Cable Laying Panel

Submarine Cable Installation in Offshore Wind Parks

10th February 2021

Intro

Harald Poppinga Operations Director Seaway7 Offshore Cables – Leer, Germany
Since January 2014 with Seaway7
Project Manager for the Submarine Cable Installation Projects:

Humber Gateway, 33kV Inner Array Grid Cable System

- Client: E.ON Climate and Renewables UK
- Scope: Transport and installation of 24x 33kV inner array grid cables as well as associated services (approx. 22km)
- Schedule: one (1) campaign 2014

Amrumbank West OWF, 33kV Inner Array Grid Cable System

- Client: E.ON Kraftwerke, Germany
- Scope: Installation, termination, testing and pre-commissioning of 86x 33kV inner array grid cables (approx. 90km)
- Schedule: two (2) campaigns in 2014 and 2015

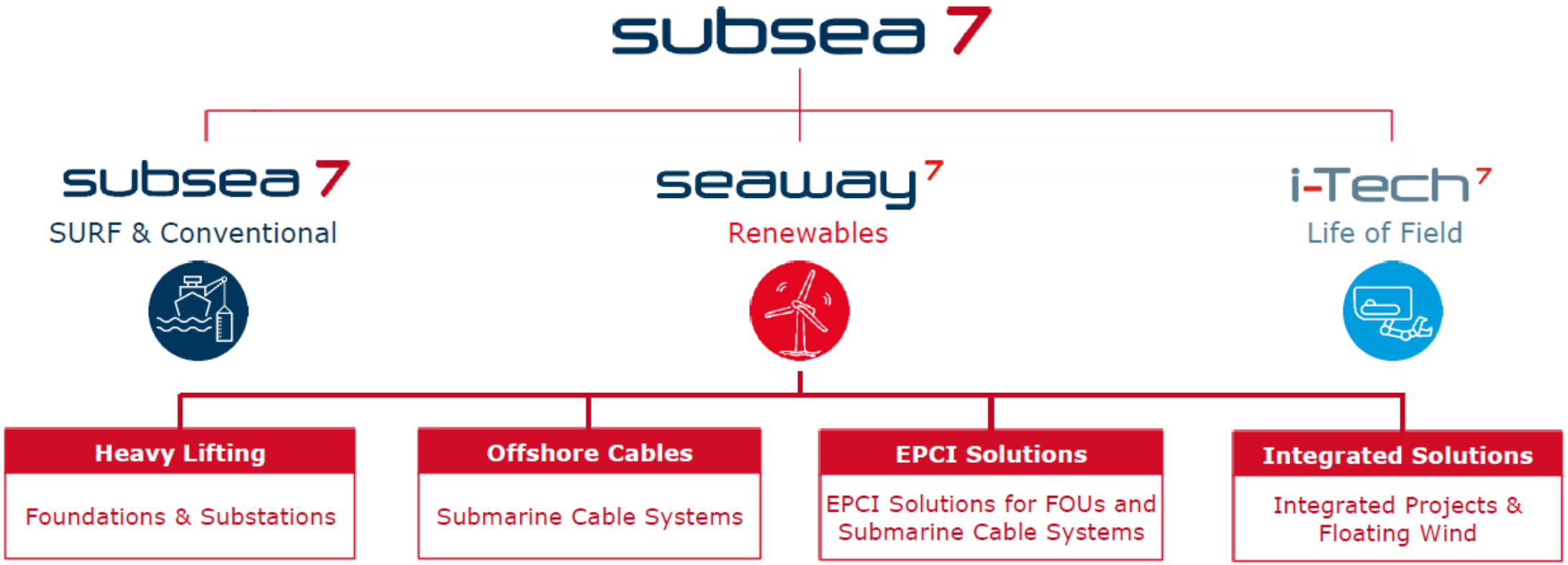
Nordsee 1 OWF, 33kV Inner Array Grid Cable System

- Client: Nordsee One, Germany
- Scope: Supply, installation, termination, testing and pre-commissioning of 59x 33kV inner array grid cables (approx. 72km)
- Schedule: one (1) campaign in 2016

