



REpower Offshore Wind Technology

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Stakeholders' Consultation on Development
of Offshore Wind in India

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Transport of the REpower 5M Nacelle (Cux)



- Length: ≈ 19 m
- Width: ≈ 6 m
- Total Height: ≈ 6.8 m
(incl. Helihoist: ≈ 8.5 m)
- Total Mass: ≈ 316 to.
- Road transport possible in modules of 120 to. and 3.8 m total height maximum

REpower 6M

The most efficient Offshore Wind Turbine



Rated Power: 6,150 kW

Same outer dimensions as the 5M

Rotor ø: 126 m

Swept Area: 12,469 m²

Hub Heights

Onshore: 100 m / 117 m

Offshore (site specific): 85 - 95 m

Design

Onshore: IEC IIA (8.5 m/s / 18% turbulence)

Offshore: IEC Ib (10 m/s / 16% turbulence)



DEWI OCC Test Site Cuxhaven



- **2 x REpower 5M, 117 m hub height**
 - Customer turbine 1: EWE AG
 - Customer turbine 2: EWC (joint venture of *e.on* Renewables and Essent)
- **Installed: Nov. 2006**
- **Commissioned: Dec. 2006**

Windfarm Büttel



- **5 x REpower 5M, 117 m hub height**
 - Customer: Allianz Specialized Investment
- **Installed: summer / autumn 2007**
- **Commissioned: Nov. / Dec. 2007**



