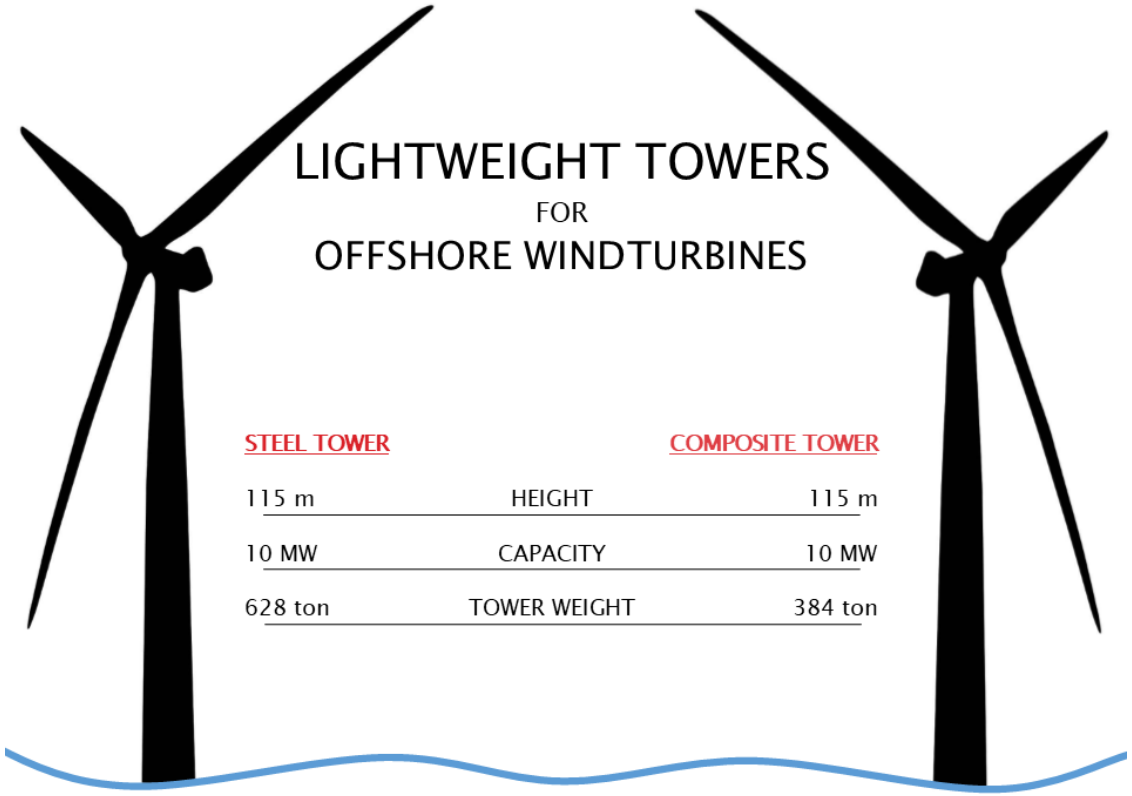
Lightweight Towers For Offshore Windturbines

C-Tower (2015-2017)

Jelmer de Lange – Jules Dock

14-02-2018



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Knowledge Centre WMC

Why Composite Towers?

- **>50% WEIGHT REDUCTION** – save time and money during transport and installation
- **MAINTENANCE** – no corrosion, no welding seems
- **DESIGN FREEDOM** – laminate thickness, fiber direction, fiber type, fiber-resin volume, resin-type, local optimizations

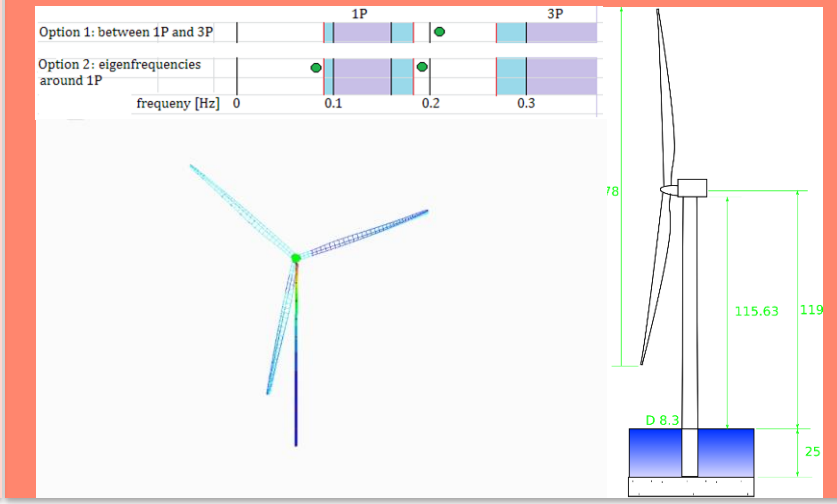
C-Tower project:

- Case definition - 10MW DTU-turbine on a steel monopile, offshore location (North Sea)
- Laminate based on fibre reinforced plastics, tested with FOCUS6
- Started with a flexible and stiff design
- Optimizing the flexible design
- Load cases IEC-61400-3
- Feasible tower concept – C-Tower v1.0
- Production tests, scaled model, static + dynamic tests

	Stiff	Flexible
Top thickness (D 5.5m)	200 mm	10 mm
Bottom thickness (D 80m)	450 mm	32 mm
Tower weight	1191 ton	92 ton
1st frequency	0.199 Hz	0.065 Hz
2nd frequency	Not relevant	0.217 Hz
Maximum stress	168.7 MPa	330.2 MPa
Buckling SF	47.4	<< 1

Results:

- Composite tower section 104m, diameter 8.3m
- Tower weight of 384t instead of 628t steel
- 38% weight reduction
- More flexible than steel towers
- Eigenfrequencies around 1P



C-Tower (2015 – 2017)

C-Tower 1.0

- *Scaled factor 0.05 in length (5.2m instead of 104m)*
- *In-house designed production technique*
- *T-Bolt connections root - top*
- *Static load tests, max. bending moment at root: 333kNm*
- *Dynamic load tests, simulating 20 years*

IDL-Tower (2017 – 2019)

Jules Dock – WMC – ECN

- Integral design incl. foundation & controller
- Weight reduction 50%
- Offshore & onshore case study
- Improve production technique and quality
- Prototyping & Testing

Any questions?