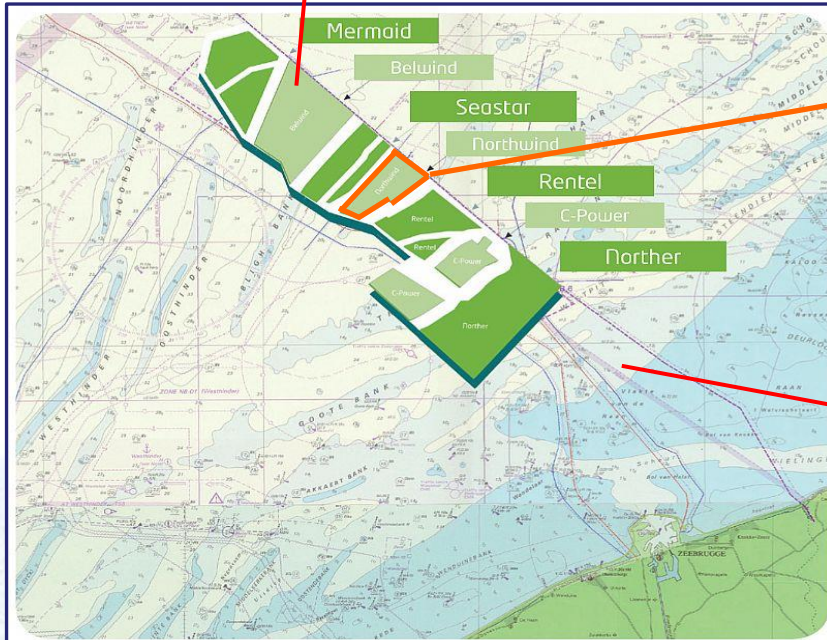
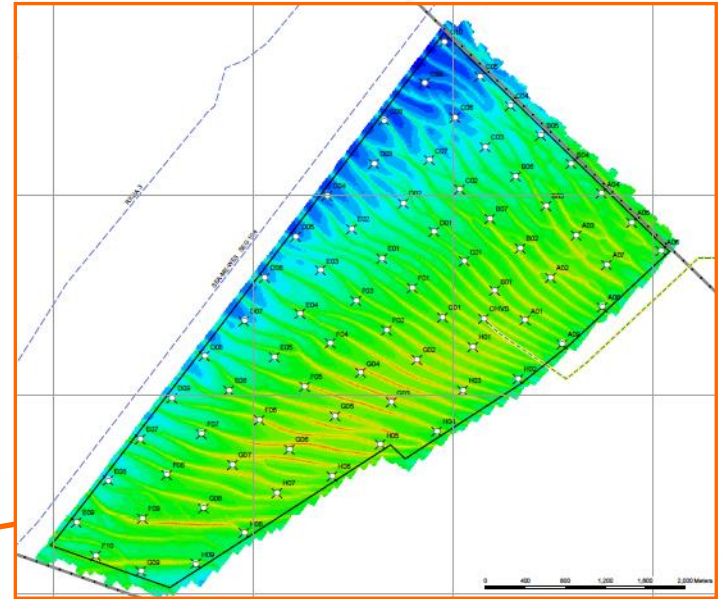
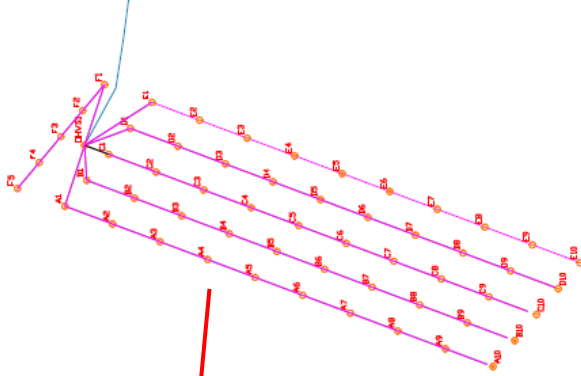




Belwind 1 + Northwind  
165MW + 216 MW Offshore Windfarm



## Belwind I:

- 55 WTG Vestas V90 + 1 OHVS
- ca. 48km off Zeebrugge
- 17km<sup>2</sup>
- 52km export cable
- 550 GWh ~ 160.000 ton CO<sub>2</sub>  
~ 160.000 household
- construction 2009-2010
- ± 650 mio EUR

## Northwind:

- 72 WTG Vestas V90 + 1 OHVS
- ca. 37km off Zeebrugge
- 14,5km<sup>2</sup>
- 43km export cable
- 875 GWh ~ 235.000 ton CO<sub>2</sub>  
~ 230.000 household
- construction 2013-2014
- ± 750 mio EUR



