

Learning from the Experts Webinar Series

Mini-Series: Offshore Construction

Foundation Installation



Bart Ummels
Expert Engineer
Ventolines

October 8, 2026

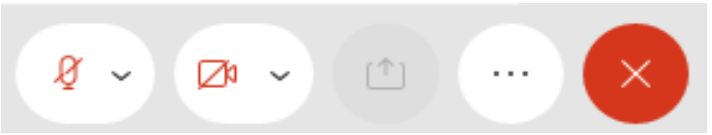
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Learning from the Experts



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

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NYSERDA – Learning from the Experts – October 8, 2026

Ventolines
Moving forward with renewable energy



Offshore Wind Foundation Installation

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

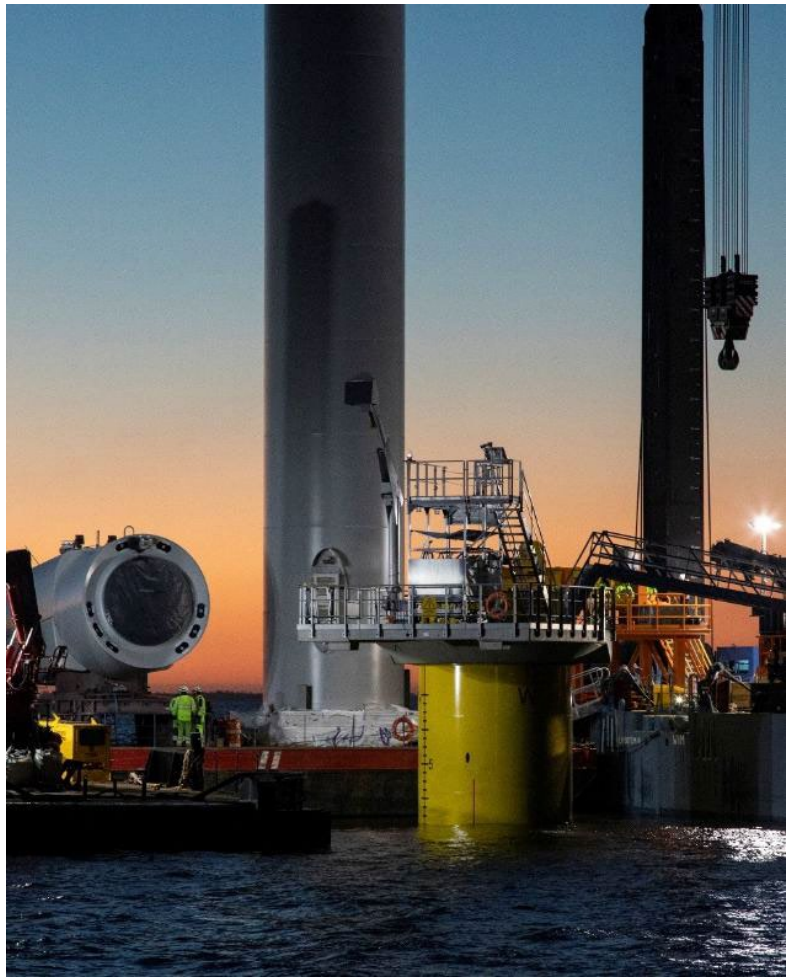




We aim for a world in which renewable energy projects are valuable for everyone

Example: Windpark Fryslân





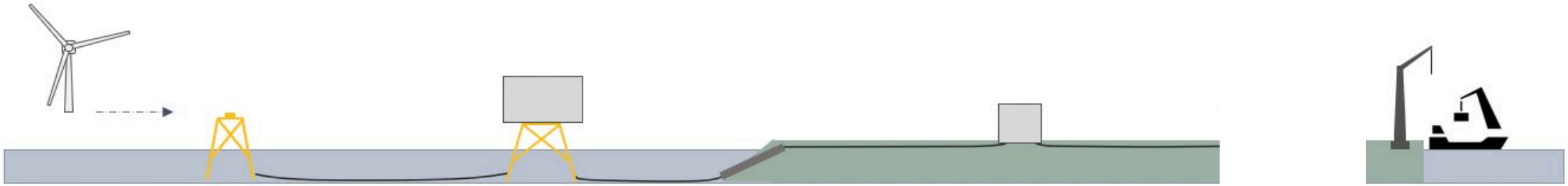
- 89 nearshore wind turbines
- Largest in-lake wind park
- Onshore substation
- Export cable through sea defence
- Nature-inclusive design
- Fit-for purpose installation method
- Constructed during covid – safely, on quality, on time, within budget

Agenda

- Wind project overview
- Foundation example: Cape Inch OWF (UK)
- Designs and considerations
- Engineering
- Manufacturing
- Offshore Installation
- Post-installation works
- Summary and take-aways

