PTSC MECHANICAL & CONSTRUCTION

SOLUTIONS FOR THE OIL & GAS INDUSTRY

Offshore Wind Supply Chain Opportunities for Provinces

30th Nov, 2022

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2. PTSC M&C paves the way for local supply chain
3. Opportunities in other coastal provinces
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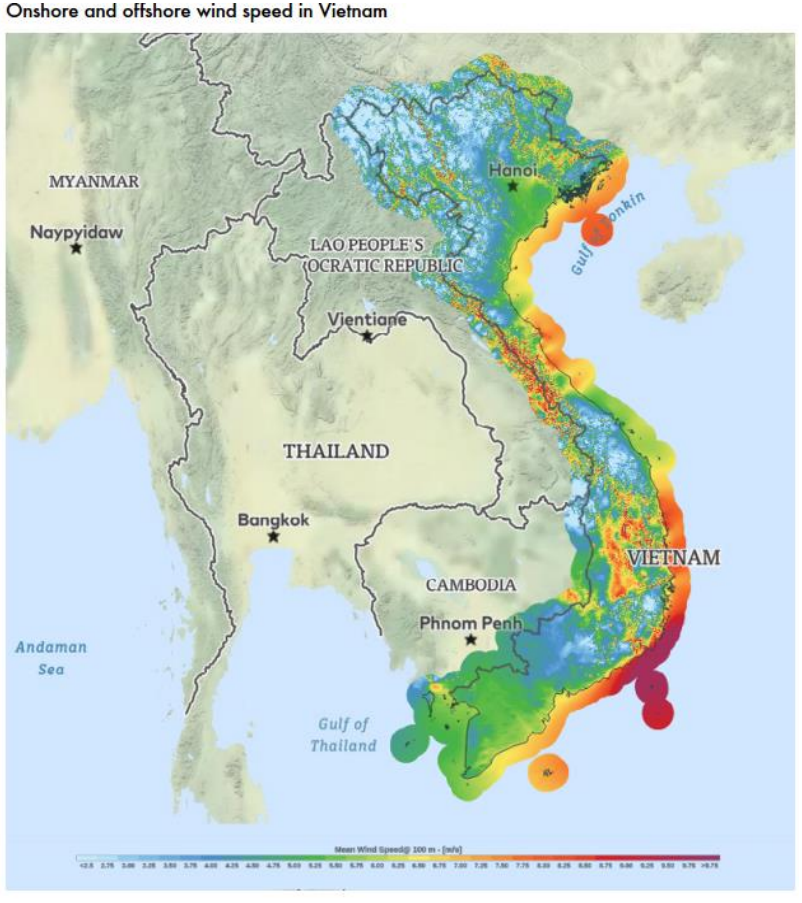
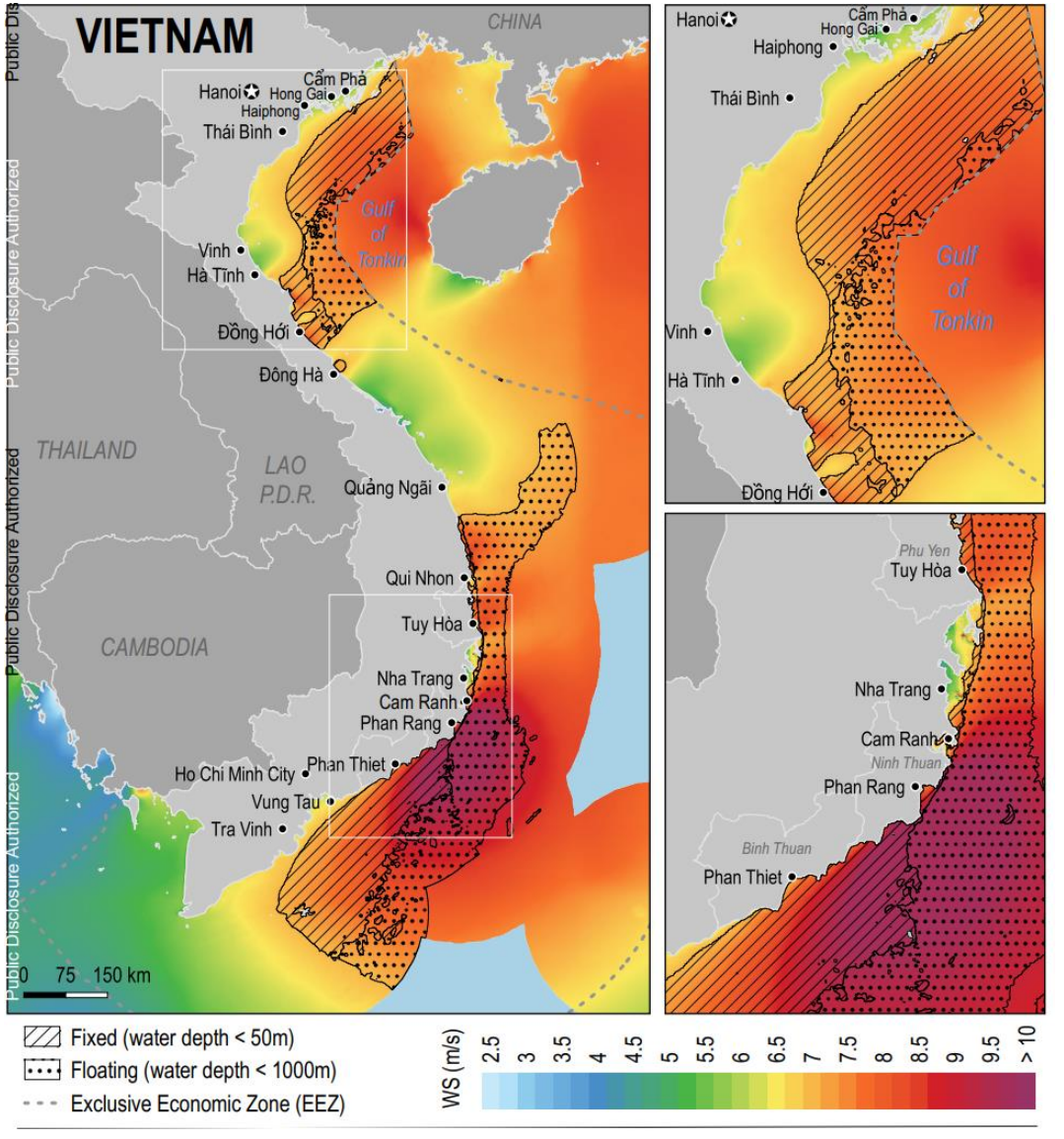
1. Background

