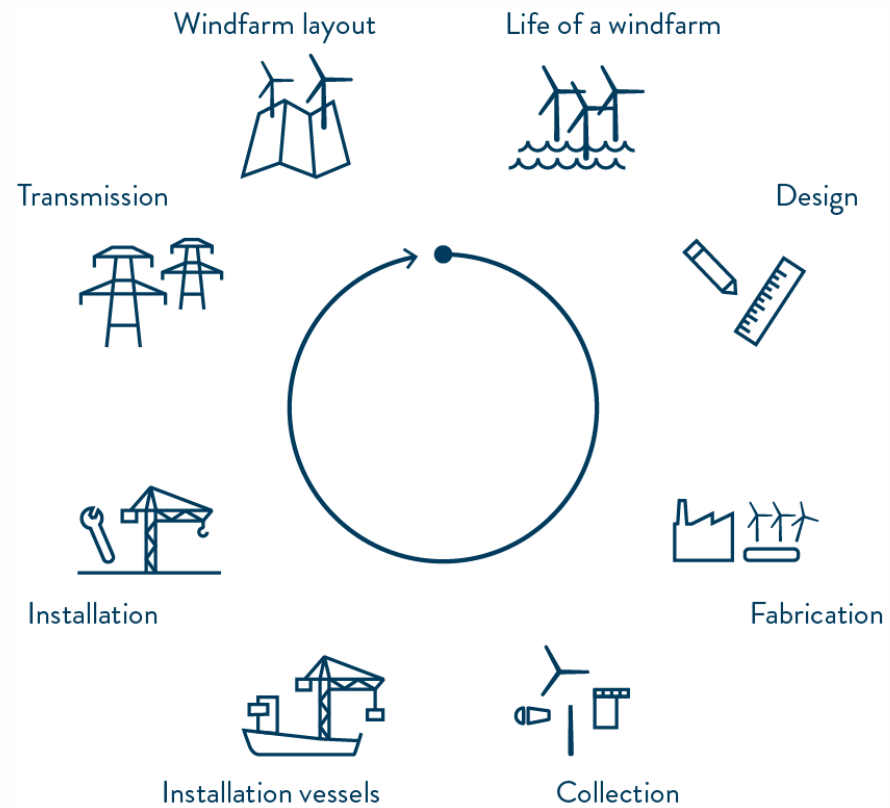




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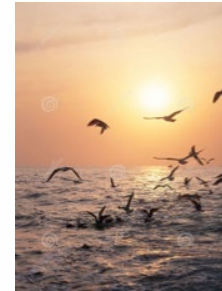
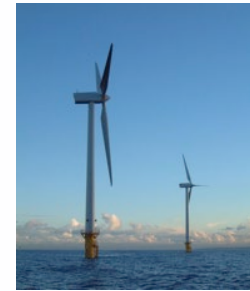