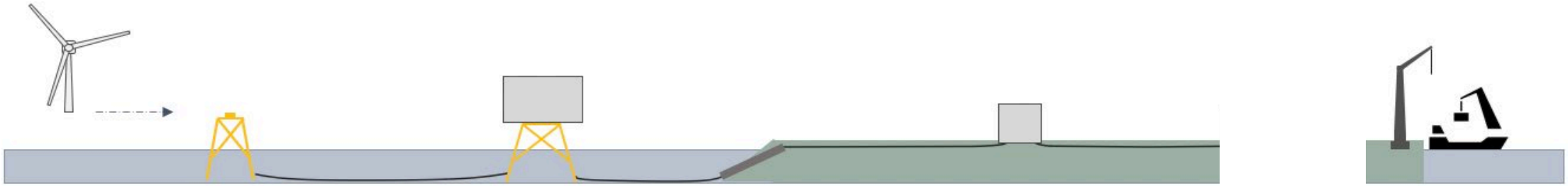

Cape Inch, 2026

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

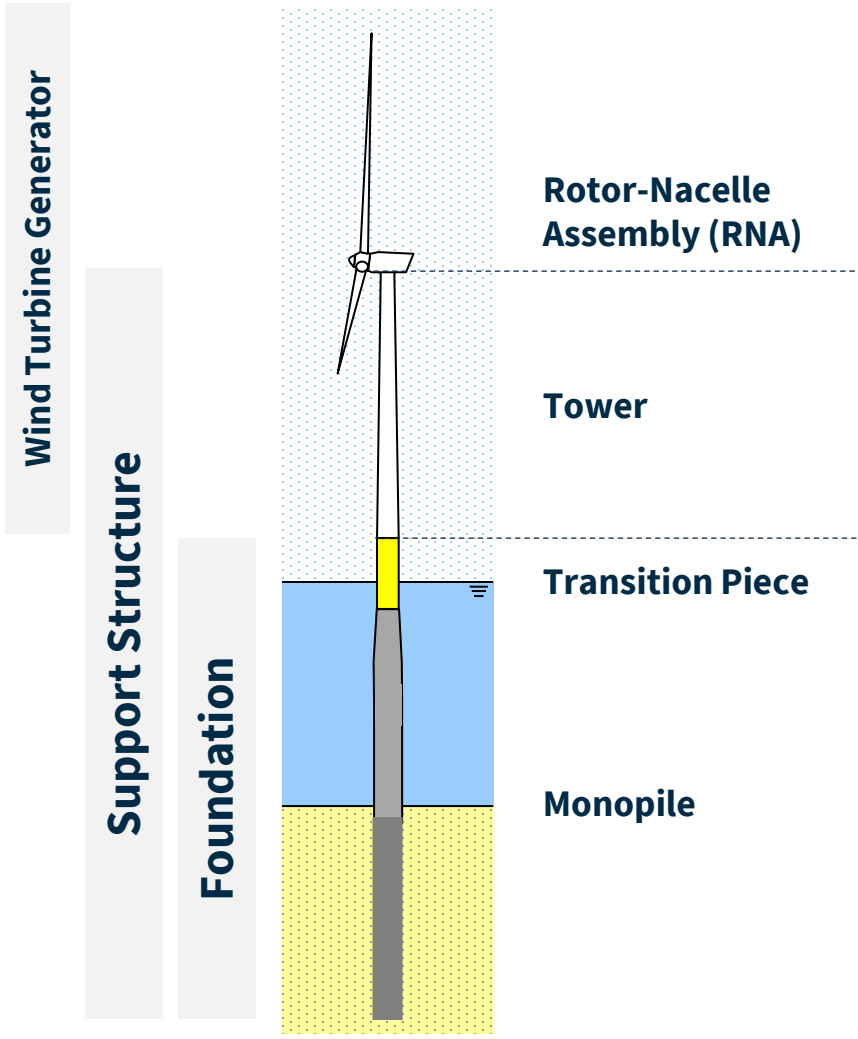


	WTG	FOU	IAC	OSS	ExCa	Onshore ExCa	Onshore Substation	Grid Connection	• **Fabrication locations** • **Marshalling harbour** • **Transport & installation**
	• 15 MW • 236 m rotor Ø • 25 m tip low • 143 m hh • 261 m tip high	• Monopiles • Jackets • Gravity-based (GBF)	• 66 kV • Three-phase cable strings • 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**

Foundation: Definitions

- Wind Turbine Generator (WTG)
- WTG = RNA + tower
- Support structure = WTG tower + foundation
- Foundation (FOU): fixes the WTG to the seabed
- **Monopile** (~80%), **Jacket** (~15%), Gravity-Based (~ 5%)

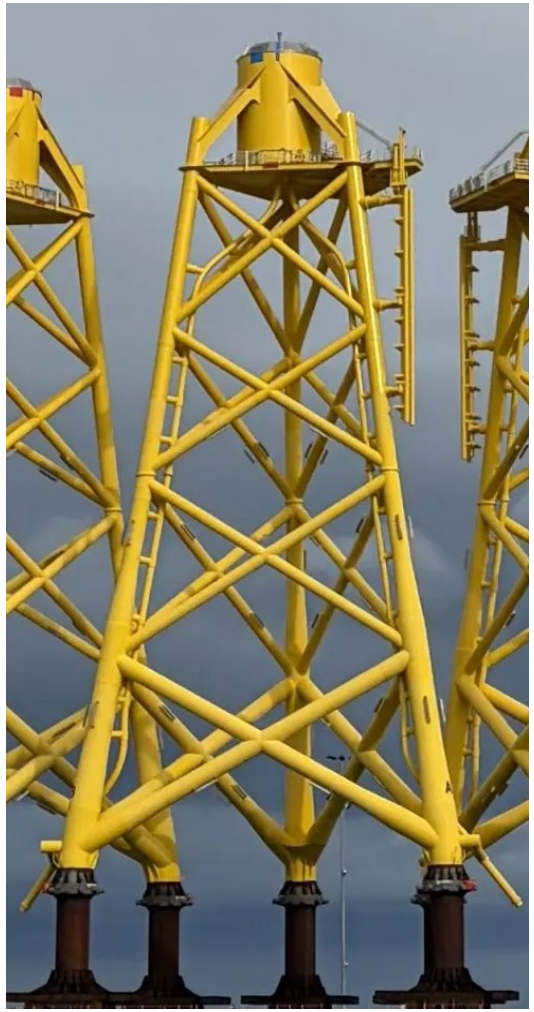
- Every foundation is location-specific
- A foundation can have a mass of 3000+ mt
- Foundation installation starts onshore
- Integrated support structure design



Foundation Example: Cape Inch

- 54 monopiles (MPs)
- 18 Jackets with pin piles
- Wind turbine tower interface

- External platform / main access platform
- Davit hoist
- Internal platforms
- Boat landing
- J-tubes for submarine cabling
- Corrosion protection (paint, anodes, ICCP)