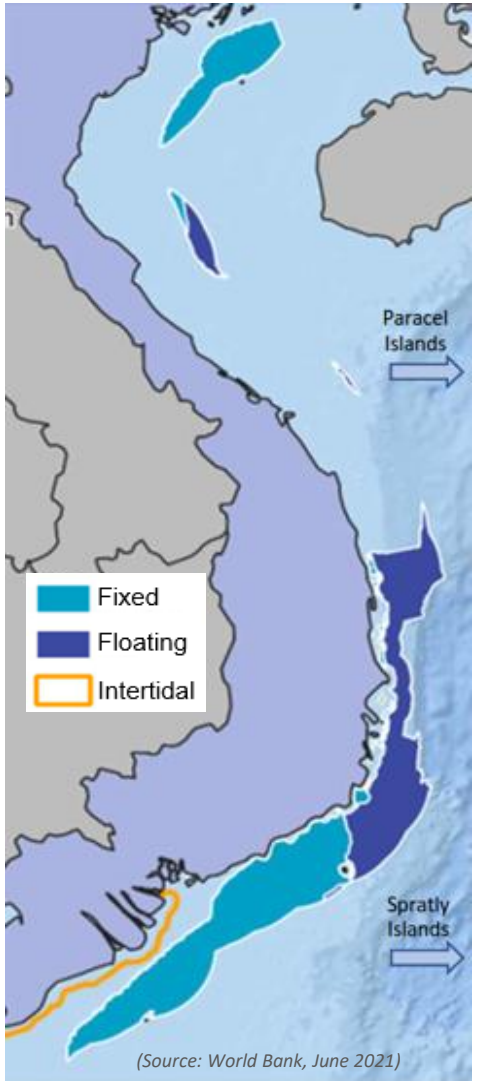
- WBG estimated that the offshore wind technical potential is 599 GW (261 GWs for fixed and 338 GWs for floating).
- DEA has identified 160 GWs *(130 GWs for fixed)* of non-exhaustive technical potential sites for offshore wind.



(*) Onshore and Offshore wind speed. Source: Global Wind Atlas



Fixed & Floating Foundation

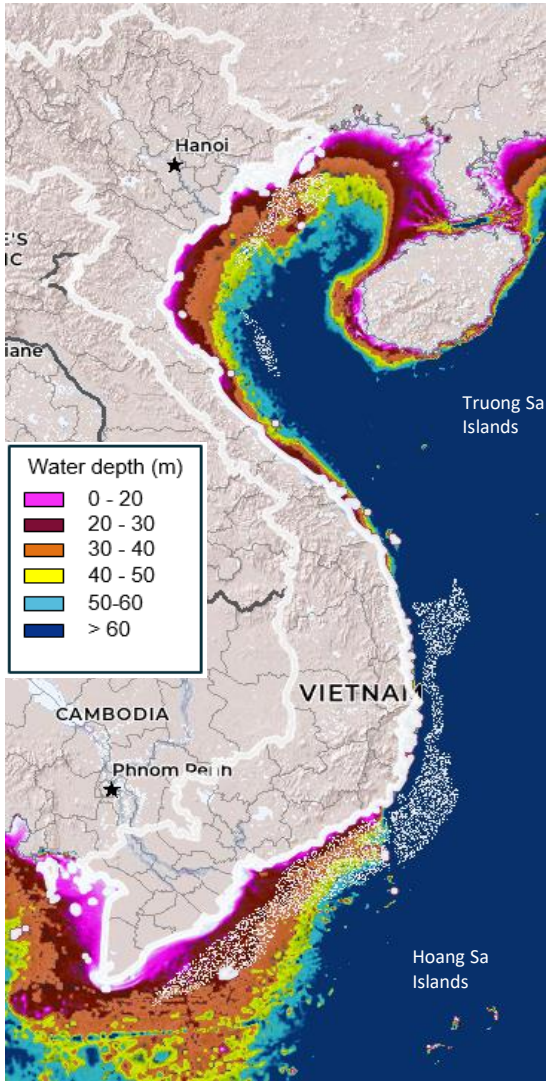


WATER DEPTH

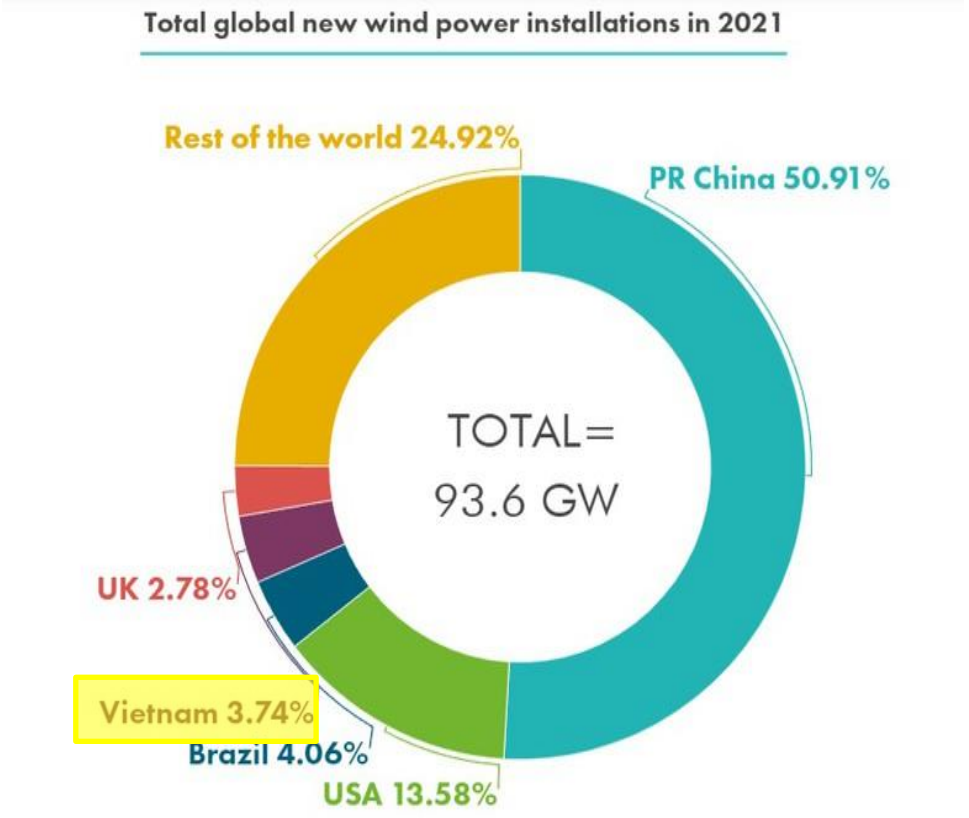
FOUNDATION	DEPTH [m]	CUM 2012	TREND 2020	COMMENTS
Gravity-based foundations (GBF)	<20[1)]	21%		Currently only used in shallow water; however, new GBF concepts could have potential for renewed future application up to 40 meters
Monopile	10-30[1)]	75%		Remains most widespread foundation type. Limitations in water depth and weight are increasingly being overcome with new concepts
Tripod/-pile	25-50	2%		High production costs due to complex structure and great weight are likely to limit use of both concepts
Jacket	20-60	2%		Jackets will increase their share due their flexibility and low weight (40-50% less steel than monopiles), commercially worthwhile >35 m
Floating	> 50	<1%		Currently at R&D stage, but could become relevant for countries with steep shores. No commercial use expected before 2020

