MARITIME INDUSTRY DECARBONISATION SYMPOSIUM 2025 (IMAResT At the University of Strathclyde)

WET STORAGE AT CONSTRUCTION PORTS FOR FLOATING OFFSHORE WIND TURBINES

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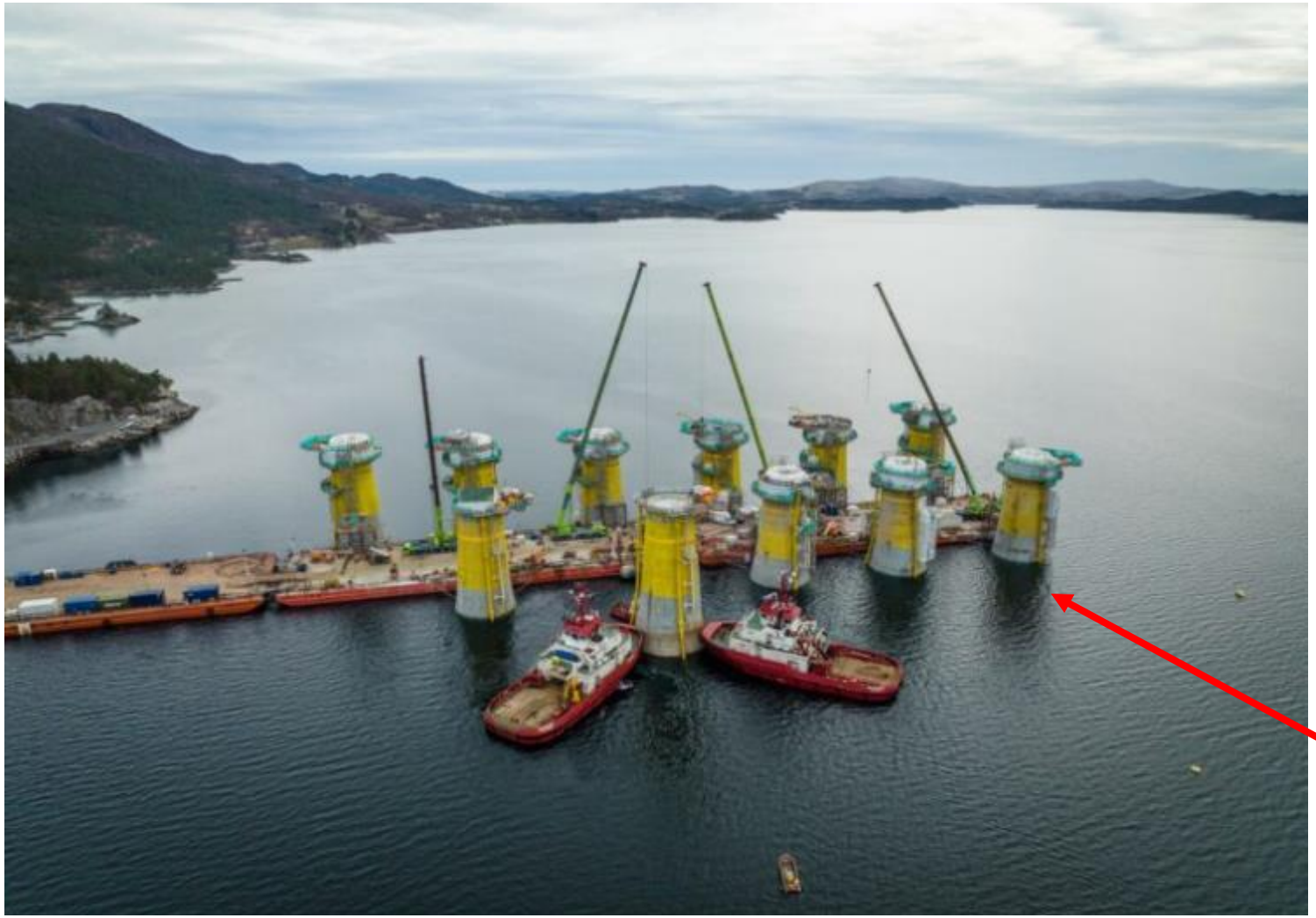
HYWIND TAMPEN [11]



What is wet storage? Floating wind turbines need to be assembled and temporarily stored in ‘wet storage’ areas prior to being towed out to their intended position. [1].