Cape Inch, 2025

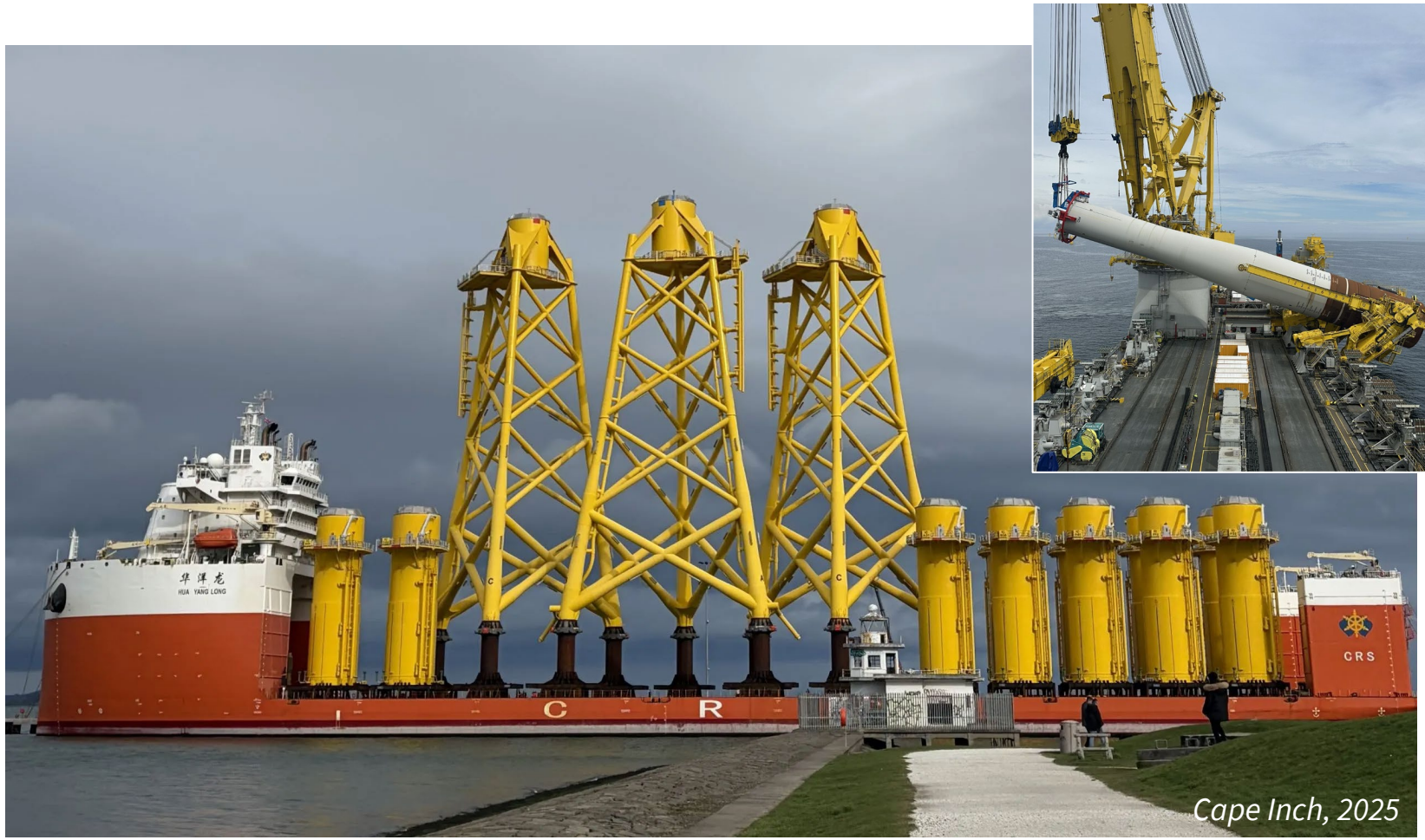


Example: Cape Inch OWF

- FOU installed 2025-2026
- 72x 15 MW WTGs
- MP/TPs and Jackets

- 54 MPs: ~102 m. long, Ø 11.5 m. ~**2300 mt.**
- 54 TPs: ~30 m. high, Ø 8.3 m. **~600 mt.**

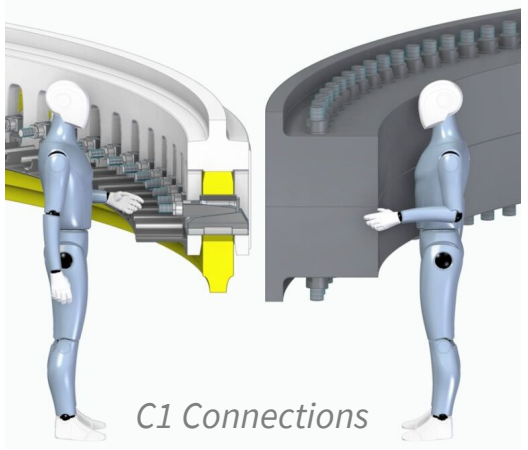
- 18 jackets: 83-95 m. high, 32 m. wide, **2050-2250 mt.**
- 54 pin piles: 45 m. long, Ø 3.5 m. **< 230 mt.**



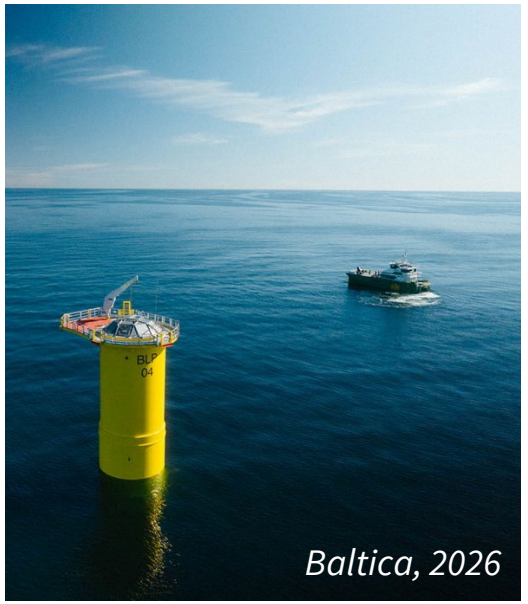
Cape Inch, 2025

Designs and considerations

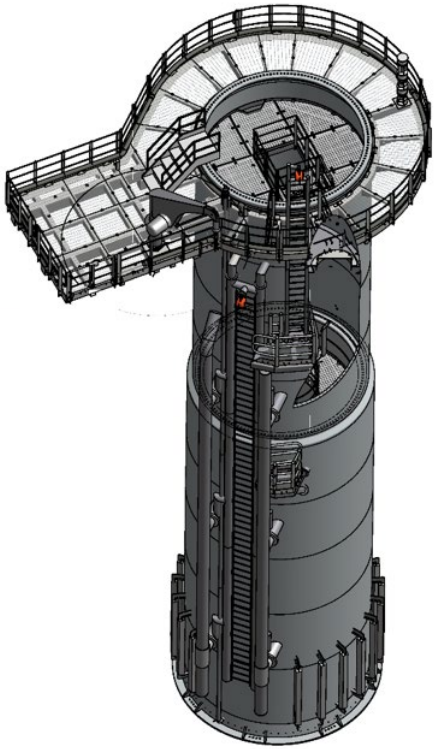
- Soil types and conditions, water depths, currents
- Wind climate and wind turbine type
- Installability and installation vessels
- **Wind turbine interfaces**