Design and installation





The cycle of an offshore wind farm



Contracting

Design

Fabrication

Transport

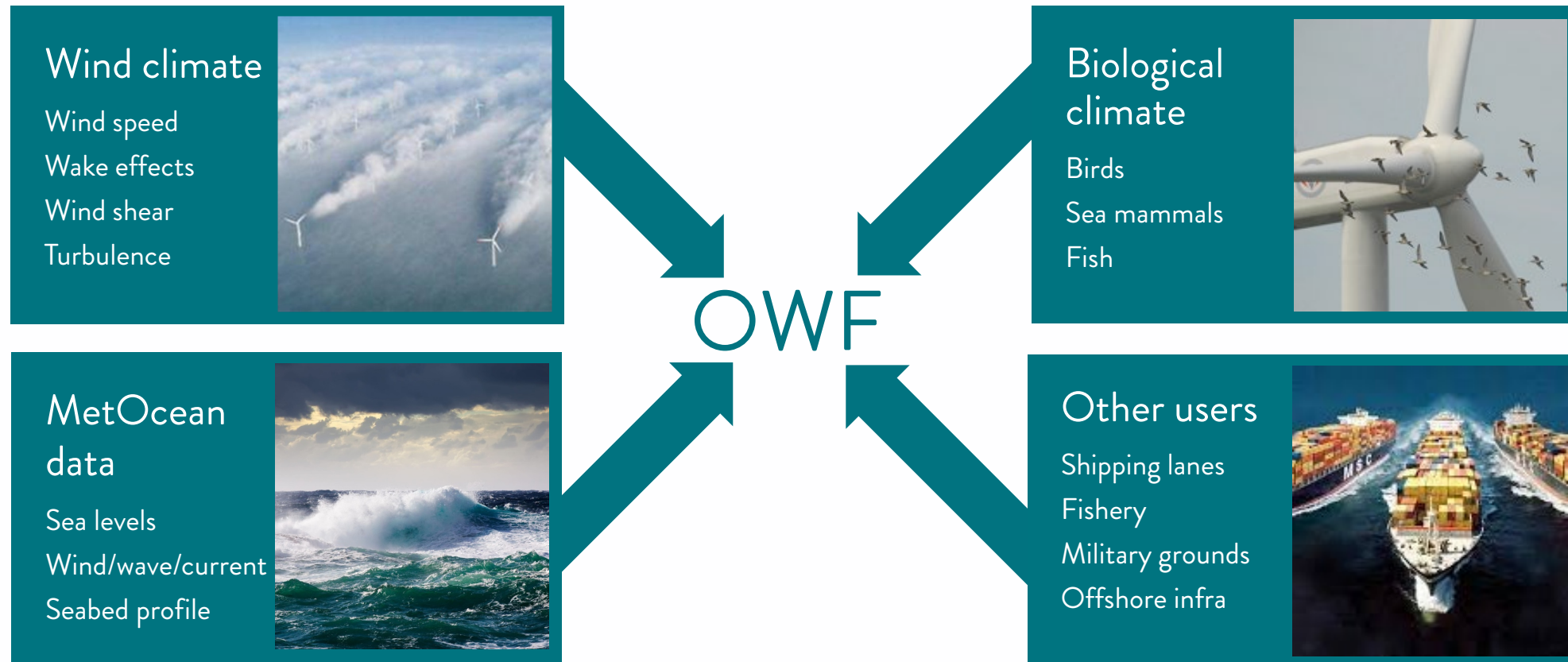
Installation

O & M

Decommissioning



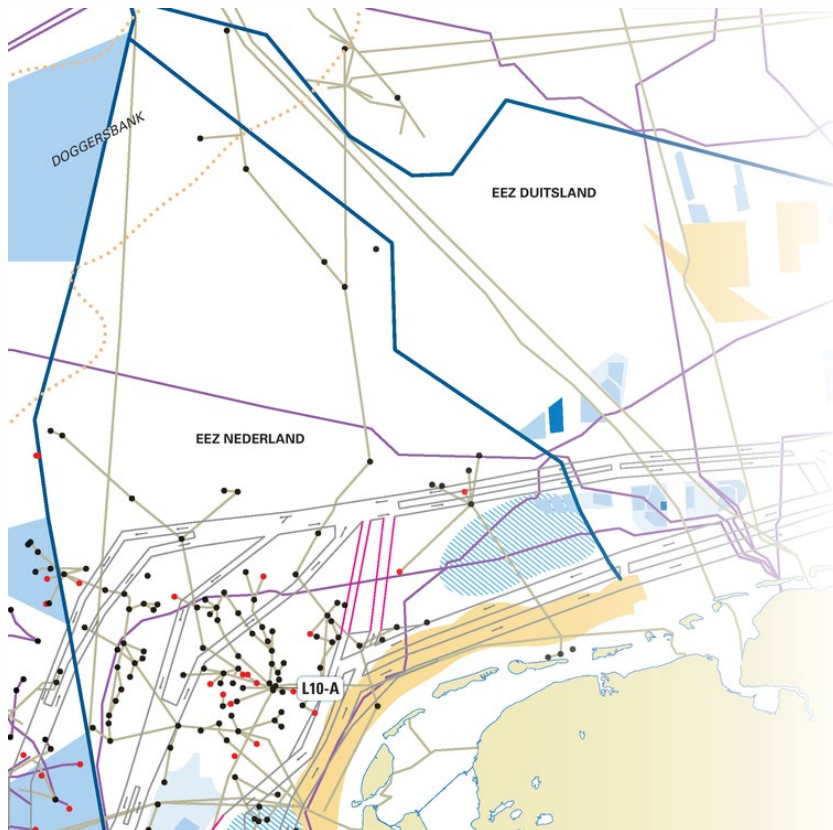
Prominent influencing factors



World Maritime News
Birdnote



North Sea





Design considerations

- Fabrication
- Transport
- Installation
- Maintenance
- Decommissioning





Complex process

Many trade-offs during the process, e.g.:

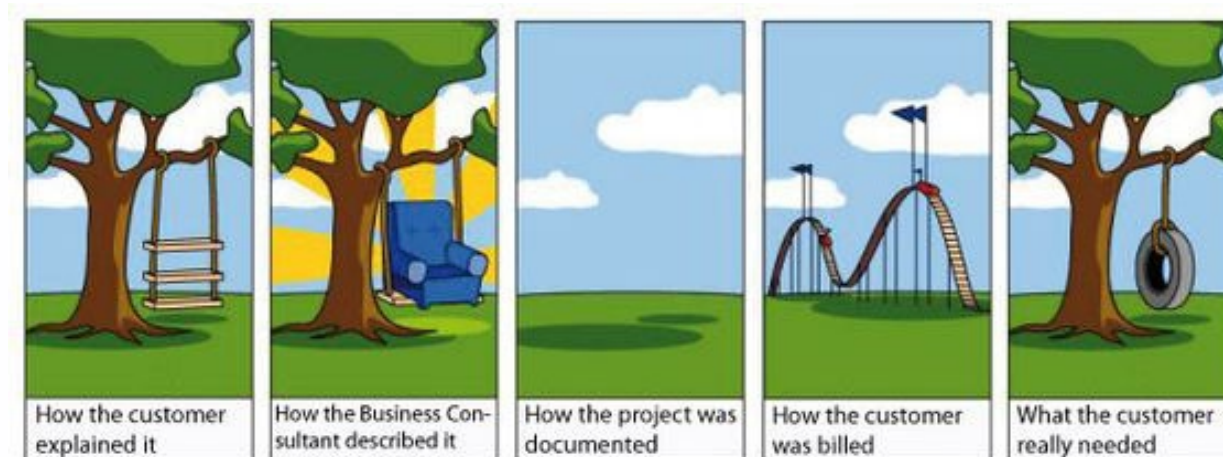
Design aspect	Positive effect	Negative effect
Large space between turbines	Low wake losses	High cable cost
High availability	High yield	High O&M cost
No scour protection	Simplify installation	Longer foundation pile





Design focus

- Complex relations with involved people
- Series-work!!
 - Small cost reduction for one turbine means big cost reduction for the total wind farm
- In the end it all boils down to
 - Safety
 - Cost effectiveness