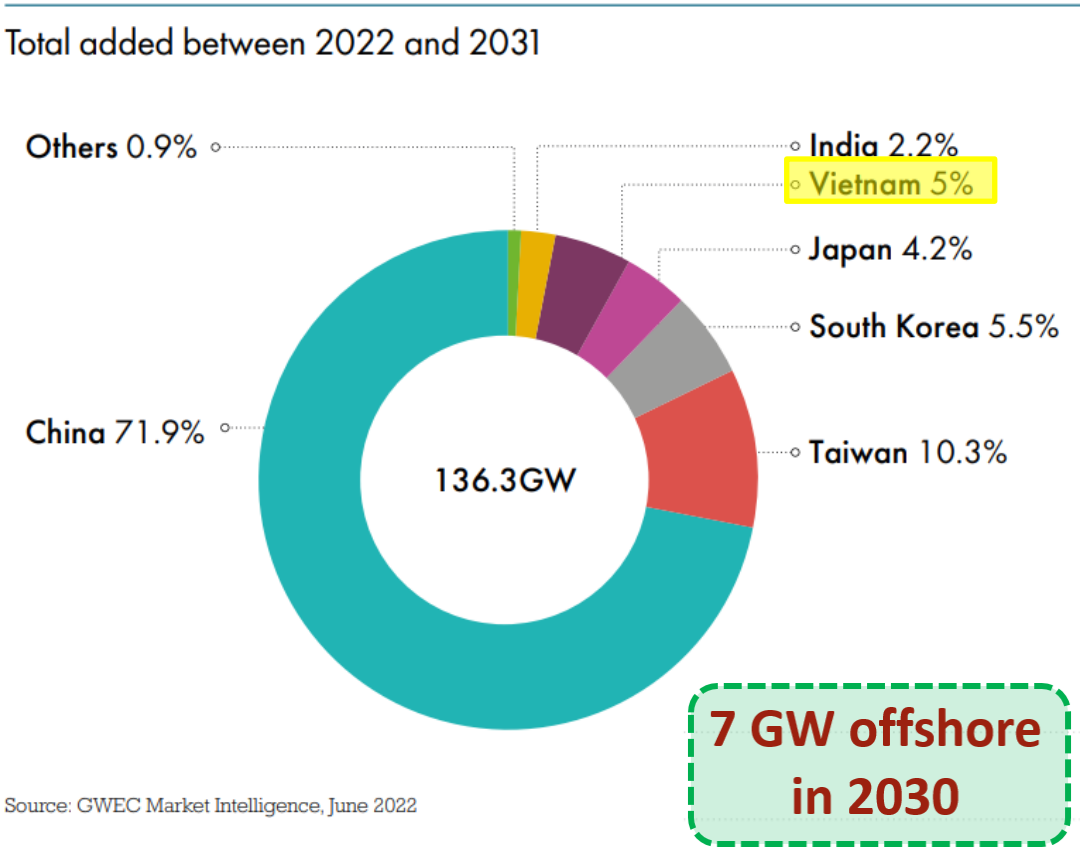
1) Up to 40 m with new concept

- ❑ **The fixed foundations will be distributed at water depth ranging from 20m to 60m**
- ❑ **MONOPILE may be a governing solution for water depths from 20 to 30m. However, considering large WTG capacity (> 10MW), Tripod/TriPile or even Jacket may be a suitable substitutions.**
- ❑ **JACKET type substructure is preferable for water depth range from 30m to 60m.**



Vietnam Wind Power installation: 2021-2031





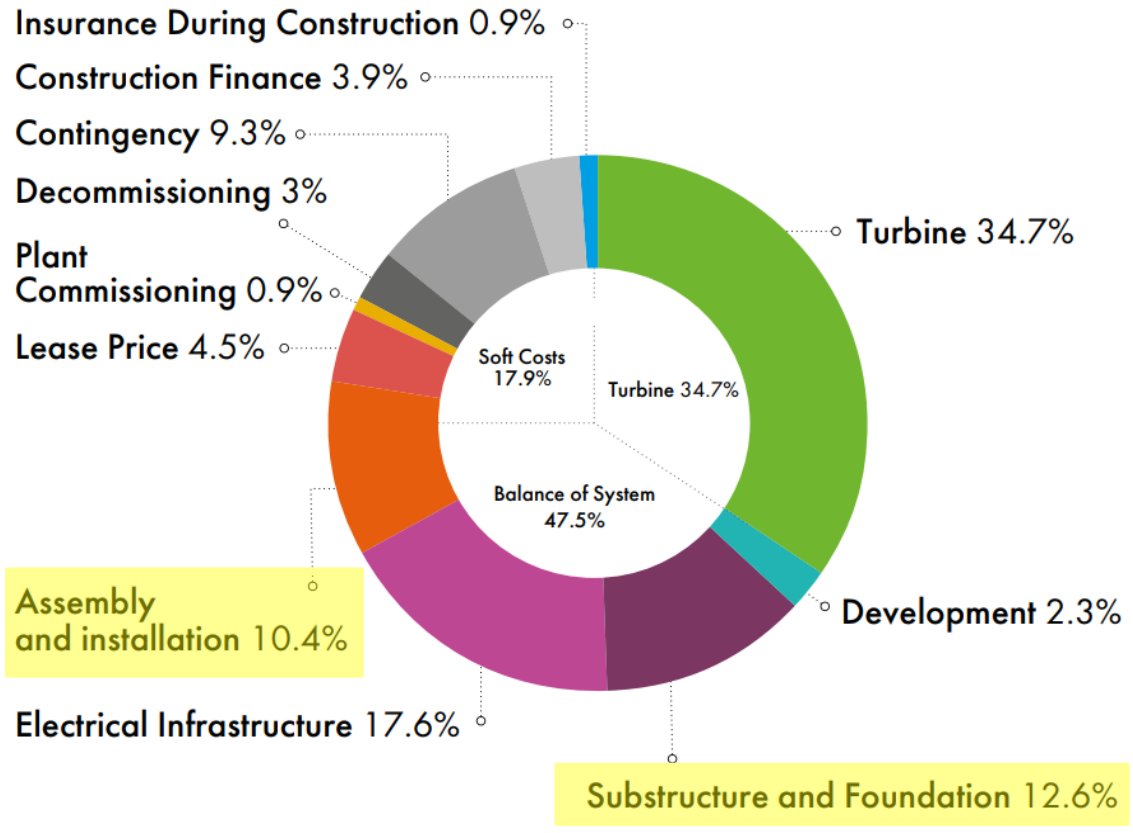
7 GW offshore in 2030

New offshore wind installations in 2021:

- ❑ Vietnam (779 MW, *intertidal only*)
- ❑ Taiwan (109 MW)

Balance of Plant (BOP) Scope

CAPEX for typical fixed-bottom offshore wind farm, 2020



Source: 2020 Cost of Wind Energy Review, Tyler Stehly and Patrick Duffy, National Renewable Energy Laboratory, 2021.
Note: The reference project represents a typical 600 MW fixed-bottom offshore wind project comprising 75 wind turbines at 8.0 MW each, operating for 25 years with no major O&M events.