C1 Connections



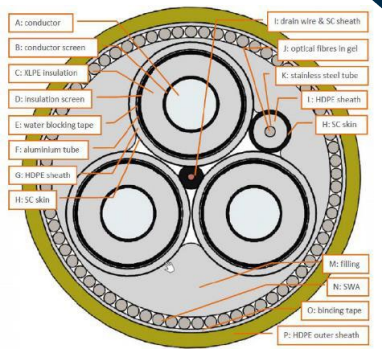
Baltica, 2026



LIC Engineering

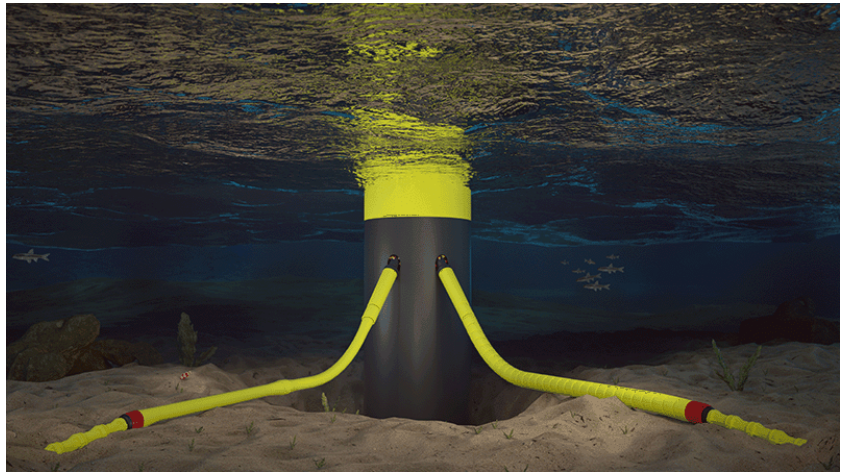
Designs and considerations

- Soil types and conditions, water depths, currents
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- Wind turbine interfaces
- **Inter-array cabling interfaces**









Designs and considerations

- Soil types and conditions, water depths, currents
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- Wind turbine interfaces
- Inter-array cabling interfaces
- **Access interfaces**





Designs and considerations

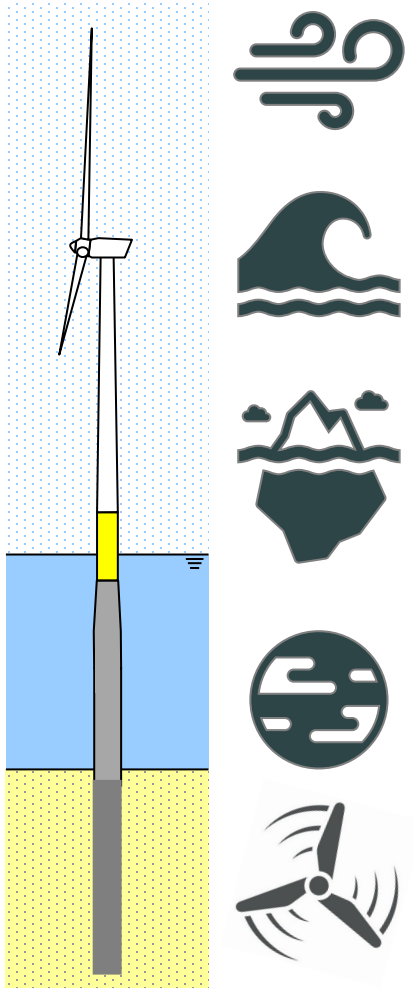
- Soil types and conditions, water depths, currents
- Wind climate and wind turbine type
- Installability and installation vessels
- Wind turbine interfaces
- Inter-array cabling interfaces
- Access interfaces
- **Noise mitigation system(s)**
- Manufacturing location
- Onshore vs. offshore scope of work


Hydrotechnik

Engineering

- Wind climate
- Waves and currents
- Salinity of air and water
- Ice
- Vessel impacts
- Soil conditions
- Earthquakes
- …

- **Design frequency outside frequency ranges of waves and rotor**

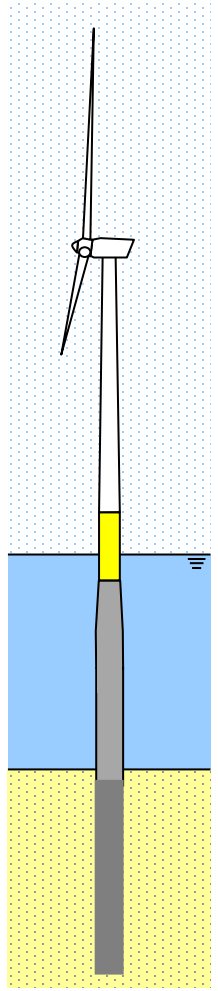


Engineering

- Rotational frequency of 15+ MW WTGs
- All WTG offshore operational and non-operational conditions in 30+ years
- Extreme loads (50-100 y. worst cases)
- Fatigue loads and fatigue life

- Main interfaces: WTG tower, IAC, sea floor
- Access interface: boat landing, davit
- Electrical interfaces: inter-array cables, switchgear, low-voltage cabling

wave height [m]		wind speed [m/s]	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	
		wave period [s]	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	total
8,5	9	8 9															1	1
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		9 10												1				1
		10 11											1					1
7	7,5	7 8														1		1
		8 9												1				1
		9 10												2				2
6,5	7	8 9												5				5
		9 10											1	2	1			4
6	6,5	7 8													2			2
		8 9												5	2	1		8
		9 10											3	4	1			8
		10 11										1	3					4
5,5	6	7 8											2	3	2	2	1	10
		8 9								1	5	4	3					13
		9 10							1									1
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4,5	5	6 7									1	4	8	5	2			20
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		9 10							1									1
4	4,5	6 7						2	5	22	74	56	13	3	1			176
		7 8						1	22	104	83	18						228
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		7 8				1	2	12	76	72	12							175
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		6 7				6	38	239	504	326	61	5		1				1180
		7 8				1	1	21	42	4								69
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		6 7		2	9	46	111	324	172	10	1							675
		7 8						1	1									2
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		5 6	9	33	99	429	1185	1632	676	171	9	1	1					4245
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1,5	2	3 4								1								1
		4 5	3	20	104	648	1746	1590	789	109	3							5012
		5 6	49	232	543	929	824	256	25									2858
		6 7	2	10	28	20	2	1										63
		7 8	1	1		1												3
1	1,5	2 3							34									34
		3 4				26	284	177	90	1								578
		4 5	108	469	1423	3217	3143	1094		3	1							9458
		5 6	219	604	761	323	38	2										1947
		6 7	16	28	27	4	1											76
		7 8	1	2		1												4
		8 9		1														1
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		4 5	539	1592	2891	1627	183	1										6833
		5 6	400	851	636	59	1											1947
		6 7	58	126	75	1												260
		7 8	9	17	14	2												42
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		9 10	1	3	1													5
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		3 4	211	622	890	107	2											1832
		4 5	513	1102	550	37												2202
		5 6	187	331	131													649
		6 7	67	101	30													198
		7 8	38	63	15													116
		8 9	16	20	9													45
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		total	2480	6364	9362	9974	8634	6104	3657	1891	812	272	82	35	9	2	1	49679





