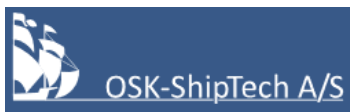


A photograph of an offshore wind turbine. The top part of the image shows the orange-painted tower legs against a grey sky. Below the tower, a white nacelle is visible, with a person in a dark jacket partially seen on the left side. The bottom half of the image is dominated by a large, white, curved surface, likely a part of the nacelle or a blade.

Offshore Wind Logistics brief report 2

- The cost of logistics in offshore wind

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This *Offshore Wind Logistics brief report 2* is part of a series of brief industry-focused reports on the key conclusions from the global wind energy shipping and logistics PhD research project. The reports have been crafted by the Panticon team during the months of January through September 2019 in order to crystalize the main findings from the academic research project in a non-academic language and style which would support industry in implementing the key changes proposed as a result of the PhD research project. The report has been created primarily based on the PhD research project output, i.e. the PhD thesis and the academic publications produced by Thomas Poulsen during the PhD research project. Where necessary, additional data sources have been utilized as well in order to ensure that the findings are relevant and up-to-date (see Reference section).

The report contains forward-looking statements, which by their very nature, address matters that are, to different degrees, uncertain as they pertain to the future. These, or any other uncertainties, may cause the actual future results to be materially different than those expressed in the forward-looking statements as contained within this report. At Panticon we do not undertake to update our forward-looking statements, nor do we assume any liability for actions or dispositions made by firms, organizations, and/or individuals based on information contained in this report.

Panticon is particularly strong in the Offshore Wind and Logistics sectors within the three core disciplines of Strategic Management Advisory, Mergers & Acquisitions, and Market Intelligence.

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The Report authors: Victor Musuku
Thomas Poulsen

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Panticon | Vivede Møllehuse 15, 4640 Faxe, Denmark

Web: www.panticon.com | Email: info@panticon.com



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1. Introduction

This *Offshore Wind Logistics brief report 2* is the second in a series of eight short industry-focused reports.

The goal of the brief reports is to make the latest research in the market for logistics within the global offshore wind industry more accessible and usable for a wide range of constituencies on a global basis. The brief reports can be read consecutively or individually.

This *second report* in the series promotes the treating of offshore wind logistics as a separate cost discipline in offshore wind by providing an understanding of the overall cost of logistics in offshore wind farms. Logistics costs are considered at offshore wind farm life-cycle phase level as well as for the entire offshore wind farm life-cycle.

2. The four categories of costs of offshore wind farms

In the energy sector, costs are measured according to international standards developed to simulate and compare costs for generating electricity across different energy forms. Traditionally, logistics as a percentage of the **levelized cost of energy** has been used. In this regard, for the offshore wind industry:

The levelized cost of energy (LCoE) “...expresses the ‘levelized’ unit cost of 1MWh over the lifetime of an offshore wind farm by taking the sum of the discounted lifetime costs relative to the sum of the discounted energy production at the time of the financial investment decision.”

Simply put:

LCoE = Present value (of all costs) / Present value (of all energy production over project’s lifetime)

Meanwhile, each of the four offshore wind life-cycle phases namely, **Development & Consent**, **Installation & Commissioning**, **Operations & Maintenance** and **De-commissioning & Site Abandonment** (For more information on the supply phases and corresponding supply chains see *Offshore Wind Logistics brief report 1: Defining logistics in offshore wind*), has unique characteristics and attracts companies with unique competences. Therefore, it is necessary to look at costs of each lifecycle phase.

Accordingly, the lifetime costs for an offshore wind farm can be divided into four respective categories corresponding to the offshore wind farm’s lifecycle phases (Figure 1).