- ❖ EPCI for Offshore Substation
- ❖ EPCI for WTG foundation
- ❖ Logistic/ Offshore installation for WTG
- ❖ O&M
- ❖ Decommissioning

EPC value of BoP scope for a 500 MW Offshore Wind Farm ~ 300 Mil. USD

EPC for BoP Vietnam market volume

- ~ 4.2 Bil. USD/ 7GW - 2030
- ~ 42.9 Bil. USD/ 71.5 GW - 2045

Can we do in Vietnam?

Offshore Wind Manufacturing and Construction Ports in Vietnam

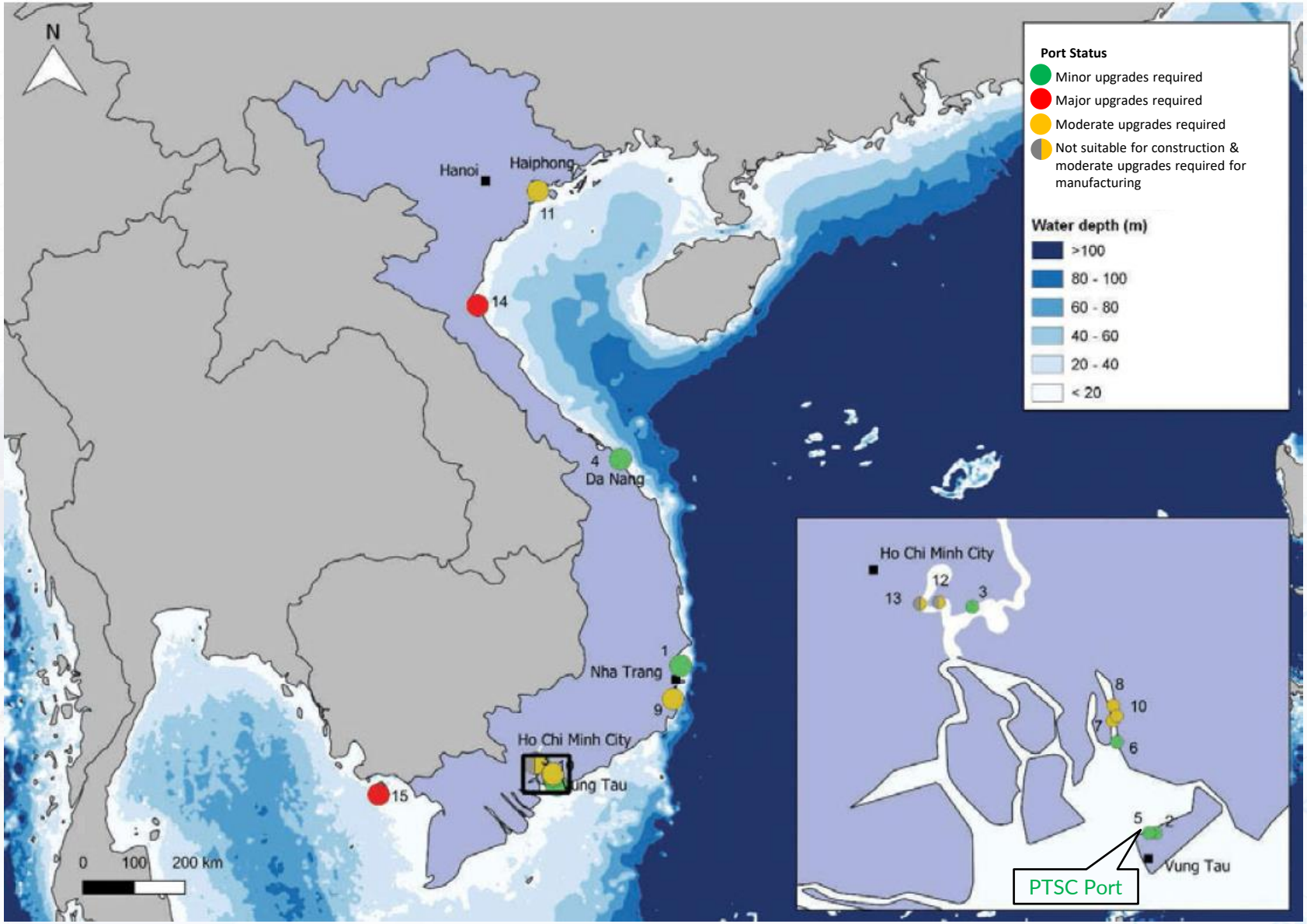
- Vietnam has more than 3,000 km coastline with a number locations that are the potential to supply for the offshore wind industry;
- Vietnam has Oil & Gas Industry. There are many resources and skills that are transferable from offshore O&G to wind such as engineering & designing (E); supply chain management (P); building jackets and substations (C); lifting and handling large objects safely on shore and offshore (I)…

#	Port	Suitable for construction	Suitable for manufacturing
1.	**Huyndai Vinashin Shipyard** (Nam Van Phong)	Suitable with minor upgrades	Suitable with minor upgrades
2.	**Vietsovpetro Port** (VungTau)	Suitable with minor upgrades	Suitable with minor upgrades
3.	**Tan Cang Cat Lai Terminal** (Ho Chi Minh City)	Suitable with minor upgrades	Suitable with minor upgrades
4.	**Tien Sa Port** (Da Nang City)	Suitable with minor upgrades	Suitable with minor upgrades
5.	**PTSC Port (*)** (Vung Tau)	Suitable with minor upgrades	Suitable with minor upgrades
6.	**Tan Cang–Cai Mep Terminal** (Ba Ria)	Suitable with minor upgrades	Suitable with minor upgrades
7.	**Thi Vai General Port** (Phu My)	Suitable with moderate upgrades	Suitable with moderate upgrades
8.	**SITV** (Phu My – Ba Ria Vung Tau)	Suitable with moderate upgrades	Suitable with moderate upgrades
9.	**Cam Ranh Port** (Khanh Hoa Province)	Suitable with moderate upgrades	Suitable with moderate upgrades
10.	**PTSC Phu My port** (Phu My– Ba Ria Vung Tau)	Suitable with moderate upgrades	Suitable with moderate upgrades
11.	**PTSC Dinh Vu** (Hai Phong City)	Suitable with moderate upgrades	Suitable with moderate upgrades
12.	**VICT** (Ho Chi Minh City)	Not suitable for construction	Suitable with moderate upgrades
13.	**Hiep Phuoc Port** (Ho Chi Minh City)	Not suitable for construction	Suitable with moderate upgrades
14.	**Nghe Tinh** (Vinh City)	Suitable with major upgrades	Suitable with major upgrades
15.	**Duong Dong** (Phu Quoc Island)	Suitable with major upgrades	Suitable with major upgrades

Remark:
Minor upgrades costing <US$5 mil
Moderate upgrades costing from US$5 mil to US$50 mil
Major upgrades costing >US$50 mil

Source: BVG Associates.

