DSI, Lindø 21.09.2023

The foundation for the green energy transition offshore

Agenda

- Bladt Industries / ISC Consulting Engineers
- Offshore Substations
- U.S Portfolio and Supply Chain
- Conditions for Transatlantic projects
- Questions

Your Hosts

- Steffen Engberg – VP, Substations
  - Structural Engineer, BSc
  - ISC Engineering – Energinet - Bladt

- Niesl Seier – Head of Project Management, Renewables
  - Structural Engineer, BSc
  - ISC Engineering

SAFETY MOMENT!

Slips, Trips, and Falls

If you notice a hazard, act

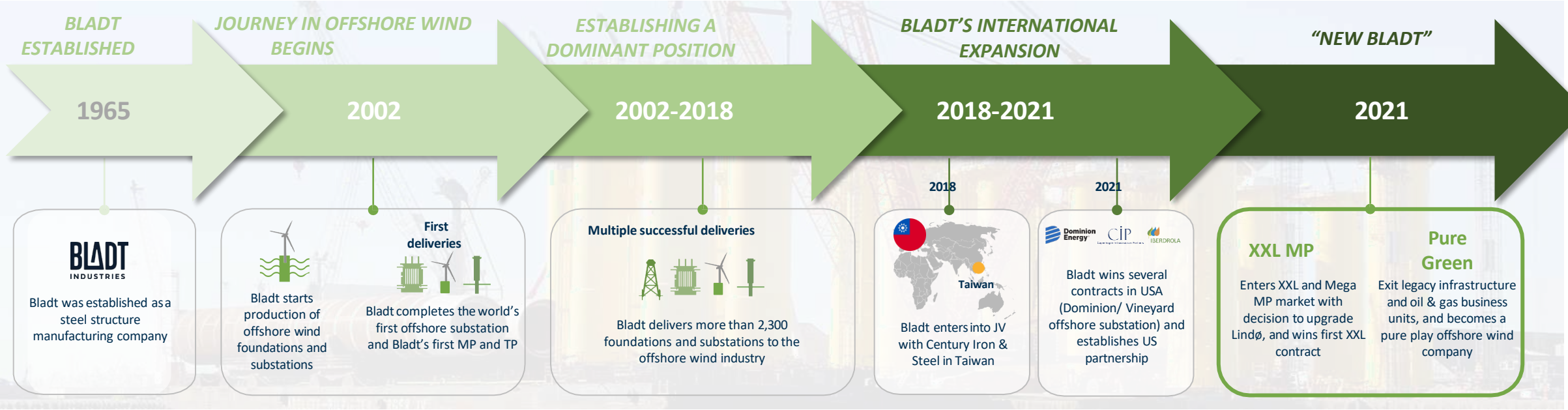
Common hazards

- Contaminants on the floor
- Indoor/outdoor walking surface irregularities
- Weather conditions
- Poor lighting
- Stairs and handrails
- Stepstools and ladders
- Trip hazards
- Improper use of floor mats and runners

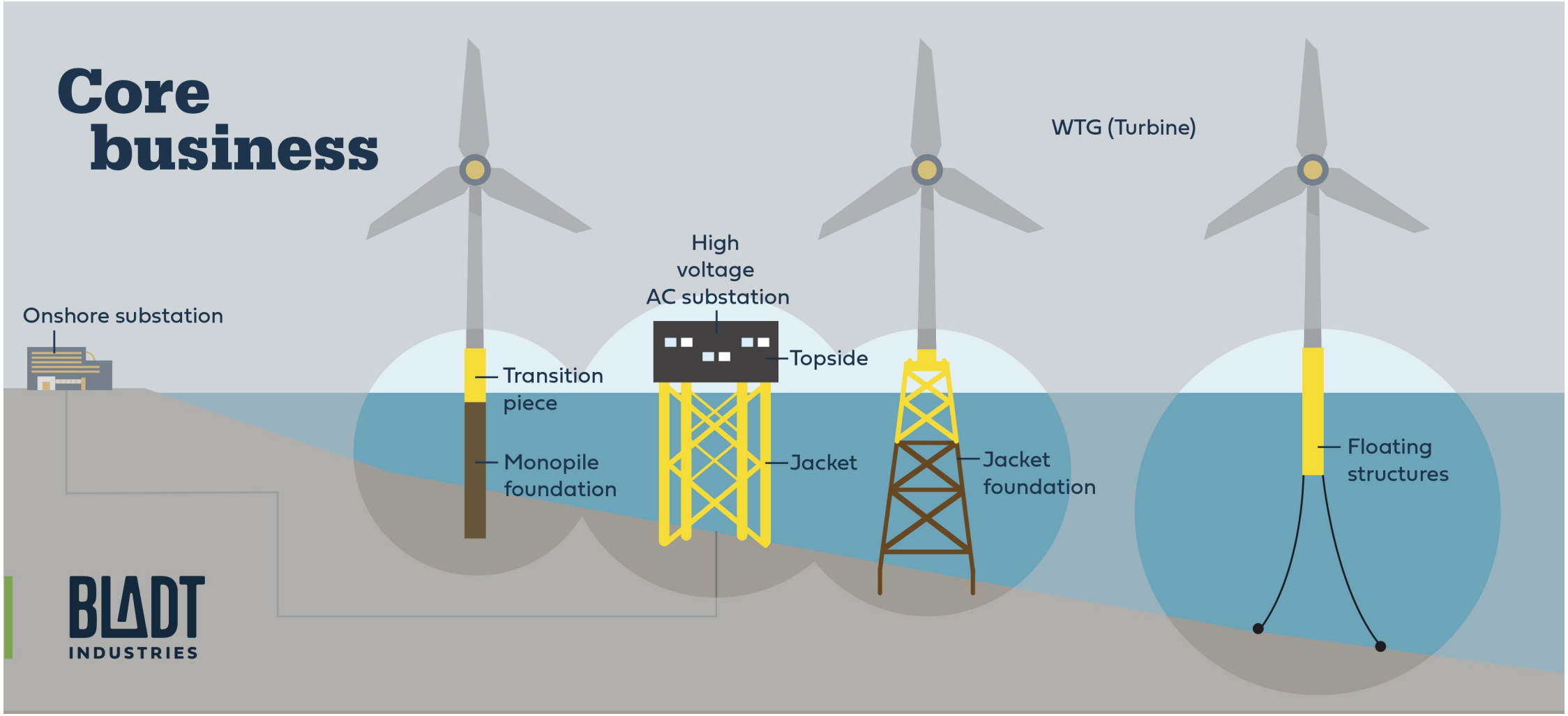
Bladt Industries

- Established in 1965
- A history of delivering high quality steel structures for a range of projects, including infrastructure and the oil and gas industry
- Since 2021: a clear company vision to be the market leader within offshore foundations and substations
- Supporting a green future
- Acquried by CS Wind Summer 2023 - Pending
- Approximately 800 employees