Trianel Windpark Borkum II, 33kV Inner Array Grid Cable System

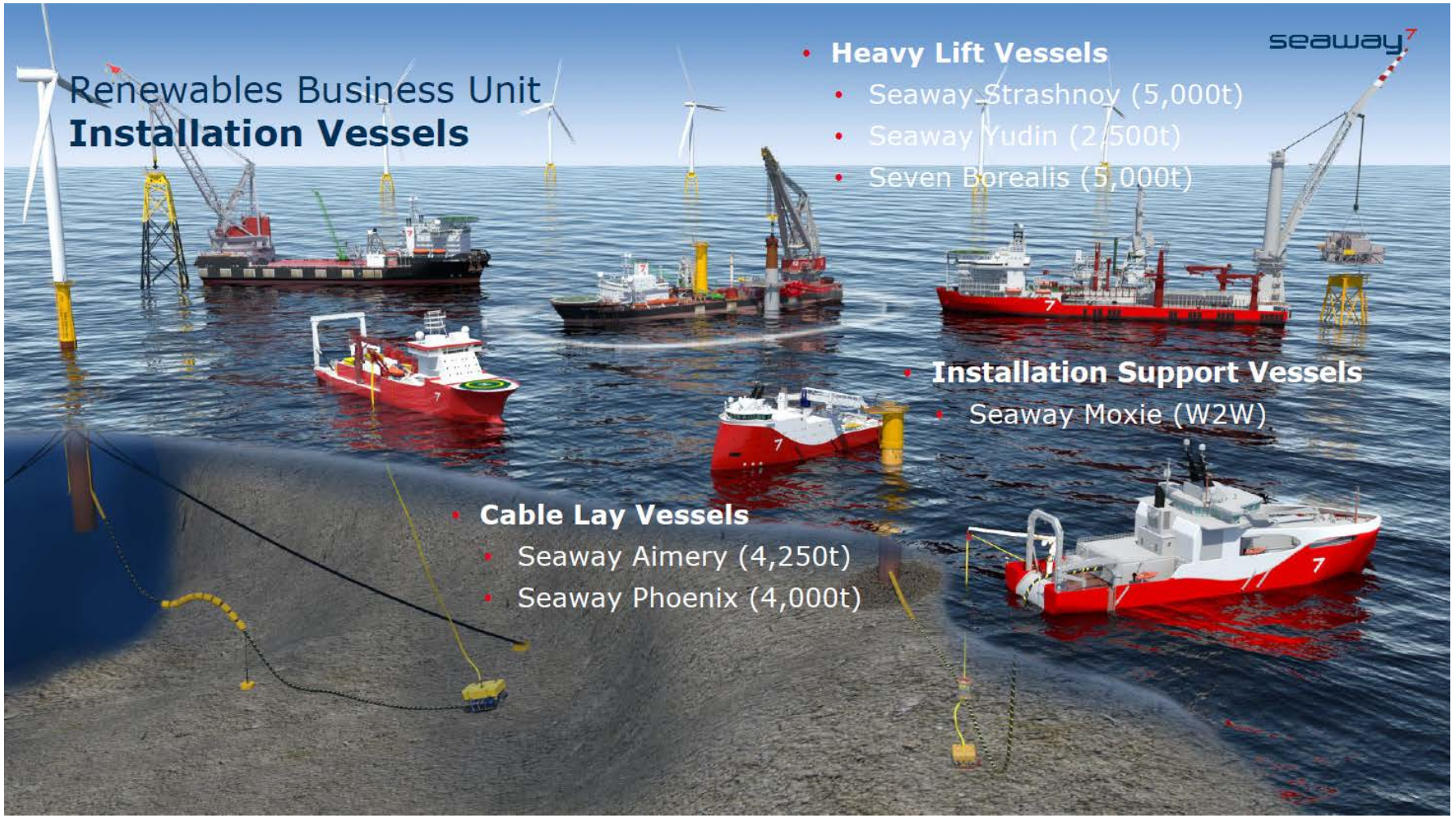
- Client: Trianel Windkraftwerk Borkum, Germany
- Scope: Turnkey supply, installation, termination, testing and pre-commissioning of 36x 33kV inner array grid cables (approx. 59km)
- Schedule: one (1) campaign in 2018