Map of Offshore Wind Manufacturing and Construction Ports in Vietnam



Source: BVG Associates.

2. PTSC M&C INTRODUCTION

PTSC M&C, a subsidiary of PTSC Corporation, established on May 15th, 2001, is the leading turn-key contractor in Vietnam providing premium Engineering, Procurement, Construction, Installation, Transportation, Hook-up & Commissioning (EPC/EPCIC) services for both Oil & Gas sector (including Upstream, Midstream and Downstream) and Renewables Energy sector.

PTSC M&C has successfully delivered about 80 projects for a wide range of Oil & Gas facilities such as processing platforms, wellhead platforms, living quarters, subsea modules, process modules, etc. for the local and regional markets.

At present, PTSC is implementing 05 Projects in Vung tau. All projects gained from international bids and will be delivered to Qatar, Myanmar, and Taiwan in 2023 and 2024.

Construction Capability

Berth & quayside

- Quay length: 500 m
- Water depth: 9.3m – 13.5m
- Capacity: 60.000 DWT
- Skidway: 25.000 T cargo

Yard capacity

- Main yard area: 24 ha (incl. office)
- Satellite Yard: 60ha (ready in use)
- Backyard: 94ha
- Office Area: 6,000 m2
- Ground capacity: 35-50 T/m2

Main Facilities

- Cranes 1250T cap.; SPMT 1200 Te
- Workshops: Structural Fab.; auto beam manufacturing; Piping fab.; Mechanical; Blasting & Painting; X-Ray…
- Covered workshops: 80,000 m2

Engineering & Project Management

- In-house Engineering with **300+** Engineers and Designers who have strong Offshore experience;
- Expert in offshore structural engineering *(experienced in Offshore Taiwan, wind turbine foundation analyses…)*
- **R&D for Offshore Wind Industry:**
  - ✓ OWT Foundation Engineering and Design
  - ✓ Key requirements for transition to OW Industry
  - ✓ Yard set-up for Batch production and Investment
  - ✓ Local Supply Chain Management *(Ports/ Logistic Base/ Local Manufacturings/ Marshalling Ports…)*
- Experienced in managing international T&I Contractors *(Heerema, McDermott, Boskalis, Saipem, SapuraEnergy, Meindo, Hyundai offshore, Subsea 7/ Seaway Heavy Lifting, etc.)*
- Strong capable to manage the interface among EPCI scope

MARINE CONTRACTORS · Boskalis Dredging & Marine Experts · subsea 7 · PT. MEINDO ELANG INDAH Engineering and Construction · HYUNDAI HEAVY INDUSTRIES · SAIPEM · sapura energy

Hai Long 2&3 Wind Farm Project – Offshore Substation

- Client: Hai Long Offshore Wind
- Consortium Partner: Semco Maritime
- Project Location: Taiwan
- Project scope: EPC
- Duration: Q3.2022 – Q1/2024 (*scheduled*)

MAIN FACILITIES	WEIGHT (MT)
EPC for 2 sets of Jackets & Piles	13,000 MT
epC for 2 sets of Offshore Substations	8,000 MT

Sao Vang & Dai Nguyet Project

- Client: Idemitsu Kosan Co., Ltd (IKC)
- Project Location: Vietnam
- Project Scope: EPCIC
- Duration: 11/2017 - 10/2021
- Water depth: 120m

MAIN FACILITIES	WEIGHT (MT)
Sao Vang Processing Platform	15,500 MT
Sao Vang CPP Jacket & Piles	16,500 MT
Dai Nguyet WHP Topsides	1,500 MT
Dai Nguyet WHP Jacket & Piles	8,700 MT
Infield flexible pipeline, export pipeline	13 km
26” SSCV valve, subsea cable 10.4 km	

PTSC M&C

Gallaf – Batch 1 Project

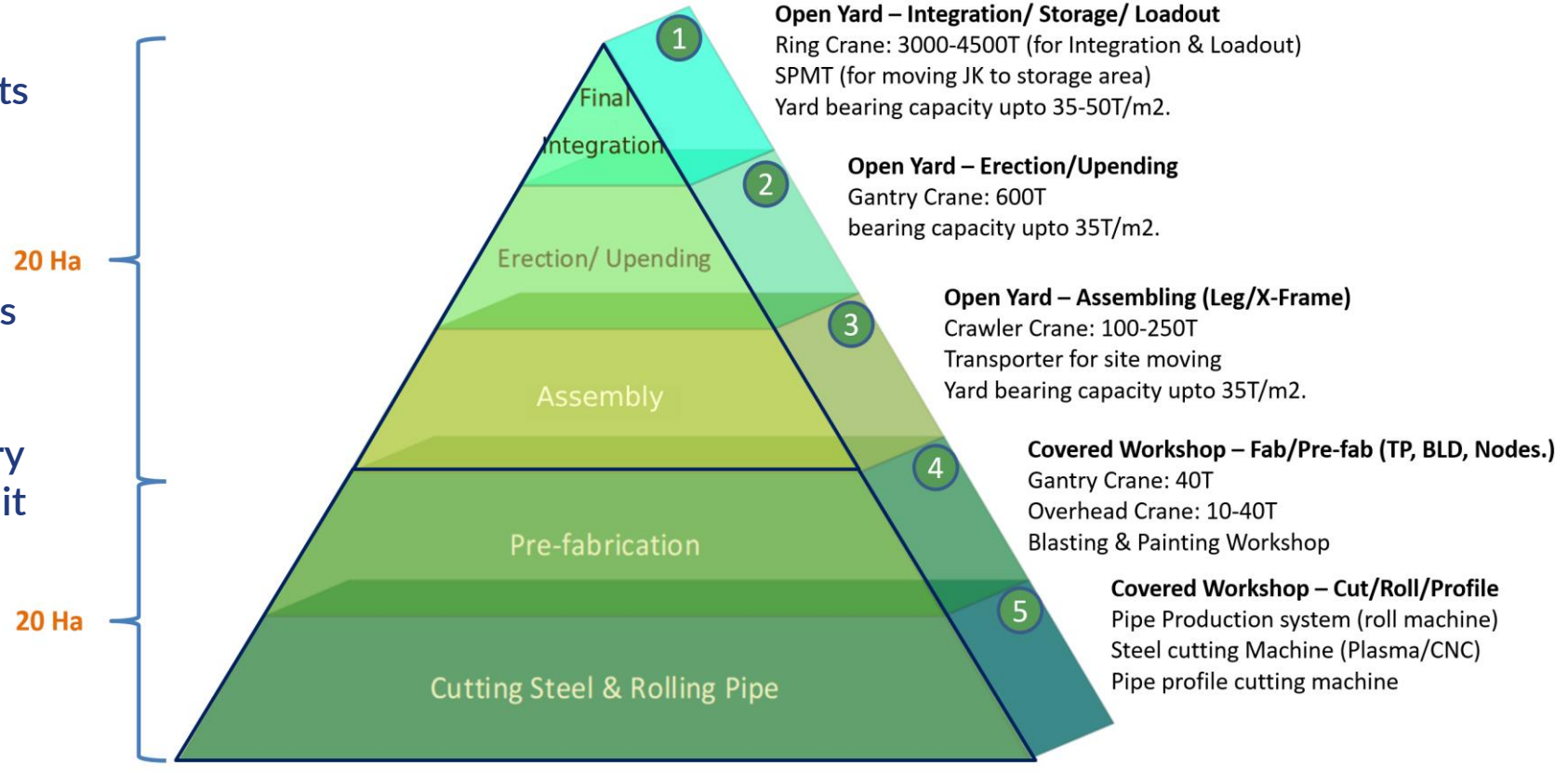
- Client: North Oil Company (NOC)
- Project Location: Qatar
- Project Scope: EPCIC
- Duration: 11/2018 - 03/2021