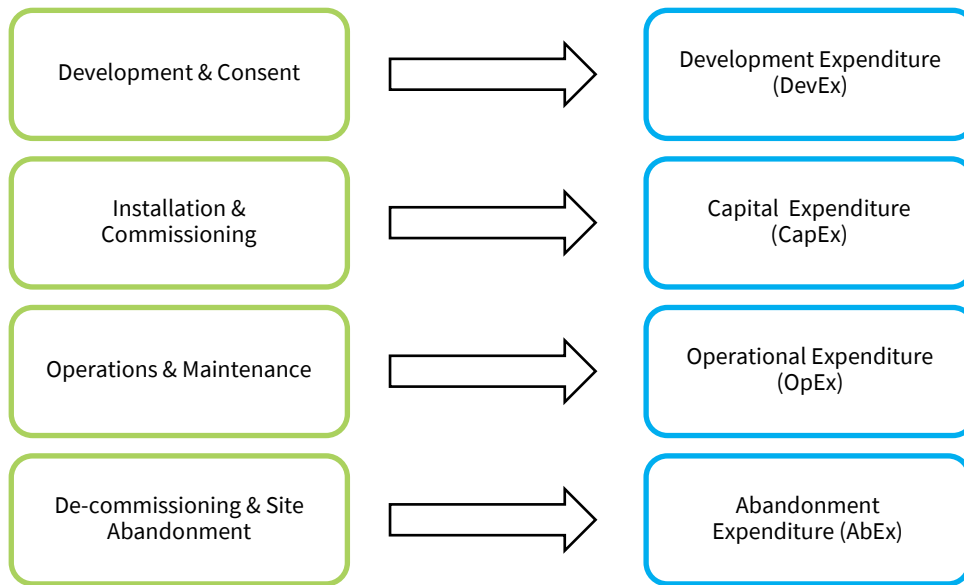


Figure 1: Offshore wind farm life cycle phases and the lifetime cost categories

Thus, the lifetime cost of energy is the sum of the above-mentioned expenditures, as expressed in the equation below (Figure 2).

$$\text{Lifetime cost of energy} = \text{DevEx} + \text{CapEx} + \text{OpEx} + \text{AbEx}$$

Figure 2: Lifetime cost of energy and the lifetime cost categories

By ascribing cost separately to each of the four offshore wind farm lifecycle phases, it becomes easier to compare each lifecycle phase's share of the **lifetime cost of energy**. Subsequently, it is easier to isolate the logistics costs per respective offshore wind farm lifecycle phase. Once the logistics costs per offshore wind farm lifecycle phase are isolated, the total across the phases becomes apparent. This highlights the full contribution of logistics as seen in relation to the total cost of an offshore wind farm. If not seen horizontally, logistics costs appear insignificant and do not attract the attention they deserve. This results in missing a significant opportunity for reducing costs.

3. Cost of logistics in offshore wind farms

Each of the four lifetime cost categories is unique and requires special investigation. The research project set out to investigate logistics as a percentage of LCoE overall. To do so, one of the four lifetime cost categories had to be picked for a more detailed analysis.

Development expenditure, where all costs spent are in the period from idea and development to design and planning, is not a significant cost item for an offshore wind farm. Similarly, **abandonment expenditure**, where all the costs are incurred during the decommissioning and abandonment of the offshore wind farm from the offshore wind farm termination date, is a limited field. This is due to the relatively small number of offshore wind farms that have so far been decommissioned. This leaves **capital expenditure** and **operational expenditure**, as categories of most interest for offshore wind logistics. The focus is reflected in the three definitions of offshore wind logistics costs:

Logistics as % of CapEx

Logistics as % of OpEx

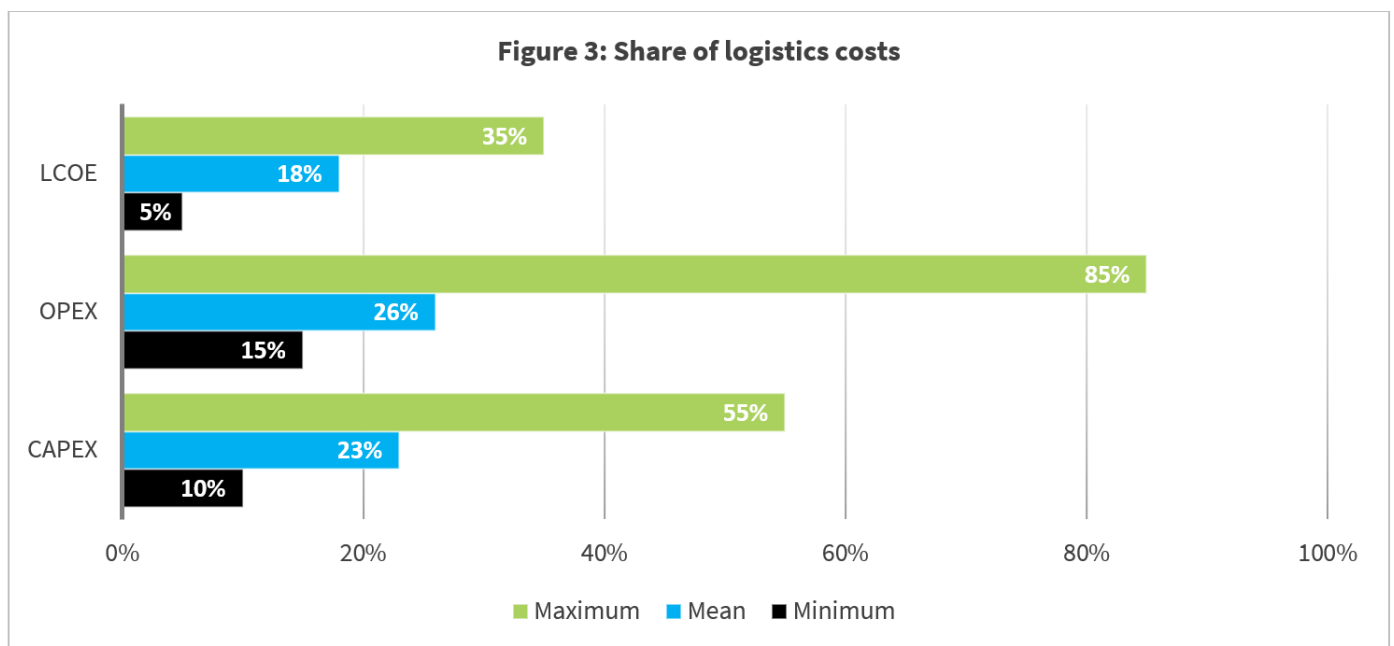
Logistics as % of LCoE

Logistics as a percentage of all the expenditure in the period of construction up to the date the offshore wind farm is commissioned.

Logistics as a percentage of all the expenditure in the period of construction up to the date the offshore wind farm is commissioned. Logistics as a percentage of all expenditure occurring from immediately after point of takeover, whether one-time or recurring, related to the wind farm, measured on an annual basis. Excluded are expenses inherent to the operation of the operator's business but not directly related to the operation and management of the wind farm.

The LCoE expresses the levelized unit cost of 1MWh over the lifetime of an offshore wind farm by taking the sum of the discounted lifetime costs relative to the sum of the discounted energy production at the time of the financial investment decision.

These three definitions were applied to real data from 12 cost studies. The results (Figure 3) showed that across the three parameters of **levelized cost of energy**, **operational expenditure**, and **capital expenditure**, the differences between the means were not significant. Meanwhile, logistics costs as a share of an offshore wind farm's **operational expenditure** had the highest disparity (difference between minimum and maximum): 70 percentage points, versus 30 and 45 percentage points for **levelized cost of energy** and **capital expenditure**, respectively.