Pinterest





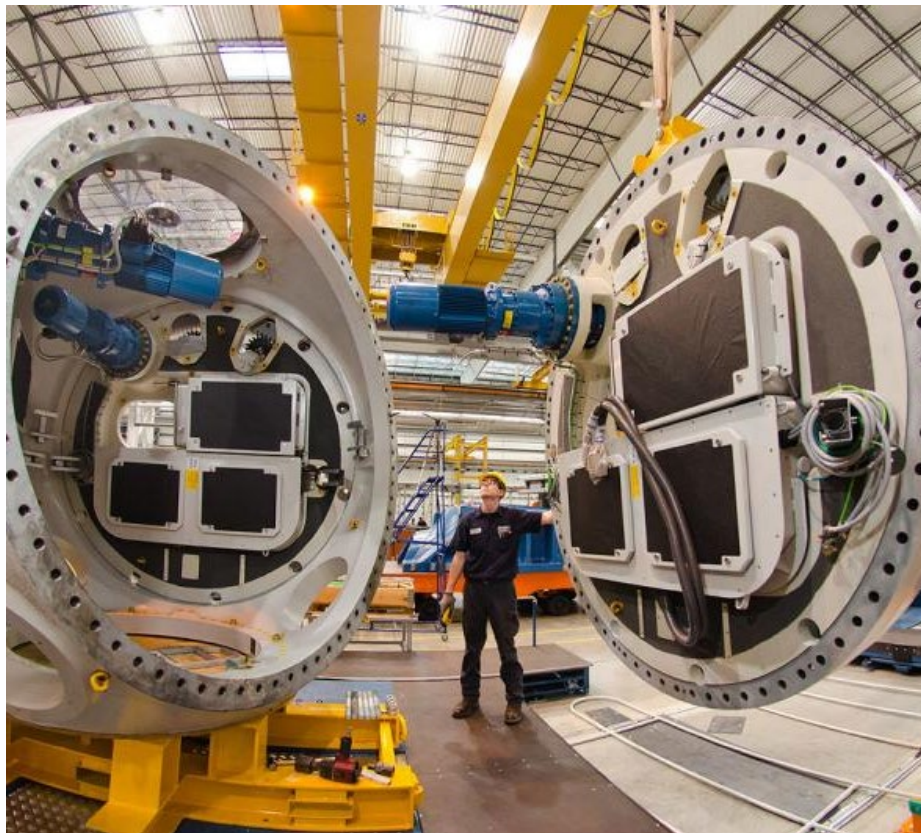
Governing aspects fabrication

- Series-work
- Supply chain management





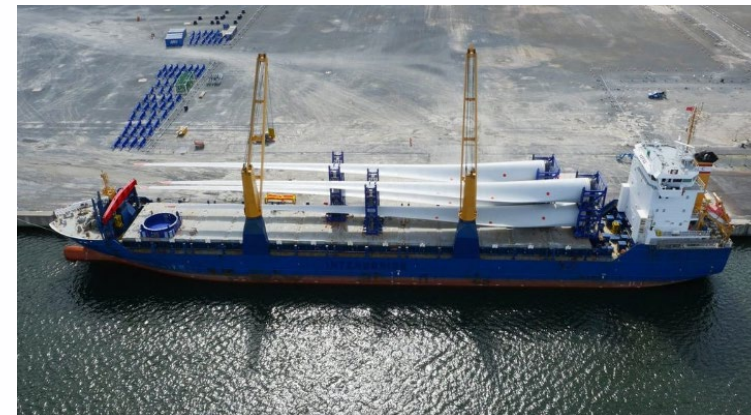
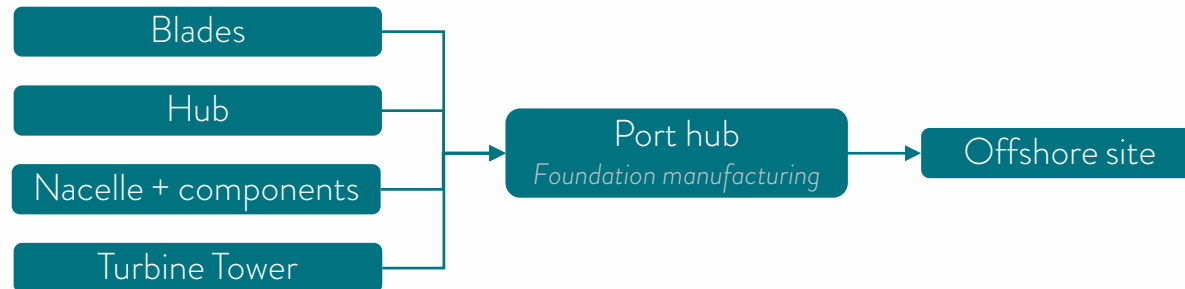
Turbine components