Undisputed track record with decades of experience



Our core business areas

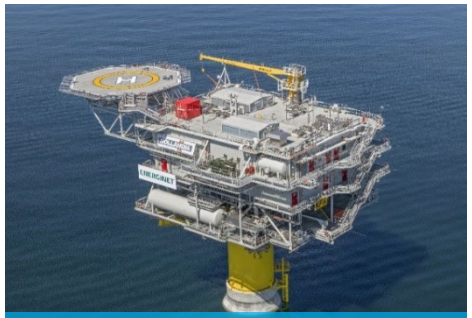


ISC Innovative Engineering

BLADT INDUSTRIES

Renewable Energy Consulting Areas

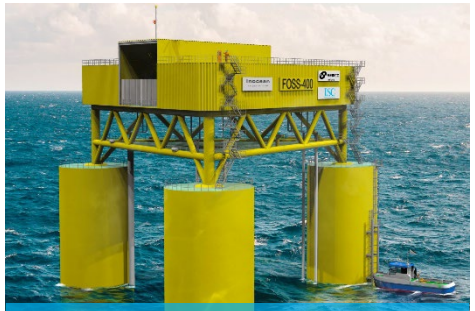
- Main Activity: Advisory, Planning, Design & Engineering Consultancy
- World Wide Clients - Client Consultancy, Studies, Concept Design, FEED, Detail Design, EPC(I) Contracts, O&M

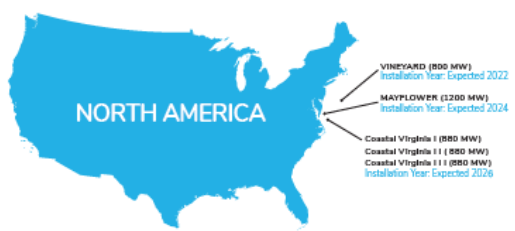

Substations HVAC / HVDC

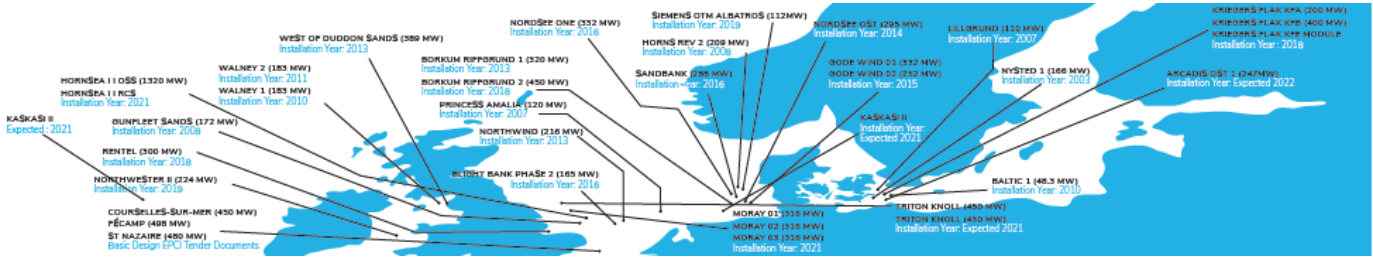

Substructures

WTG Foundations


Power to X/Green


Floating Substations



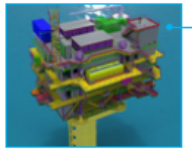


Offshore Substation – Our History

Leading Engineering Consultancy with + 50 Offshore Substation detailed designs and +60% marked share

DETAILED DESIGNS

US PROJECT (N/A MW)
Topside Weight : N/A
Installation Year : N/A
Water Depth : N/A
Substructure : N/A
Detailed Design : N/A
Owner/Client : N/A
Location : N/A



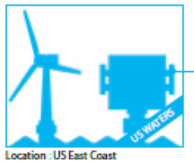
KASKASI II (325 MW)
Topside Weight : 1.250 tonnes
Installation Year : Expected 2021
Water Depth : 38.3 meters
Substructure : Jacket
Detailed Design : Topside/MP/TP
Owner/Client : Innogy/Bladt
Location : German Bight

SIEMENS OTM ALBATROS (112 MW)
Topside Weight : 742
Installation Year : 2019
Water Depth : 39 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : EnBw/Siemens
Location : German Bight

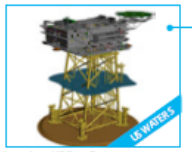
BLIGH BANK PHASE 2 (165 MW)
Topside Weight : 970 tonnes
Installation Year : 2016
Water Depth : 10 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : Nobelwind/Bladt
Location : Belgian North Sea

NORTHWIND (216 MW)
Topside Weight : 1.140 tonnes
Installation Year : 2013
Water Depth : 20 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : Northwind Offshore Energy/Bladt
Location : German Bight

GUNFLEET SANDS (172 MW)
Topside Weight : 1.155 tonnes
Transition Piece : 155 tonnes
Installation Year : 2008
Water Depth : 15 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : Ørstad
Location : UK North Sea



COASTAL VIRGINIA I (880 MW)
COASTAL VIRGINIA II (880 MW)
COASTAL VIRGINIA III (880 MW)
Topside Weight : 4.000 tonnes
Installation Year : Expected 2026
Water Depth : 25.8/31.1/28.4 meters
Substructure : Jacket
Detailed Design : Topside and jacket
Owner/Client : Dominion Energy
Location : US East Coast



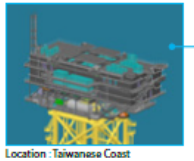
VINEYARD (800 MW)
Topside Weight : 3040 tonnes
Jacket Weight : 2000 tonnes
Installation Year : Expected 2022
Water Depth : 38.3 meters
Substructure : Jacket
Detailed Design : Topside/Jacket
Owner/Client : Vineyard Wind/Bladt
Location : US East Coast

KRIEGERS FLAK KFA (200 MW)
KRIEGERS FLAK KFB (400 MW)
KRIEGERS FLAK KFE MODULE (220/150 KV)
Topside Weight : 1.350/1.675/685 tonnes
Installation Year : 2018
Water Depth : 20/31/16 meters
Substructure : Concrete Gravity Base
Detailed Design : Topside/Substructure
Owner/Client : Energinet.dk
Location : Danish Baltic Sea

SANDBANK (288 MW)
Topside Weight : 2.230 tonnes
Jacket Weight : 1.560 tonnes
Installation Year : 2016
Water Depth : 29 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Vattenfall/Bladt
Location : German Bight

WEST OF DUDDON SANDS (389 MW)
Topside Weight : 1.520 tonnes
Jacket Weight : 1.180 tonnes
Installation Year : 2013
Water Depth : 19 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client :
Dong Energy and Scottish Power
Location : UK Irish Sea

HORNS REV 2 (209 MW)
Topside Weight : 1.238 tonnes
Jacket Weight : 798 tonnes
Installation Year : 2008
Water Depth : 13 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Energinet.dk
Location : Danish North Sea