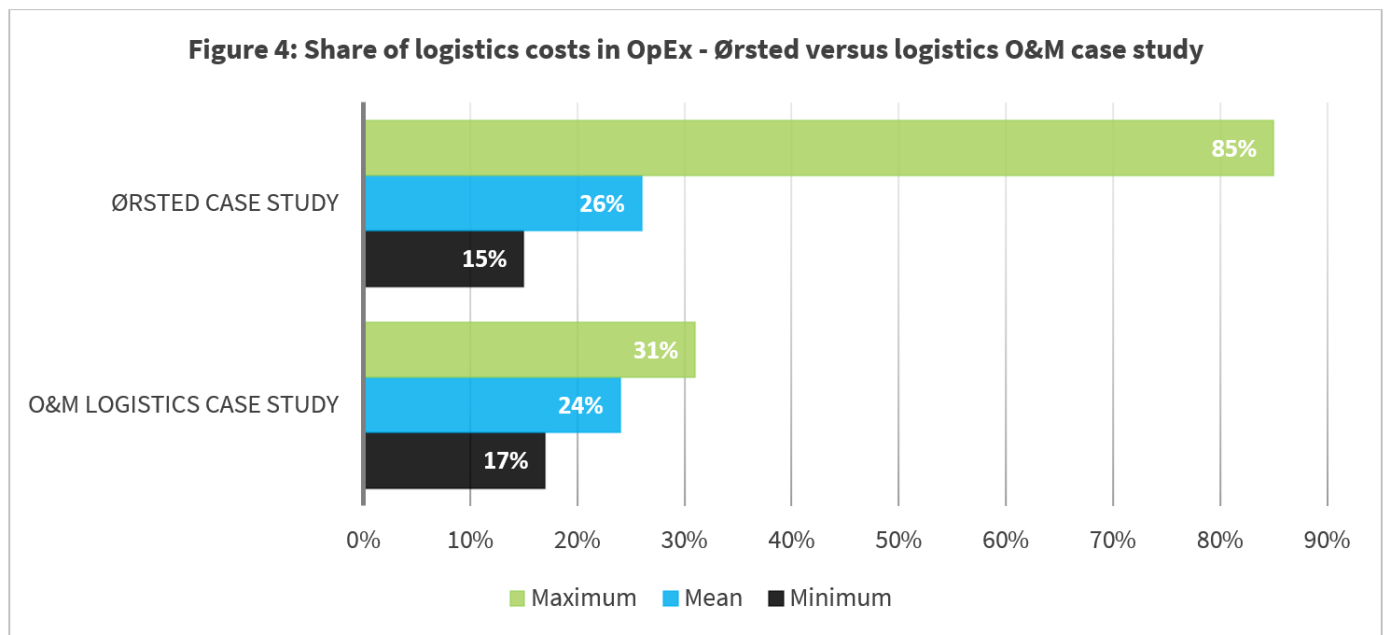


Source: Poulsen & Hasager (2016), Panticon analysis based on Figure 5

Therefore, the research project focused on performing a deep-dive investigation of the **operational expenditure**, the parameter with the highest disparity. A case study of operations and maintenance (O&M) in general, and **operational expenditure** in particular, was done. Denmark's Ørsted, global leader in offshore wind development and asset ownership, was the subject of the case study.

4. Reliability of results

The results of the O&M case study are shown in Figure 4 below. They confirm that logistics costs' share of operational expenditure is about 25%. At the same time, the case study reduced the disparity from 70 percentage points to a mere 14 percentage points.



Source: Poulsen (2018), based on Table 18. Comparison of the Ørsted versus logistics O&M case study results on logistics costs measured as a percentage of OpEx

5. Conclusion

An improved understanding of logistics costs in offshore wind requires that logistics is treated as a separate cost discipline. Prior to the global wind energy shipping and logistics PhD research project, the definition of offshore wind logistics had mostly been perceived from individual and narrow sub-segments of the offshore wind supply chain. Typically, offshore wind experts have a grasp of logistics in their isolated part of the offshore wind supply chain. By pointing out the costs at each phase of the offshore wind life-cycle and how logistics make up at least 18% of the **levelized cost of energy**, this *Offshore Wind Logistics brief report 2* gives such experts an overview of logistics costs across the entire offshore wind farm lifespan. This broad perspective highlights the significance of offshore wind logistics as a candidate for cost reducing measures as opposed to when offshore wind logistics costs are not measured and managed horizontally.

At the same time, by defining the cost of logistics in offshore wind as share of **capital expenditure**, **operational expenditure** and **levelized cost of energy**, this *Offshore Wind Logistics brief report 2* promotes comparing logistics costs at various offshore wind life-cycle phases. This is beneficial in at least two ways. First, it helps existing offshore wind industry players identify which logistics operations are cost competitive to perform in-house and which operations to outsource. Second, it helps potential offshore wind industry constituencies identify logistics operations which they are competent at and hence facilitate their competitive entry into the offshore wind industry. Eventually, this results in reducing overall LCoE.

