TTPO
Presentation
December 15th 2016

Semco Maritime

Projects, solutions and competences for the global energy sector

SEMCO MARITIME

35 years of energy experience

Safety briefing

NO COMPROMISE **NO COMPROMISE** WE CARE NO COMPROMISE NO COMPROMISE WE CARE NO COMPROMISE **NO COMPROMISE WE CARE** NO COMPROMISE WE CARE NO COMPROMISE WE CARE **NO COMPROMISE** WE CARE **NO COMPROMISE WE CARE** NO COMPROMISE NO COMPROMISE WE CARE NO COMPROMISE WE CARE **NO COMPROMISE** WE CARE **NO COMPROMISE** NO COMPROMISE **NO COMPROMISE WE CARE** NO COMPROMISE WE CARE NO COMPROMISE NO COMPROMISE WE CARE NO COMPROMISE NO COMPROMISE WE CARE **WE CARE** NO COMPROMISE WE CARE **NO COMPROMISE** WE CARE NO COMPROMISE NO COMPROMISE WE CARE NO COMPROMISE **NO COMPROMISE** NO COMPROMISE NO COMPROMISE **NO COMPROMISE** WE CARE **NO COMPROMISE**

Semco Maritime

Participates as a general contractor or subcontractor within the following market sectors:

- Oil & Gas
- Wind Power
- Rig Projects
- Power Projects
- Manpower
- Fabrication and Workshops

Headquartered in Esbjerg, Denmark

With subsidiaries in Norway, UK, Dubai, Germany, Singapore, China, Vietnam, Central America, Australia and the USA

1.500 **dedicated** employees providing services for the global energy sector.

Sandbank Offshore Substation

by longterm partners
Bladt Industries
Semco Maritime

Facts – Sandbank OSS

Client:	Vattenfall/Stadtwerke München
Location:	North Sea, Germany
Installation:	2016 – 28 meters water depth
Type of Contract:	EPCI contract
Electrical facts:	2 transformer - 2 x 180 MVA
	92 km cables
	HV GIS
	MV GIS
	Main diesel engines 2x 1840 KVA
Size:	2,250 tons topside
	1,700 tons jacket
Construction Time:	18 months

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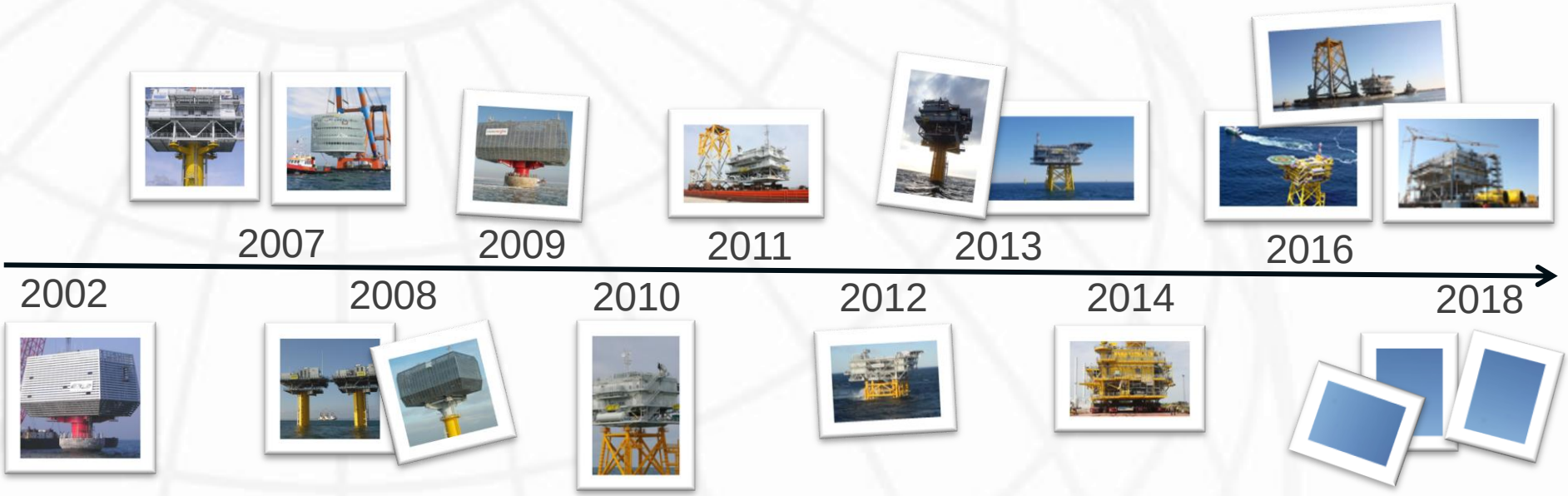
Pioneers