HAI LONG II (532 MW)
HAI LONG III (512 MW)
Topside Weight : 2.700/2.700 tonnes
Installation Year : Expected 2025
Water Depth : 26.8/30.1 meters
Substructure : Jacket
Detailed Design : Topside and jacket
Owner/Client : Hai Long Offshore Wind
Location : Taiwanese Coast

NORTHWESTER II (224 MW)
Topside Weight : 930 tonnes
Installation Year : 2019
Water Depth : 31 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : Northwester II/Bladt
Location : Belgian North Sea

TRITON KNOLL 01 (450 MW)
TRITON KNOLL 02 (630 MW)
Topside Weight : 1100 tonnes
TP + Cage : 755 tonnes
Installation Year : 2018
Water Depth : 27 meters
Substructure : MP/TP/Cage
Detailed Design : Topside/MP/TP/Cage
Owner/Client : Innogy/Siemens
Location : UK North Sea

NORDSEE ONE (332 MW)
Topside Weight : 1.890 tonnes
Jacket Weight : 1.375 tonnes
Installation Year : 2016
Water Depth : 29 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : RWE Innogy/Bladt
Location : German Bight

BORKUM RIFFGRUND 1 (320 MW)
BORKUM RIFFGRUND 2 (450 MW)
Topside Weight : 1.835/2.185 tonnes
Jacket Weight : 1.685/1670 tonnes
Installation Year : 2013 - 2018
Water Depth : 24/27 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Ørsted
Location : German Bight

LILLGRUND (110 MW)
Topside Weight : 670 tonnes
Installation Year : 2007
Water Depth : 10 meters
Substructure : Concrete Gravity Base
Detailed Design : Topside
Owner/Client : Vattenfall/Bladt
Location : Swedan Oresund

MAYFLOWER (1200 MW)
Topside Weight : 4.200 tonnes
Installation Year : Expected 2024
Water Depth : 45 meters
Substructure : Jacket
Detailed Design : Topside and jacket
Owner/Client : Mayflower Wind/BSR
Location : US East Coast

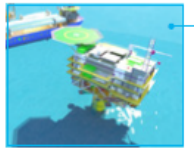
HORNSEA II OSS (1320 MW)
Topside Weight : 6.718 tonnes
Installation Year : 2021
Water Depth : 36 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Ørsted
Location : UK North Sea

RENTEL (300 MW)
Transition Piece Weight : 800 tonnes
Monopile Weight : 1.100 tonnes
Installation Year : 2018
Water Depth : 31 meters
Substructure : MP/TP incl. Cable-deck
Detailed Design : TP/MP/Cabledeck
Owner/Client : Rentel/STX
Location : Belgian North Sea

GODE WIND 01 (332 MW)
GODE WIND 02 (332 MW)
Topside Weight : 1.930/1.930 tonnes
Jacket Weight : 1.790/1.790 tonnes
Installation Year : 2015
Water Depth : 30/33 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Ørsted
Location : German Bight

BALTIC 1 (48 MW)
Transition Piece Weight : 1.100 tonnes
Installation Year : 2010
Water Depth : 18 meters
Substructure : Monopile
Detailed Design : TP/monopile
Owner/Client : EnBW/Ballast Nedam
Location : German Baltic Sea

PRINCESS AMALIA (120 MW)
Topside Weight : 650 tonnes
Installation Year : 2007
Water Depth : 24 meters
Substructure : Monopile
Detailed Design : Topside
Owner/Client : Eneco/Bladt
Location : Netherlands North Sea



ARCADIS OST 1 (247 MW)
Topside Weight : 2.200 tonnes
Installation Year : Expected 2022
Water Depth : 43.7 meters
Substructure : MP/TP
Detailed Design : Topside
Owner/Client : Parkwind OST Gmbh
Location : German Baltic Sea

HORNSEA II RCS
Topside Weight : 1.852 tonnes
Installation Year : 2021
Water Depth : 32 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Ørsted
Location : UK North Sea

MORAY EAST 01 (316 MW)
MORAY EAST 02 (316 MW)
MORAY EAST 03 (316 MW)
Topside Weight : 1.252 tonnes
Installation Year : 2021
Water Depth : 22 meters
Substructure : Jacket
Detailed Design : Topside
Owner/Client : Edp renewables/Siemens
Location : UK North Sea

NORDSEE OST (295 MW)
Topside Weight : 1.650 tonnes
Installation Year : 2014
Water Depth : 23 meters
Substructure : Jacket
Detailed Design : Topside
Owner/Client : RWE Innogy/Bladt
Location : German Bight

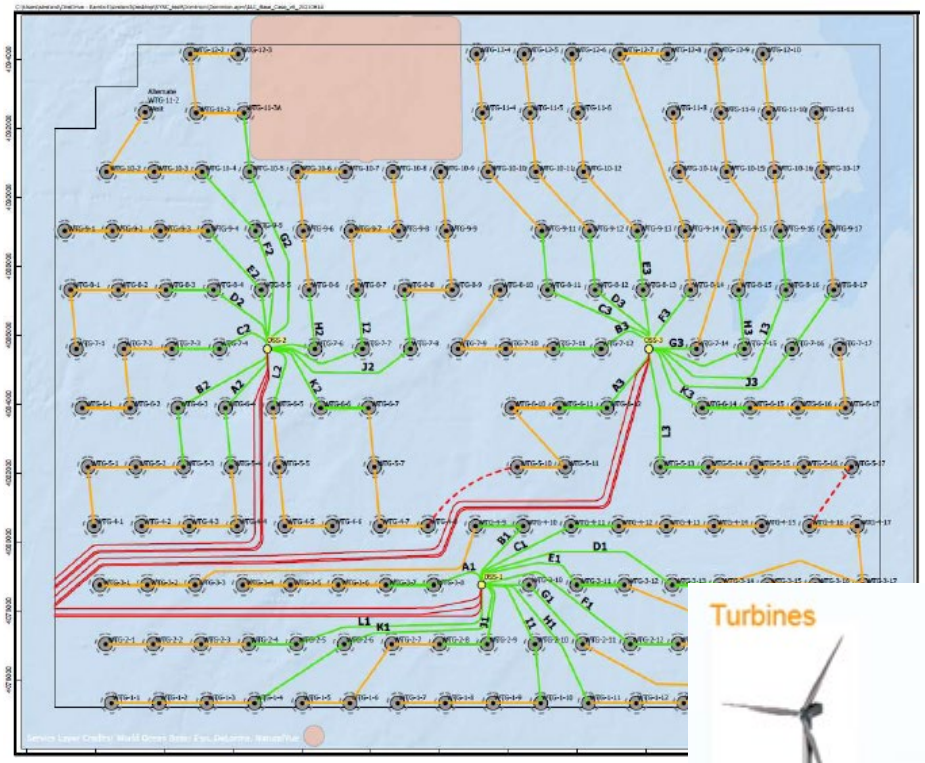
WALNEY 1 (183 MW)
WALNEY 2 (183 MW)
Topside Weight : 1.000 tonnes
Jacket Weight : 940/965 tonnes
Installation Year : 2010/2011
Water Depth : 21/24 meters
Substructure : Jacket
Detailed Design : Topside and Jacket
Owner/Client : Dong Energy
Location : UK Irish Sea

