

Learning from the Experts Webinar Series

Mini-Series: Offshore Construction

Cable Installation



Bart Ummels
Expert Engineer
Ventolines

November 5, 2026

Meeting Procedures

Webinar recordings and presentations will be available at:

www.nyserda.ny.gov/osw-webinar-series

Participation for Members of the Public:

> Members of the public will be muted upon entry.

> Questions and comments may be submitted through the Slido Q&A feature at any time during the webinar.

> If technical problems arise, please contact Adam.Hauck@nyserda.ny.gov

Learning from the Experts



This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

DISCLAIMER:
The views and opinions expressed in this presentation are those of the presenter and do not represent the views or opinions of NYSERDA or New York State.

NEW YORK STATE | NYSERDA

NYSERDA – Learning from the Experts – November 5, 2026

Ventolines
Moving forward with renewable energy



Offshore Cable Installation

We guide our clients at every phase of wind, solar, energy storage, and system integration projects



Ventolines



1 USA
Block Island

2 USA
NYSERDA

3 USA
Clear Water Wind

4 Canada
The Great Lakes

5 Canada
Nova Scotia

6 Latvia and Estonia
Elwind

7 Estonia
Saare Liivi

8 Latvia
Technical Due Diligence and Grid Compliance Studies

9 Sweden
Stenkalles Grund

10 Ireland
Future Energy Island

11 Australia
Elanora

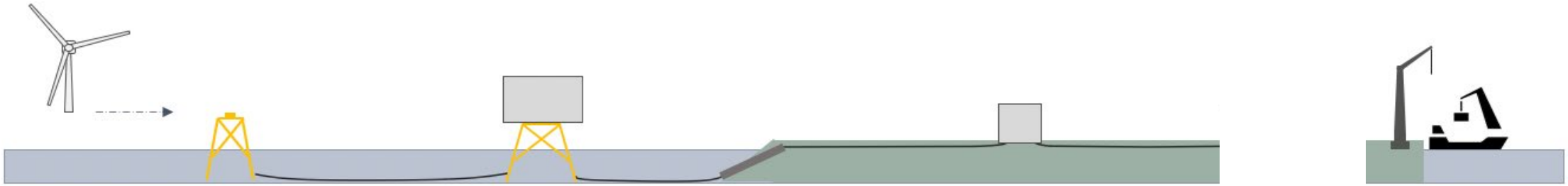
We aim for a world in which renewable energy projects are valuable for everyone

Agenda

- Wind project overview
- Cable Example: Hollandse Kust Noord
- Offshore, onshore, AC, DC
- Design and considerations
- Engineering
- Offshore Installation
- Post-installation works
- Summary and take-aways

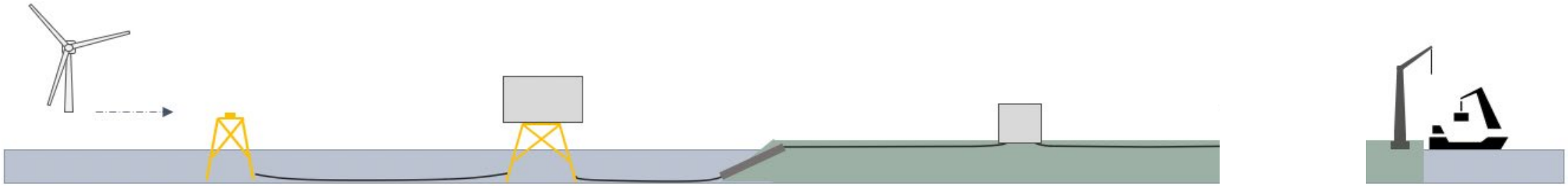


Offshore wind project overview



WTG	FOU	IAC	OSS	ExCa	Onshore ExCa	Onshore Substation	Grid Connection	
• 15 MW • 236 m rotor Ø • 25 m tip low • 143 m hh • 261 m tip high	• Monopiles • Jackets • Gravity-based (GBF)	• 66 kV • Three-phase cable strings • 4-6 WTGs per string	• 66/220+ kV • HV, AC • Jacket foundation • SCADA	• 220+ kV • HVAC • Three-phase cable	• 220+ kV • HVAC • Single-phase cables	• 220+/400 kV • HVAC • SCADA	• 400 kV	• **Fabrication locations** • **Marshalling harbour** • **Transport & installation** • **PM**

Offshore wind project overview



	WTG	FOU	IAC	OSS	ExCa	Onshore ExCa	Onshore Substation	Grid Connection	• **Fabrication locations** • **Marshalling harbour** • **Transport & installation**
	• 15 MW • 236 m rotor Ø • 25 m tip low • 143 m hh • 261 m tip high	• Monopiles • Jackets • Gravity-based (GBF)	• 66 kV • Three-phase cable strings • 4-6 WTGs per string	• 66/220+ kV • HV, AC • Jacket foundation • SCADA	• 220+ kV • HVAC • Three-phase cable	• 220+ kV • HVAC • Single-phase cables	• 220+/400 kV • HVAC • SCADA	• 400 kV	
Soon	• *18-24+ MW*	• *3500+ mt MPs* • *Floating*	• *132 kV, AC*	• ***AC/HVDC***	• ***HVDC***	• ***HVDC***	• ***HVDC/AC***	• *BESS*	• **PM**

Project Example: Crosswind/ Hollandse Kust Noord

- 67x 11 MW offshore wind turbines, 759 MW
- 12x 66 kV inter-array cabling strings (AC)
- 5 or 6 WTGs per string (55 or 66 MW), no loops
- Aluminium conductors
- Total IAC length around 140 km.



Project Example: Crosswind/ Hollandse Kust Noord

- 67x 11 MW offshore wind turbines, 759 MW
- 12x 66 kV inter-array cabling strings (AC)
- 5 or 6 WTGs per string (55 or 66 MW), no loops
- Aluminium conductors
- Total IAC length around 140 km.

- 2x 220 kV export cabling circuits (AC)
- 350-380 MW per circuit (partially redundant)
- *NL: Export Cable and Offshore Substation delivered by grid operator TenneT ahead of wind project*



Offshore vs. Onshore Cables

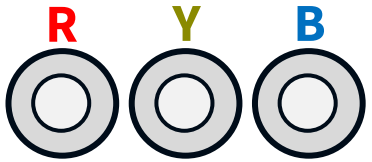
Ventolines

- 3-Phase, High-Voltage Alternating Current (HVAC)
- Aluminium or copper conductors

- 3-Phase submarine cables, incl. fibre-optic(s)
- Steel armouring carries mechanical forces
- Standard voltage for Inter-Array Cabling: 66 kV
- Voltage range for Export Cabling: 150-275 kV

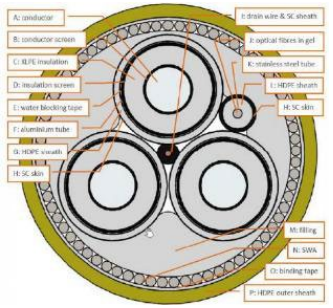
- Large weight per m. of length
- Large bending radiuses (3-phase vs. power core)
- Cable handling and installation is challenging

< 70 mm.
< 10 kg / m.



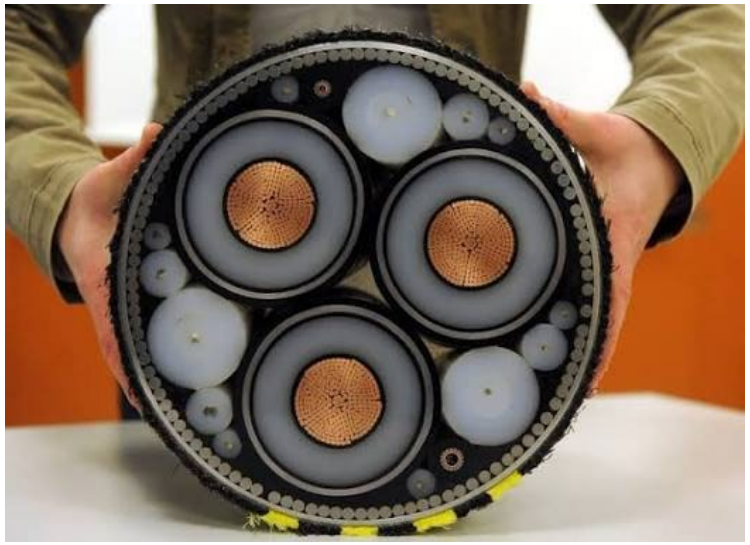
MV, onshore

< 200 mm.
< 80 kg / m.