BLADT INDUSTRIES

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Organisation – Internal

EPCI contract

Semco Maritime Project Management

EPCI Construction	Semco Maritime Electrical Package	Niras Design Package	Installation
• Construction Topside • Construction Jacket + pin piles • Loadout • Seafastning	• Grid study • Design MV/HV • Utility system • Construction • On- offshore commissioning	• Overall layout • Topside design • Jacket design	• Offshore transport • Offshore installation

Tender Phase

- ✓ Construction optimization
- ✓ **Close dialogue with stakeholder**
- ✓ Interaction with client to clarify requirements and specifications
- ✓ **Comply with legal requirements and specifications (Grid Studies)**
- ✓ Commercial challenges

Design/Planning Phase

Tender Phase → **Design/Planning** → Onshore Construction/Test → Offshore Installation/commissioning

- ✓ Construction optimization
- ✓ Early involvement
- ✓ Design workshops
- ✓ Comply with legal requirements and specifications
- ✓ **Authority approval (Grid Studies) and certifications**

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Onshore Construction/Test

Tender Phase → Design/Planning → **Onshore Construction/Test** → Offshore Installation/commissioning

- ✓ Construction – Jacket
- ✓ Construction - Topside
- ✓ Topside E&I
- ✓ Mechanical
- ✓ Final Acceptance Test, HAT, SAT
- ✓ Documentation and manuals
- ✓ **Hands on training of clients personnel**
- ✓ Handling of punch items

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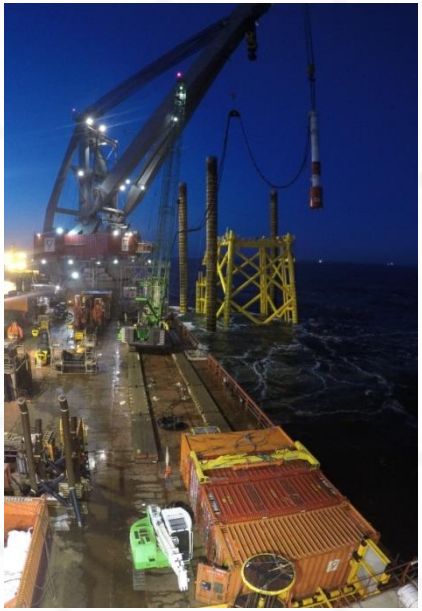
Installation/commissioning

Tender Phase → Design/Planning → Onshore Construction/Test → **Offshore Installation/commissioning**



- ✓ Offshore Transportation
- ✓ Installation
- ✓ Hook-up
- ✓ Connection of export and array cables
- ✓ **Final commissioning of all systems**
- ✓ Final test and takeover