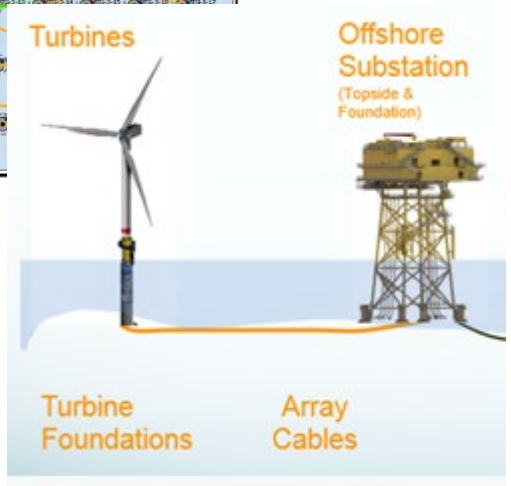
NYSTED I (166 MW)
Topside Weight : 670 tonnes
Installation Year : 2003
Water Depth : 6-10 meters
Substructure : Concrete Gravity Base
Detailed Design : Topside
Owner/Client : Ørsted
Location : Danish Baltic Sea

Substations

Topside + Foundation

Offshore Substation (OSS)





Offshore Substations collect the electricity generated by the wind turbines and increase/transform the electricity to a higher voltage level. The increased voltage level ensures that the electricity can be transmitted to the onshore grid with a limited loss.

The interface towards wind turbines and onshore grid are established by subsea high/medium voltage cables buried in the seabed.

The primary purpose of the OSS is to house the high and medium voltages equipment incl. auxiliaries to ensure availability of the grid connection.

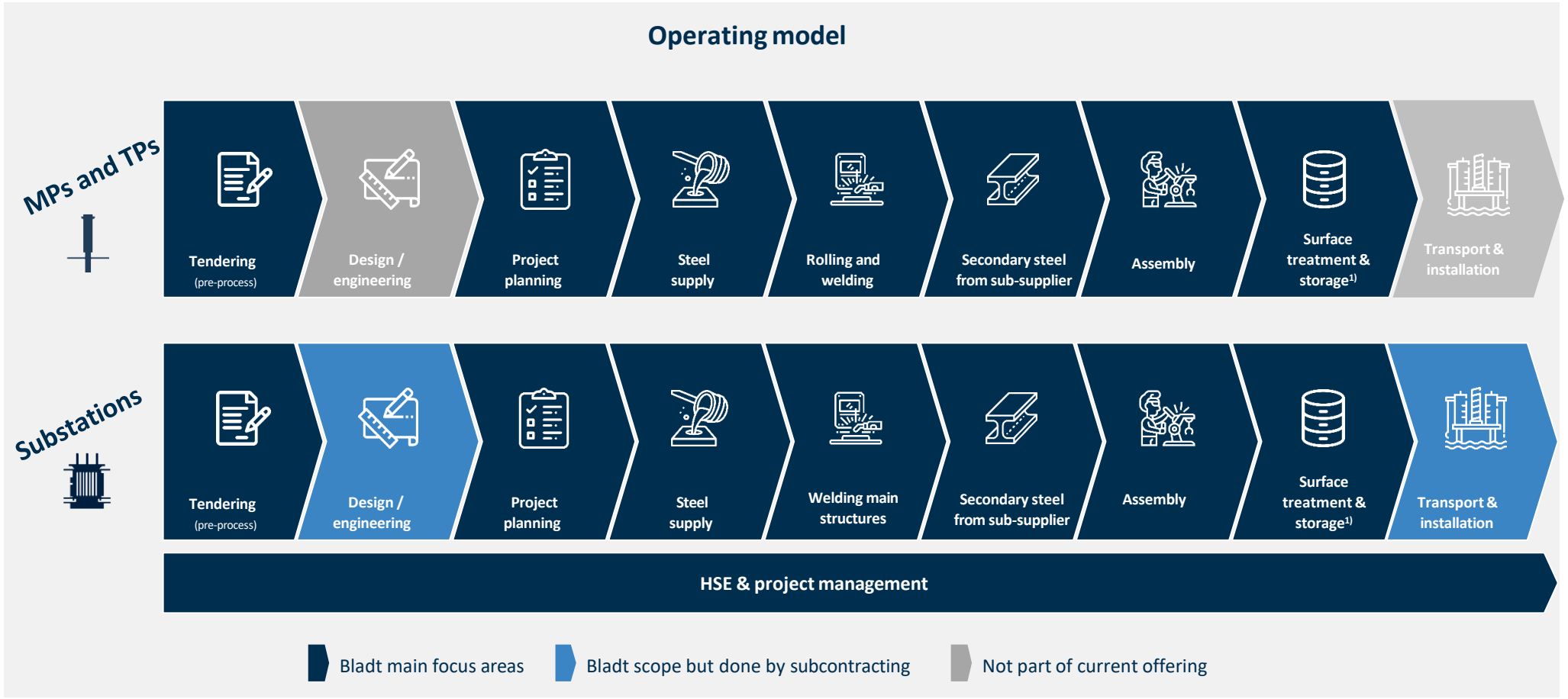
Offshore Substation (OSS)

Substations range in size. However, they tend to consist of four floors:

- *A cable deck* used for pull-in installation of export cables from offshore
- *A main deck* to support high and medium voltage equipment for the high voltage transformer
- *A utility deck* with, among other things, day crew rooms
- *A roof deck* where the main crane for lifting is located

Weight: Between 800 – 4,400 tonnes.

Bladt/SEMCO/ISC's proven operating model



Substation strategic partners

BLADT INDUSTRIES

ISC Innovative Engineering — Design & engineering

SEMCO maritime — Electrical components

Long-term relationships with strategic partners ensure top-quality deliveries

Bladt is specialised in large-scale and complex steel foundations for the offshore wind industry

Notes: *1) Surface treatment takes place at different times in the process; 2) Substructures (foundations) for substations is also part of Bladt's offering. Bladt also offer design and installation for substructures*

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Offshore EPC(I) Substation Projects - US

Under construction

US Project
3 x 440 MW - 2024
Location: East Coast, USA

US project
3 x 880 MW - 2025
Location: East Coast, USA

Completed

Vineyard EPC 800 MW
Location: Atlantic Ocean,
off the coast of Massachusetts, USA

Scale: DK marked has developed approximately 2 GW since 2003!