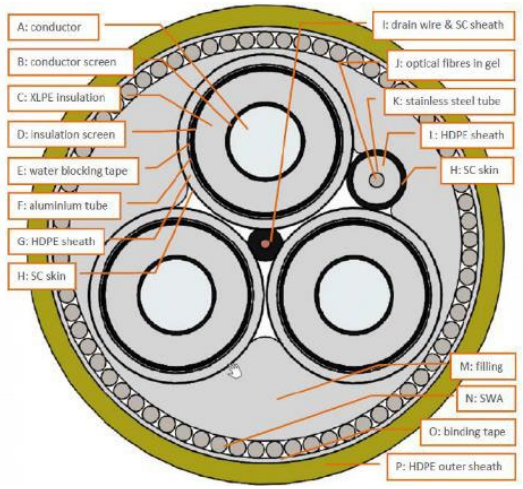
66 kV, offshore

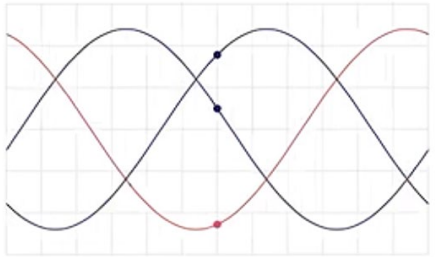
< 300 mm.
< 180 kg / m.



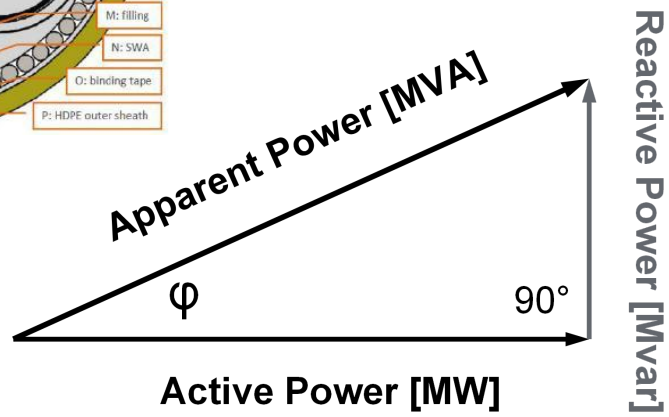
HVAC vs. HVDC

- High-Voltage Alternating Current
- Balanced power, three phases at 120°
- Large capacity:
  - <~80 MW per 66 kV circuit (inter-array cabling)
  - <~350 MW per 220 kV circuit (export cabling)





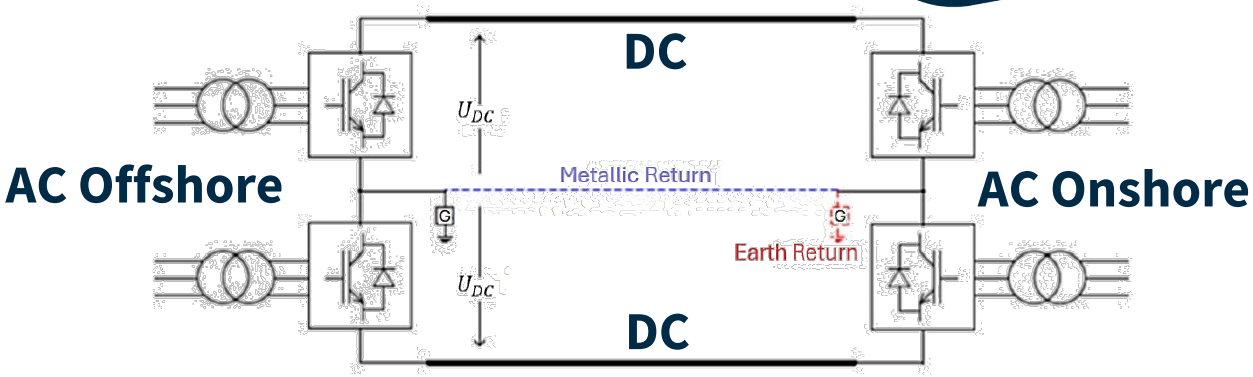
- Reactive power flow supports power transfer
- A large distances, reactive power flow increases:
  - High losses: active + reactive
  - Less cable capacity available for active power
- Transmission distance limit for AC submarine cables

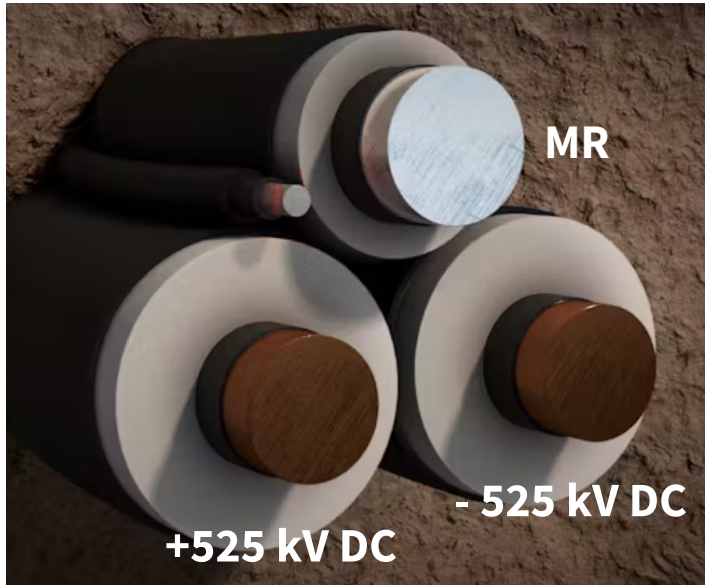


HVAC vs. HVDC

- High-Voltage Direct Current
- No reactive power flow
- Only resistive losses
- Two conversions: AC-DC and DC-AC
- Conversion losses

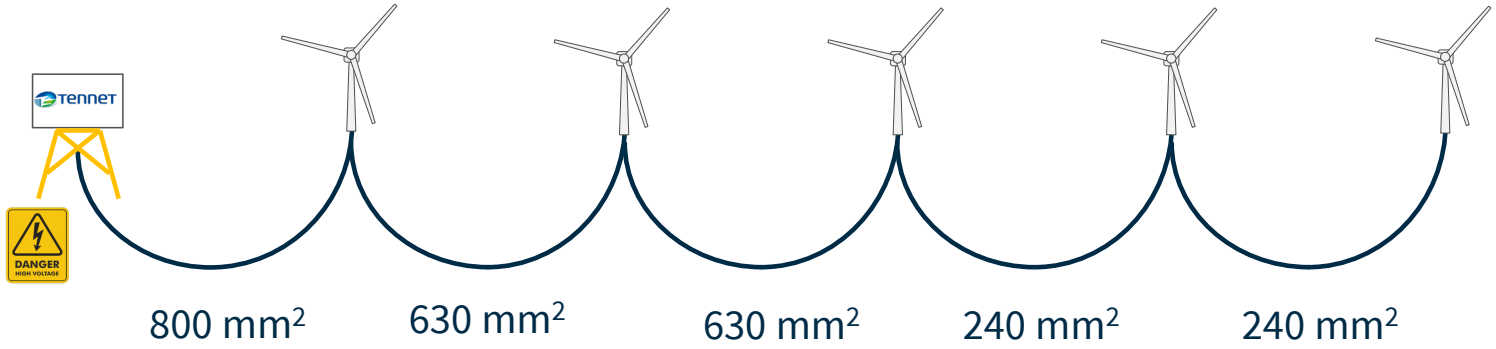
- Bipolar power transmission, + and –
- Metallic return for 50% redundancy
- Very high capacity (< 2GW for +/- 525 kV DC)
- Very large distances (>> 1000 km)
- Very high investment cost