MAIN FACILITIES	WEIGHT (MT)
03 WHP Topsides (EG, FC & DC)	~9,000 MT
03 bridges	~2,000 MT
Offshore modification and integration	

PTSC M&C

3. Opportunities for other coastal provinces

- Offshore substations (OSS) are often built as single units or two units at a time and are very similar to oil and gas fabrications;
- Turbine jacket foundation is very similar to O&G but required series/ batch production with the delivery requirement is about 01 unit per week normally;

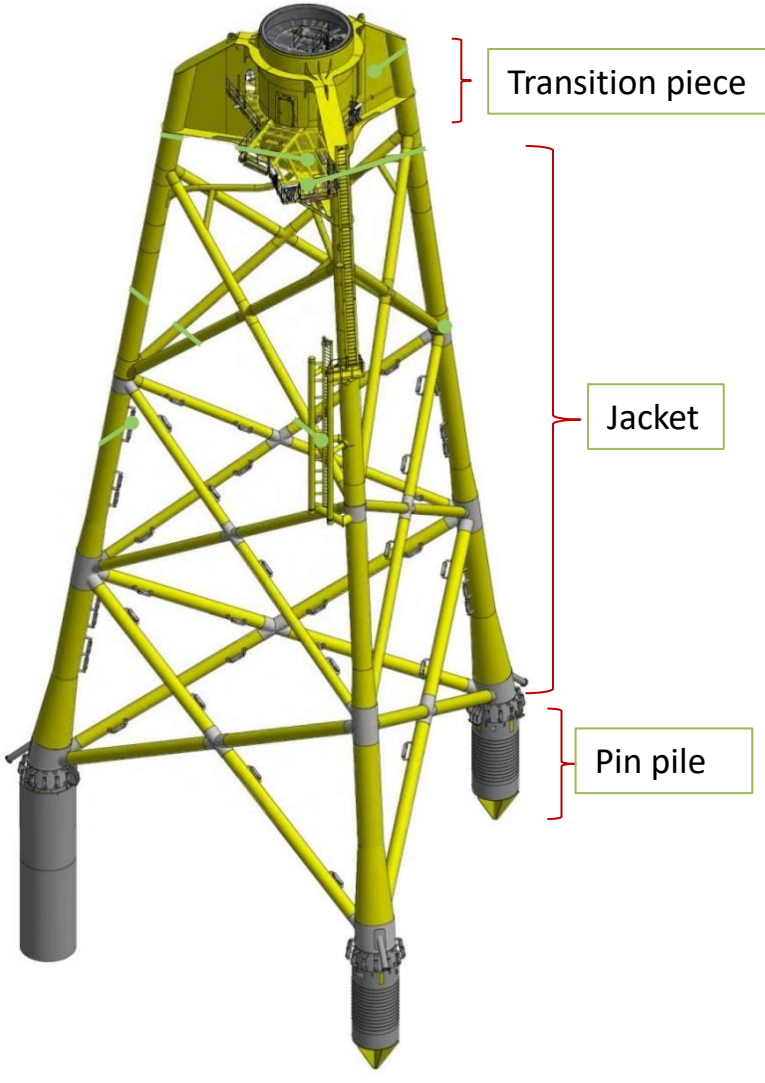


BATCH PRODUCTION

- There are many opportunities for the coastal provinces as part of supply chain for (5) pipe production mills; (4) Pre-fabrication or (3) Fabricate components of Turbine foundation