How to execute an

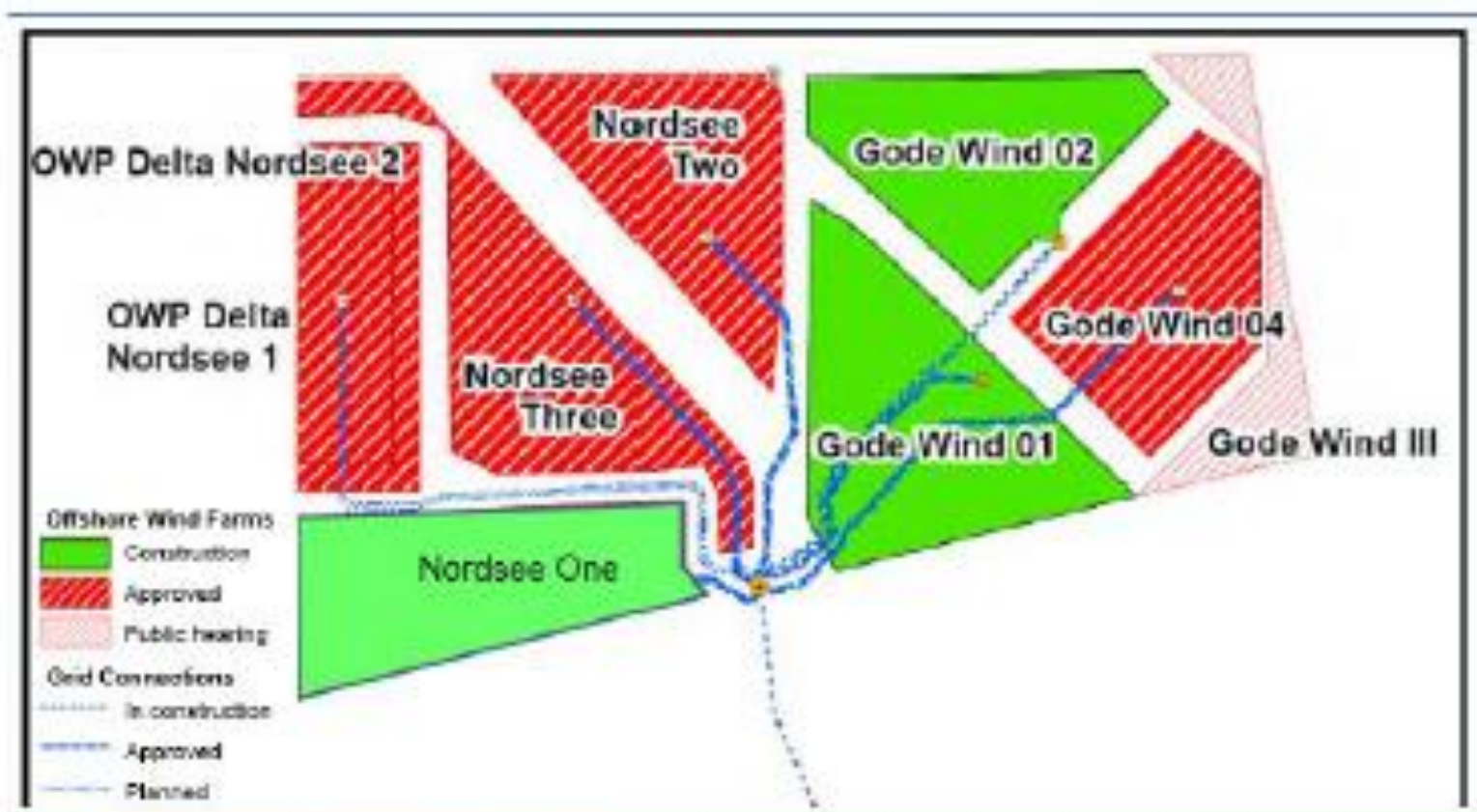
EPCI contract in 2 minutes!

Commercial

possibilities and issues

- ✓ Warranty and O & M requirements – weather risk ……
- ✓ **Local content**
- ✓ **Common lessons learned**
- ✓ Availability provisions (performance guarantees) should be reasonable
- ✓ Tender cost
- ✓ Negations timeframe – cost
- ✓ Cash flow

