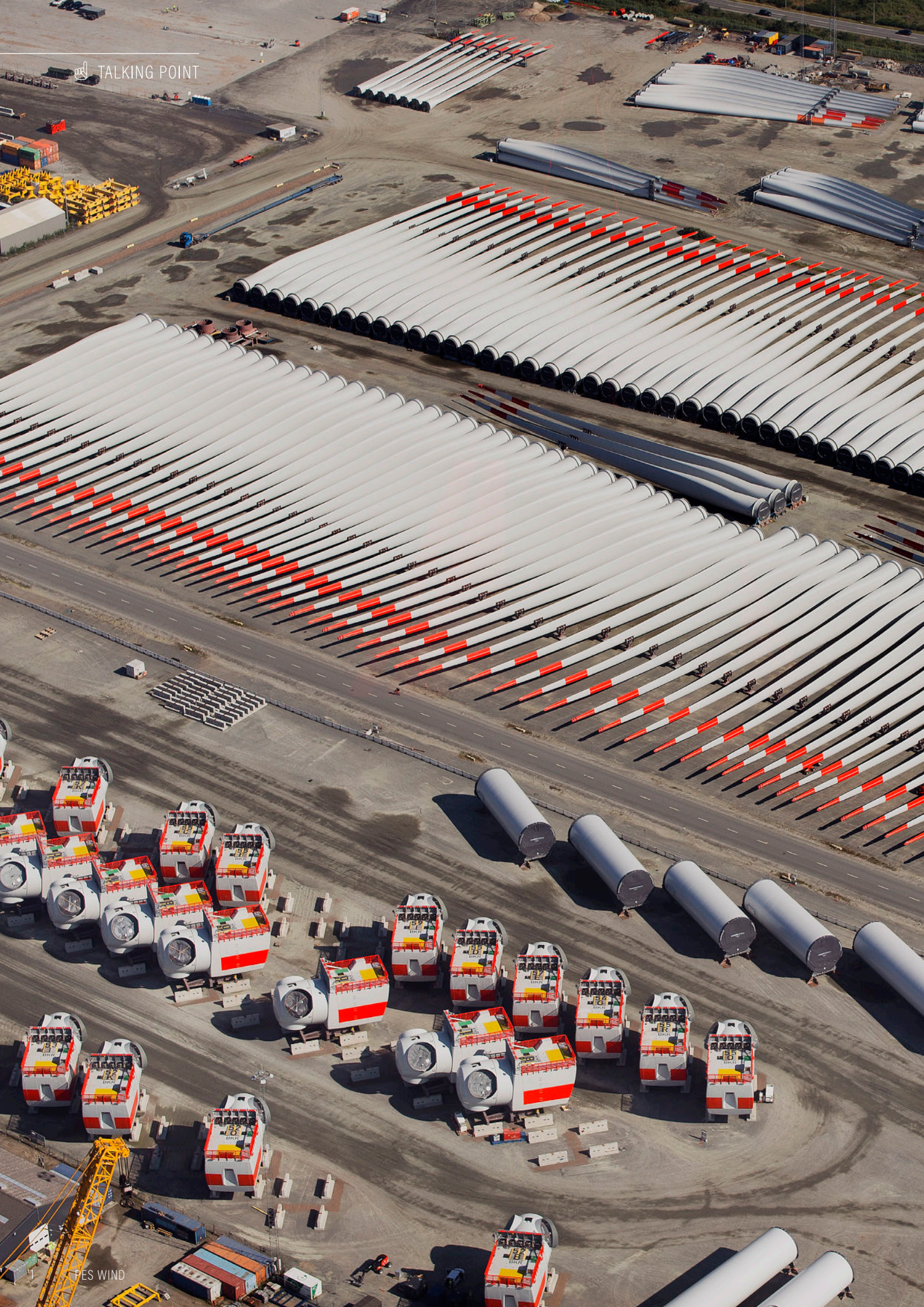

The challenge of scaling offshore wind ports

Words: Dennis Jul Pedersen, Director Port Esbjerg

Port Esbjerg exemplifies the evolving role of ports in the green transition by balancing offshore wind and emerging power-to-X industries. As one of the largest offshore wind ports, it underscores the necessity for ports to adapt their infrastructure and governance to meet new demands. Effective planning, investment, and collaboration are essential to support this transition and prevent project delays.

The supply chain must align with the strategies of decision makers. This principle is particularly applicable to ports, which act as essential hubs in the extensive networks that facilitate global trade. Currently, 80% of the world's goods are transported by sea, highlighting the critical role ports play in the global economy. In addition to this traditional function, many ports are now pivotal in the energy transition, serving as sites for the marshaling and preassembly of offshore wind installations.

This situation presents a new set of challenges, as these projects, by nature, are short term and often do not provide the long term lease agreements that justify heavy investments in port infrastructure. Adding to this problem is the rapid change in the size and weight of wind turbines and the even larger capacities needed to accommodate the larger installation ships. Constant upgrades of port infrastructure based on short term leases do not justify the scale up of offshore wind ports.

Conversely, the challenge of developing ports to industry needs is nothing new. The size of ships has grown with the trade volumes, and the construction of quays and dredging are included in numerous master plans from port administrations. Ports can be said to compete on location, price, and efficiency in addition to connections to the hinterland.