Engineering: Noise Mitigation

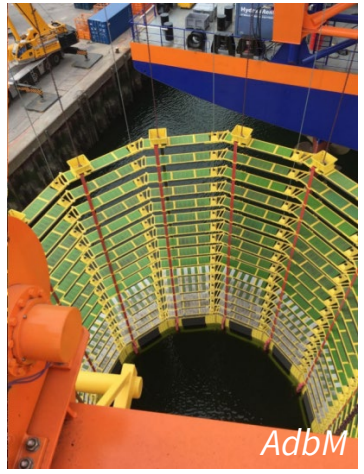
- No hammers
  - Suction buckets (jackets)
  - Jetting (e.g. Osonic) and vibro-jetting (e.g. GBM)
- Smaller hammer size
- Pinging system
- Tuned absorption/dispersion elements
  - Sound mitigation elements (e.g. HSD)
  - Encapsulated air bubbles (e.g. AdbM)
- Bubble curtains (BBC, DBBC)

- Combinations of strategies
- Water depth, pile sizes, site, …


Jetting / Vibrojetting


HSD + BBC at Crosswind, 2023


HSD

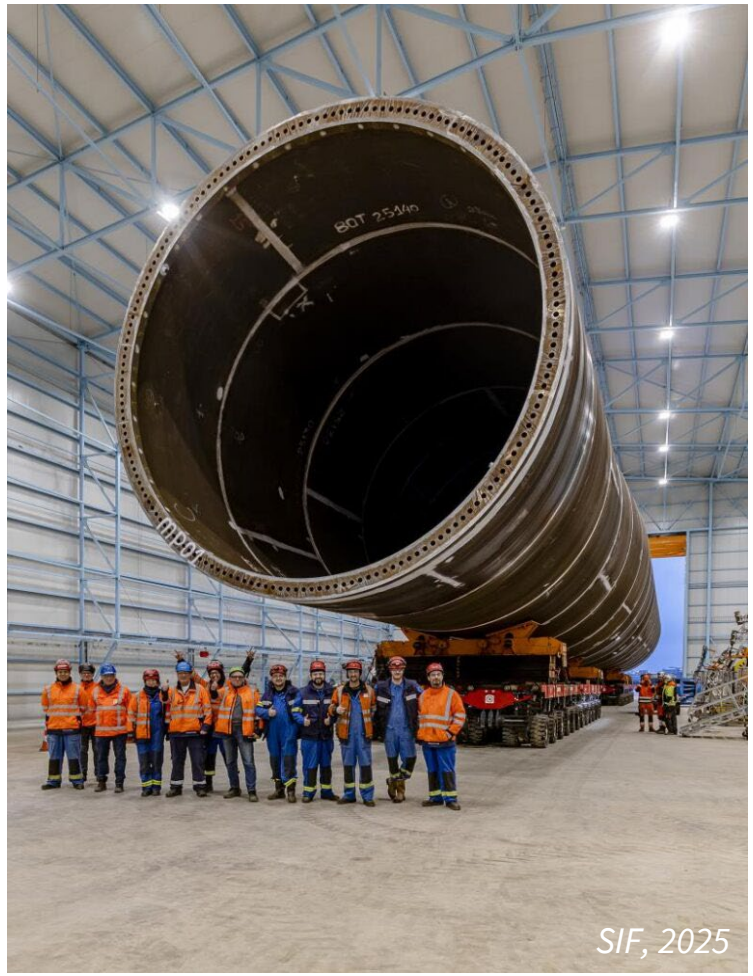

AdbM


DBBC at Kriegers Flak, 2024

MP Manufacturing

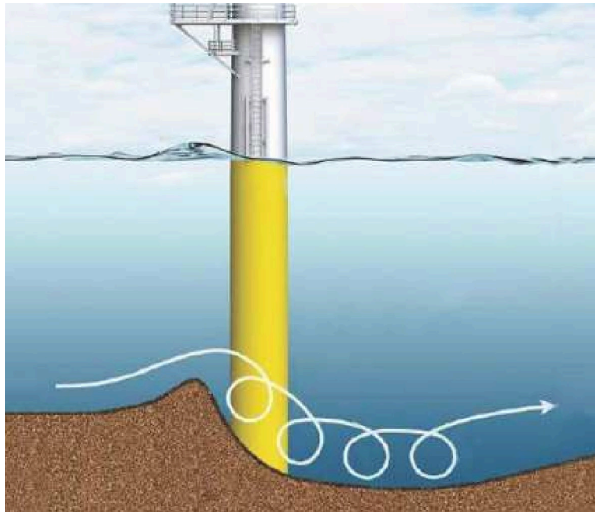
- Unique MPs, same TPs
- Diameter
- Plate thicknesses
- Add-ons
- L-flange
- **Weldings**
- Manufacturing tolerances
- Handling and transportation
- Lifting and hammering

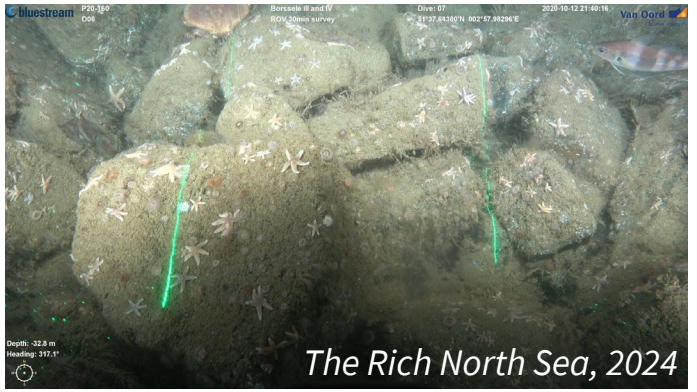

Crosswind, 2023


SIF, 2025

Offshore Installation

- Monopile foundation clusters (mass, diameter, water depth)
- WTG energization sequence drives foundation installation
- FOU installation sequence drives manufacturing sequence
- Seabed preparation
- Scour protection: rocks
  - Filter rock layer
  - Armour rock layer(s)
  - Inspection and monitoring
  - Cable interface (CPS)
  - Ecology