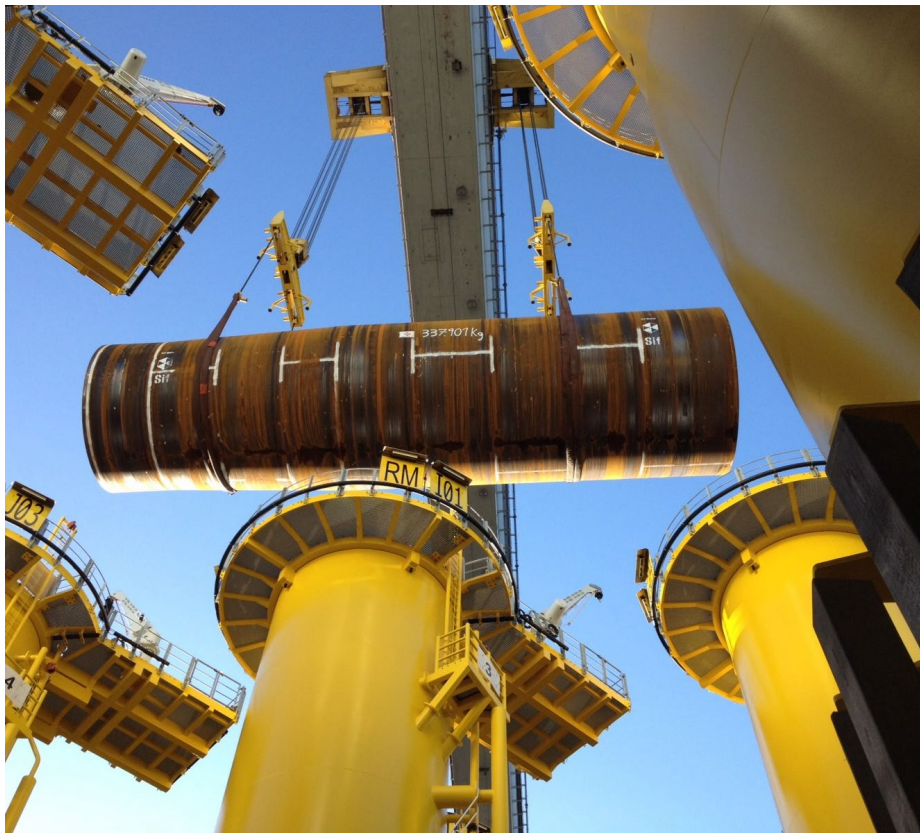


Collection at port





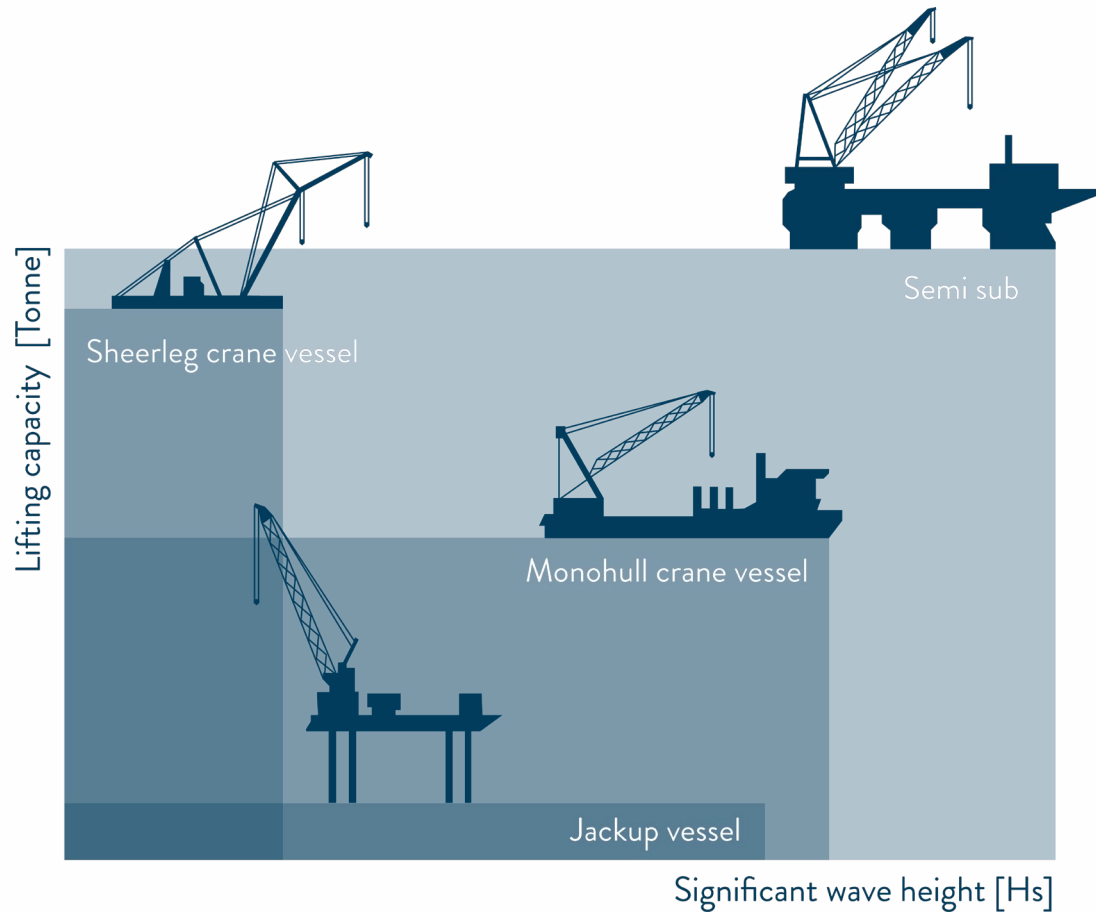
Collection



Siemens



Installation vessels





Jack-up vessels

Example: Van Oord Aeolus

- Max. water depth: 45m
- Deck area: 3300 m²
- Deck load: 6500t
- Draught:
- Crane load 30m: 990t
- Crane load 86m: 100t



Van Oord



Sheerleg crane vessels

Example: Matador 3

- Max. water depth: None
- Deck area: Limited
- Deck load: -
- Draught: 2.5-5.8 m
- Crane load 40m: 1800t
- Crane load 75m: 900t





Crane vessels

Example: Oleg Strashnov

- Max. water depth: None
- Deck area: 3700 m²
- Deck load: 8500t
- Draught: 8.5-13.5 m
- Crane load 102m: 5000t





Semi submersible vessels

Example: Heerema Thialf

- Max. water depth: None
- Deck area: -
- Deck load: 12,000t
- Draught: 11.8-31.6 m
- Crane load 102m: 14,200t