Offshore EPC(I) Substation Projects - US

Supply chain

Present:
- One (1) OSS has been delivered from the U.S. Marked
- Primary experienced Contractor involved in OSS projects
- “One of” production is difficult to scale
- Jones Act – requirements on U.S. produced, owned and operated vessels

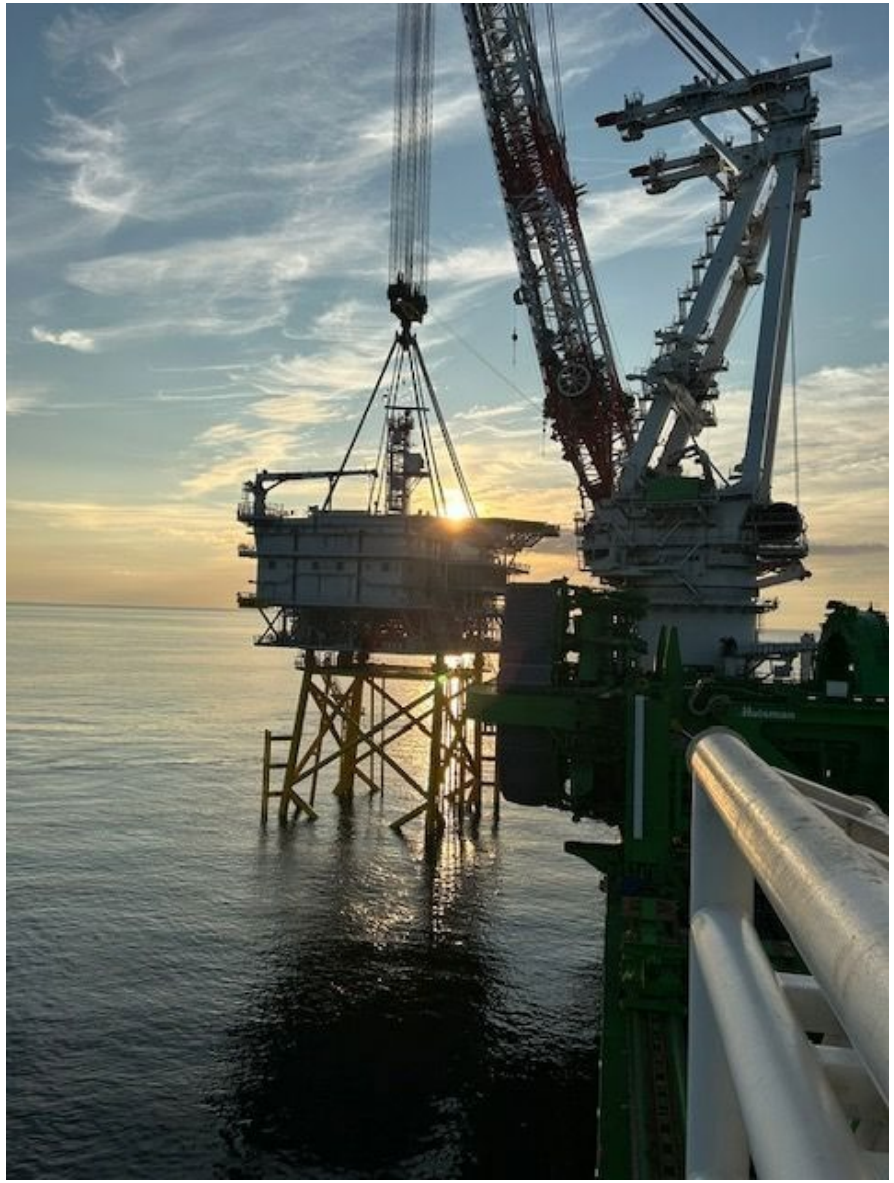
Future expectations:
- Increased requirement for local content
- US Project are subject to tax reduction for domestic execution of works

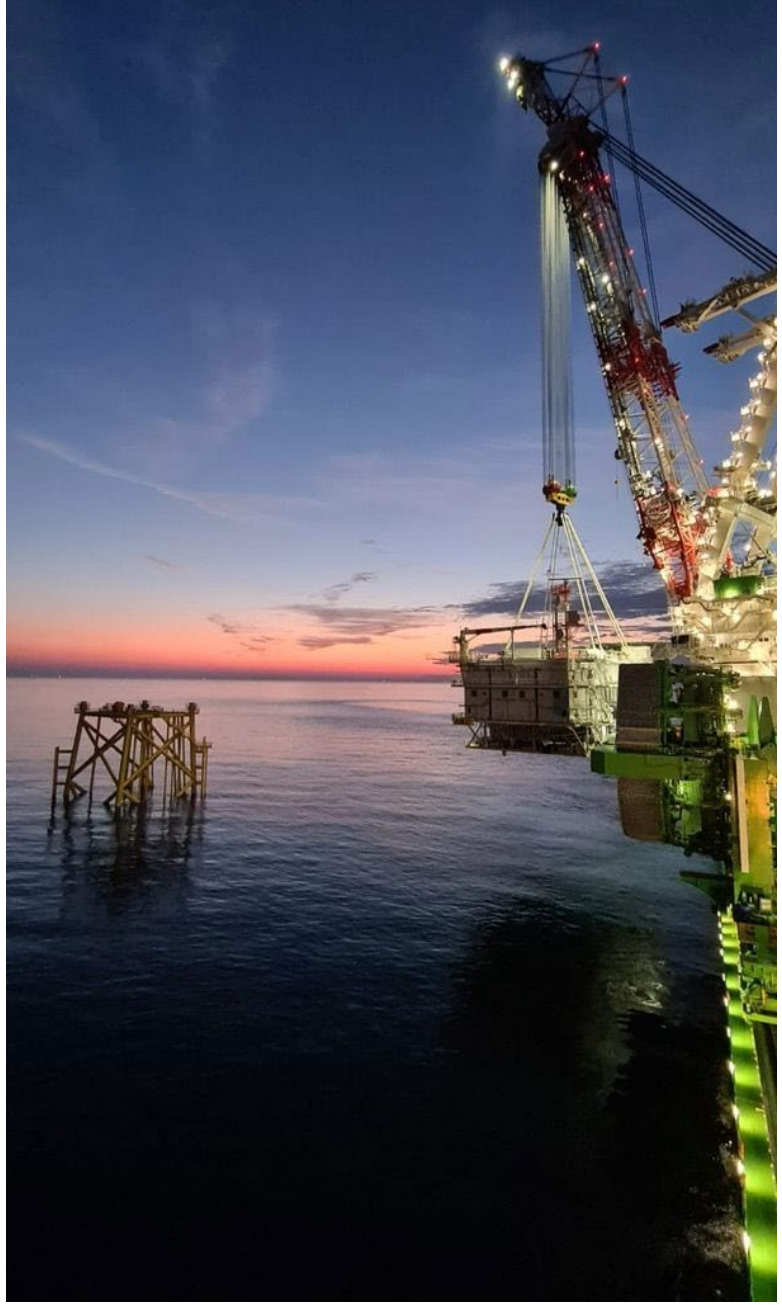
Vineyard Wind 1, Atlantic Ocean

https://lnkd.in/d3zAbQhE

FACTS

Client:
CIP & Iberdrola
Year:
2023
Location:
US
Scope:
Design and fabrication
of one substation and one jacket
Output:
806 MW
Renewable electricity to power
more than 400,000 U.S homes.
Type of Contract:
EPC
Weight:
3,500 + 2,000 jacket / 1,200 piles



