one pickup and delivery structure between the port and the wind farm and a many-to-many structure within the wind farm. We allow for selective task completion to model instances with restricted resources.

We conduct experiments on a mix of simulated and real-life instances from an offshore wind farm. We examine the impact of various instance characteristics such as the task profiles, weather conditions and technicians available on the vessel routes and crew transfer plans.

Keywords: offshore wind

*Speaker

†Corresponding author: t.kingsman1@lancaster.ac.uk

‡Corresponding author: b.boyaci@lancaster.ac.uk