Cable laying vessels





Stone dumping vessels





Multipurpose vessels

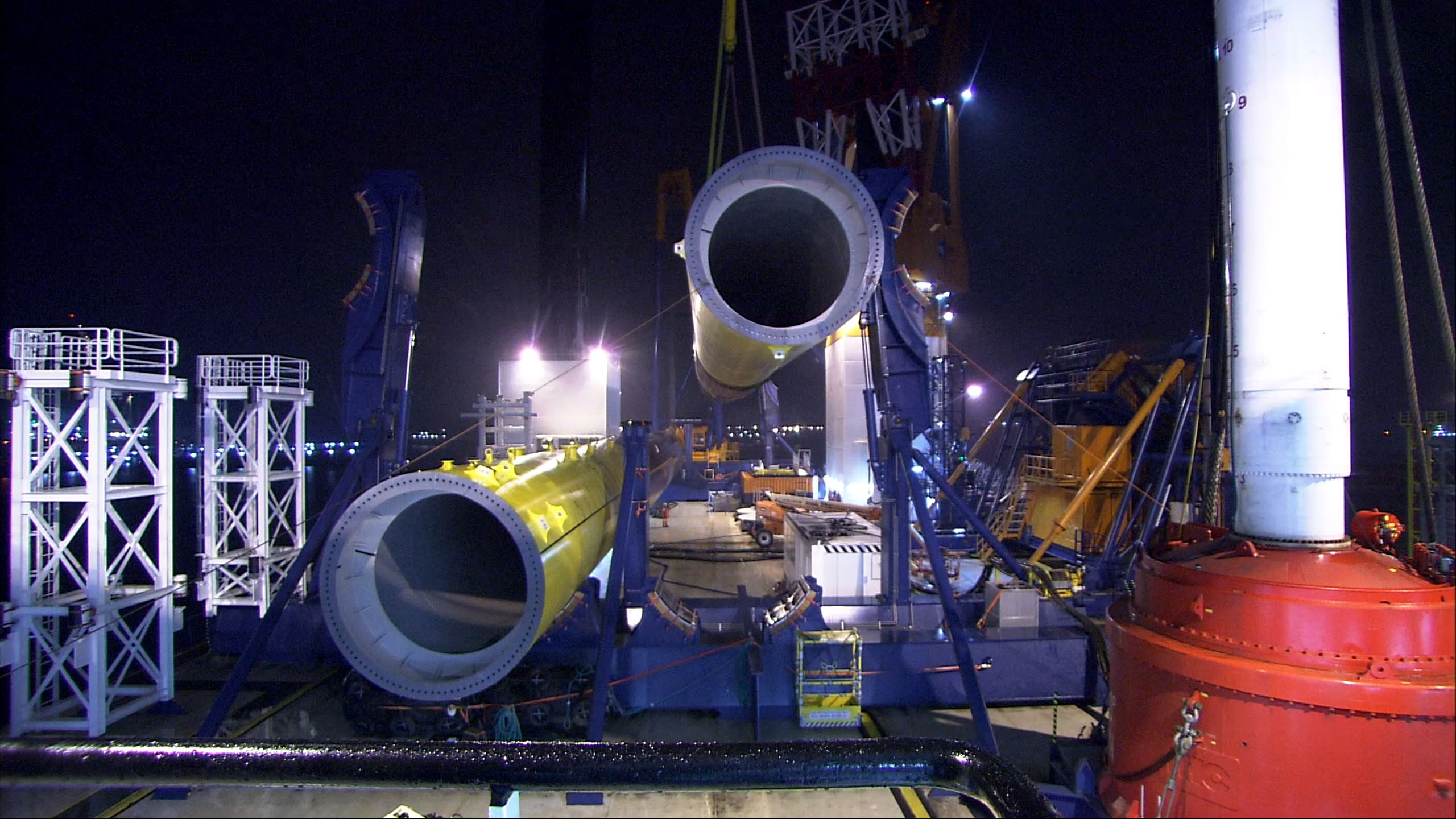




Installation – Monopile

- Pile driving
 - Transition piece installation
 - Tower installation
 - Rotor installation
 - Nacelle installation
 - Scour protection
- } Turbine Installation