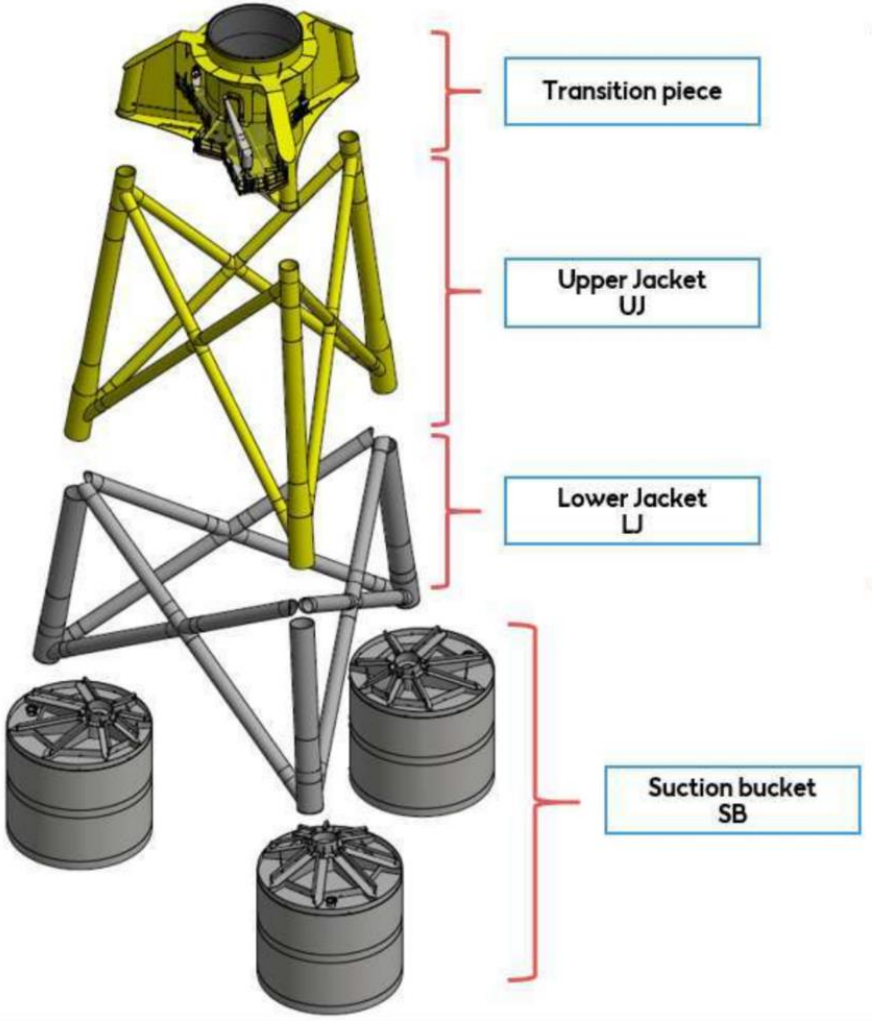
A case study

BATCH PRODUCTION



WORKSTATION

- Flange towards Tower
- Transition Piece
- Chord Section of Tubular Joints
- Landing Plates
- Stub Section of Tubular (X, Y, K) Joints
- Jacket Legs
- Jacket Braces
- Conical Sections - Jacket Leg & Brace
- Suction Buckets Lid.
- Suction Buckets Skirt
- Boat landing main fenders & supports
- External platform incl. Support brackets
- External shifting platform incl. Railing
- External resting platform
- Door structure
- External ladder
- J-tube



Construction/ Marshalling Port Requirements

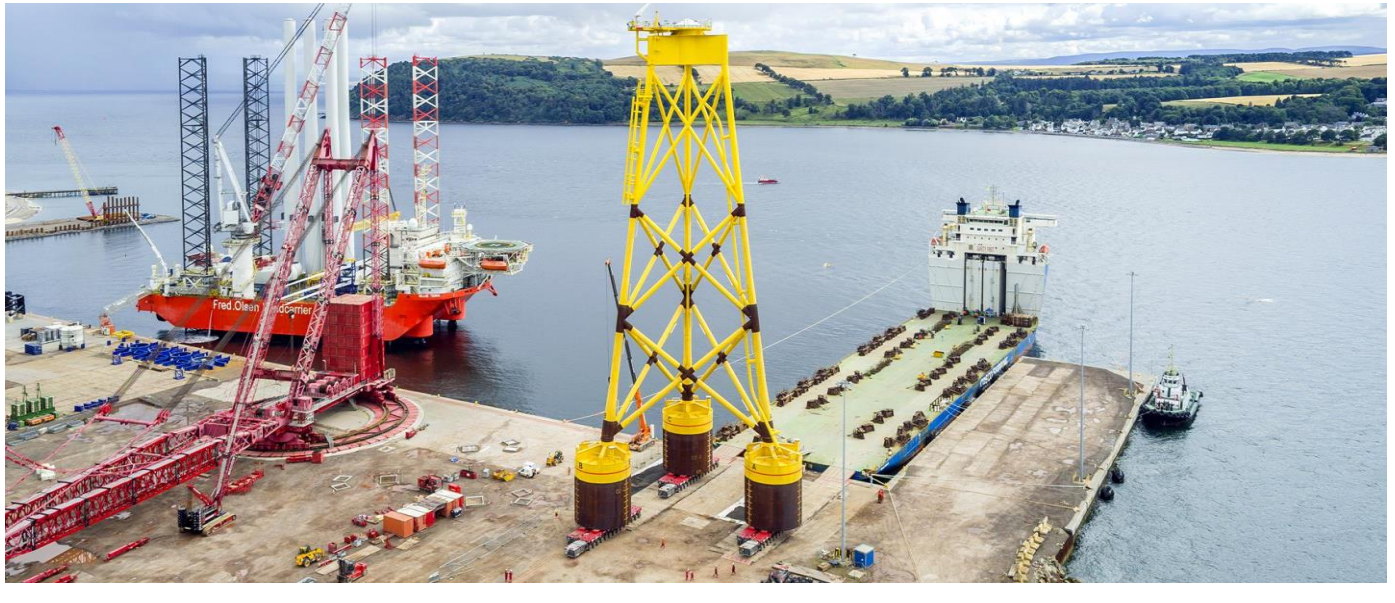
Description	Minimum Requirements
Quay Length	250 m
Water Depth	8 m
Quay Bearing Capacity	20 t/m2
Storage area (10t/m2)	13 Ha
Seabed capacity for jack-up operation (For WTG only)	10 t/m2

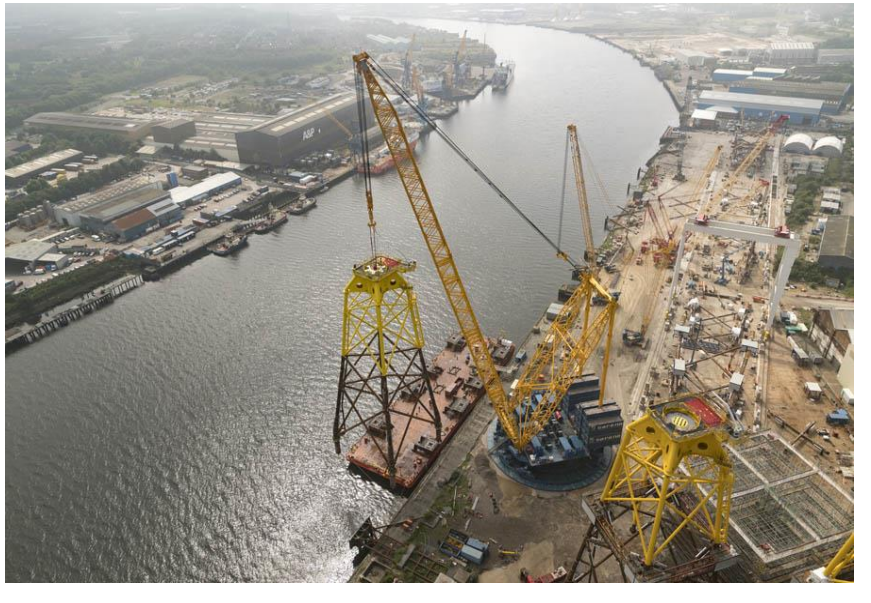
**Minimum requirement = suitable for a 500 MW project*

Key Requirements

For Loadout & Transportation

- Loadout method: Ring Crane/ Shear leg or SPMT
- Transportation on deck cargo barge: 20,000 DWT/ 400’ class





Requirements for Manufacturing

Description	Minimum Requirement	
	Jacket Fabrication	Monopile Factory
Yard space (for major fab. activities)	40 Ha	
Yard bearing capacity for assembly	25 t/m2	
Quayside for loadout (02 spreads)	300m length/ 9m water depth	
Method of Production	Batch Production	Mass + Batch Production
Fabrication workshops	15mH x 40mW x 150mL	30mH x 45mW x 270mL
Blasting/ Painting workshops	15mH x 30mW x 90m L	15mH x 30mW x 90m L