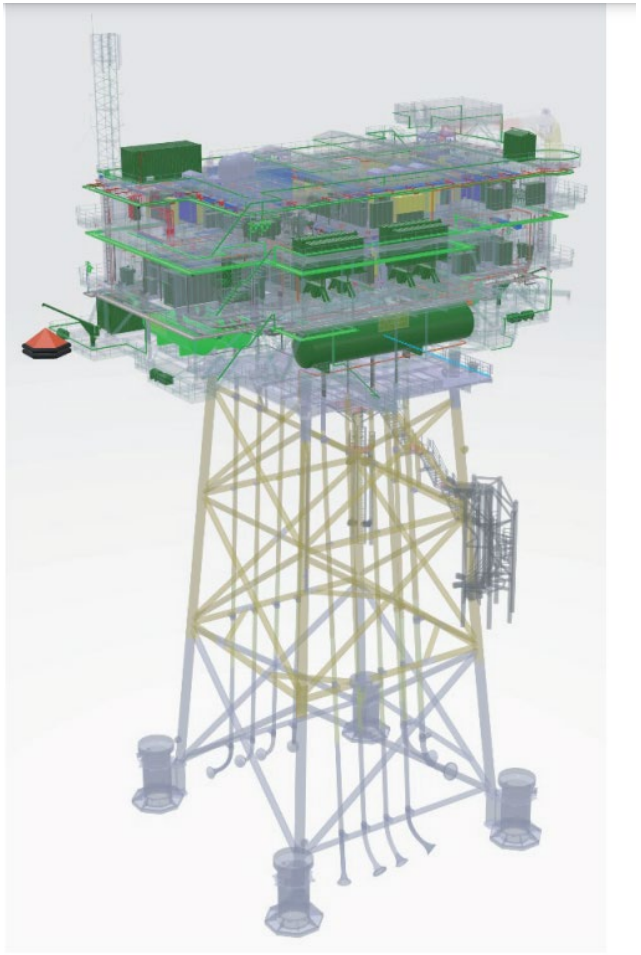


Conditions for Transatlantic projects

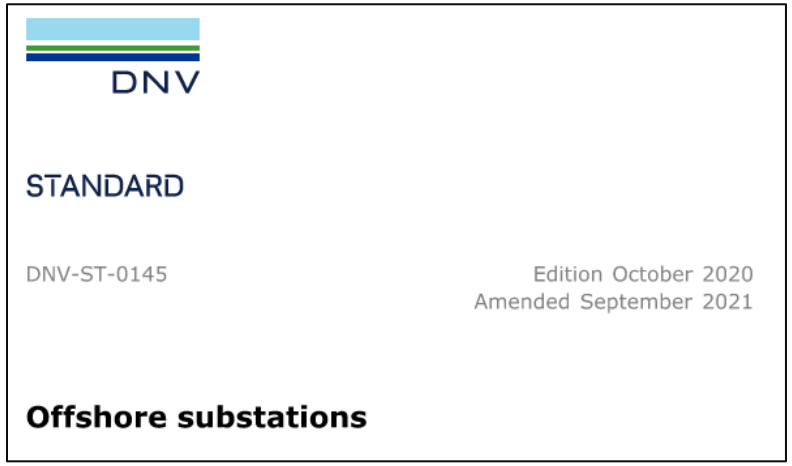
– from the structural designer's perspective

Differences when taking a European design to US waters

- Engineering / design
- Certification / review
- Fabrication
- Transportation
- Installation



Conditions for Transatlantic projects
– Engineering – overarching design standards



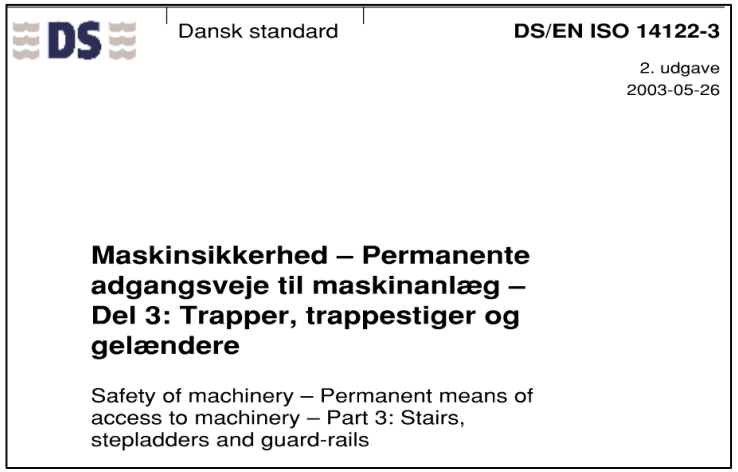
VS

American Petroleum Institute

Common wish of utilizing ‘local’ standards and codes

Oil / Gas standards not 1:1 applicable within wind industry

Conditions for Transatlantic projects
– Engineering – work enviroment


DS Dansk standard DS/EN ISO 14122-3

2. udgave
2003-05-26

Maskinsikkerhed – Permanente adgangsveje til maskinanlæg – Del 3: Trapper, trappestiger og gelændere

Safety of machinery – Permanent means of access to machinery – Part 3: Stairs, stepladders and guard-rails

VS

'Normal' OSS within Europe follows EN ISO norms + local nation regulations

In US, also OHSA is applicable, which is designed for onshore only.

Conditions for Transatlantic projects
– Certification / approving

Approving authority - BOEM

The Office of Renewable Energy Programs facilitates the responsible development of renewable energy resources on the Outer Continental Shelf through conscientious planning, stakeholder engagement, comprehensive environmental analysis, and sound technical review.

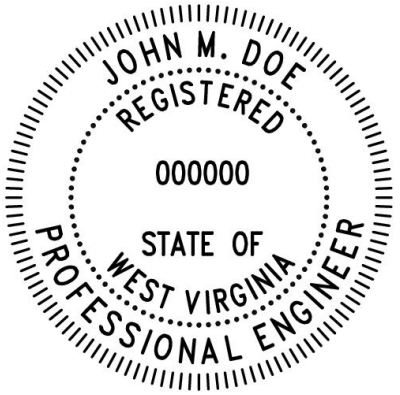
BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

ISC Innovative Engineering
BLADT INDUSTRIES

Conditions for Transatlantic projects
– Certification / approving

Process for increasing safety

- Design Documentation by ISC (incl internal QA)
- Review by PE
- Review by Certifying Verification Agency (e.g. DNV)
- Final review by PE and PE Stamping
- Documents issued to BOEM
- Review by BOEM (e.g. DNV)
- Final approval.



What is a professional stamp?