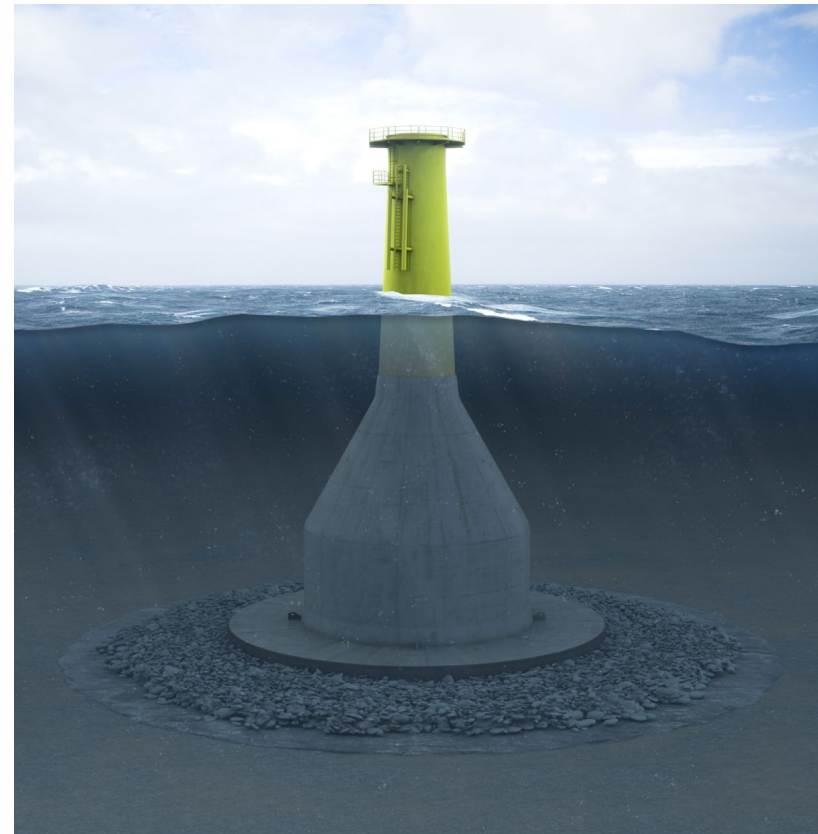






Installation: Gravity Base Structure

- Seabed preparation
- Floating transport
- Submerged by ballasting
- Turbine installation
- Scour protection





Installation: Multimembers

- Seabed preparation
- Lowering of structure
- Piling
- Turbine installation
- Scour protection





Cable installation: J-tube

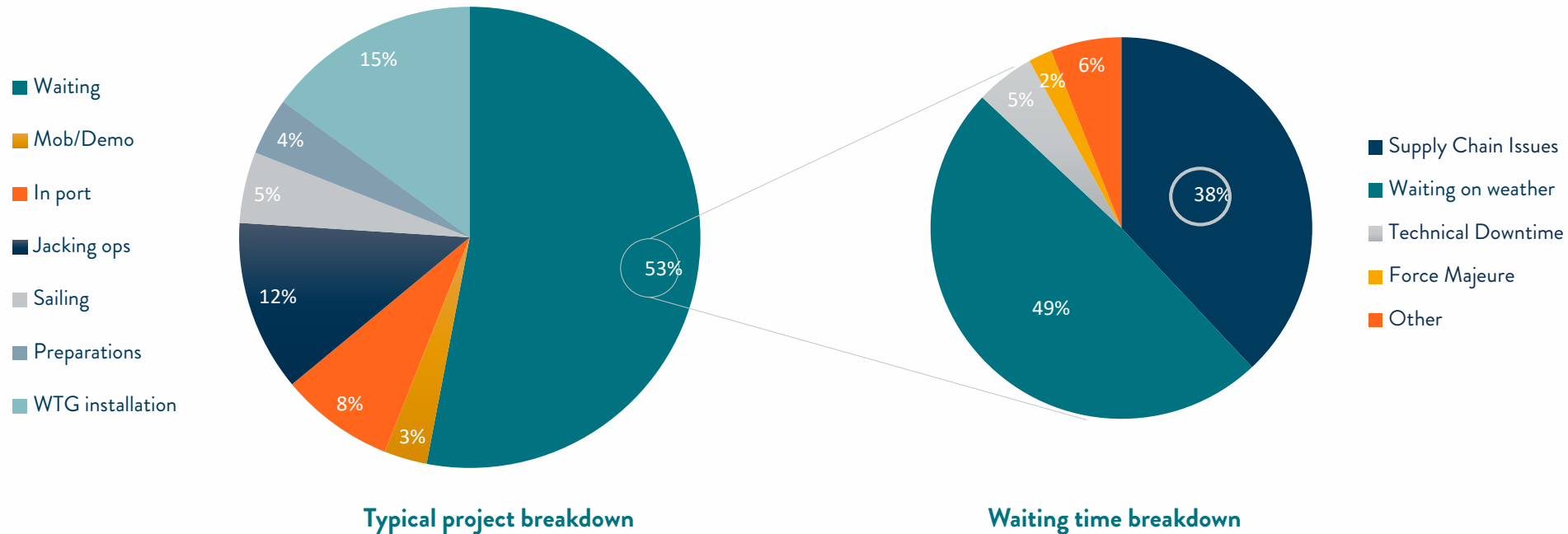




Installation

Time consuming process!

Many links in the chain – supply chain management



Van Oord



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