# Belwind vessels



# Northwind vessels

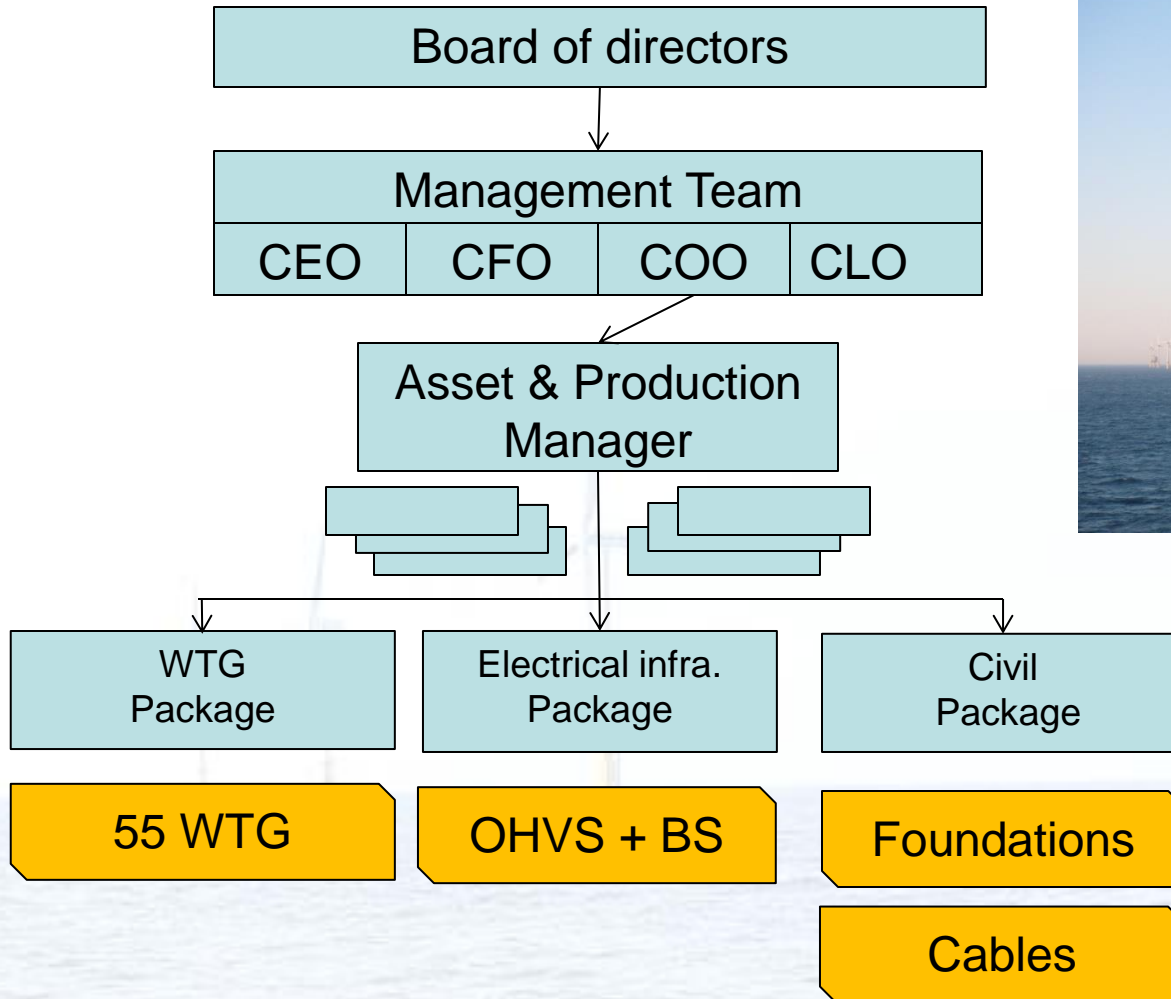


- Main + auxillary transformers
- HV + MV switchgear
- Power-SCADA
- Automation
- Generator/UPS
- Fire Fighting
- HVAC
- ...