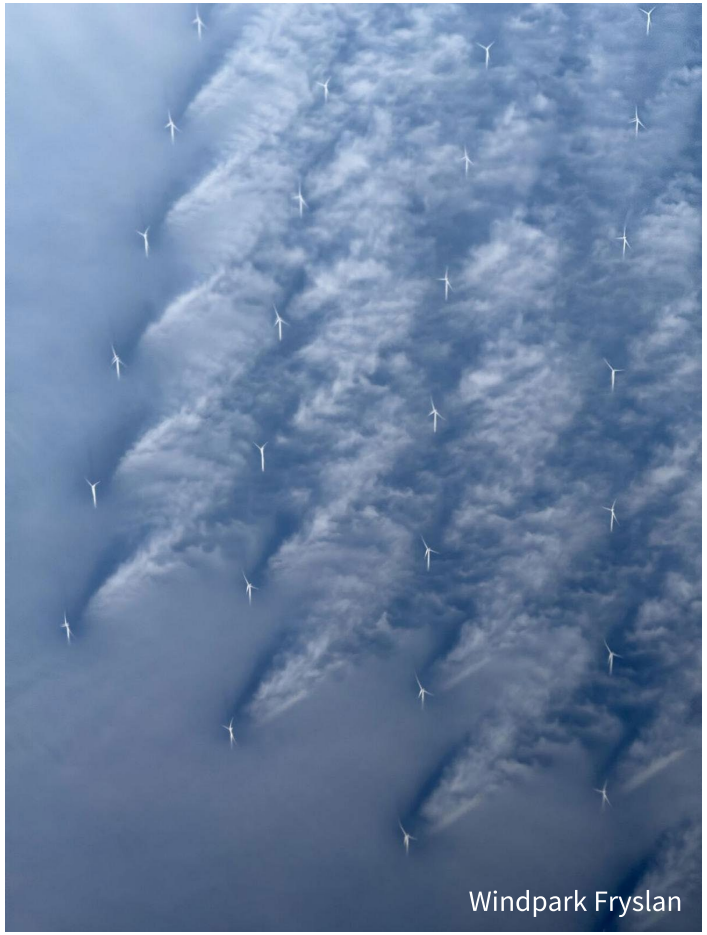




Design and Considerations

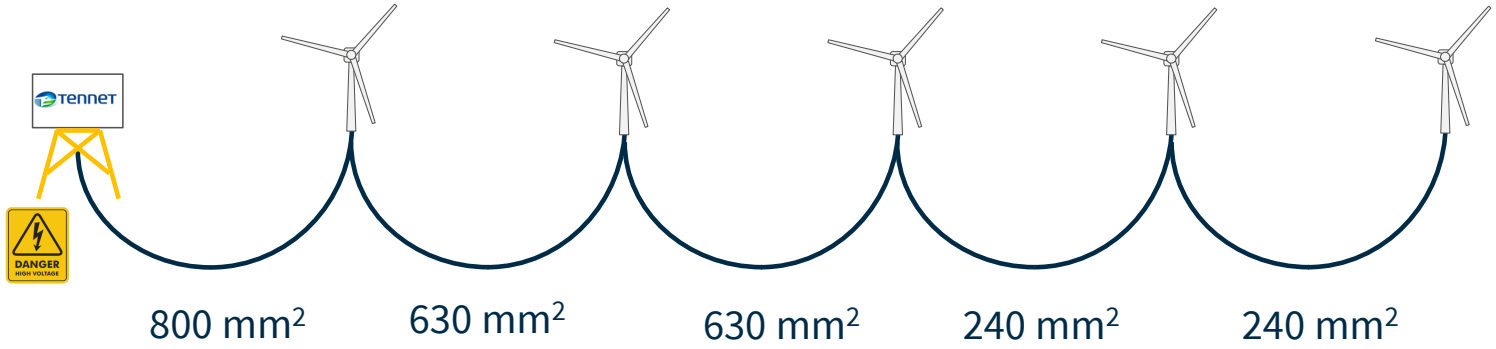
- Windpark layout optimization for LCoE
- Maximize annual energy production: minimize wake loss
- Minimize foundation costs: avoid specific soils/depths
- Minimize cable costs: avoid crossings, minimize length & size
- Cable layout optimized based on yield and foundation layout

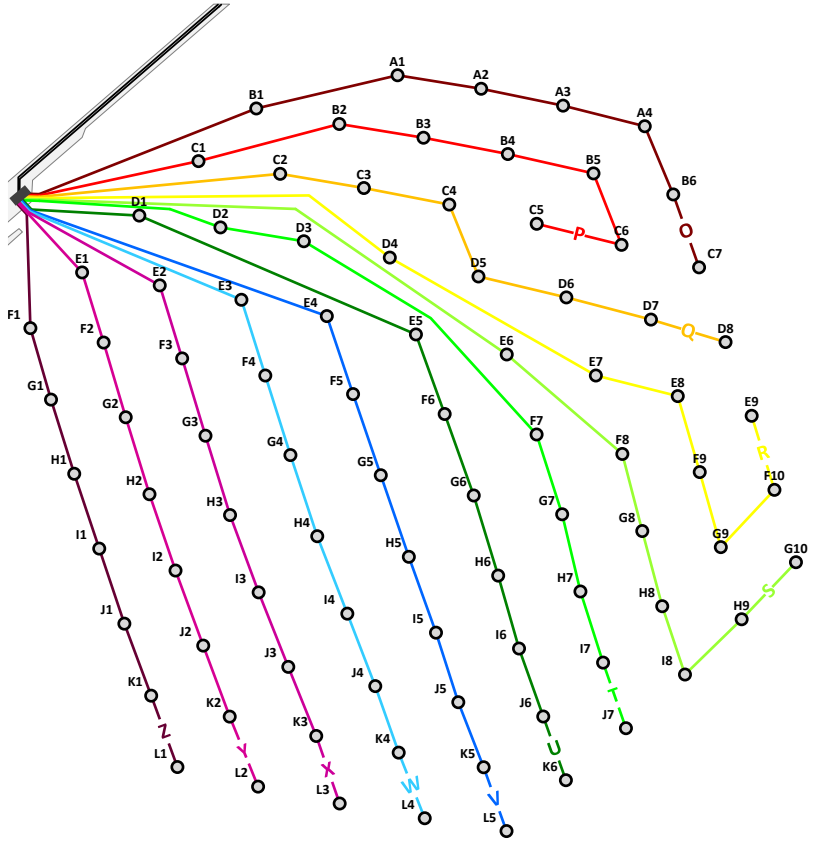



Windpark Fryslan

Designs and considerations

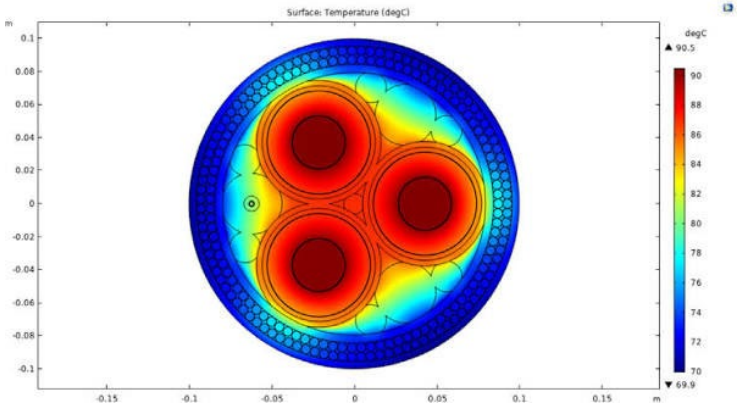
- Windpark layout optimization for LCoE
- Maximize annual energy production: minimize wake loss
- Minimize foundation costs: avoid specific areas
- Minimize cable costs: avoid crossings, minimize length & size
- Cable layout optimized based on yield and foundation layout



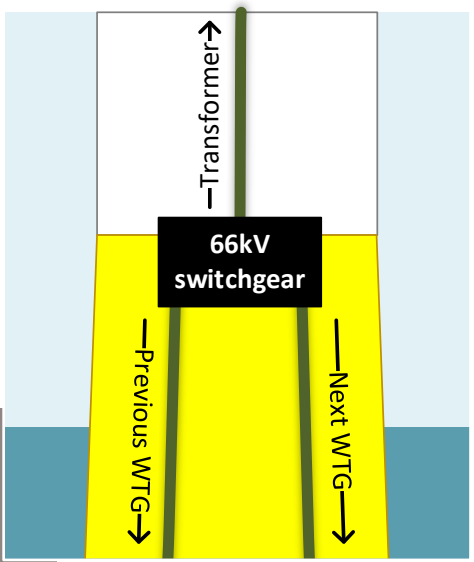


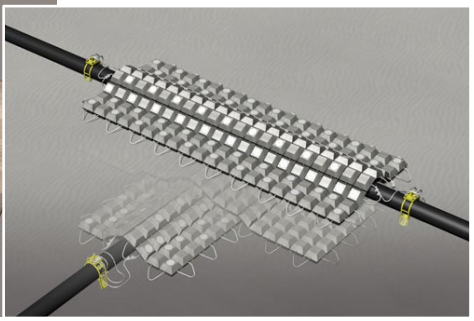
Engineering

- Soil types and conditions
- Water depths, currents
- Target burial depth
- Foundation interfaces: pull-in
- Scour rock interface: movement
- Turbine interface: switchgear
- Manufacturing location: transport
- Cables and accessories
- Mechanical and electrical design