Substructures moored to spacer barges

HYWIND TAMPEN [11]

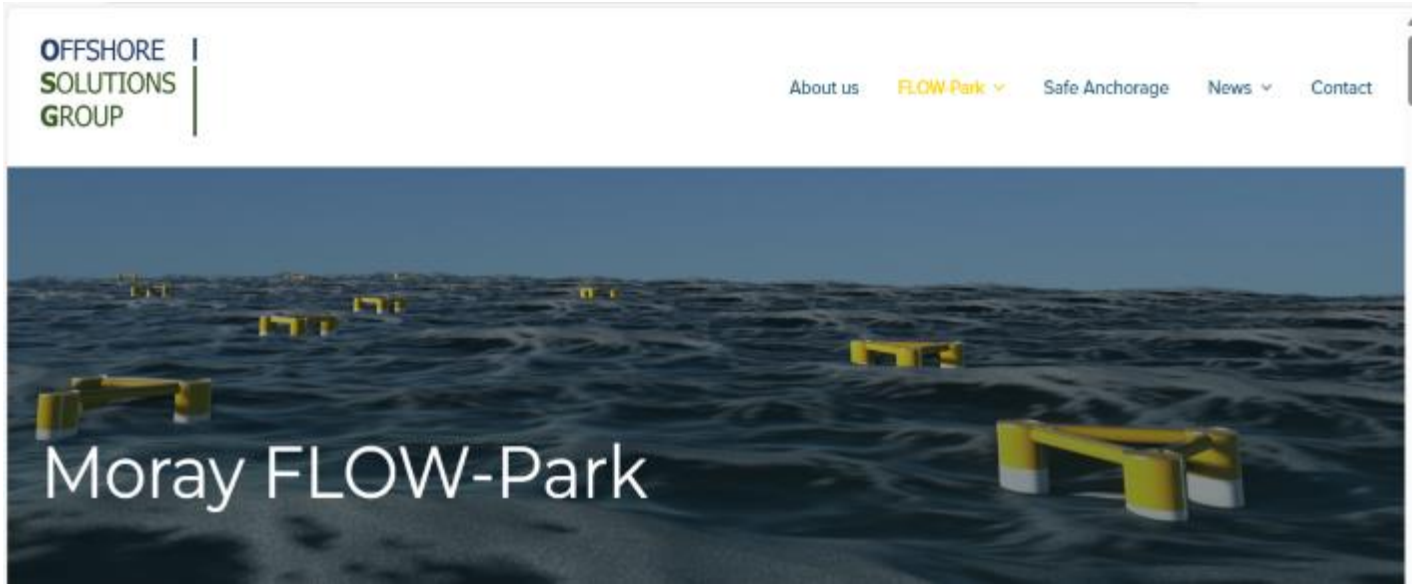
Substructures in wet storage. Before fitting Topsides (temporary moored to seabed)

Floating wind structure moored to spacer barge

Spacer barge moored to quay

HYWIND TAMPEN [11]

Completed floating wind structure
in wet storage before towing offshore
(moored to seabed)



The Moray FLOW-Park, [22], aims to provide temporary safe anchorage (wet storage), for FLOW assets thus optimising risk management and logistics during the assembly, wind turbine generation (WTG) integration and deployment process.

Over the next few years a series of detailed technical studies and surveys, including offshore surveys, will be undertaken to determine the final extent of the FLOW-Park area and the technical details of the development. In parallel with the technical studies and surveys, there will also be a series of necessary environmental studies and a programme of detailed stakeholder and consultee engagement.

A range of potential social/human and ecological impacts will need to be assessed when consenting to wet storage projects.

Broadly speaking, these might encompass visual, cultural/heritage, birds, underwater noise as a result of installation techniques, marine mammals (for example, potential impacts on seal haul-outs or disturbance in the marine environment), and seabed habitats to name a few.

There is also potential for impacts on existing offshore industries such as commercial fisheries and shipping and navigation that will require assessment..