BW: Trafo 33/150 kV  
NW: Trafo 33/220 kV

# O&M Organisation



Long term contract with Vestas

- Competent and trained technicians/experts
- Access to knowledge database
- Spare part availability

→ 15 year full covering service agreement

Availability guarantees  
Revenue sharing model

## **2 contract managers**

- Monitor availability
- Maintain a downtime database
- Define red flags
- Steering in priorities

## **1 site manager**

- Safe working
- Quality of work
- Audit and inspections
- Technical queries





## 2 OHVS 1 Booster Station



Maintenance performed by CG with long-term contract

- Steering of production 24/7
- Emergency standby 24/7
- Bundle activities of specialist partners

### 2 contract managers

- Contract responsible
- Follow-up preventive maint.
- Define adaptive maintenance
- Control corrective maintenance
- Spare part management
- Continuous Improvement

### 1 site manager

- Safe working
- Quality of work
- Audit and inspections
- Technical queries



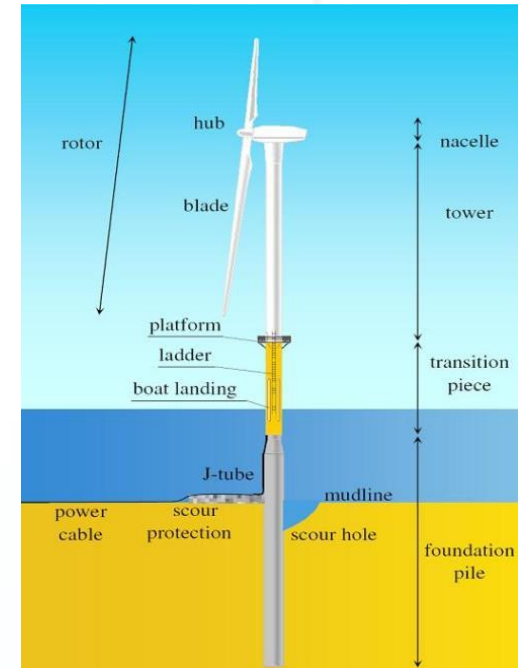
## 129 Foundations

- Paint
- Cathodic protection
- Diving + ROV
- Grout + bearings
- Mechanical
- Scour protection