Renewables Business Unit
Organisation Structure

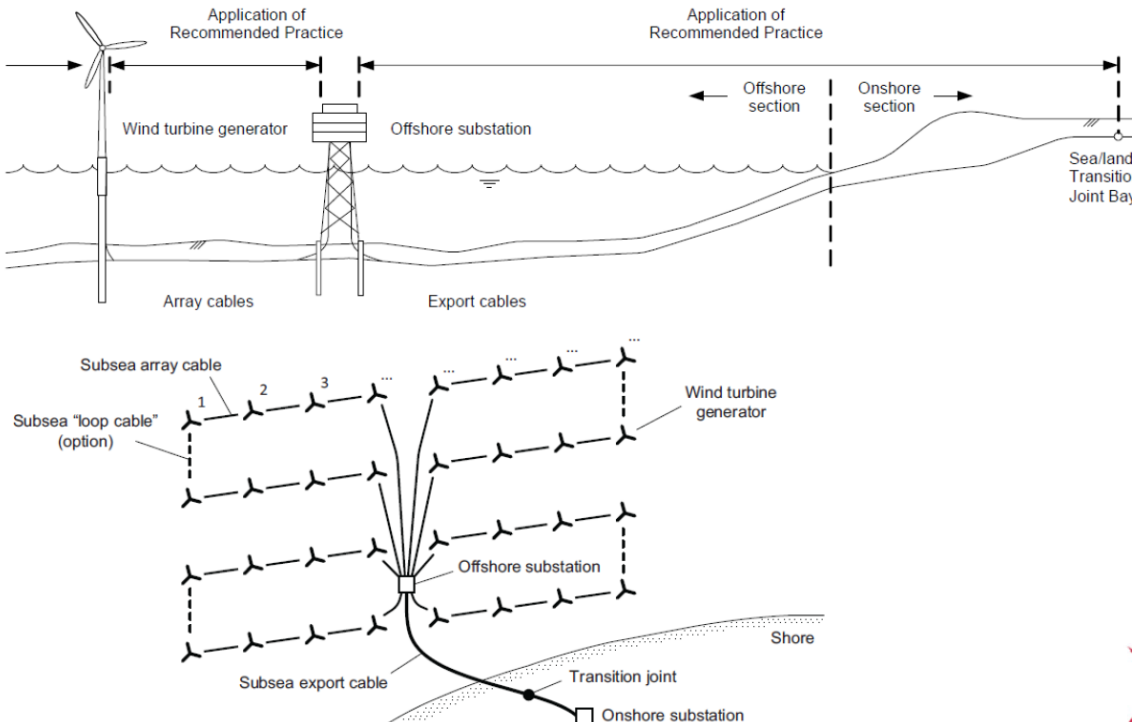


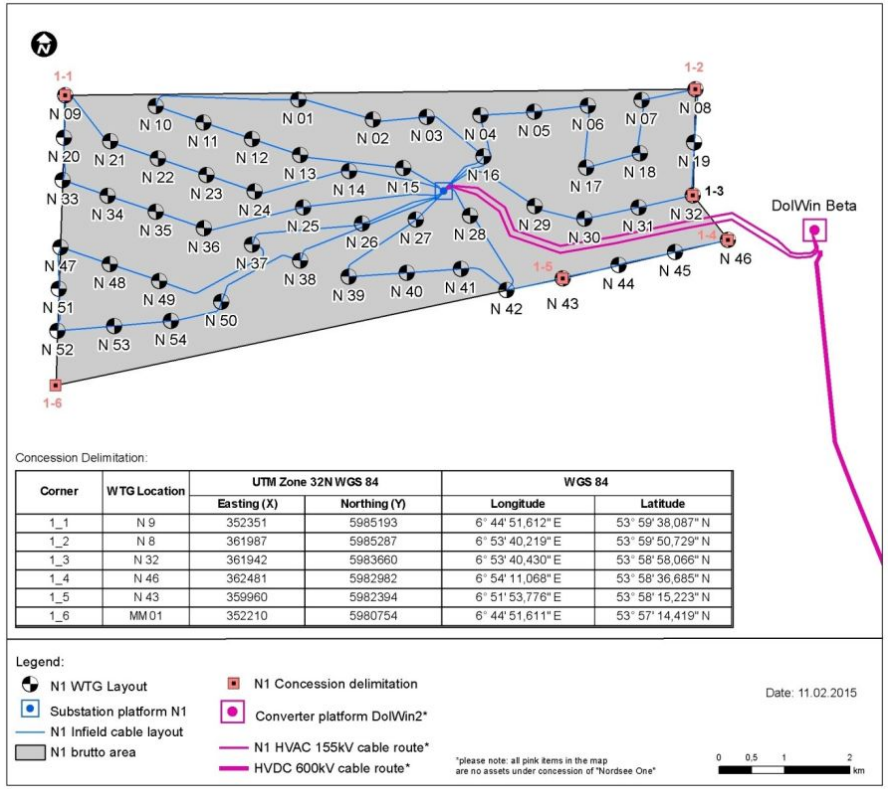
- An **experienced partner** for the delivery of **offshore wind farm projects** and a **specialist heavy lifting** and **cable installation services** contractor
- Ability to offer **specialized T&I** as well as **integrated EPCI solutions**