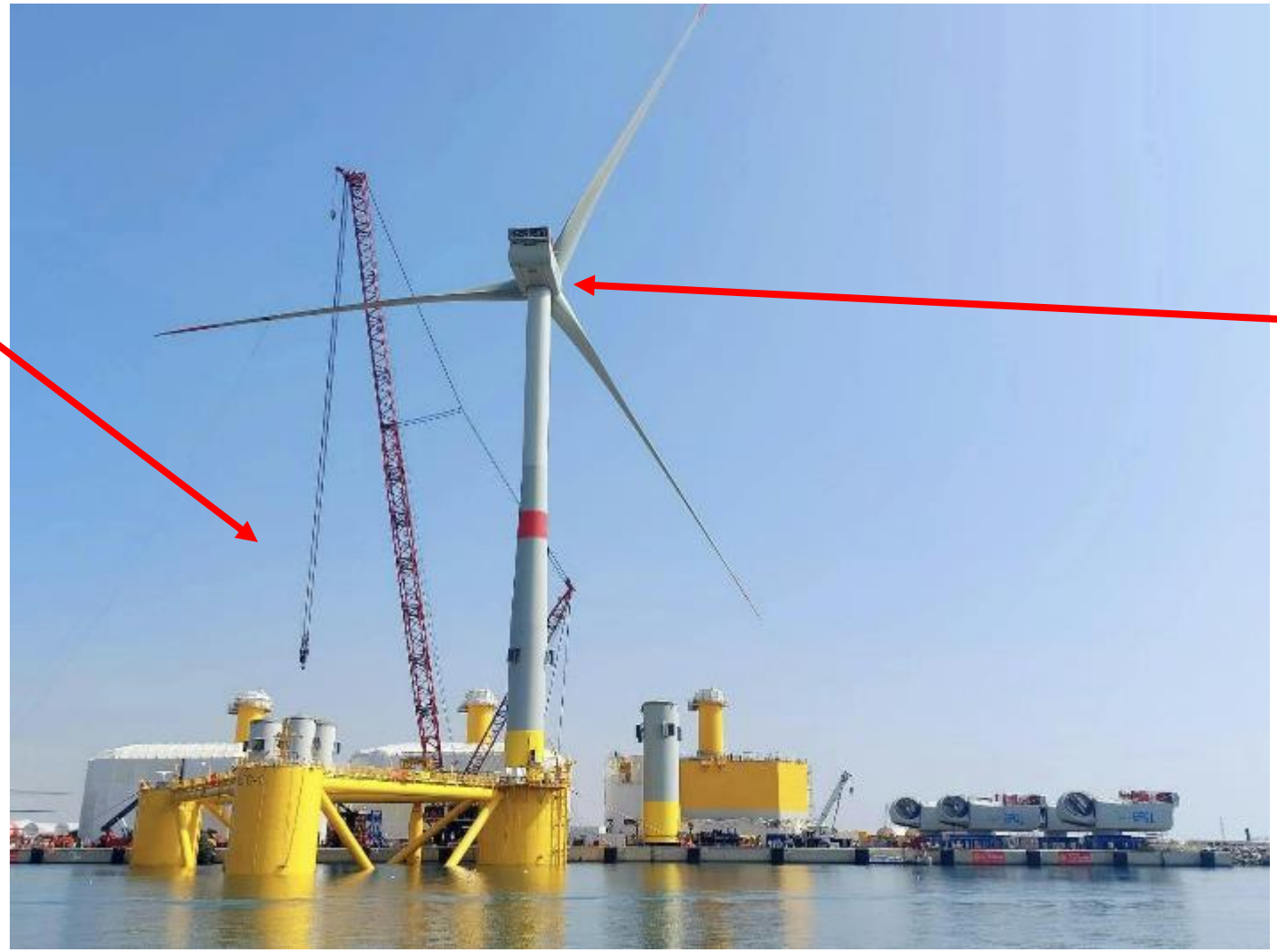
TUGDOCK [3]

Wet storage for floating offshore wind is a key component to fit out port selection.