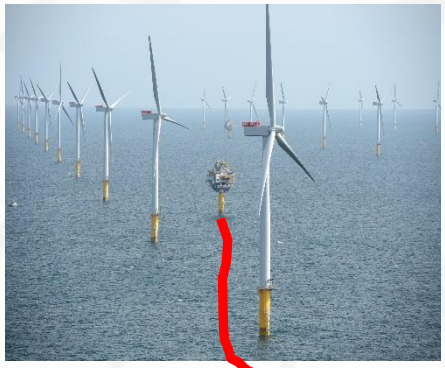
Off-shore HVDC site Lay-out



Overview which adjacent windfarms

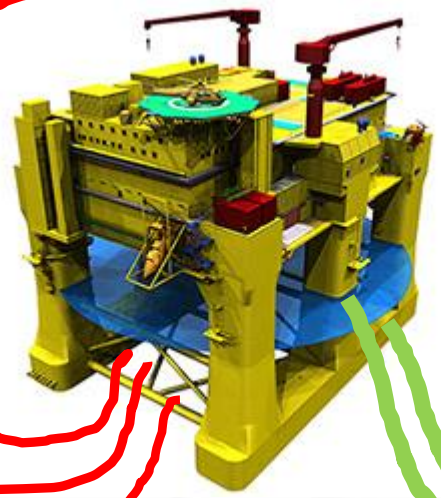
Source: BSH, translated

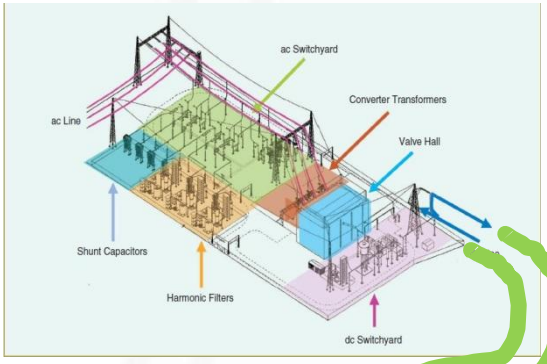
Off-shore HVDC principal Lay-out

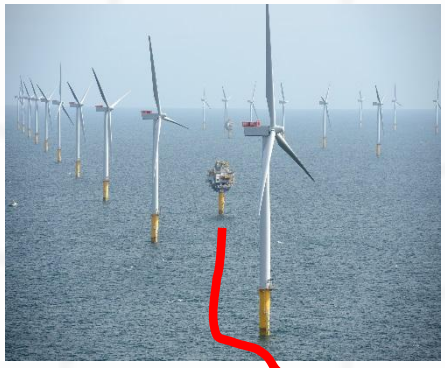


"Gode Wind I"

"Northsee One"







"Gode Wind II"

DolWin 2
916 MW HVDC
converter station

2x135 km cable

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Facts of DolWin2 Light HVDC converter station

Commissioning year:	2016
Power rating:	916 MW
No of circuits:	1
AC Voltage:	155 kV (Platform DolWin beta), 380 kV (Dörpen West)
DC Voltage:	±320 kV
Length of DC submarine cable:	2 x 45 km
Length of DC underground cable:	2 x 90 km
Main reason for choosing HVDC Light:	Length of land and sea cables
Size (L x W)	100.1m x 74.1m
Application:	Offshore wind connections

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Dolwin2 HVDC Substation from ABB

EPCI contract worth around $1 billion consisting of:

- one off-shore 916 MW, 320 kV HVDC converter platform
- 2x135 km off-shore and onshore 320 kV HVDC cables
- one onshore HVDC converter station

Advises gained from experience

- So far only 6 – 7 off-shore HVDC converter station is in operation today
- Only economical for Wind farms > 800 – 1,000 MVA
- Evaluate carefully the real need for off-shore HVDC systems
- Explore cheaper alternative solutions as HVAC and possible off-shore reactors
- Evaluate the cost of Loss of Production with HVDC system faults
- >80% of the Insurances off-shore expenditures is paid out to off-shore HVAC cable repairs
  - Repair time of off-shore HVAC cables is 120 -180 days
  - Repair cost of offshore HVDC cables is much higher than for off-shore HVAC cables
- Distinguish carefully between:

What is nice to have

and

What is really needed

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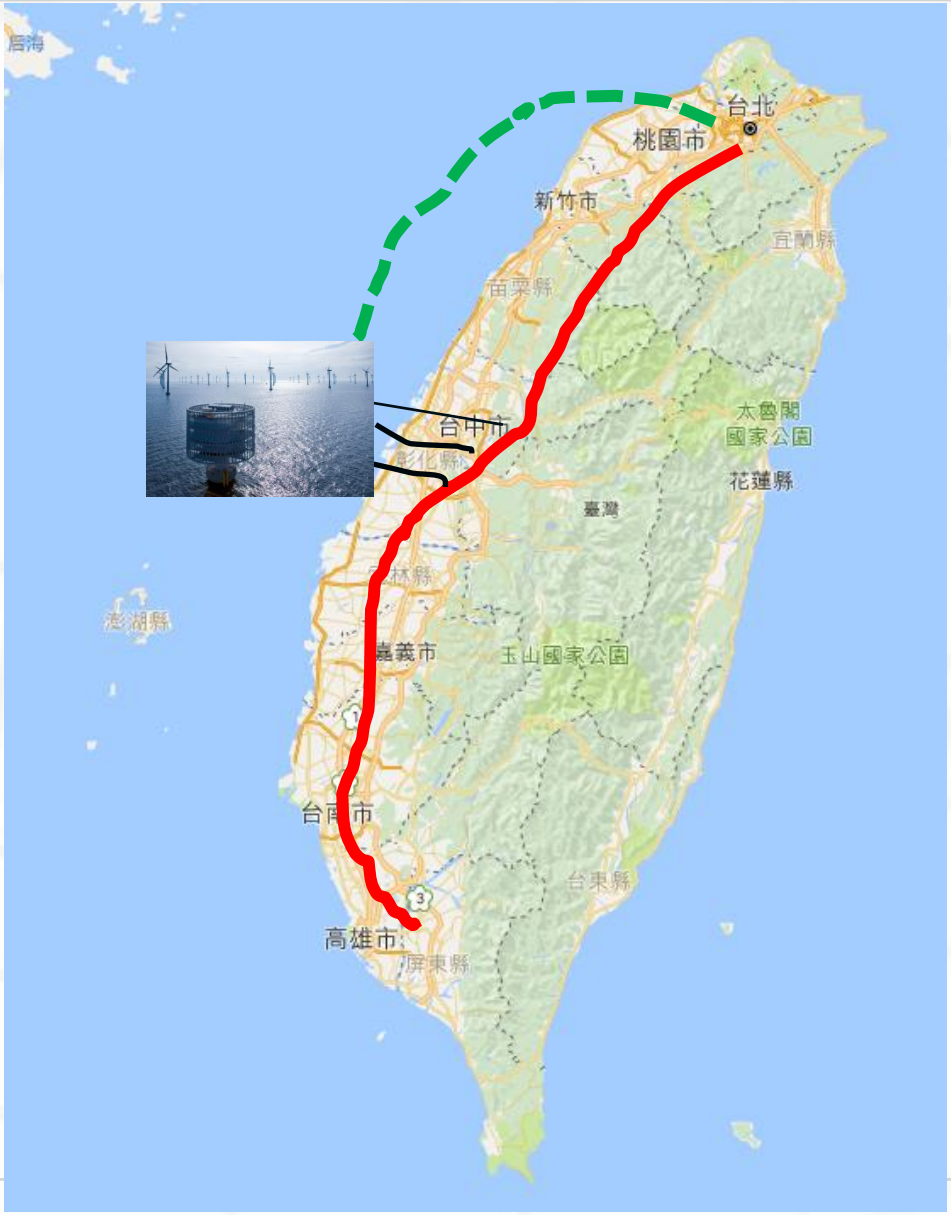
Taiwan Grid Challenges



