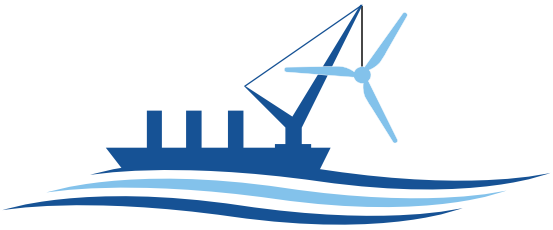

leanwind

Logistic Efficiencies and Naval architecture for Wind Installations with Novel Developments

Project acronym: LEANWIND
Grant agreement nº 614020
Collaborative project
Start date: 01st December 2013
Duration: 4 years

Decision making model for port layout/configuration selection

Work Package 5 - Deliverable number 5.5

Lead Beneficiary: University of Portsmouth
Due date: 30 November 2015
Delivery date:
Dissemination level: CO (Confidential)

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No. 614020.

Disclaimer

Document Information

Version	Date	Description		
		Prepared by	**Reviewed by**	**Approved by**
V1	13.11.2015	Chandra Irawan Dylan Jones Xiang Song Negar Akbari	Lars Magne Nonås Thanos Pappas	
V2	30.11.2015	Chandra Irawan Dylan Jones Xiang Song Negar Akbari	Lars Magne Nonås Thanos Pappas	Jan Arthur Norbeck

Author(s) information (alphabetical):	
Name	**Organisation**
Chandra Irawan	UOPHEC
Dylan Jones	UOPHEC
Xiang Song	UOPHEC
Negar Akbari	UHULL

Definitions

OWF	Offshore wind farm
O&M	Operations and maintenance

MILP	Mixed Integer Linear Programming
BMILP	Basic Mixed Integer Linear Programming
IMILP	Improved Mixed Integer Linear Programming
EMILP	Enhanced Mixed Integer Linear Programming
FLP	Facility Layout Problem
ACO	Ant Colony Optimisation
GA	Genetic Algorithms
SA	Simulated Annealing
TS	Tabu Search
VNS	Variable Neighbourhood Search
SS	Scatter Search
IAGA	Improved Adaptive Genetic algorithm
VNS-MS	Variable Neighbourhood Search with Multi Start
SBSBPP	Single Bin Size Bin Packing Problem
NFP	Nofit Polygon
ha	Hectare
CPLEX	Optimiser Software developed by IBM
MBVNS	Matheuristic based on basic VNS
MVNSMS	Matheuristic based on VNS with multi-start
C++	One type of Programming Language
PS	Small Polygon
PL	Large Polygon
CPU	Computing Processing Unit
DBMS	Database Management System
ERD	The Entity Relation Diagram

Executive Summary

The trend towards employing larger offshore wind turbines to harness the wind energy more effectively, not only has its unique technical and design challenges, but it also requires efficient ports and infrastructure to undertake the storage, assembly and (un)loading of these components prior to their offshore installation. Ports and infrastructure play a pivotal role in the development of offshore wind energy. The logistics complexities associated with moving these components requires ports with efficient layouts in order for the components handling costs to be minimised. The major size of the components imposes a significant requirement on the available space, and the available handling equipment in the port such as the cranes. Hence, arranging the layout of the port, in a way that the component transportation cost is minimised could contribute to reducing the overall cost associated with the installation phase. This report presents an optimisation model for arranging the layout of an installation port in a manner that the wind turbine components' transportation cost within different areas of the port, including the storage, staging and (un)loading areas is minimised. The optimisation introduced in this study has also been applied to optimise the layout of a real-case offshore wind port, Port of Arderiser. This port located in Scotland has been recognised by the Scottish Enterprises National Renewables Infrastructure Plan (NRIP) as a port location for offshore wind manufacturing, installation staging and operations and maintenance for the Moray Firth arrays. This report also produces the user interface (software) to solve the port layout problem for an offshore wind farm with the user guide of the software provided.