SOUTH OF FRANCE TLPs [22]

WTGs (and their associated substructures) will need to be temporarily stored in port until deployment becomes possible during an appropriate weather window, [2] and [3]

SOUTH OF FRANCE SEMI SUBMERSIBLES [12]



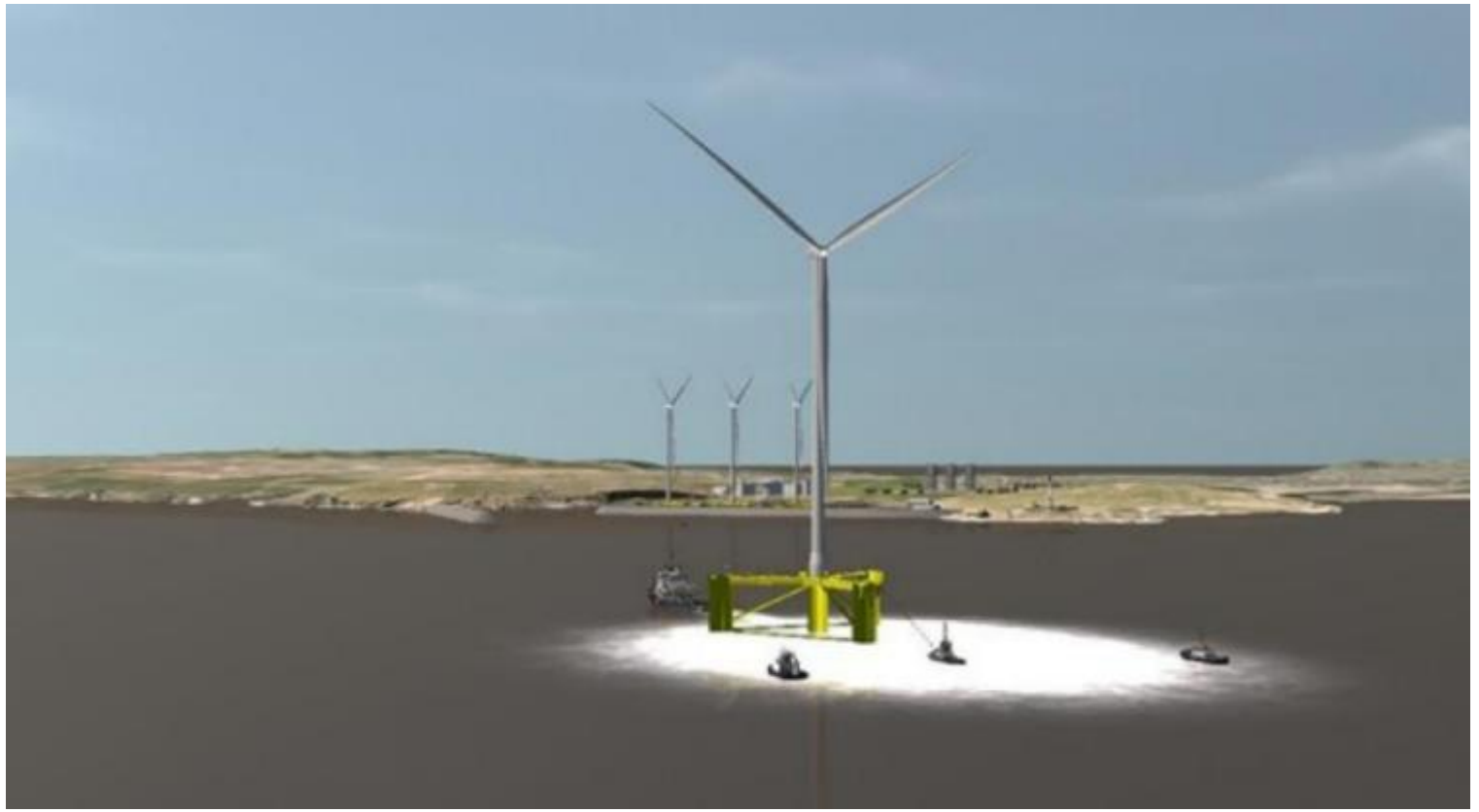
Why is wet storage likely to be necessary for many regions?

•A harsh wave climate will result in narrow weather windows for FOWT installation.

• Locations with such weather restrictions will almost certainly require an additional lay-down area during installation.

• FOWTs will need to be temporarily stored in port until deployment becomes possible during an appropriate weather window.

A review, [4], shows that temporary wet storage is crucial to the successful delivery of large-scale floating wind projects, and adds significant value to local economies. However, it also highlights that suitable locations are extremely limited, and calls for more developers, ports and yards to get involved in the initiative.