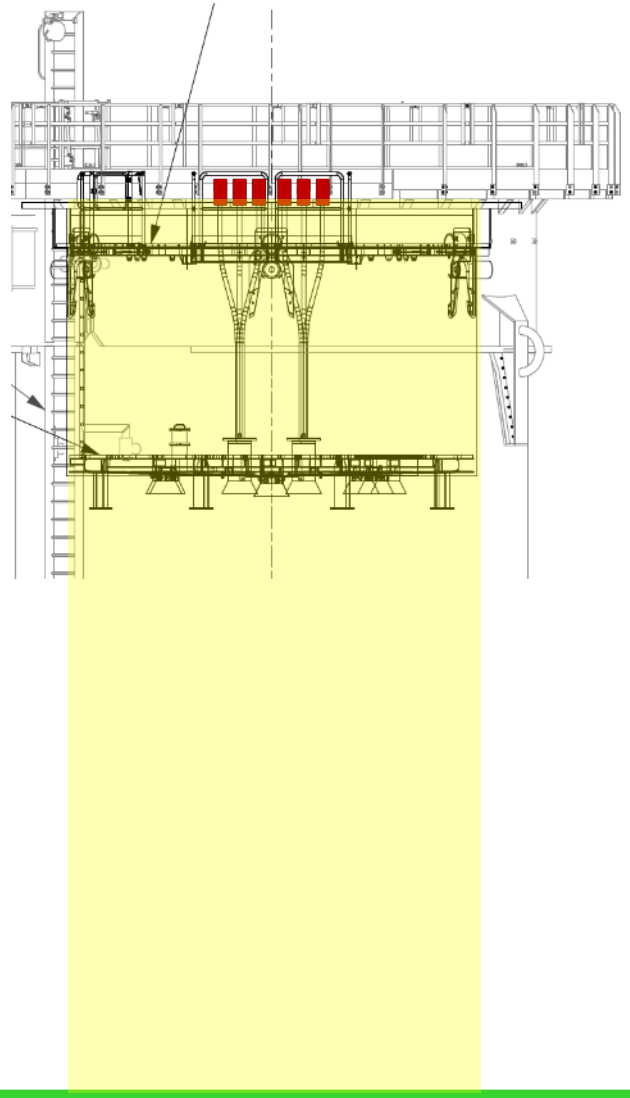


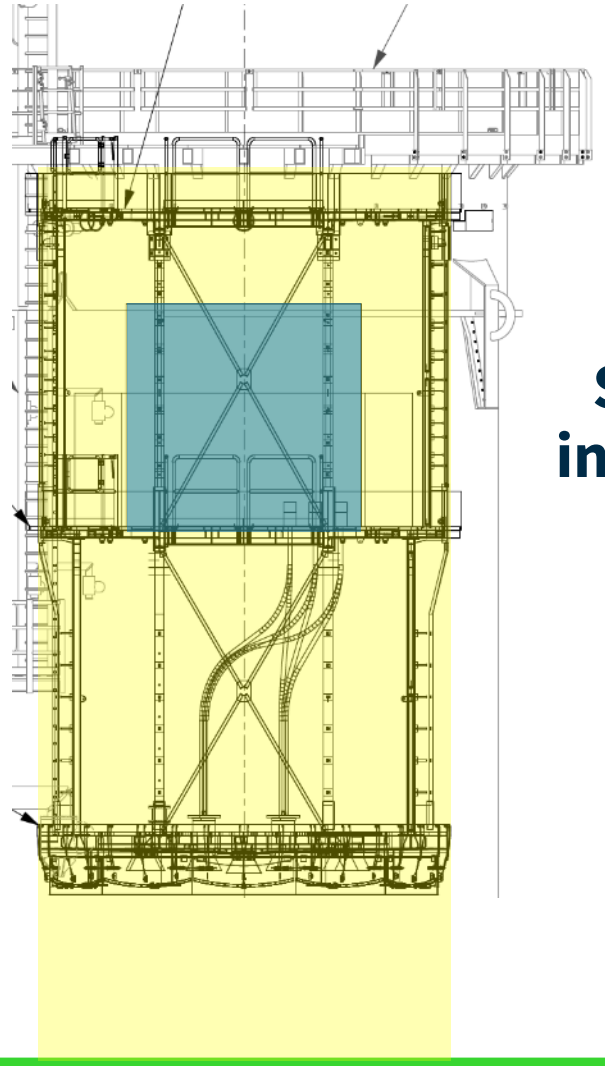




Engineering

Connector Boxes



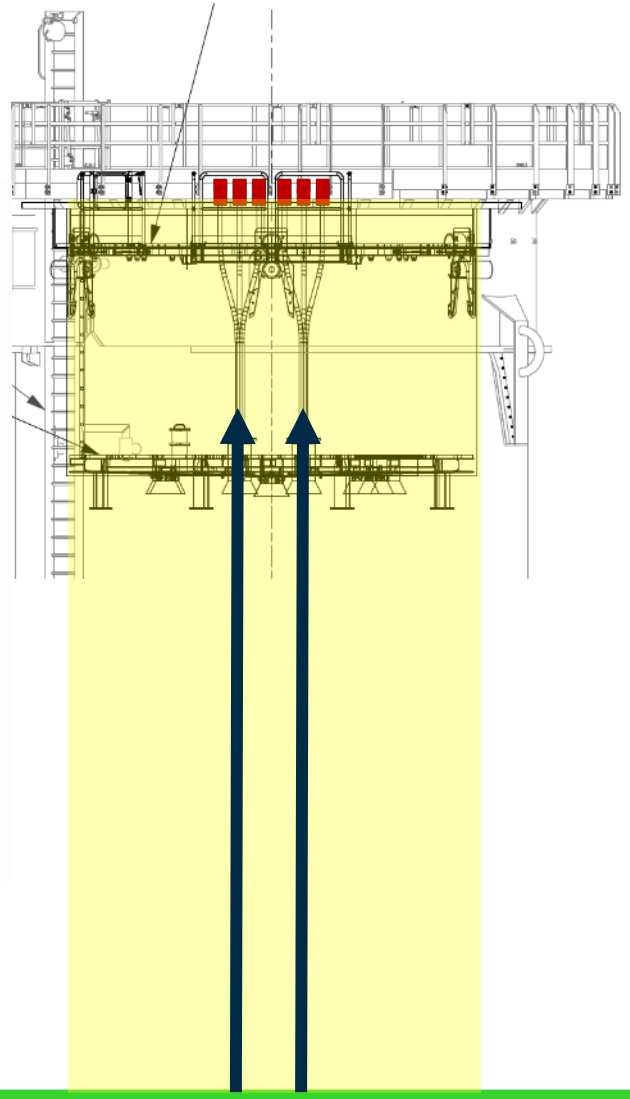


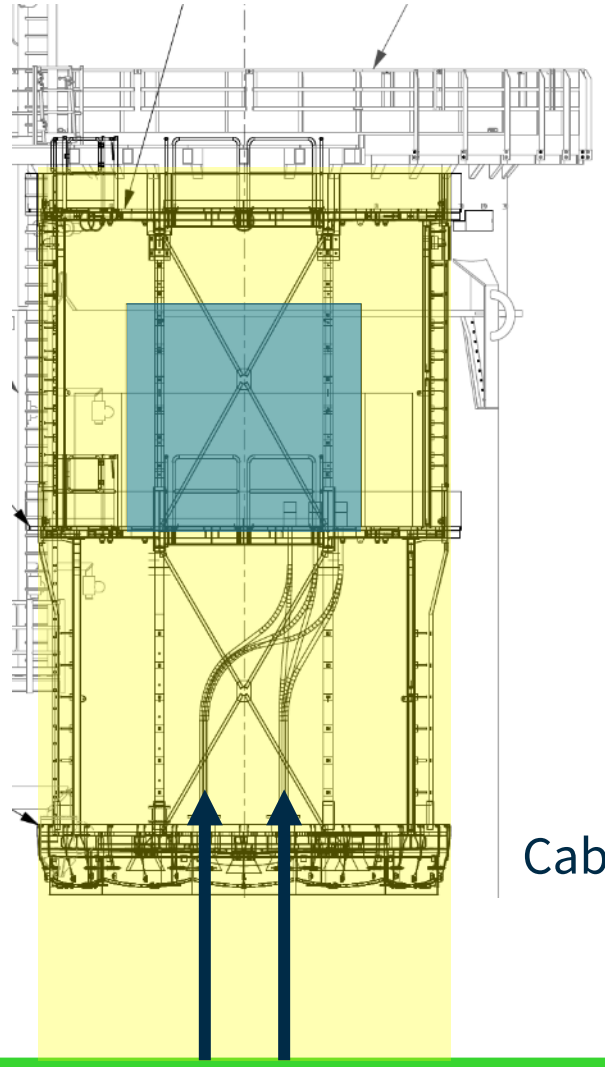
Switchgear in Foundation

Engineering

Cable hang-off





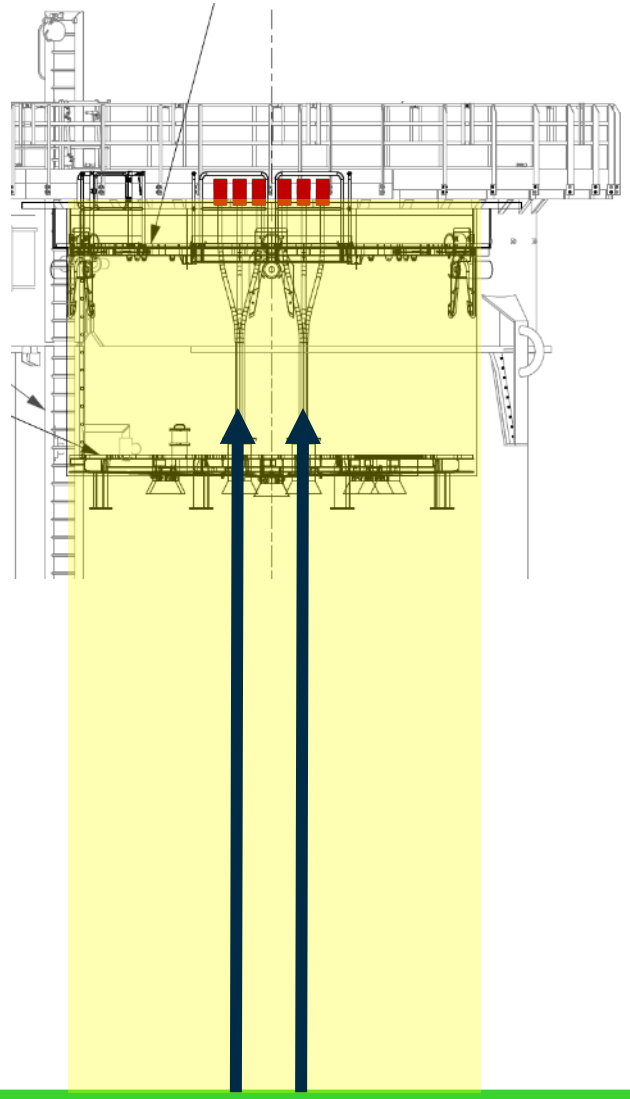


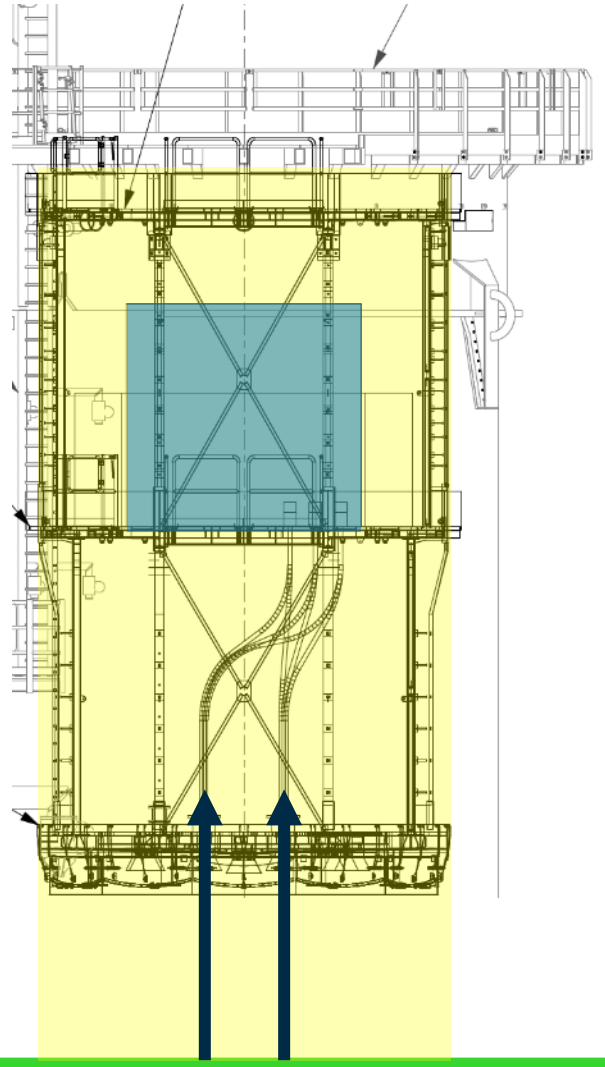
Cable hang-off

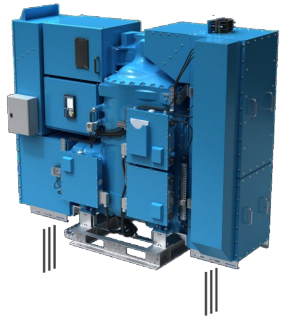
Engineering



Connector Boxes