The future of offshore wind ports adds complexity to their role in supporting offshore wind installations. Preassembly sites must be capable of handling the weight of the towers, while the seabed must endure the static pressure from increasingly larger installation ships. Port infrastructure must be modified for each project, demanding that port administrations excel in project management. Constructing an offshore wind port that remains relevant for 20 to 30 years is unrealistic; thus, constant adaptation is essential.

Looking ahead, we must assume that in the coming decades, the largest markets for offshore wind will extend beyond European waters, shifting the focus away from European energy policy, which will have achieved its ambitious green transition goals. Therefore, a dual approach is necessary when planning offshore wind ports. The appeal of these ports lies in their proximity to future offshore wind farms and their capabilities, including expansive marshaling areas, reinforced quays, suitable water depths, and favorable seabed characteristics. These features support the intricate supply chain of service companies that need to operate within offshore wind ports.

Therefore, incorporating duality in planning for the power-to-x industry appears credible in master planning, though it poses several challenges. Securing consent for offshore wind farms can take five to ten years, and planning and executing large scale power-to-x plants may require similar timelines. This highlights the necessity for early collaboration between developers of offshore wind farms and power-to-x projects. It also underscores the importance of involving port administrations in the early planning stages, as port expansions necessitate comprehensive environmental impact studies.

The notion of an offshore wind port turning into a power-to-x hub raises many questions and concerns, the most obvious of which is the development of new business models for such ports. The primary revenue for traditional ports is from leasing areas, cargo tariffs, and ship dues, whereas some also engage in port services such as stevedoring, pilotage, and towage. Value-adding activities for offshore wind require other competencies, such as the ability to perform preassembly activities. Similarly, this applies to power-to-x plants, which most ports have no experience in operating.

The choice for ports is best illustrated by comparing a terminal for modular goods with offshore wind and power-to-x requirements. A terminal for modular goods can handle 1.5 mio. tons of cargo in an area of 10 ha., whereas installing 1 GW of offshore wind will require a marshaling area of 40 ha. for the turbine parts alone with a total weight of less than 1 mio. tons. Hence, at the outset, conventional cargo handling provides the most profitable option for ports. This may be the epitome of the scarcity of offshore wind ports, and similar challenges may apply to the future of power-to-x.

Greenfield port developments enable parties to collaborate from the early planning phases, though this may be the most expensive option. Rejuvenating port areas near offshore wind farms offers tailored solutions and allows port administrations to make the investment decisions that the offshore wind industry needs. However, port administrations face challenges when offshore wind and power-to-x projects compete for the same areas.

This raises the question of whether the scarcity of port space for offshore wind also hinders the development of power-to-x projects. Ports supporting both offshore wind and power-to-x must be adaptable, flexible, and cooperative. Rejuvenating port areas to support individual offshore wind projects requires ingenuity while developing power-to-x terminals for handling commodities like hydrogen, ammonia, and methanol necessitates collaboration with specialists. Therefore, port administrations need to study these industries and engage with stakeholders.

For example, Port Esbjerg has supported the installation of 59 offshore wind farms since 2001 and is one of the largest offshore wind ports globally. Additionally, large power-to-x plants are currently being planned. The Port serves as a true energy hub, having supported the Danish oil and gas industry for the past five decades. To accommodate increased activities, the Port has expanded its capacity to support the installation of 4.5 gigawatts of offshore wind annually. Nonetheless, its readiness for transformation has been crucial to its steady growth and status as one of the largest offshore wind ports in the world.

The supply chain for offshore wind is well developed, with around 60 service companies forming a robust cluster. Many of these companies have transitioned from primarily oil and gas activities into the offshore wind sector and are now also entering the power-to-x industry. Their ability to adapt is a significant competitive advantage, and they maintain close collaboration with the port administration. The positive socioeconomic effects of this strategy are evident.

Therefore, the strategy and operation of offshore wind ports differ significantly from those of conventional ports. While the competitive factors for conventional ports are price and productivity, offshore wind ports must also emphasize flexibility, collaboration, and readiness for change.

Additionally, future green energy ports must develop new value-adding activities. Initial progress is evident with many ports now providing onshore power supplies to visiting ships, creating new revenue sources while reducing greenhouse gas emissions. The future of bunkering green fuels may offer similar opportunities.

Discussing the transition from offshore wind to power-to-x is crucial to avoid repeating the current scarcity of offshore wind ports, which risks delaying vital green transition projects. While port administrations bear the responsibility for readiness, collaboration among all stakeholders is essential for plans to mature.

The need for port infrastructure is clear, and securing funding or attracting investors is a critical task for many port administrations. However, it is the combination of the meta-system, supply chain, and governance that builds the complete ecosystem of the port.

The possibility of coupling strategic master plans with the plans for offshore wind and power-to-x developments will be paramount for decision makers within the ports, albeit it is the change readiness of the supply chain within the port that builds the competitiveness of the ecosystem.

The ecosystem at Port Esbjerg can be simplified as a meta-system that includes the available supply chain, the expanding market, political targets, and the port's location near offshore wind developments. Within this meta-system, the port's supply chain must be competitive and efficient to stand out among other ports with similar advantages.

However, a meta-system and supply alone are insufficient unless port administration promotes change readiness and invests in capacity. Such investments will boost supply chain opportunities, resulting in socioeconomic benefits and fulfilling the demands of the offshore wind and power-to-x industries. In essence, the port administration must recognize and incorporate all elements within the port ecosystem to create a business model that supports and engages in the green transition.

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