Wet storage is needed to provide assembly and integration because the majority of UK port facilities don't have space to store enormous FLOW base units at their quaysides. Without wet storage, schemes are unlikely to be delivered on time due to unforeseen production delays and limited weather windows for installation at wind farms. As part of its work to facilitate wet storage, the highlights are:

- Developing wet storage areas will provide social value and support local economies. Each site could support jobs in the project lifetime, 75% of which can be delivered locally.
- Location options for wet storage sites are extremely limited..
- Consenting, licensing, and insurance compliance are highly complex and untested areas that will require intensive industry engagement.
- Collaboration with the offshore insurance industry is key when it comes to site development. The floating wind industry needs to demonstrate that having wet storage significantly lowers project risk and subsequent insurance premiums.

Storing inside the port quay, [6]

Inshore anchorage, [7] in-shore anchorage to be the temporary storage of large marine infrastructure in inshore waters using anchoring systems. Main components:

- Floating substructure pre-turbine integration, and
- Floating substructures with integrated turbines and cables.

Activities undertaken in the course of inshore anchorage may include:

- Installation of moorings
- Transport and mooring of floating substructures (pre/post-integration)
- Integration of turbines
- Pre-commissioning
- Maintenance and repair

Project stages:

- Construction, integration, and installation, and
- O&M

Wet Storing just outside the port [12]

Definition of wet storage/inshore anchorage

- Understood wet storage/inshore anchorage is only foreseen to be required for floating offshore wind projects.
- Required for the construction and the Operation and Maintenance (O&M) phases of the projects. Not only required to provide a stock
- Buffer for construction but also to free-up port quayside by moving the final integration to the wet storage area.
- Wet storage/inshore anchorage is the temporary storage of floating substructures or completed structures.
- Temporary wet storage may take place in port authority limits, and/or designated storage area.

Foreseen key wet storage/inshore anchorage requirements and operations

- Locations should be close to final assembly/integration port(s) and the projects to optimise transport cycle times.
- Locations should be sheltered areas with negligible sea states to prevent the structure from experiencing unnecessary motions

Facilitate (un)mooring operations and crew transfers for commissioning and/or repair works.

- Generic mooring for barges, TLP and semi-submersible (if possible) is advised. If not possible, then sufficient mooring options for different types of floaters will be required.