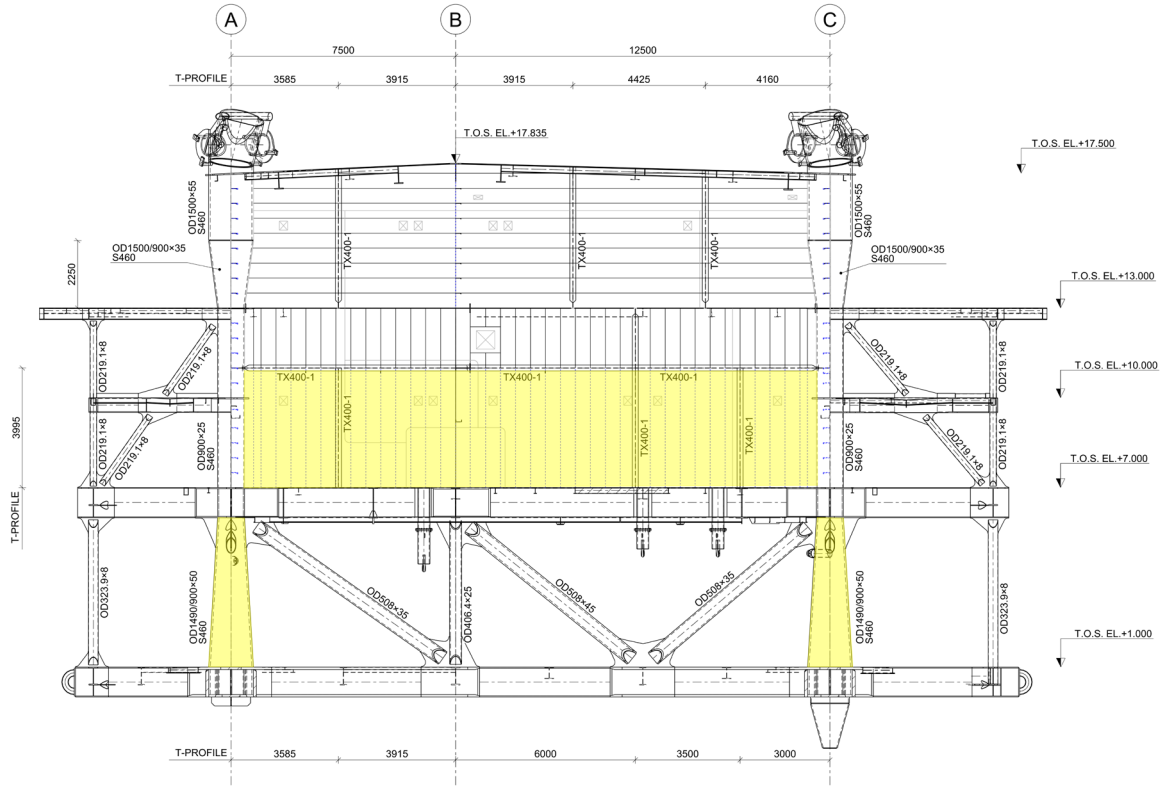
A PE stamp is a symbol of quality assurance. It means that a professional engineer has reviewed the designs and deemed them up to code and safe. This provides peace of mind for both the contractor and the customer, knowing that the project will be completed correctly and safely. 26. sep. 2022

Transportation

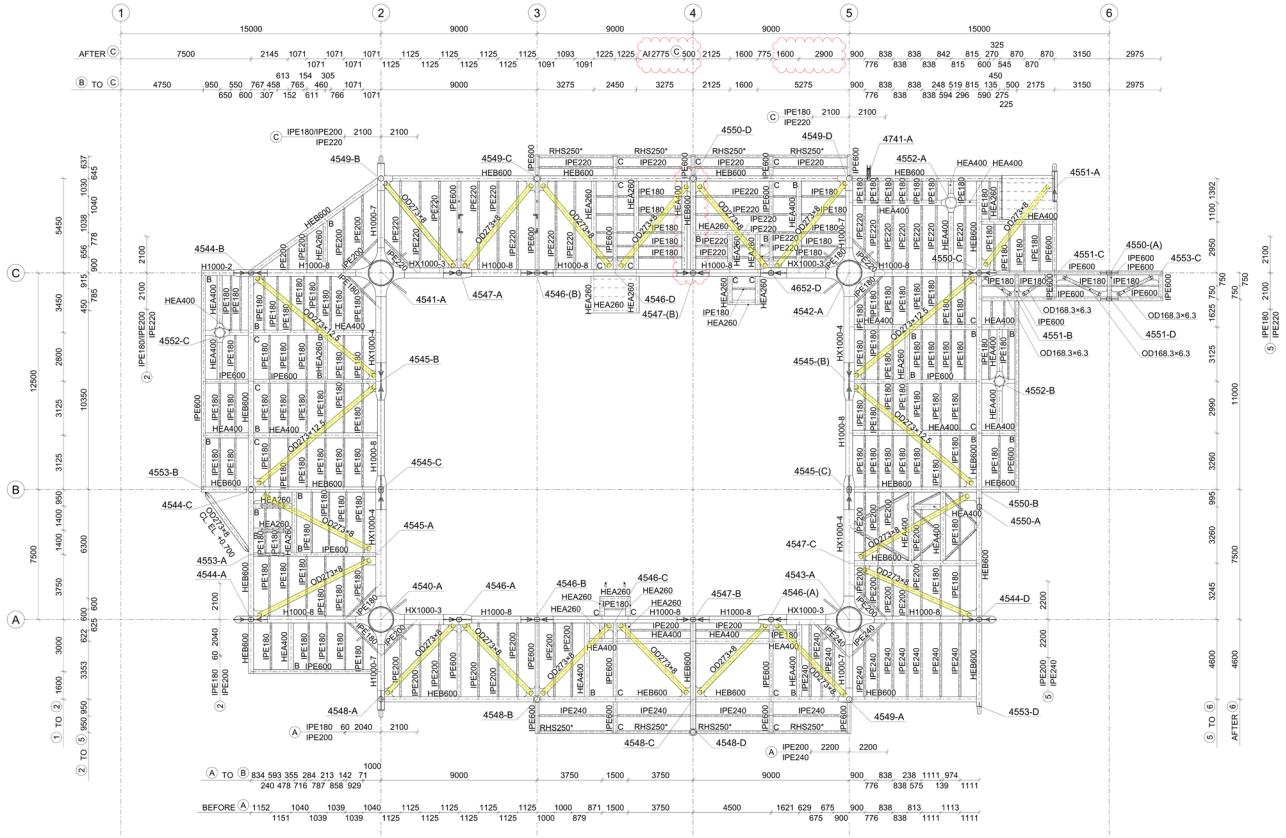
- Increased distance
- Increased duration

Introduction of fatigue assessment / fatigue design of topside structure.