References

1. Megavind (2015) <https://megavind.winddenmark.dk/sites/megavind.windpower.org/files/media/document/1500318%20Documentation%20and%20guidelines.pdf>
2. Poulsen, T. (2018). Logistics in offshore wind. Aalborg Universitetsforlag. Ph.d.-serien for Det Ingeniør- og Naturvidenskabelige Fakultet, Aalborg Universitet https://vbn.aau.dk/ws/portalfiles/portal/286674413/PHD_Thomas_Poulsen_E_pdf.pdf
3. Poulsen, T. and Hasager, C. B (2016).: “How Expensive Is Expensive Enough? Opportunities for Cost Reductions in Offshore Wind Energy Logistics”, *Energies*, 9 (6), 437; ; <https://www.mdpi.com/1996-1073/9/6/437>
4. Poulsen, T.; Jensen, C.M.; Hasager, C.B. (2017): “The Role of Logistics in Practical Levelized Cost of Energy Reduction Implementation and Government Sponsored Cost Reduction Studies: Day and Night in Offshore Wind Operations and Maintenance Logistics”, *Energies*, 10 (4), 464; <https://www.mdpi.com/1996-1073/10/4/464>
5. Poulsen, T. and Lema, R. (2017): “Is the supply chain ready for the green transformation? The case of offshore wind logistics”, *Renewable and Sustainable Energy Reviews*, Volume 73, Pages 758-771; https://vbn.aau.dk/ws/portalfiles/portal/270245059/1_s2.0_S1364032117301697_main.pdf

About Thomas Poulsen



Mr. Poulsen is a seasoned professional who has specialized in crafting strategy coupled with generating both tactical organic and strategic M&A driven growth for companies and organizations, mainly based on his experience in the shipping, transport, logistics, offshore wind, and supply chain industry. During his 30+ years in the business, Mr. Poulsen has lived in 8 countries namely his native Denmark, Indonesia (Jakarta), People's Republic of China (Shanghai), Singapore, Hong Kong (before hand-over to PRC), USA (New Jersey, California, and Florida), UK (London), and the United Arab Emirates (Dubai).

Abstract about Thomas Poulsen's PhD: Logistics in Offshore Wind

The PhD thesis is about offshore wind and focuses on logistics, broadly defined. As such, the research pertains to the offshore wind supply chain from the perspective of transportation and logistics tasks on land, through ports, at sea, and in the air. In addition, the research has dealt with logistics costs seen in relation to levelized cost of energy throughout the entire lifespan of an offshore wind farm project. The research has also dealt with the globalization of the offshore wind market, using China as the main example.

The results of the research have shown that logistics makes up a significant cost item within offshore wind. The results also revealed that it is important to organize logistics in an effective manner within those firms and organizations participating in the offshore wind industry. The eight academic articles which have been published as part of the PhD research project have been framed in the context of strategic management as well as the mergers & acquisition efforts forming part of the offshore wind industry as the market consolidation intensifies.

The research has been conducted in close collaboration with a series of leading offshore wind organizations and companies. The research was funded by Aalborg University and the Danish Maritime Foundation (Den Danske Maritime Fond) through grant number 2012-097.

What we do at Panticon

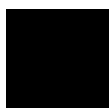
At Panticon, we are particularly strong in the Offshore Wind and Logistics sectors within our three core disciplines of **Strategic Management Advisory**, **Mergers & Acquisitions**, and **Market Intelligence**. We are mainly focusing on the business side to improve our clients' performance, create value in the long-term, and to create sustainable competitive advantages.

How we create value

- Tailor-made strategies
- Support M&A endeavours
- Share knowledge
- Analyse markets
- Advise our clients in every aspect of our three core disciplines



Strategic Management Advisory



Mergers & Acquisitions



Market Intelligence



Offshore Wind



Logistics



Panticon | Vivede Møllehuse 15, 4640 Faxe, Denmark

Web: www.panticon.com | **Email:** info@panticon.com