Seaway7 - Fleet



Inner Array Cables in Offshore Wind Parks





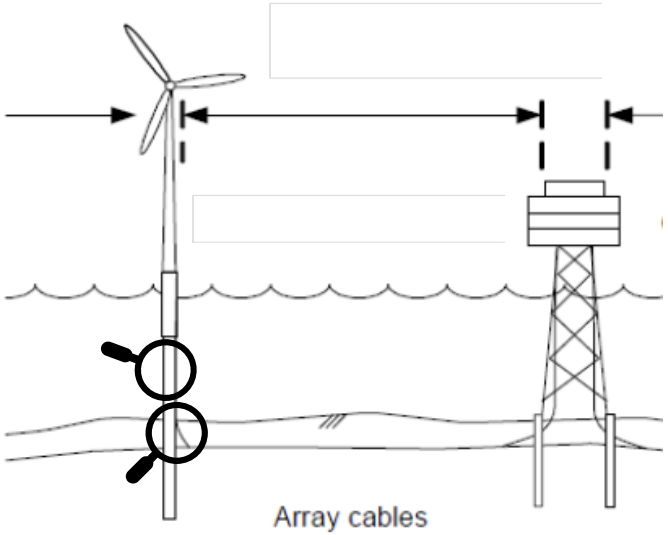
Corner	WTG Location	UTM Zone 32N WGS 84		WGS 84	
		Easting (X)	Northing (Y)	Longitude	Latitude
1_1	N 9	352351	5985193	6° 44' 51,612" E	53° 59' 38,087" N
1_2	N 8	361987	5985287	6° 53' 40,219" E	53° 59' 50,729" N
1_3	N 32	361942	5983660	6° 53' 40,430" E	53° 58' 58,066" N
1_4	N 46	362481	5982982	6° 54' 11,068" E	53° 58' 36,685" N
1_5	N 43	359960	5982394	6° 51' 53,776" E	53° 58' 15,223" N
1_6	MM 01	352210	5980754	6° 44' 51,611" E	53° 57' 14,419" N

https://www.nordseeone.com/wind-farm/wind-farm-layout.html

The focus of this presentation is on AC - Inner Array Cables

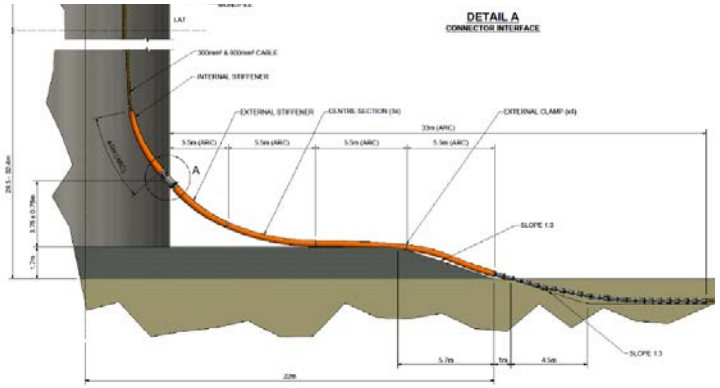
Installed Components

https://www.vos-prodect.com/products/cable-hang-off-system/



Cable Protection System Material e.g:

- Fibre reinforced PU elastomers
- Cast iron

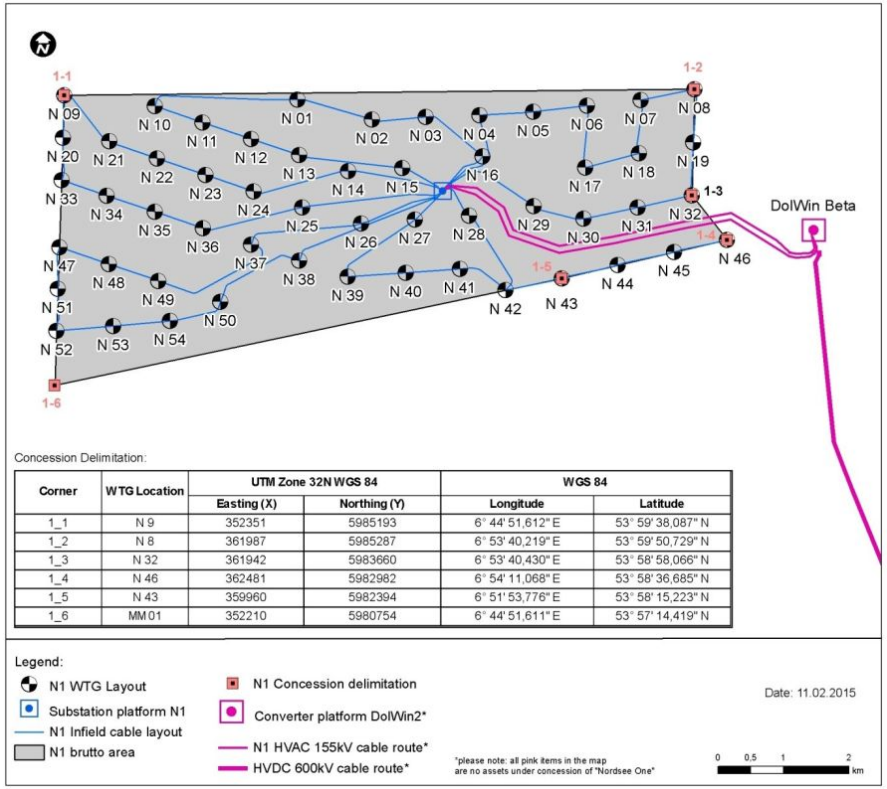


- Scour Protection
- Concrete Mattresses
- Rock Bags

Basics - Submarine Cable Types

Current:
- Alternating current – 3-core cable
- Direct current – bipolar or single core cable

Voltage Classification (IEC 60038)
- Medium voltage – up to 35kV
- High voltage – 35kV to 230kV
- Extra high voltage – 230kV to 800kV
- Ultra high voltage – above 800kV



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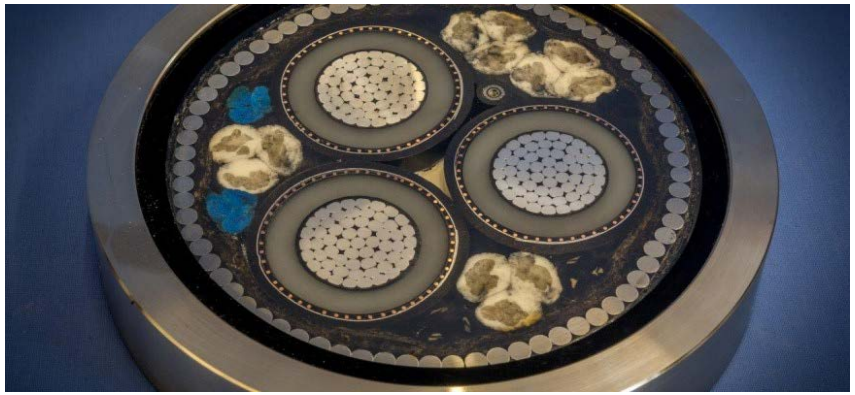
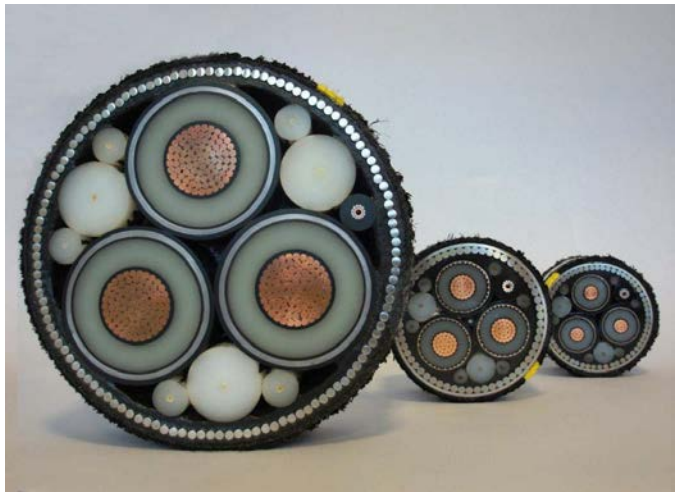
Basics - Submarine Cable Types

Insulation Material
- EPR (ethylene propylene rubber-insulated)
- XLPE (cross-linked polyethylene)

Conductor Material
- Cu (copper)
- Al (aluminium)



www.jdrcables.com



www.generalcable.com

Basics - Submarine Cable Types

Fibre Optic Element

Optical fibres

Copper buffer tube
Thixotropic water blocking compound, hydrogen scavenger

Armouring
Galvanized steel wires

Jacket / Outer sheath
Black PE

Assembly

Filler
LDPE, round shaped

Bedding layer
PP yarn

Armouring
Galvanized steel wires

Cladding
PP yarn (black, yellow)

Power Cores

Conductor
Stranded copper wires, waterblocked

Inner semi-conductive layer

Insulation
Cross-linked polyethylene (XLPE)