Offshore Substation (OSS)



Transportation

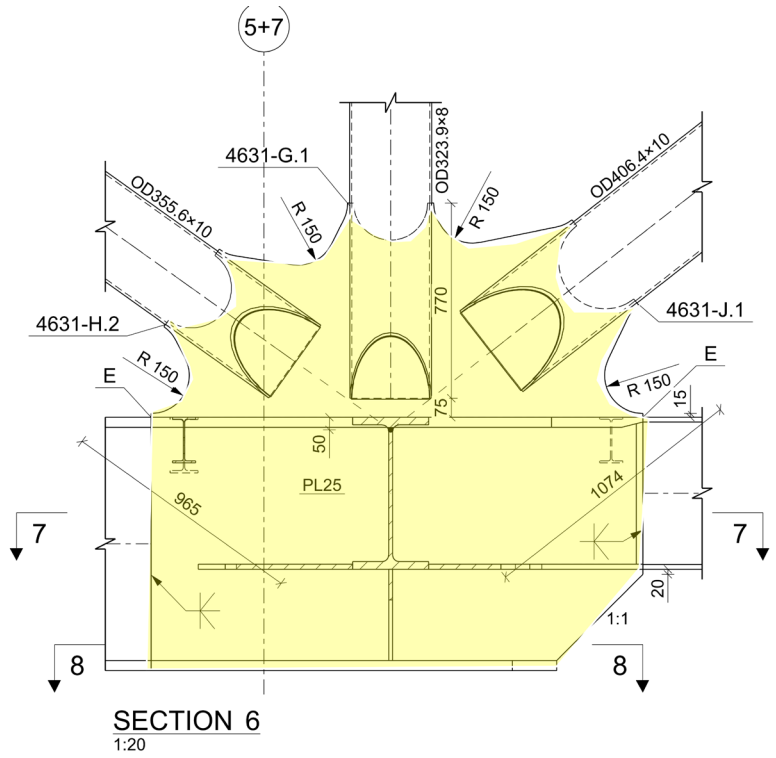


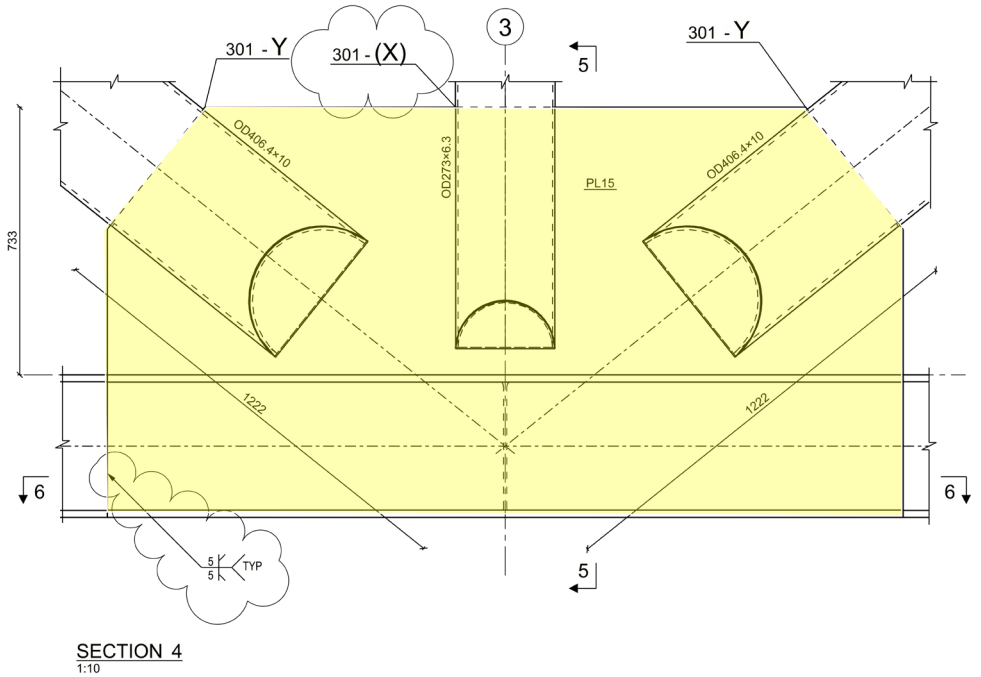
Columns / braces increased in dimensions

Gusset plates made fatigue friendly

Increased NDT requirements

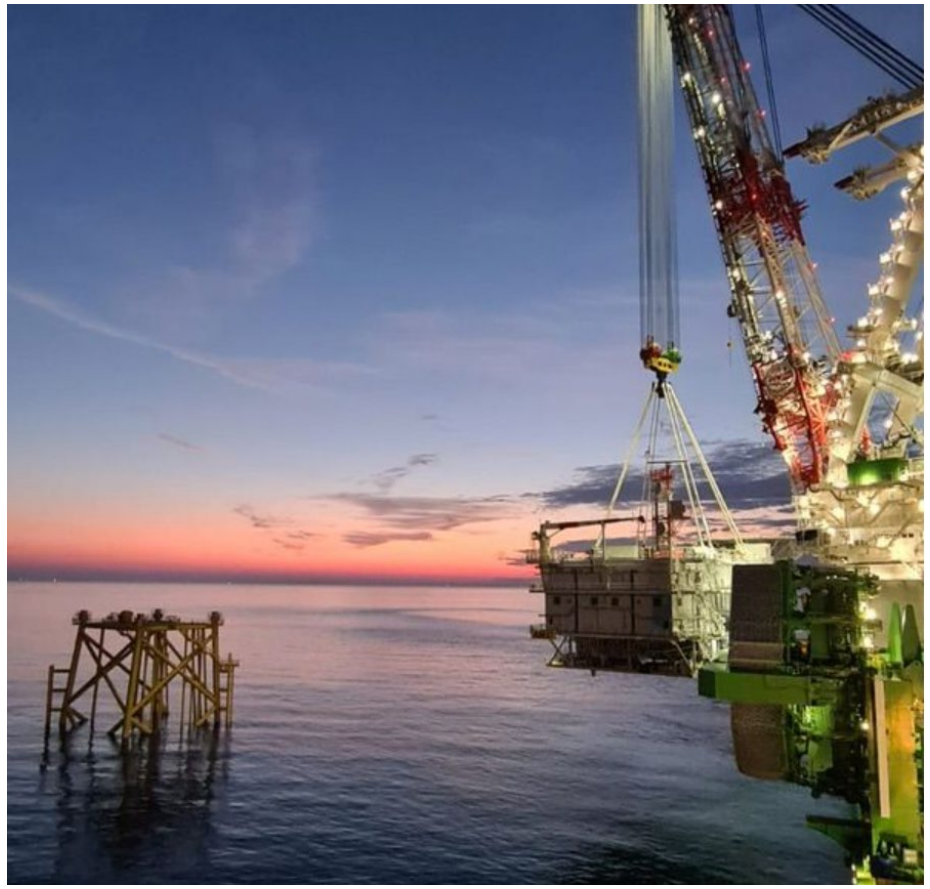
Transportation





Gusset plates made fatigue friendly

Installation – vessels avaliable and lifting method



Vineyard Wind

Kaskasi

ISC Innovative Engineering

BLADT INDUSTRIES

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