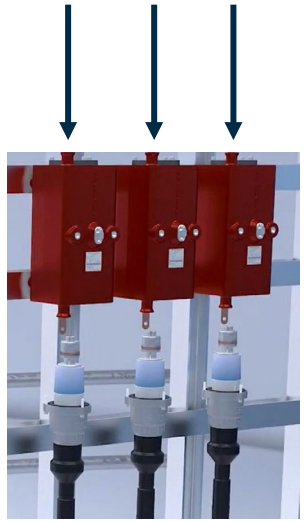




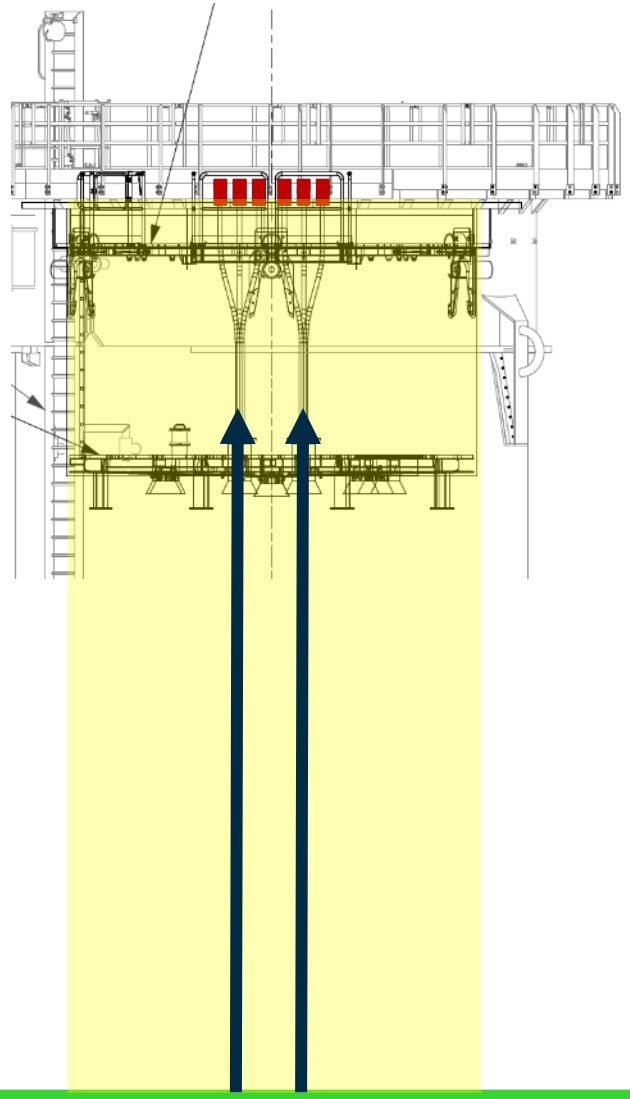


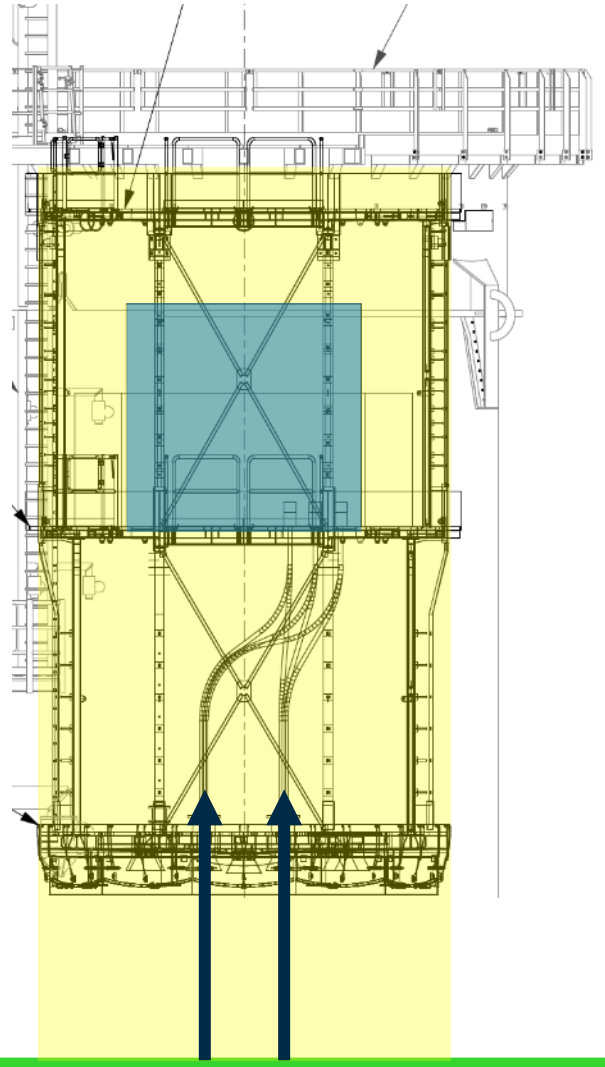
Switchgear in Foundation

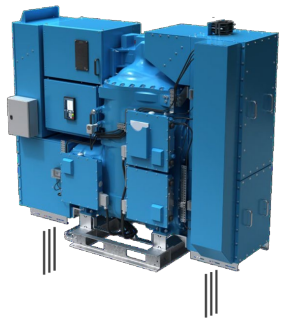
Engineering



Connector Boxes

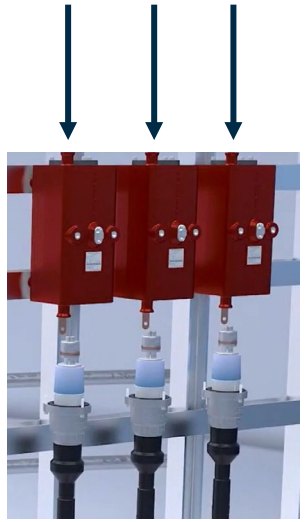




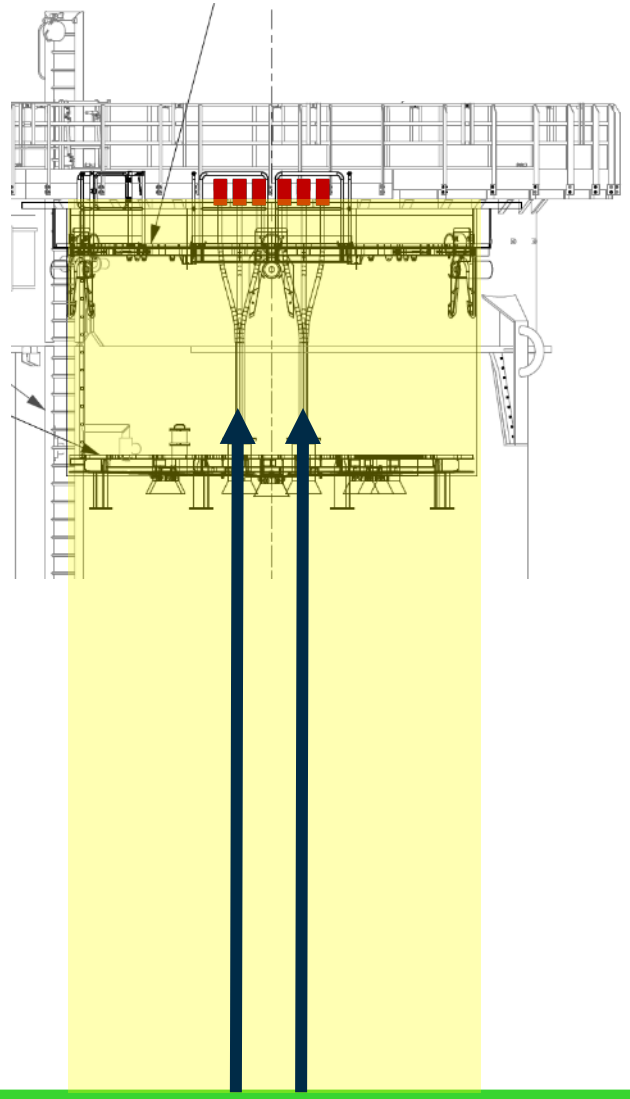


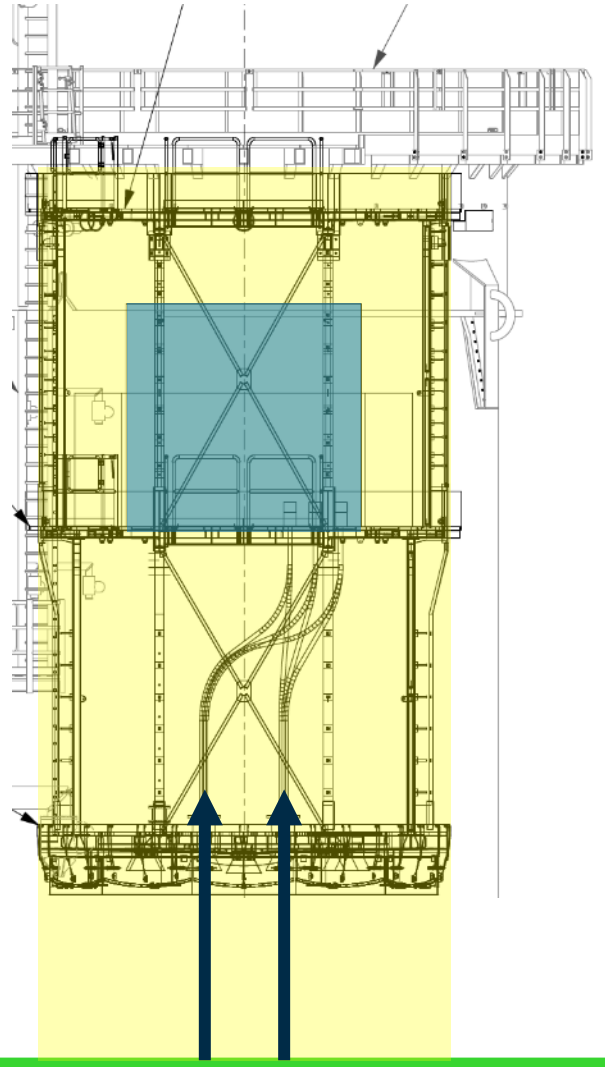
Switchgear in Foundation

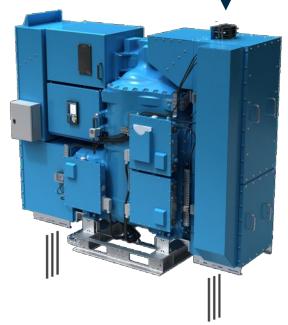
Engineering



Connector Boxes