The Rich North Sea, 2024


MDPI, 2019

MP-TP

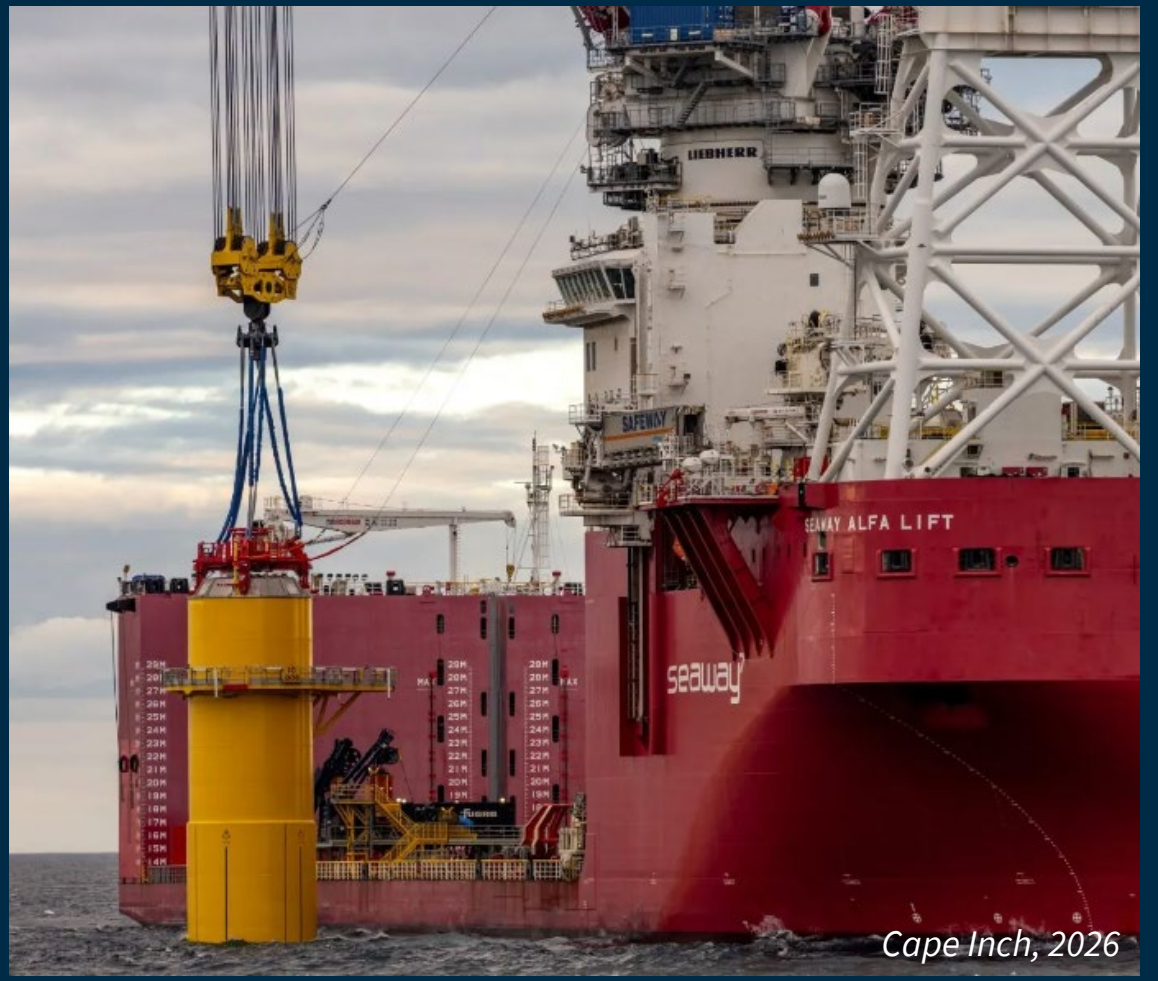


Cape Inch, 2026

MP



TP



Cape Inch, 2026

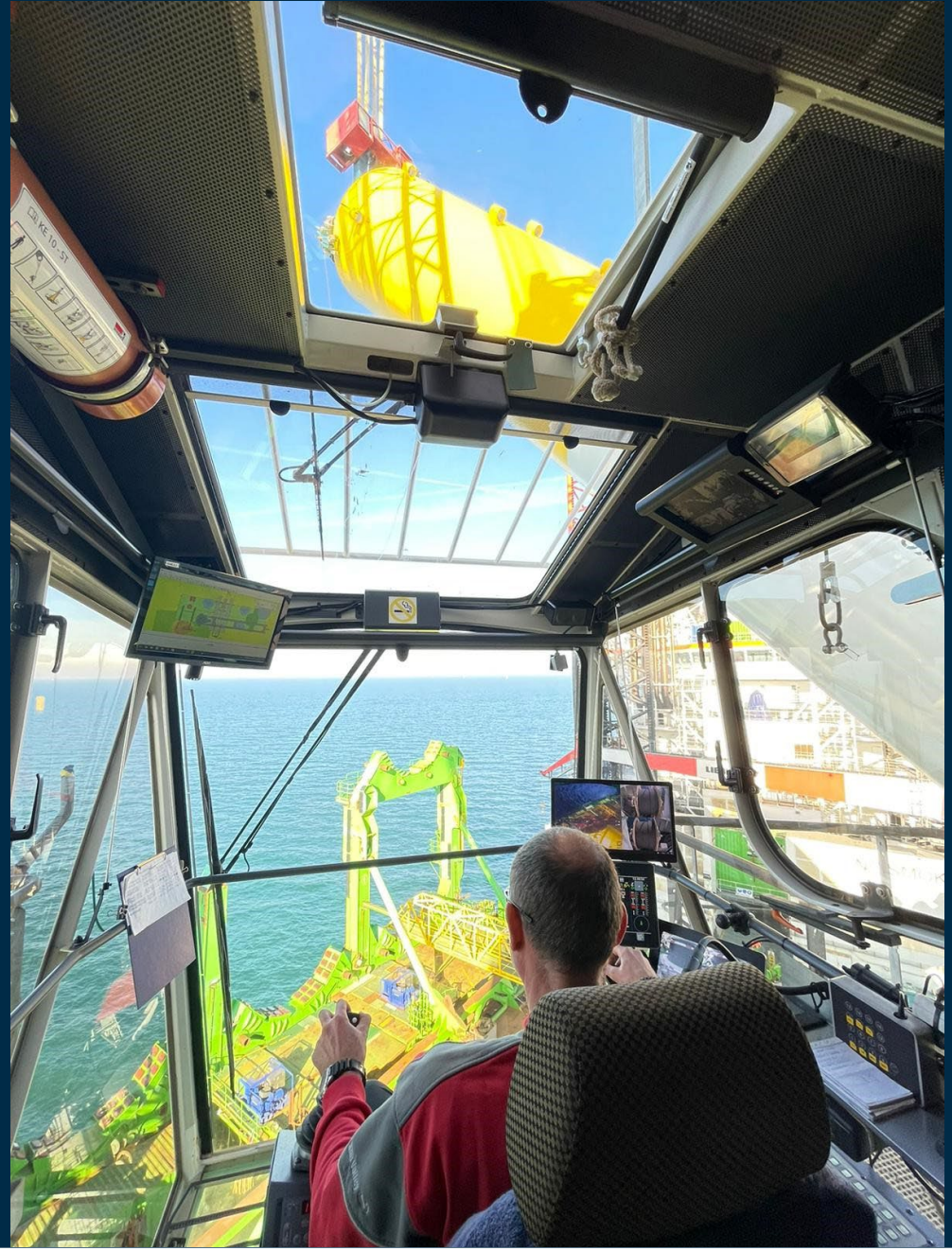


Cape Inch, 2025


华洋龙
HUA YANG LONG
C R
CRS
?
Cape Inch, **2025**

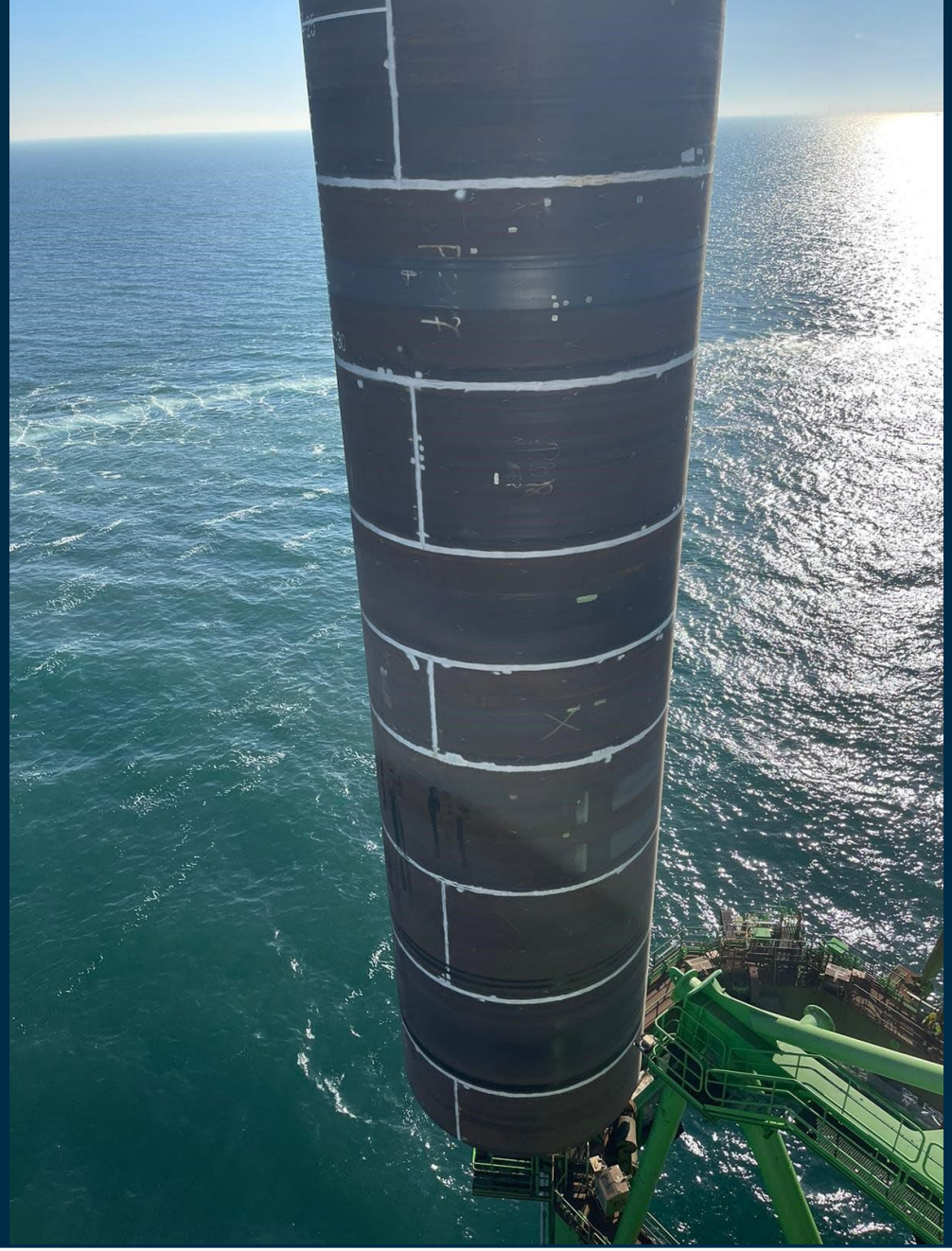

TP-less
Sif
INNOVATION
Crosswind, 2023













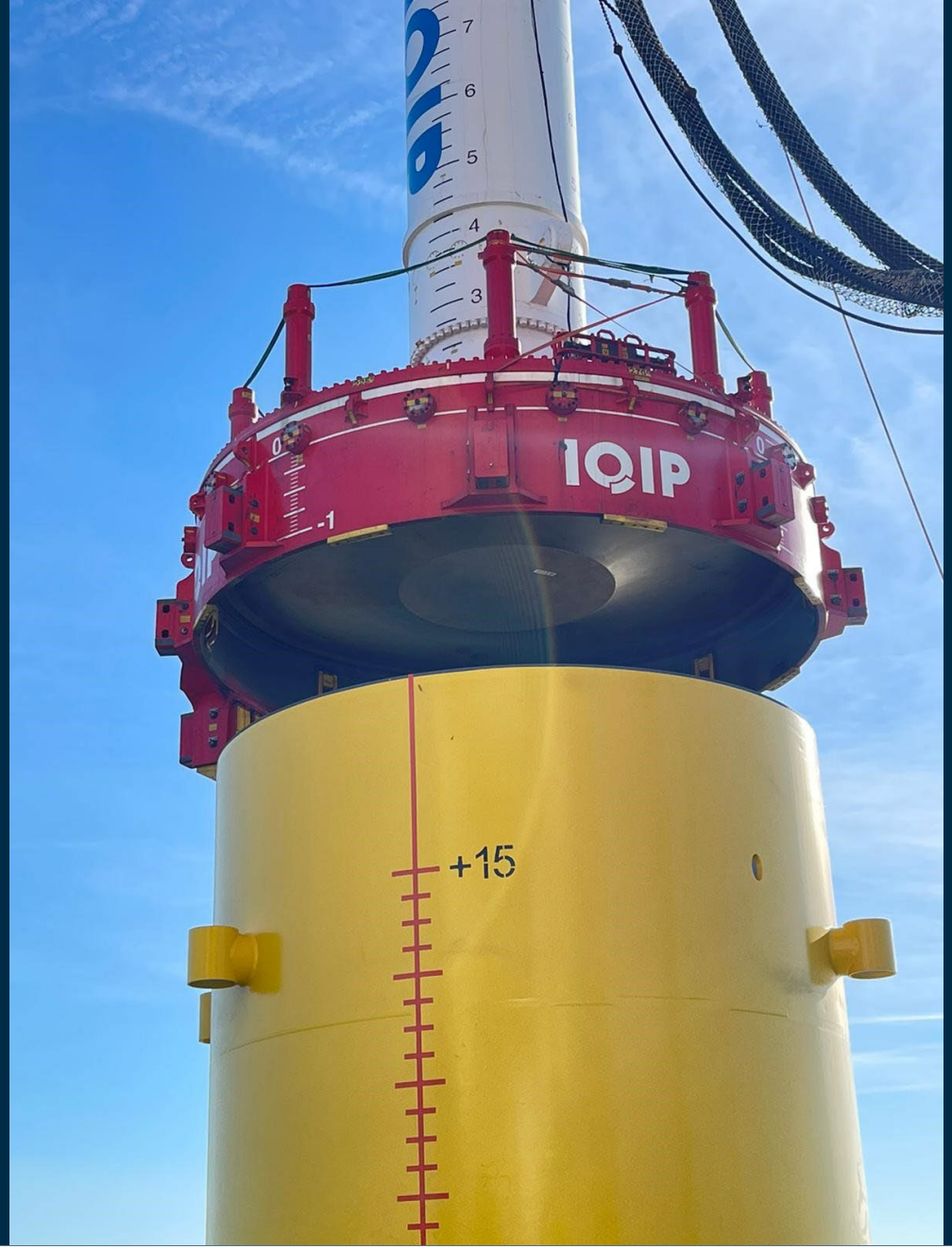

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Post-installation works

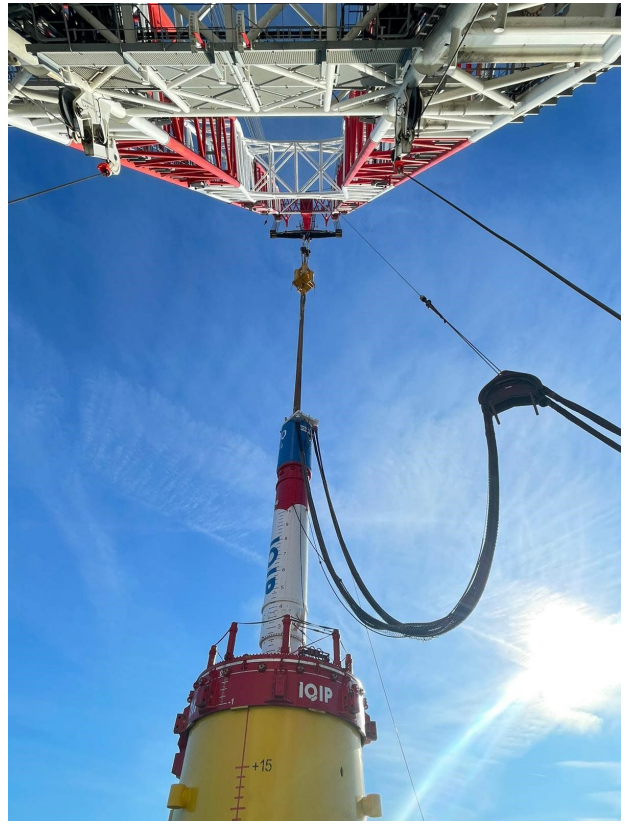
- Foundation access
- **Laying and pull-in of inter-array cabling**
- IAC testing and termination works
- Fibre-optic communication works
- WTG installation, completion, energization
- Impressed Current Cathodic Protection (ICCP)
- Installation of armour rock
- Operation and maintenance: **davit crane** use
- Visual inspections and cleaning


Boskalis


Granada Cranes

Summary and take-aways

- Support structure = tower + foundation
- Every foundation is optimized per location (clusters)
- Site data is essential for foundation concept pre-selection
- Permit requirements are essential input for engineering
- Monopiles: TP-less or with Transition Piece; Jackets
- Steel mass ≠ steel mass: integrated support structure design
- Maximize onshore work scope, simplify offshore interfaces
- WTG energization main driver for installation sequence
- Foundation installation: begin with the end in mind



Thank you!



Next Webinars

Mini-series: Offshore Construction

Cable Installation

Ventolines | November 5, 2026

Towers, Nacelles, and Blades

Ventolines | December 3, 2026

Installation Interfaces & Energization Sequence

Ventolines | December 10, 2026

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- Logistics of Offshore Wind Operations and Maintenance
- How Offshore Wind Can Bolster Grid Reliability
- Strategies for Repurposing End-of Life OSW Blades

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