HVDC Link

HVAC Back Bone

Export Cable

Array Cable

Which solution to choose?

Challenges:

- ✓ Export cables 161 kV or 345 kV
- ✓ Array cables 66 kV
- ✓ Offshore substation - Ownership
- ✓ Onshore substation - Ownership
- ✓ Number of land fall cables
- ✓ Strength of Back Bone
- ✓ ACDC Link offshore or onshore
- ✓ Network availability
- ✓ Developer compensation
- ✓ Network stability
- ✓ Grid Code compliance

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Which solution to choose?

Solutions:

- ✓ Taipower to investigate the possibilities with consideration of the most economical long term solution
- ✓ Taipower to investigate the various solutions used in Europe
- ✓ Find solutions for strengthen of the Back Bone
- ✓ To quickly develop and ensure the right solutions consultancy services in close corporation with BOE / ITRI / Taipower is needed
- ✓ Draw-up and issue the standard as guidance for the developers

Semco Maritime as a strong and reliable partner with many years of experience within the Energy Transmission system is the right independent choice for solving the Grid challenges which BOE / ITRI / Taipower faces

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Offshore safety inter-field telecommunication

The Semco Maritime inter-field telecommunication concept ensures a full and clear communication, complying to the ever stricter HSE requirements for wind park project locations by utilizing a variety of mission critical field proven technologies

Typical system supply

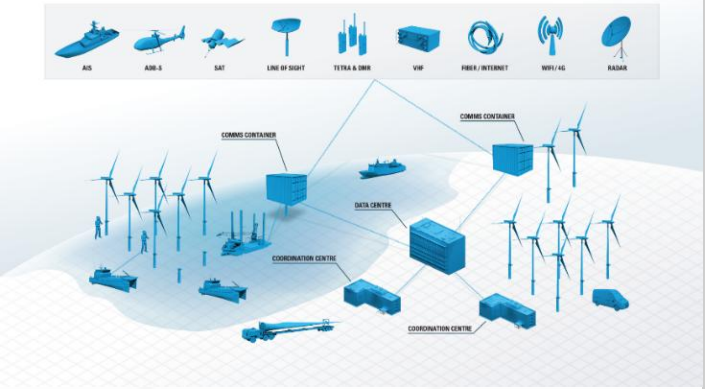
- SemTETRA (multisite group/private calls), DMR, VHF/AM (Aeronautical flight radio), VHF/FM (marine radio)
- SemAir repeater solution for TETRA indoor coverage in WTG and OSS

Transmission systems

- Microwave point-to-point/ multi-point radio link, data networks LAN/WAN

SemPAM

- The SemPAM is a web-based people and asset management and monitoring tool



SemTETRA® offers an **advanced** solution that integrates **many** other telecommunication systems with the *SemTETRA®* system.

Contacts and Questions?

Chen Qi
Manager, China Projects and Operations
chqi@semcomaritime.com

Hasan Jørgensen
Senior Sales & Business Development Manager
nhj@semcomaritime.com

Tommy Flindt
Director Technology
tofl@semcomaritime.com