4. Recommendations for potential investors

- Investors for construction need to know about the market trend i.e. monopile or jacket? Floating structure?
- The location of components manufacturing should be close to construction yards as much as possible. Manufacturers can be pipe production mills; prefabrication; fabrication of components…

Fixed Foundation Type

Monopile

Jacket pin pile

Suction bucket

Project size:	500 MW
WTG rating:	14 MW
Number of foundations:	36 units
Water depth:	50 m
Fabricated time:	12 months
Delivery requirement:	Average 01 unit/week

	JACKET SUCTION BUCKET	MONOPILE/ TRANSITION PIECE
Mass (mTon)	2500-3000	3000
Outside Diameter (m)	15	12
Overall Length (m)	90	100
Water depth	50m-80m	50m

Monopile Investment

Bladt Industries invests in XXL monopile facility

25 Feb 2021 by David Foxwell

Denmark's Bladt Industries has announced plans to invest in facilities to build XXL monopile foundations for the offshore wind industry

Bladt Industries said it expects to begin deliveries of XXL monopile foundations from the new facility by 2022. The facility will be adapted to meet demand for monopiles that will have a length of 100 m and a diameter of 15 m, and weigh more than 3,000 tonnes.

Sif OFFSHORE FOUNDATIONS

Update on Investment Plans for Expansion of Manufacturing Facilities and Korean Strategic Partnership

Roermond, 29 July 2022. Sif has gained manufacturing know-how and experience for more than two decades, during which monopile foundations for offshore wind farms have more than tripled in diameter to 9 meters. The next step-up in size is near and, supported by external technical and financial experts, we have made substantial progress studying the feasibility of expanding the manufacturing capabilities and capacity for offshore wind foundations from c. 220 to 500kton per annum.

New Jersey getting monopile factory

PORTS & LOGISTICS

December 23, 2020, by Nadja Skopljak

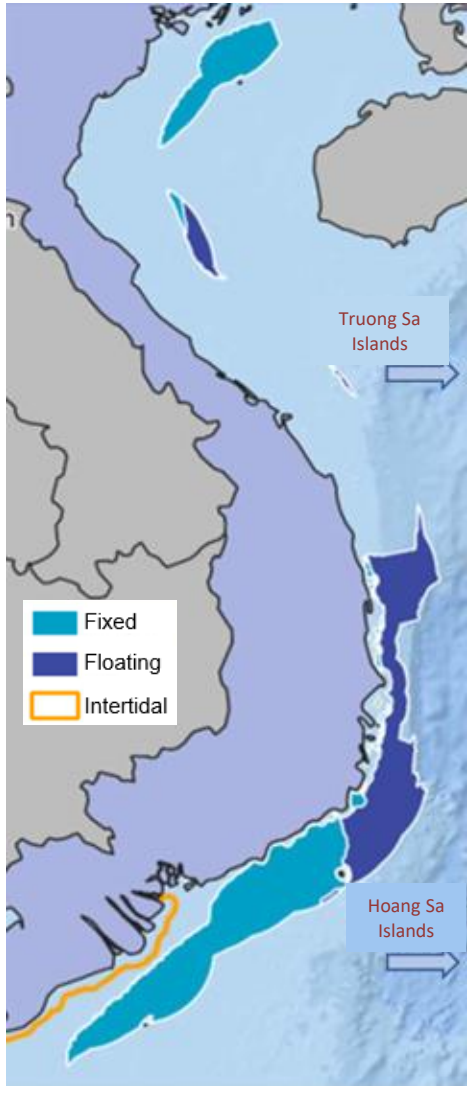
The State of New Jersey is investing USD 250 million in a monopiles manufacturing facility that will serve the U.S. offshore wind industry.

SeAH Steel Holdings Corp. will invest 400 billion won ($349.7 million) to build what would be the world's largest monopile plant for wind power farm in the United Kingdom.

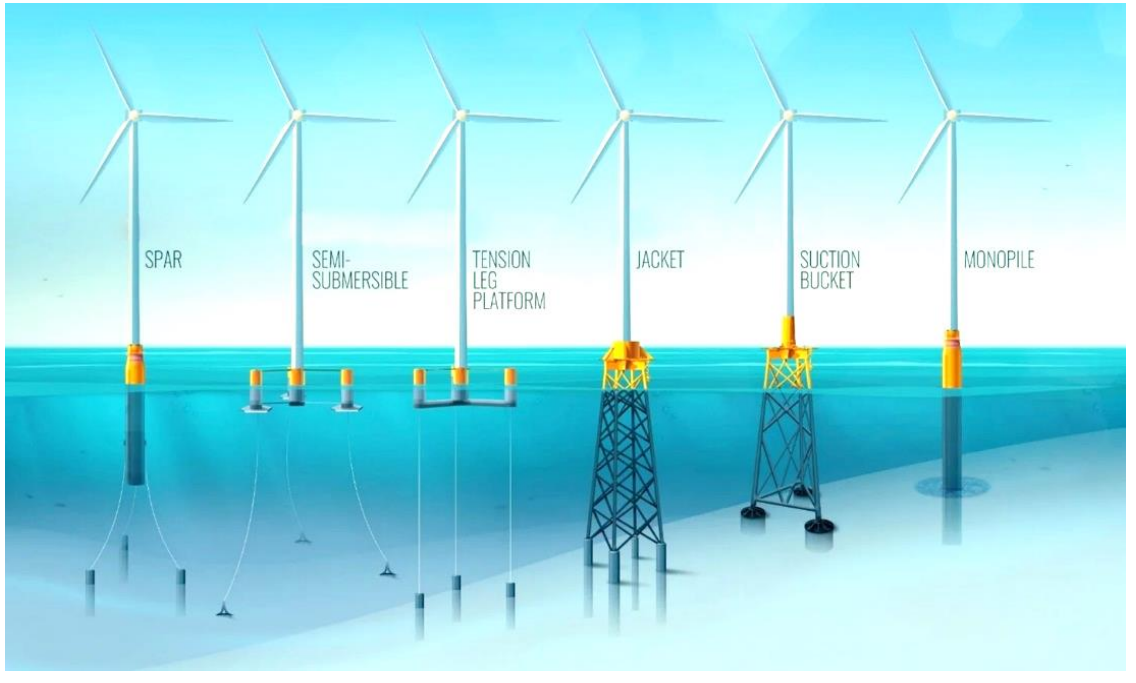
The Korean steel holding company had signed a memorandum of understanding with the British government on establishing monopile manufacturing plant in the U.K in August last year.

The investment will be made through SeAH Wind Ltd, a wholly-owned subsidiary of SeAH Steel Holdings set up in the U.K in February 2021 for the global offshore

Considering floating type for far future



- Construction of floating WTG requires **larger** yard/port.
- Floating foundation are designed for future projects however we should consider at now.



“The OWE market is huge, the collaboration is over the competition”

THANK YOU …

“The energy transition is happening whether we want it to happen or not”