NEARSHORE VERSUS OFFSHORE: COMPARATIVE COST AND COMPETITIVE ADVANTAGES

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Overview

Currently there exist high expectations for the development of wind energy, particularly in Europe, out of which offshore wind turbine developments will be central as tools to achieve current energy targets. The question between nearshore and (far)-offshore is particularly relevant, both because of increased public resistance due to visual disamenities produced by nearshore projects, and because of the potential cost reduction benefits attained by building wind farms closer to the shore.

Based on this need, an accurate analysis of the differences between costs and cost drivers for both offshore and nearshore is needed, as well as an exploration towards other possible factors that might affect the relative advantage of nearshore compared to offshore projects. We compare Danish nearshore sites with further ashore wind potentials in Denmark and elsewhere. Cost for nearshore is expected to be lower due to fewer costs of connection, foundation and to some extent operation and maintenance. This must be balanced by the less favourable wind conditions and the costs associated with public resistance. Carefully selecting the nearshore sites with low resistance and low cost characteristics can hopefully reduce the cost of expanding the offshore wind capacity in Denmark where there is considerably coast line as compared to the area of the country.

Methods

We define nearshore wind as turbines that are up to 15 km off the coast. The distance is not the only important cost driver but the one that is related both to cost advantages for nearshore development and disadvantage from public preferences against close to shore wind turbines. We begin by analysing the main cost drivers for offshore wind turbine projects, disaggregating by variables including site conditions (wind potentials, distance to shore, depth of sea bed) and construction variables (size of wind turbines, capacity, foundation types). Then we compare the influence of these drivers for both offshore and nearshore projects. Based on the Danish nearshore data we examine the cost ranges and compare to the cost ranges from several international sources and projections of LCOE.

Results

Preliminary results indicate that the shares of cost components are different for near-shore and far ashore wind farms, but the cost drivers are basically the same. Connection cabling etc. is a smaller cost share, but due to the more varying local conditions for connection, the distance from shore is less important as cost driver. The sear depth and wind conditions are the main drivers similar to far offshore, and the turbines/steel costs are providing similar cost impact for the two categories.

The ability to generalise the cost curves from a Danish sample of nearshore wind farm sites, was investigated but it is very difficult to characterise other potential sites in DK depending on the few cost drivers. The amount of local conditions affecting the optimal farm layout, seabed characteristic differences and connection costs seems to dominate the generalizable cost drivers. The connection costs for example vary more among nearshore Danish sites than between average nearshore and average offshore DK sites. We compare to international cost curves and simple LCoE figures for offshore wind farms. Figure 1illustrates the wide cost span of offshore cost levels for each of the studies referred to in the graph. Expectations have continuously been assuming a considerable cost reduction over time, but it is not clear whether this is expected to cover mainly the far off-shore projects in deeper waters. If cost decreases are expected to be dominated by foundation technology improvement and installation cost reductions the nearshore projects may benefit less.

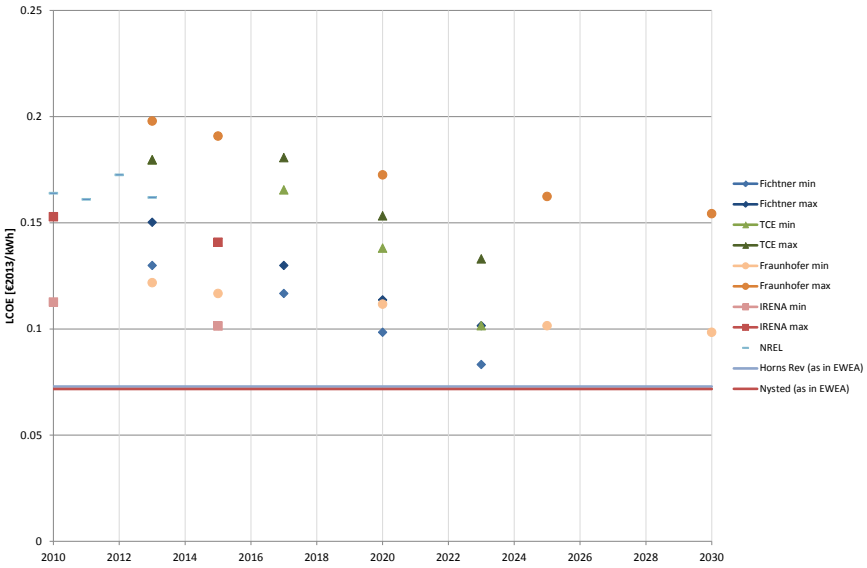

Figure 1 Comparison of cost estimates and ranges for offshore wind in the literature

The first Danish offshore wind farms also illustrated with the horizontal lines in the bottom of figure 1 provided very optimistic views on the cost levels for offshore wind. Later projections and experiences around Europe led to higher cost intervals experienced and only the most optimistic expectations for 2025 cost levels approach the first Danish experiences. Nearshore wind is expected to approach the level of costs of 7-9 c€/kWh but it is from our preliminary findings difficult to explain which is the main driver for the lower costs expected compared to the further ashore wind farms.

Conclusions

The nearshore potentials are smaller and possible wind farm sizing is also limited for some sites. However, there are still potentials with lower costs than further ashore sites. It is difficult to identify one main contribution as e.g. more shallow water as the source of expected lower costs based on a small sample of data examined for Denmark.

Furthermore, the smaller size of nearshore projects opens up the possibility for another advantage. Due to the general high share of upfront cost of offshore (both far and nearshore) wind projects, the smaller size of the nearshore projects makes financing easier, and therefore increases the amount of possible bidders. This produces a more competitive environment for the bidding process of the smaller nearshore projects that may allow new entrants into the offshore development and eventually pushes for lower prices.

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