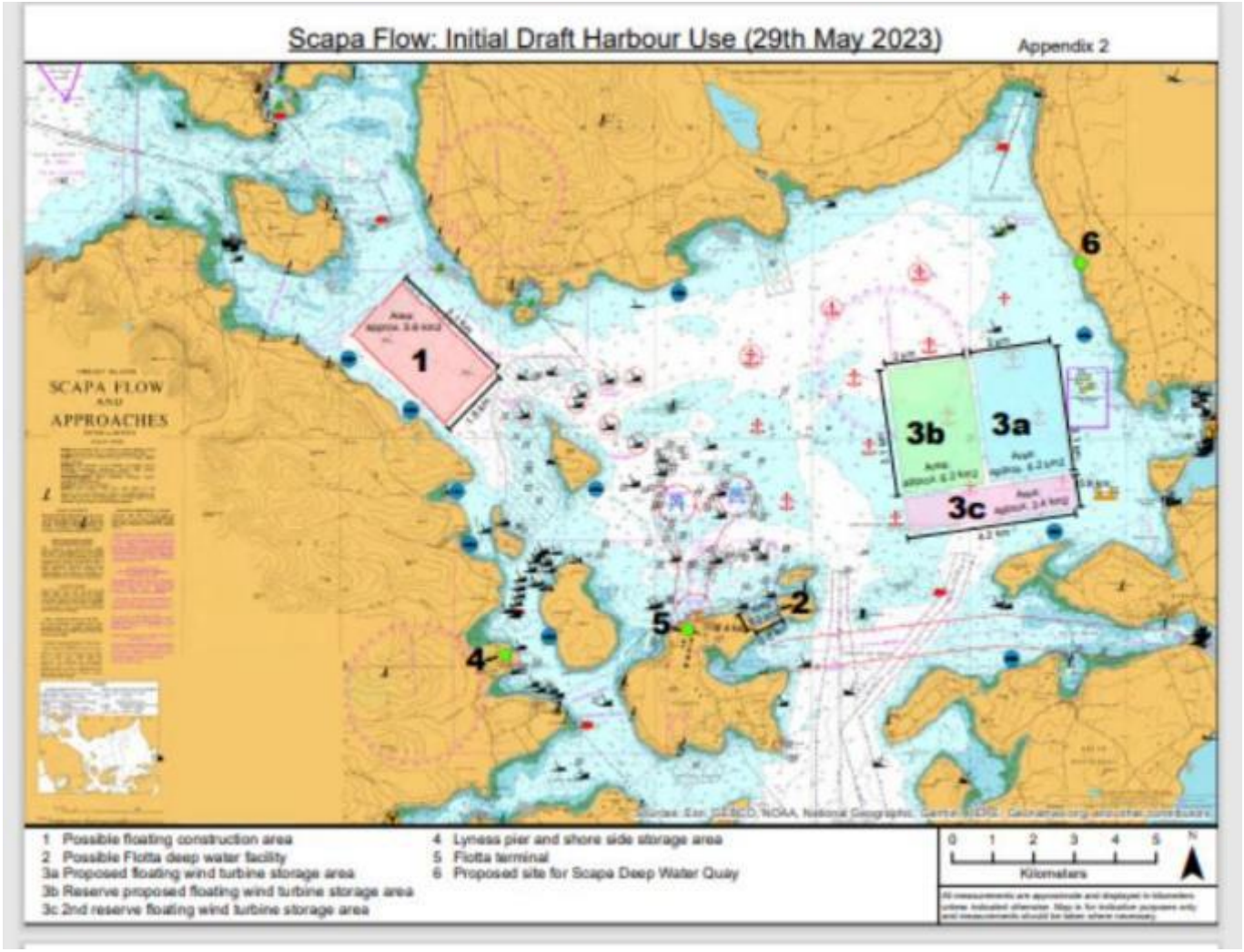
- Assembled floating units are towed to the storage site or offloaded from a heavy transport vessel and connected to a pre-installed mooring system.
- During temporary storage, assembled WTGs and floating foundations will be placed in idle mode and connected to auxiliary power (generators on substructure, or similar).
- During temporary storage, there is no foreseen requirement to pitch blades (TBC) – they will be stored in a fully closed position. During the temporary storage, rotors will periodically be moved slowly at very low speeds to protect the WTG bearing. Specific speeds are not known at this stage.
- The expectation is that activities would include regular maintenance checks on the components, minor repair works and, potentially, some pre-commissioning work on either the foundation and/or the WTG and periodic rotation of blades. Relevant to construction and O&M.
- Details such as the number of floaters at any one time in port wet storage, storage duration, and the areas required will depend on the construction and operation timelines, project-specific requirements, port/harbour capacity, and supply chain