Outer semi-conductive layer

Semi-conductive water swelling tape

Metallic screen
Copper wires, copper binder tape

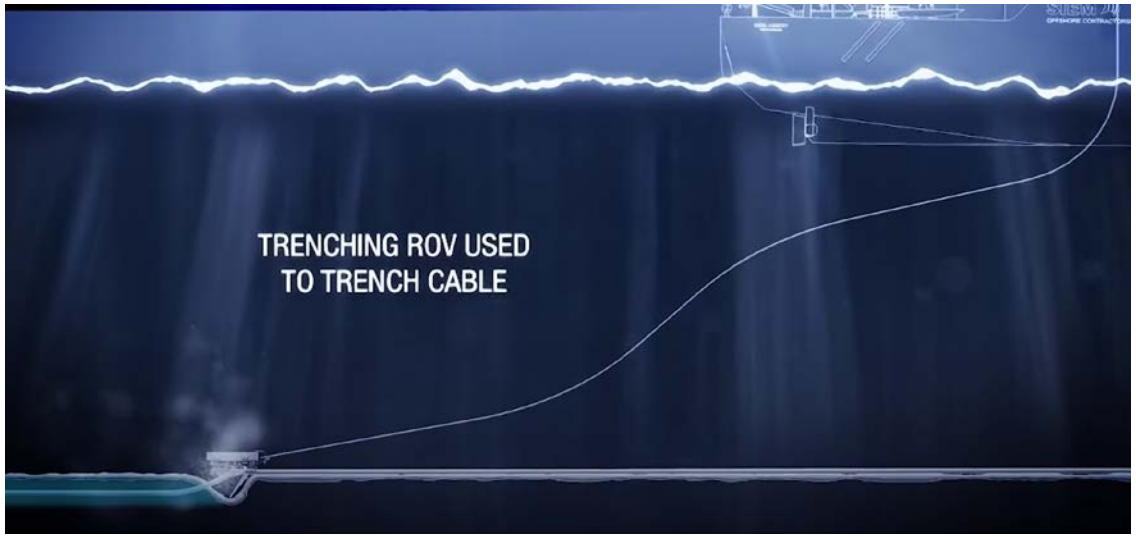
Radial tightness
Aluminium tape bonded to outer sheath

Outer sheath
Black PE

www.generalcable.com

Cable Installation Process

- S-curve Lay
- Touch Down monitoring during lay operations
- Tension Control on board of the Cable Lay Vessel



- Jet-Trenching shown on this picture
- Different trenching methods applicable, depending on seabed condition (Burial Assessment Study)

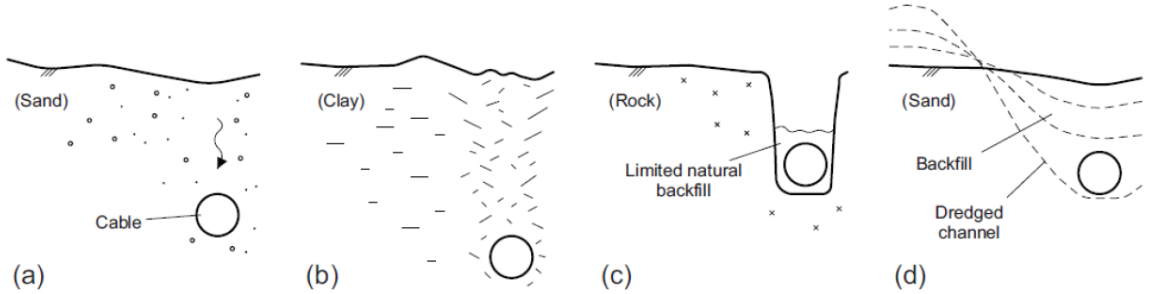
YouTube Submarine Cable Installation Works on Nordsee One OWF

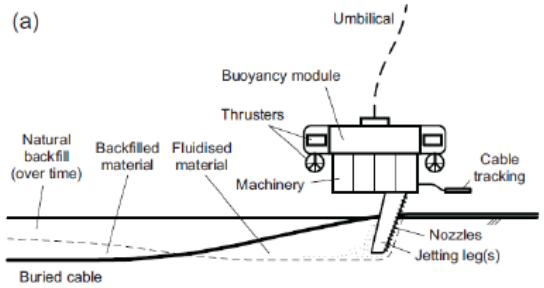
https://www.youtube.com/watch?v=3NJQZmHWQSo