± 100 km of infield cable

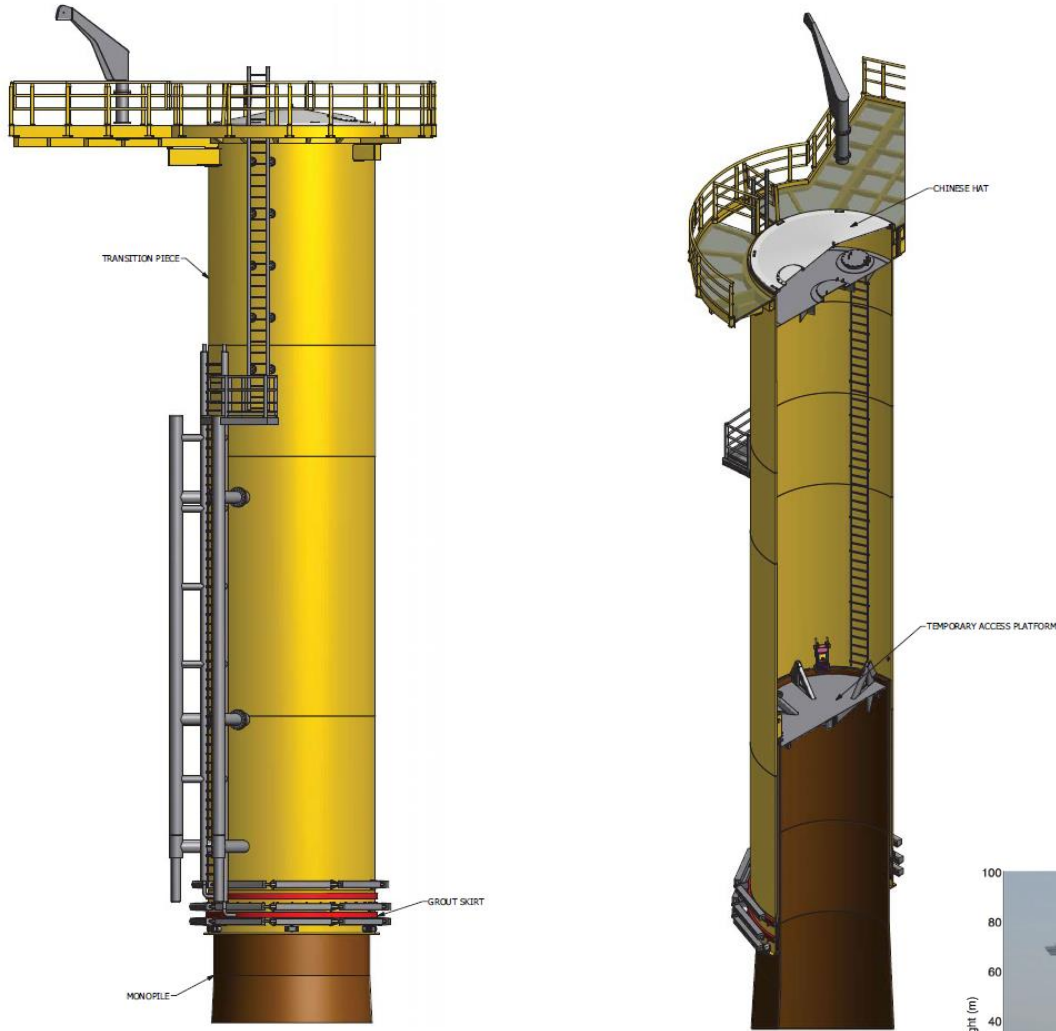
± 100 km of export cable

- Specialized contractor parties are hired
- Aim to build long term relationships
- Follow the market

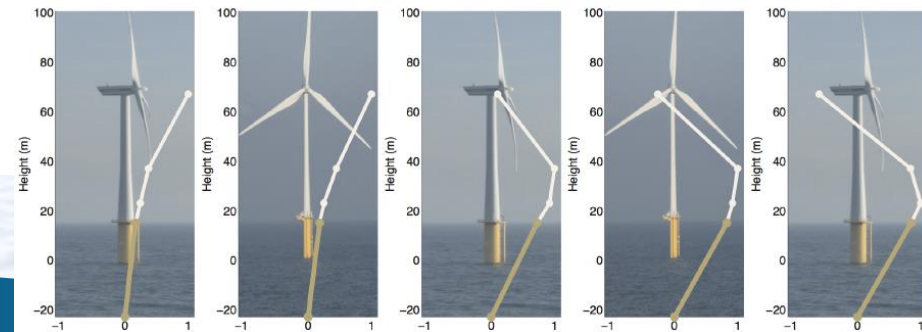


## 1 manager

- Inspections and trending
- Maintenance planning
- Coordination of activities
- Ownership of data
- Survey planning and trending
- Contingency portfolio

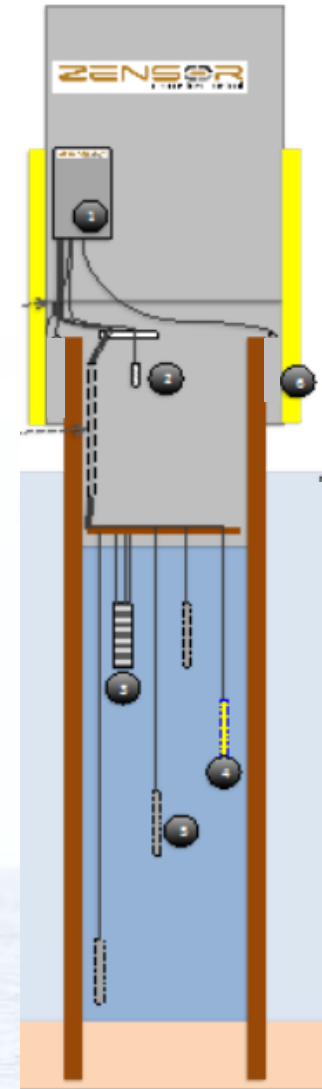
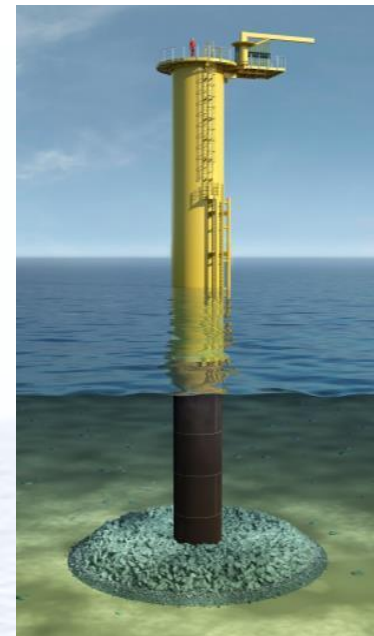


- External corrosion
  - Below water (CP)
  - Splash zone
  - Above water
- Internal corrosion
- Vibrations: macro (fatigue)
- Vibrations: micro (bolts, nuts, ...)
- Scour protection
- Appendages (cranes, nav lights, ...)
- Cable damage



# BoP monitoring

- Vibration
- Corrosion: types, speed
- Drivetrain monitoring
- Grout analysis
- Survey: MBE, SSS, ROV, ...
- O&M optimization





Thanks for your attention!  
Questions?