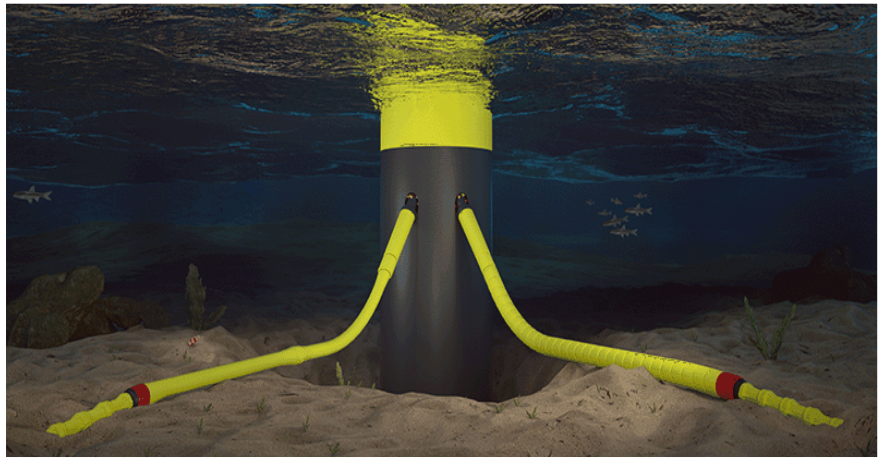


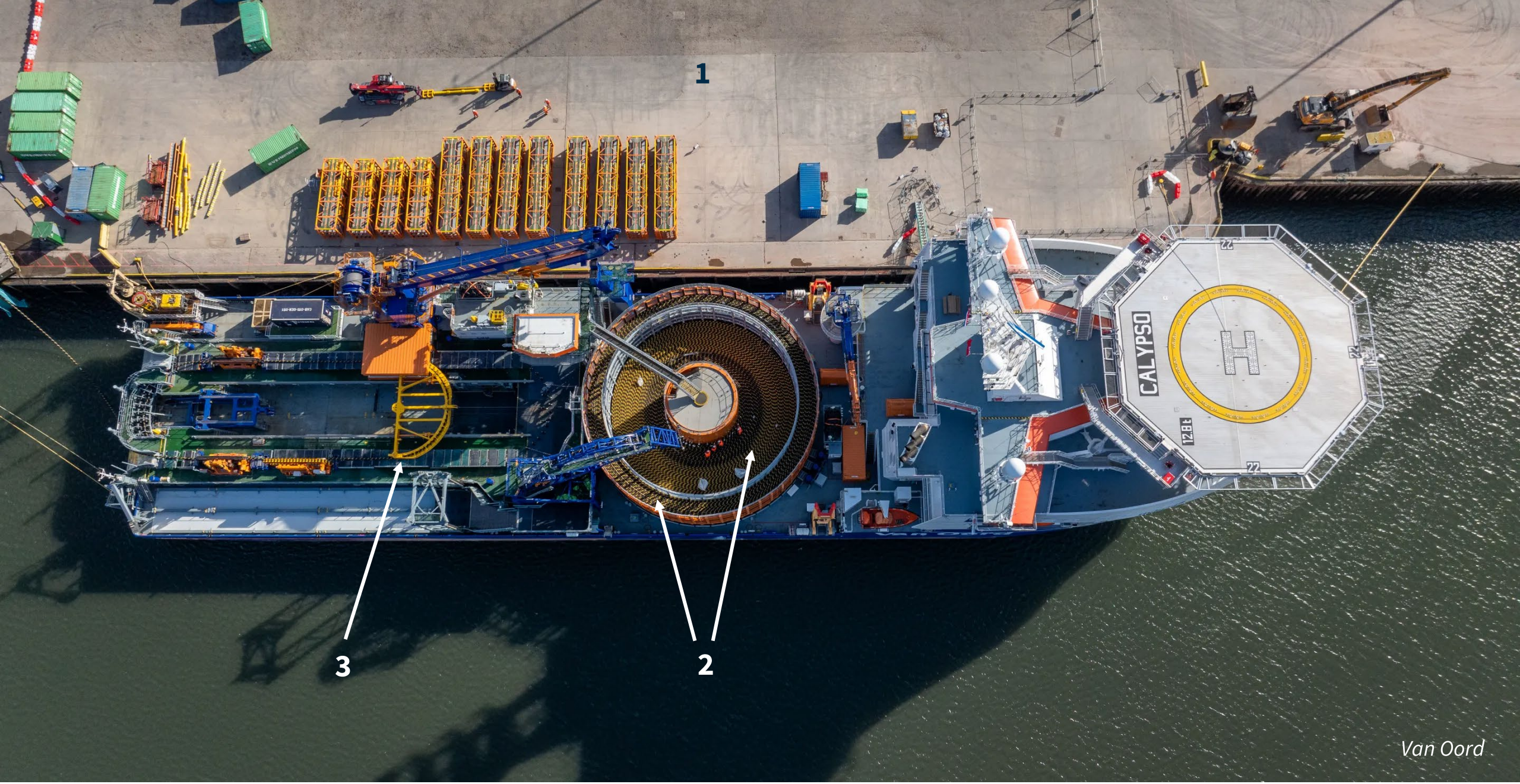
Switchgear in Foundation

Cable Installation

- Pre-Lay Grapnel Run
- Seabed preparation and cable crossings
- Scour rock and foundation installation
- Cable pull-in, including Cable Protection System
- Cable hang-off from foundation internal platform
- Stripping, routing, termination, testing
- ODTR testing of fibre-optic connections
- Electrical connection and energization