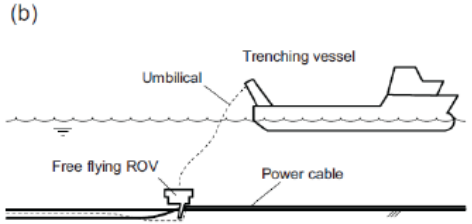
Cable Installation Process - Trenching

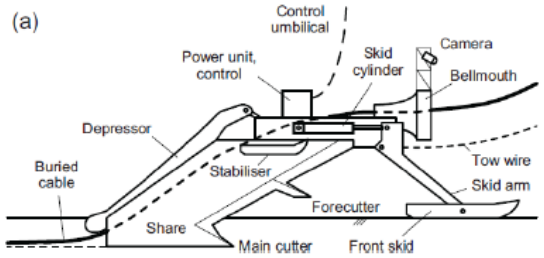
Adequate trenching techniques should be assessed, considering the following criteria:

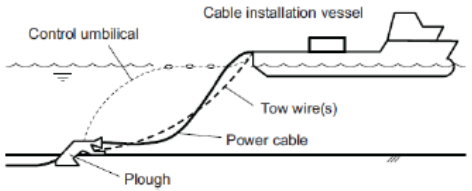
- environmental and marine impacts and conditions (water depth, currents and waves)
- soil / rock properties including horizontal / vertical homogeneity
- cable length, mechanical properties (e.g. tension, stiffness) and specific weight
- burial depth requirement as well as simultaneous lay and burial vs. post-lay burial
- potential burial equipment (and support vessel) capability and availability

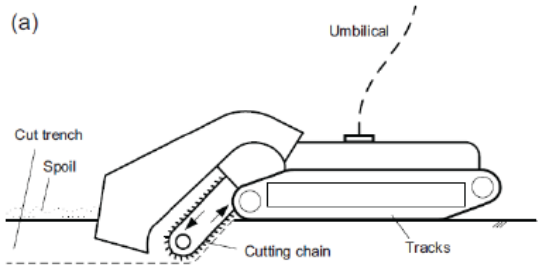


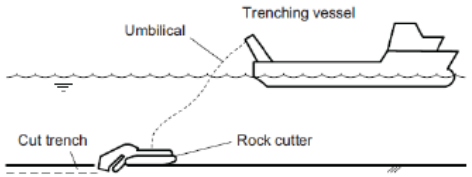












Decommission Installed Components – Submarine Cable

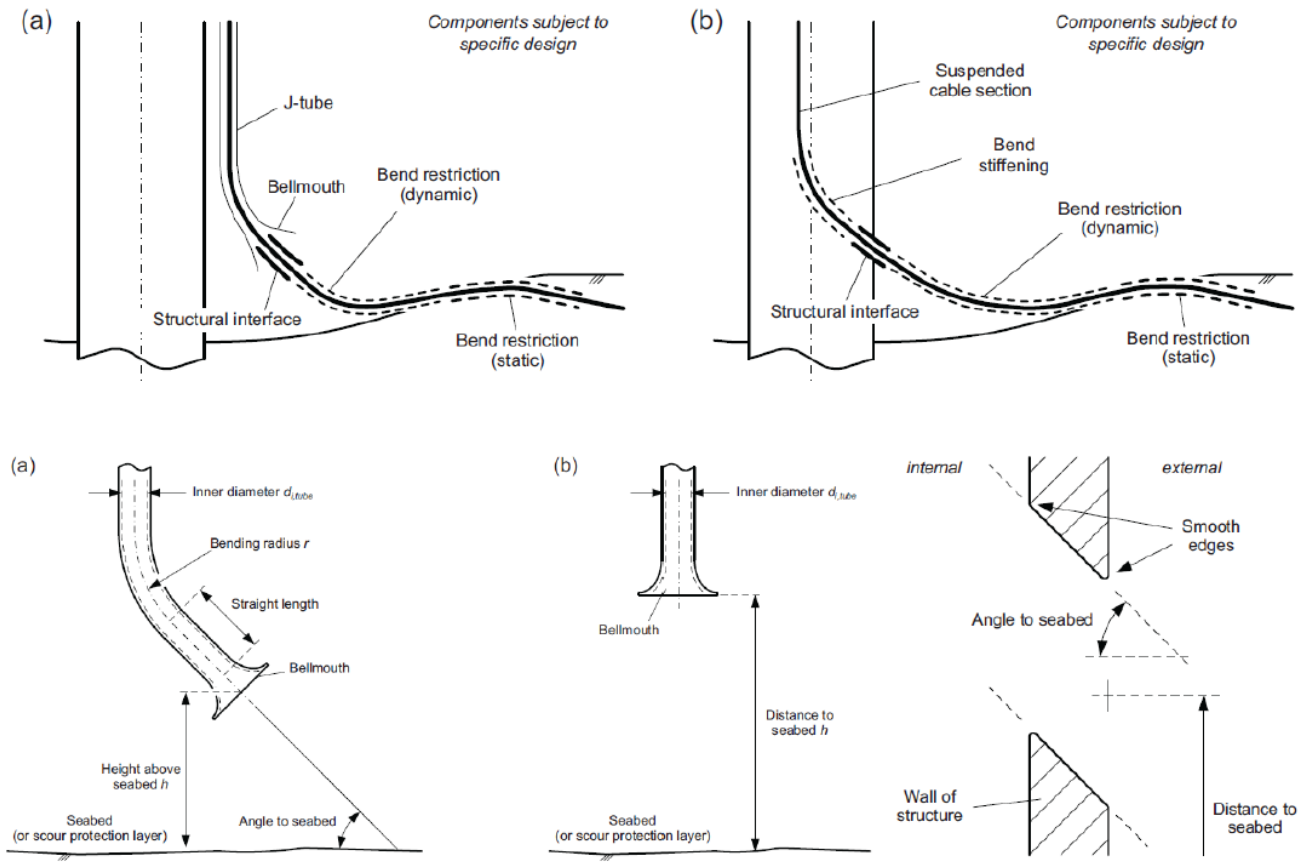
- Survey of Cable Routes (UXO migration, Cable burial depth)
- Recover of potentially installed concrete mattresses or rock bags
- Disconnection of the cables
- Exposing a cable section e.g. by dredging, so that the cable can be cut
- Recovering the cable out of the seabed (potentially additional dredging or sand removal required, depending on seabed cover)
- Disposal of cables