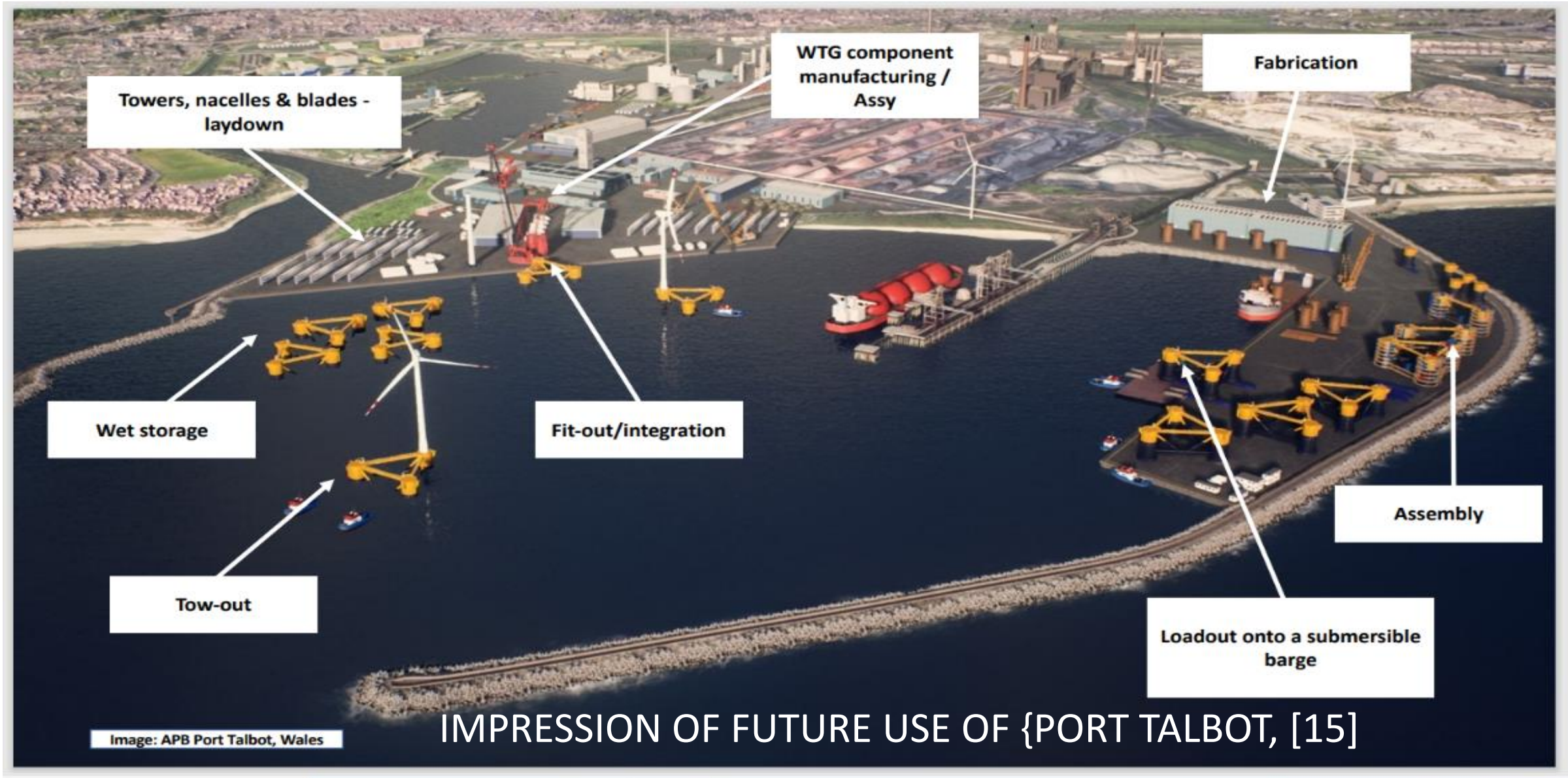
UK POSSIBLE FLOATING WIND FIT OUT SITES WITH LOCAL WET STORAGE SITES:

> Cromarty Firth
> Scapa Flow
> Port Talbot

Cromarty Firth could become wet storage base for dozens of floating wind structures, [18]

SCAPA FLOW, [19], [20]





IMPRESSION OF FUTURE USE OF {PORT TALBOT, [15]