Van Oord



Van Oord


TenneT


TenneT



Van Oord



Van Oord



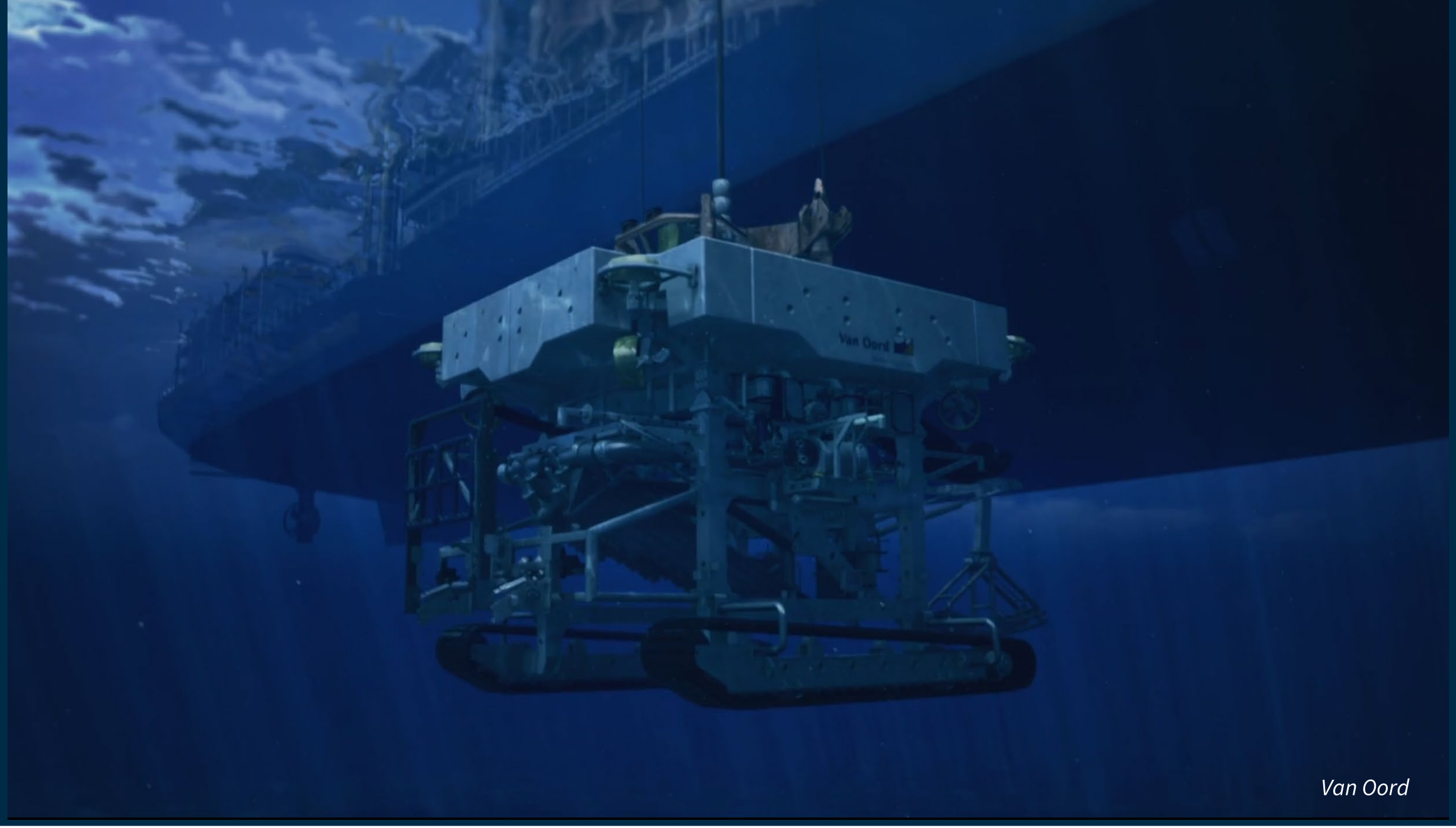
Van Oord



Kerstengroup



Van Oord



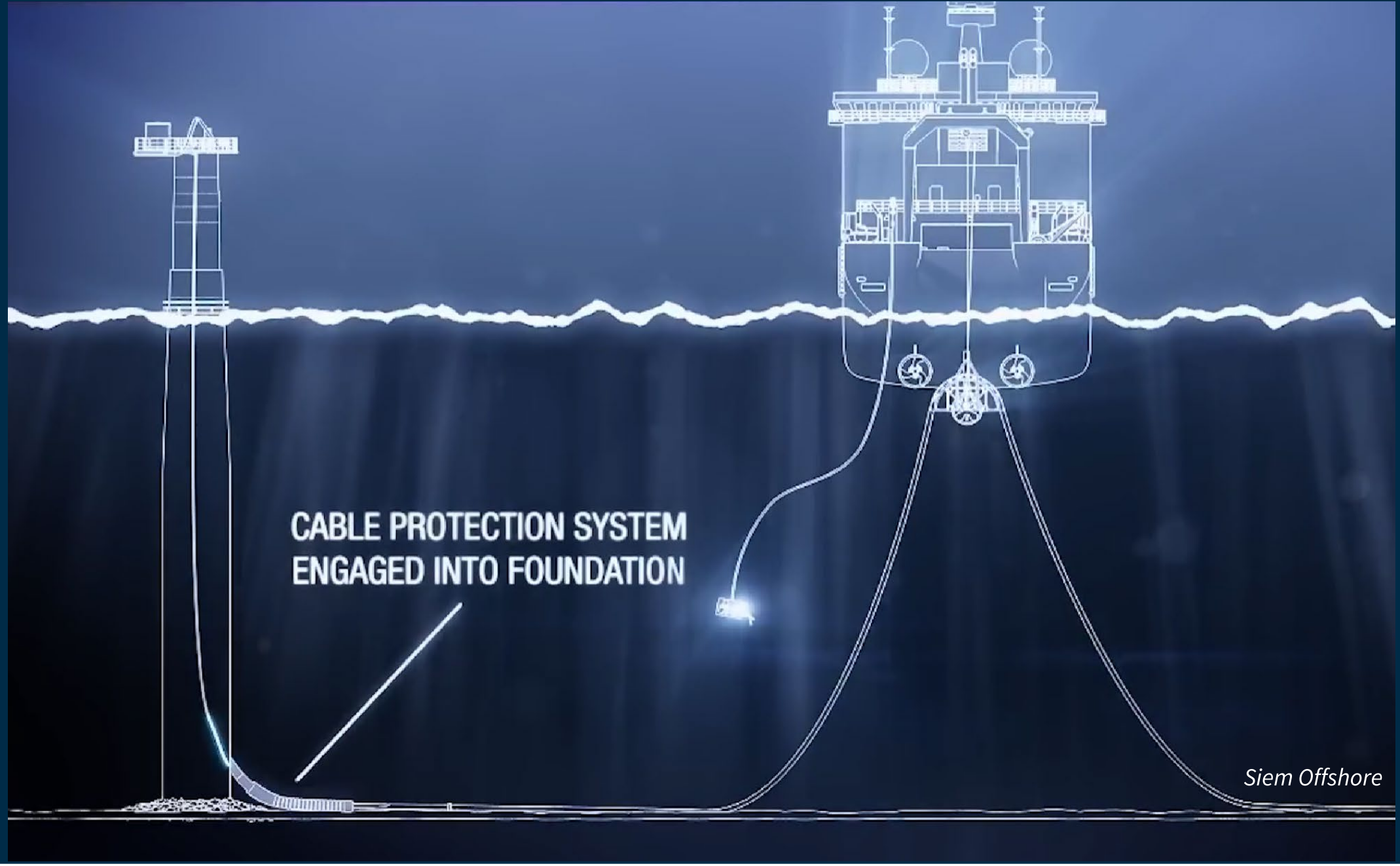
Van Oord




Hybrid
CALYPSO
Van Oord



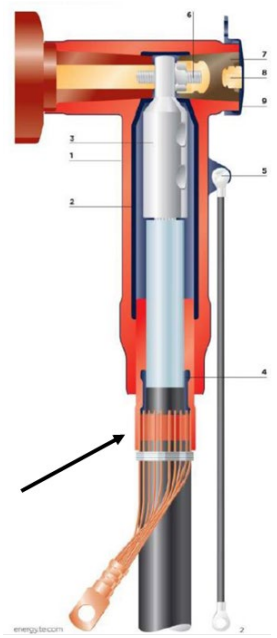
Siem Offshore

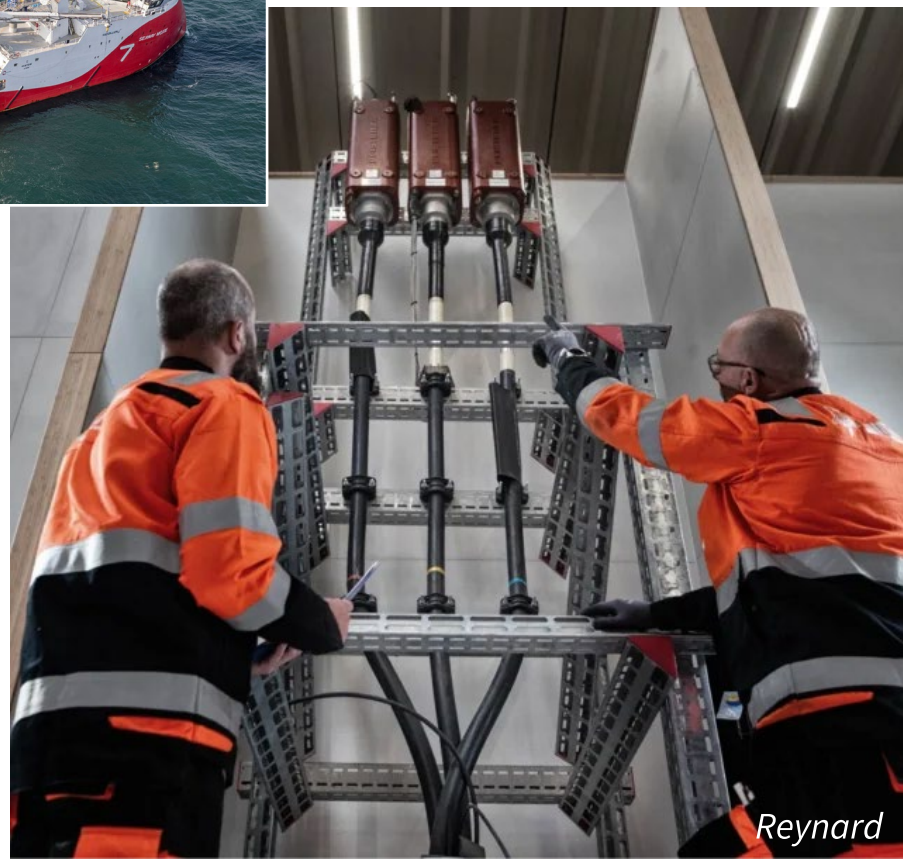

CABLE PROTECTION SYSTEM
ENGAGED INTO FOUNDATION
Siem Offshore

Post-installation works

- Foundation access
- Pull-up of cabling into the foundation
- Mechanical cable hang-off (armouring)
- Stripping, cleaning, end connector fitting
- Measurements and high-voltage testing
- Fibre-optic communication cables
- Installation of armour rock
- Visual inspections and cleaning
- Practice makes perfect



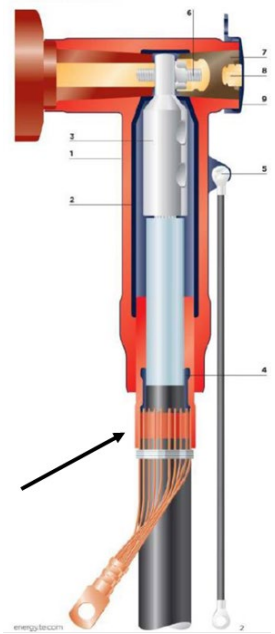


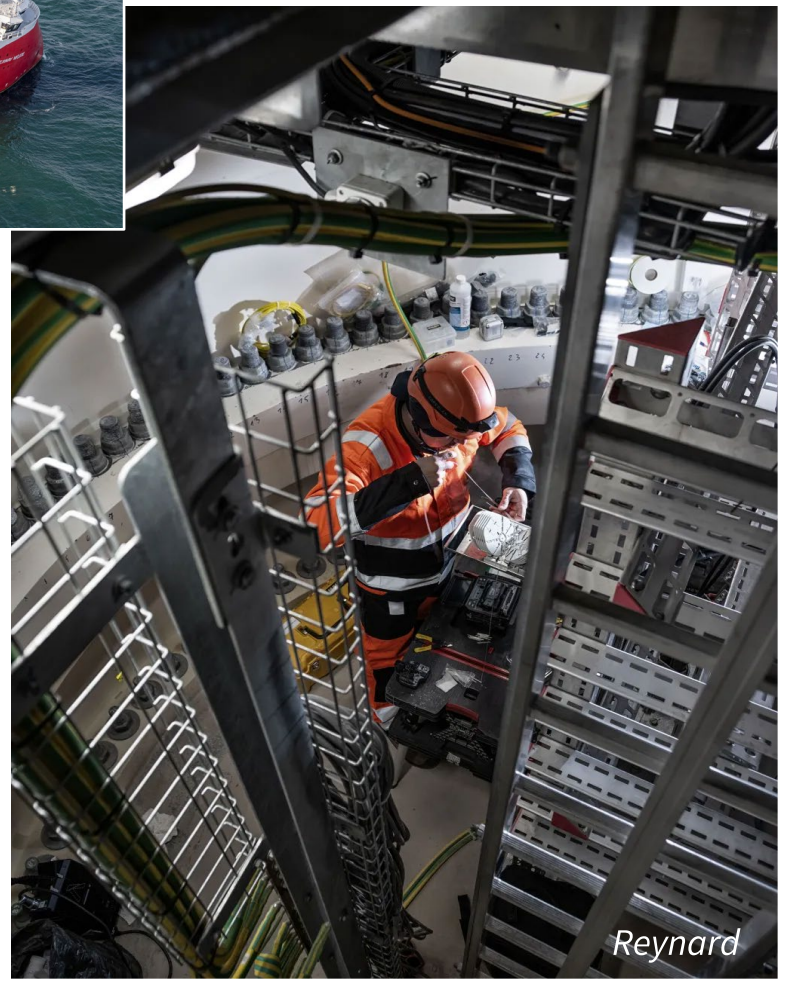


Post-installation works

- Foundation access
- Pull-up of cabling into the foundation
- Mechanical cable hang-off (armouring)
- Stripping, cleaning, end connector fitting
- Measurements and high-voltage testing
- Fibre-optic communication cables
- Installation of armour rock
- Visual inspections and cleaning
- Practice makes perfect



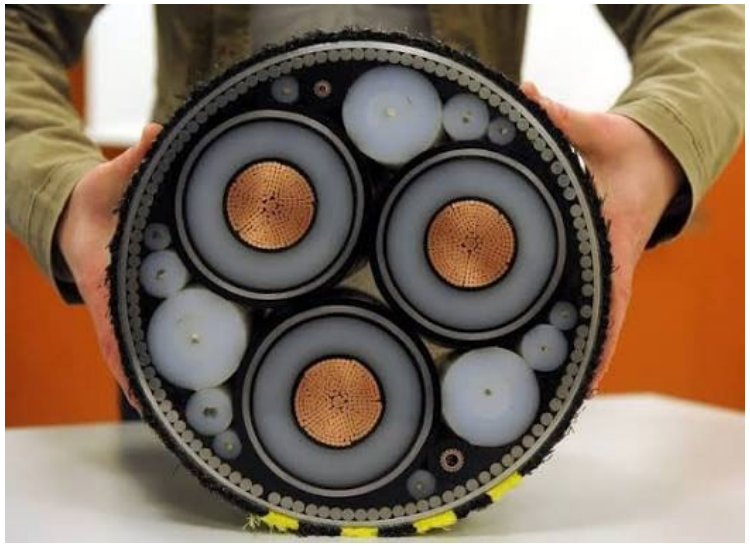




Reynard

Summary and take-aways

- HVAC: inter-array cabling (66 kV), export cabling (150-275 kV)
- HVDC for very distant, high-capacity offshore transmission
- Array cabling follows the optimized wind park layout
- Type testing and design of cables and accessories
- Interfaces with substation (J-tubes), foundation (hangoff, CPS) and wind turbine (location of the WTG switchgear)
- Installation tools: achieving target burial depth is essential
- Termination and testing on critical path to WTG energization
- Offshore cable installation: begin with the end in mind



Thank you!



Next Webinars

Mini-series: Offshore Construction

Towers, Nacelles, and Blades

Ventolines | December 3, 2026

Installation Interfaces & Energization Sequence

Ventolines | December 10, 2026

Visit wind.ny.gov to register

Check out over 70 past webinars, including:

- Foundation Installation
- Understanding the Bridge between Existing and New Energy Sources
- Substation Installation
- Logistics of Offshore Construction
- Logistics of Offshore Wind Operations and Maintenance
- How Offshore Wind Can Bolster Grid Reliability

www.nyserda.ny.gov/osw-webinar-series

We want your feedback! Fill out the "Learning from the Experts" survey at wind.ny.gov.

NEW YORK STATE | NYSERDA