www.pipeshield.com

www.pipeshield.com

www.nkaglobal.com

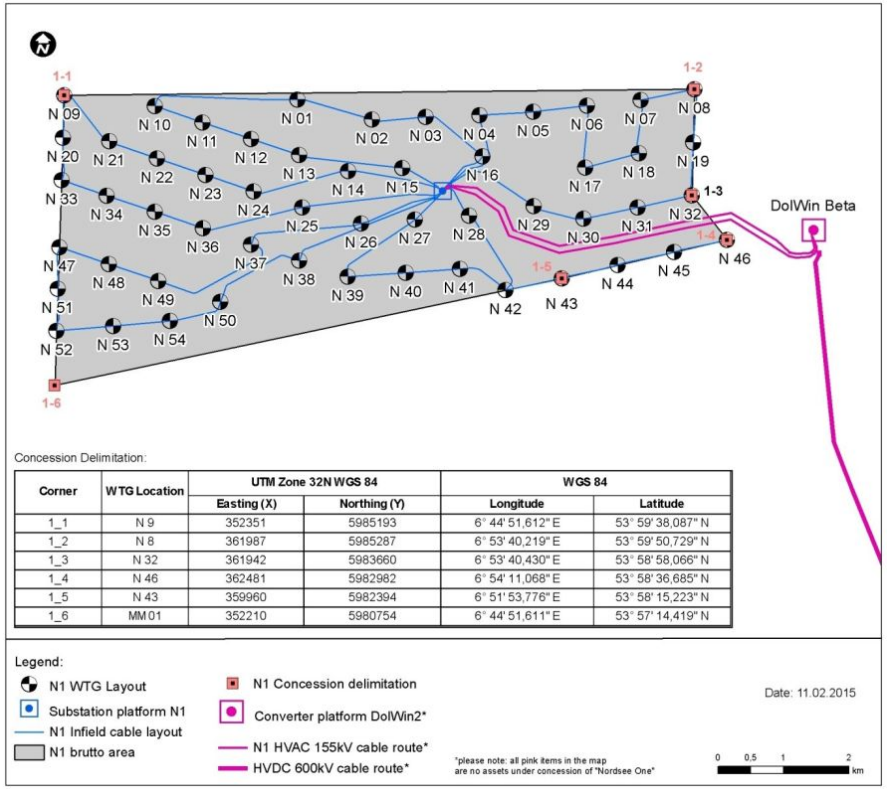
Challenge - Structural Interface



- Design of Scour Protection Layer can be challenging for recovering the subsea cable
- Recovering the Cable protection system (CPS)

Repowering

UPDATE



Concession Delimitation:

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Questions

THANK YOU