Different Floaters = Different Needs/Requirements

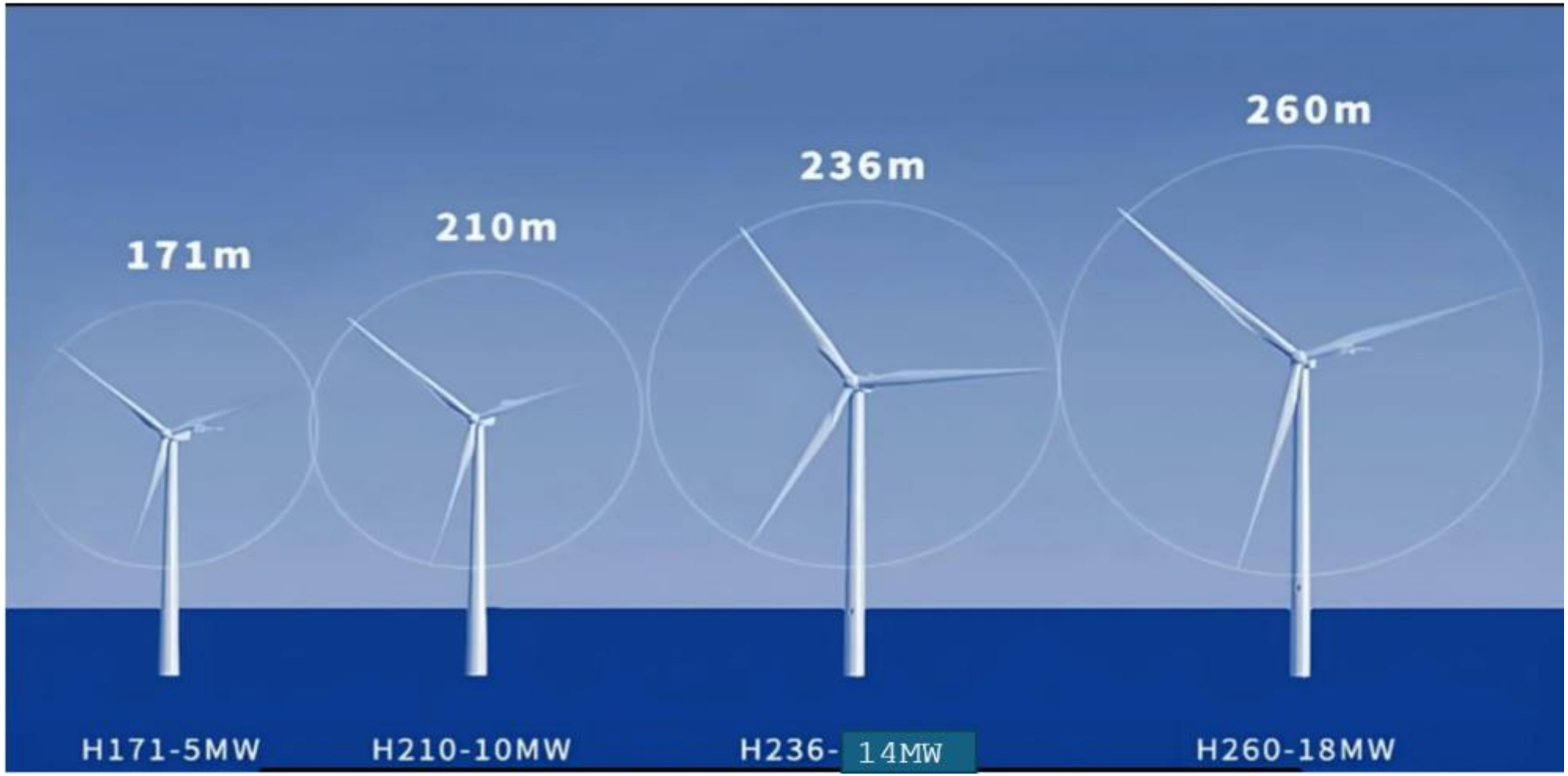
Semi-sub	Barge	Spar	TLP

• Draught 10-12m (steel)
• Draught 12-15m (concrete)
• WTG on corner/side to optimise onshore crane capacity
• Drydock float out may need temp buoyancy
• 2,500-5,000 tonnes
	• Draught 6-8m (steel)
	• Draught 10-12m (concrete)
	• Suitable for shallow draft ports
	• Assy of structure performed onshore
	• 2,000-4,000 tonnes
		• Draught 70-80m (steel)
		• Draught 80-90m (concrete)
		• Complex assy & T&I – needs a Fjord!
		• Large SSCV needed to instal WTG in sheltered deep water location
		• 2,500-5,000 tonnes, pre-ballasted
			• Draught 10-12m (steel)
			• Negative to low stability making assy complex, some options:
			  • Temp buoyancy
			  • Build offshore using crane vessel with active heave compensation

POSSIBLE FLOATING WIND TURBINES

POWER	ROTOR	ADD ABOVE	TIP ABOVE	HUB ABOVE
	DIA.	WATER	WATER	WATER
MW	M	M	M	M
5	171.0	30.0	201.0	115.5
10	210.0	30.0	240.0	135.0
14	236.0	30.0	266.0	148.0
18	260.0	30.0	290.0	160.0

WIND TURBINES FOR FLOATING WIND [21].
(Rotor diameters shown, add 30m to get the tip height)



Conclusion

- Have a clear port strategy, but one that is incorporates the wider port infrastructure available
- Look at the current state of the port, what dredging is any
- Carefully understand the needs / requirements and timescales
- Develop a strategy to maximise port and laydown area
- Consider working in clusters?
- Understand the floating technologies and the project pipelines
- Engage with developers, help them in their development process
- Obtain the necessary confidence to make port expansion / modification decisions

THANK YOU FOR YOUR ATTENTION

ANY QUESTIONS

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