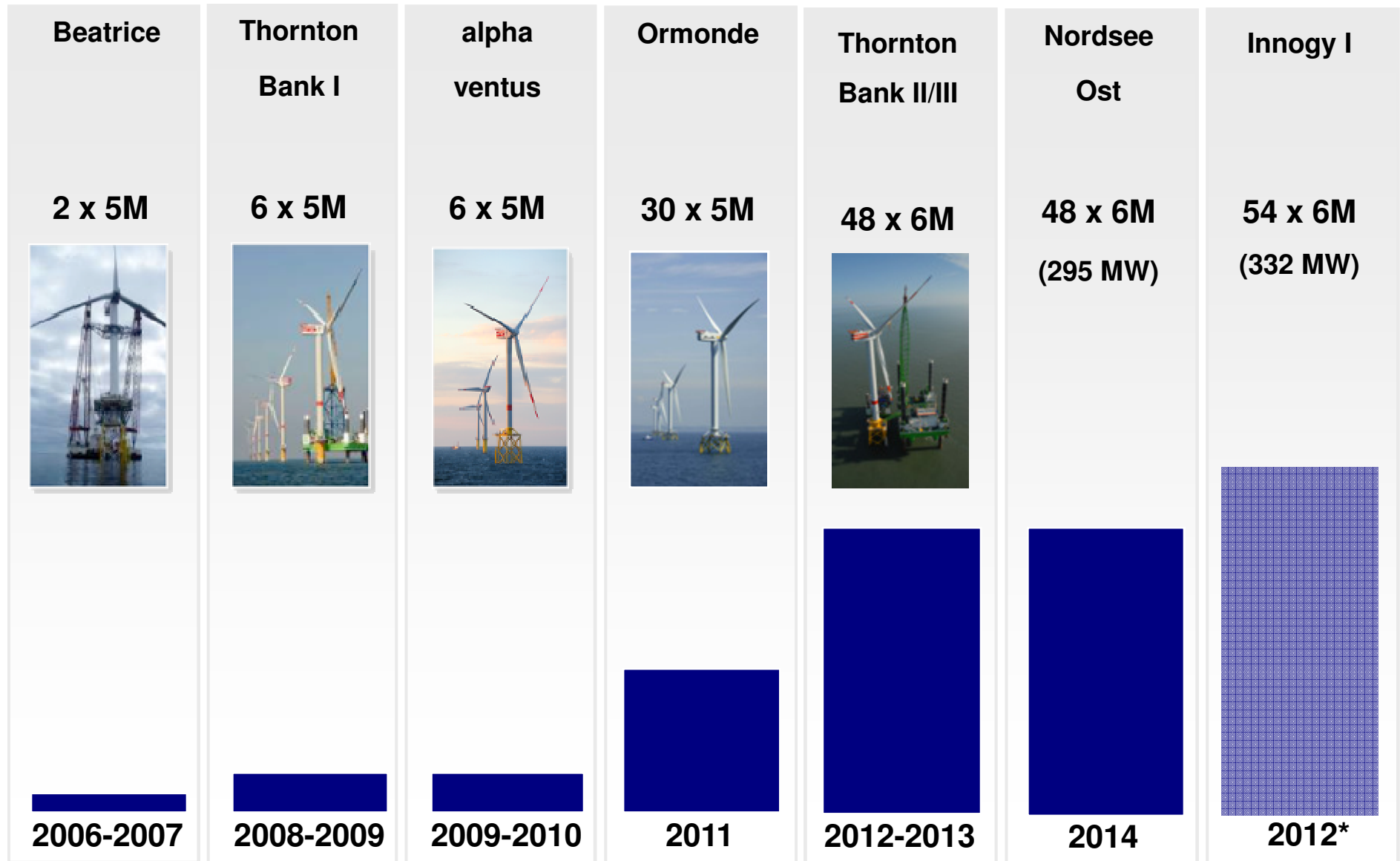
Jacket Test Project Bremerhaven



- 1 x 5M, 120 m hub height
- Installed: Q1 – 2008
- Jacket 57 m, mass: 340 tonnes
- Tower 60 m, mass: 200 tonnes



The REpower offshore success story



*signed delivery contract

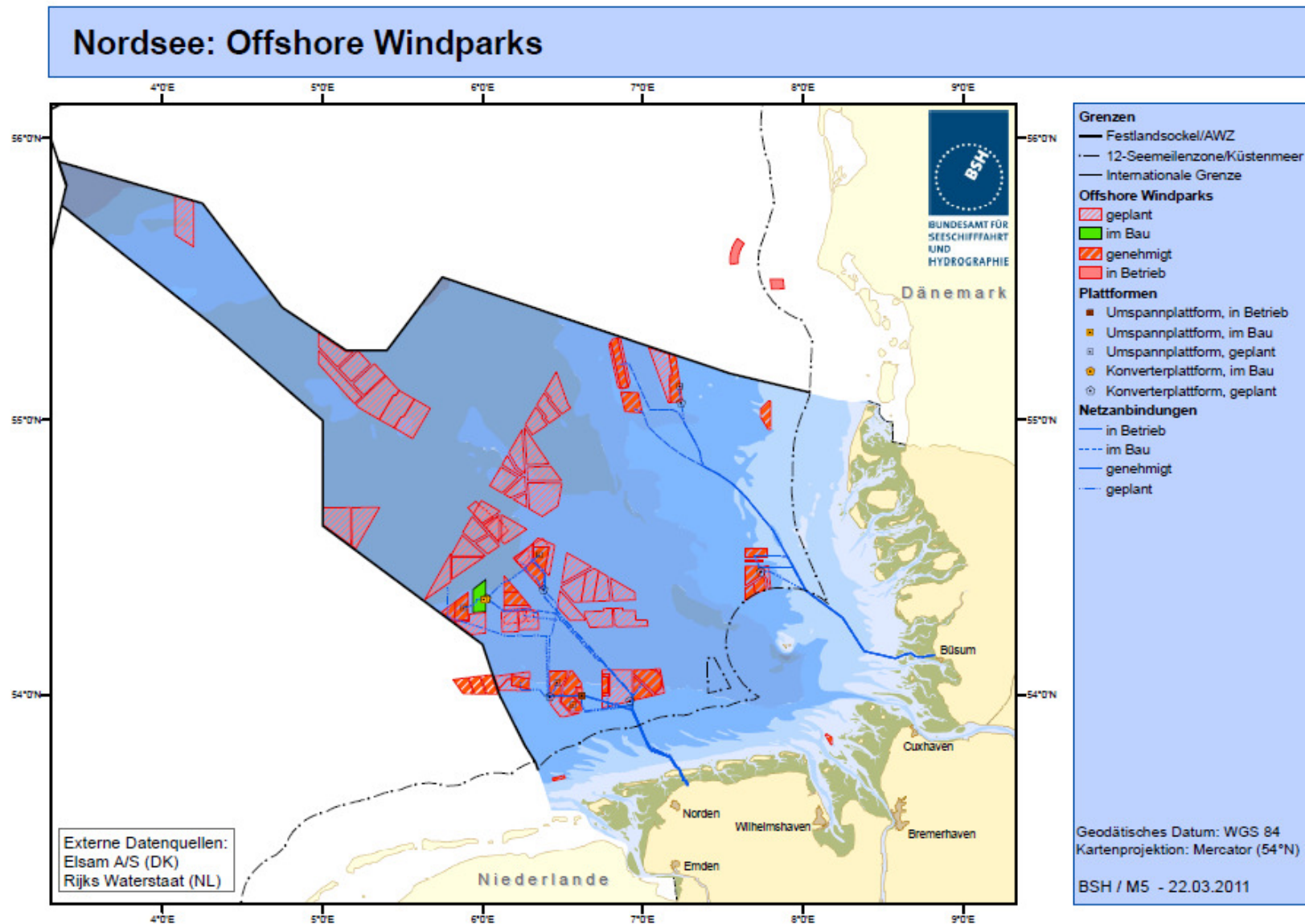
REpower Offshore Milestones

5M/6M Reference List



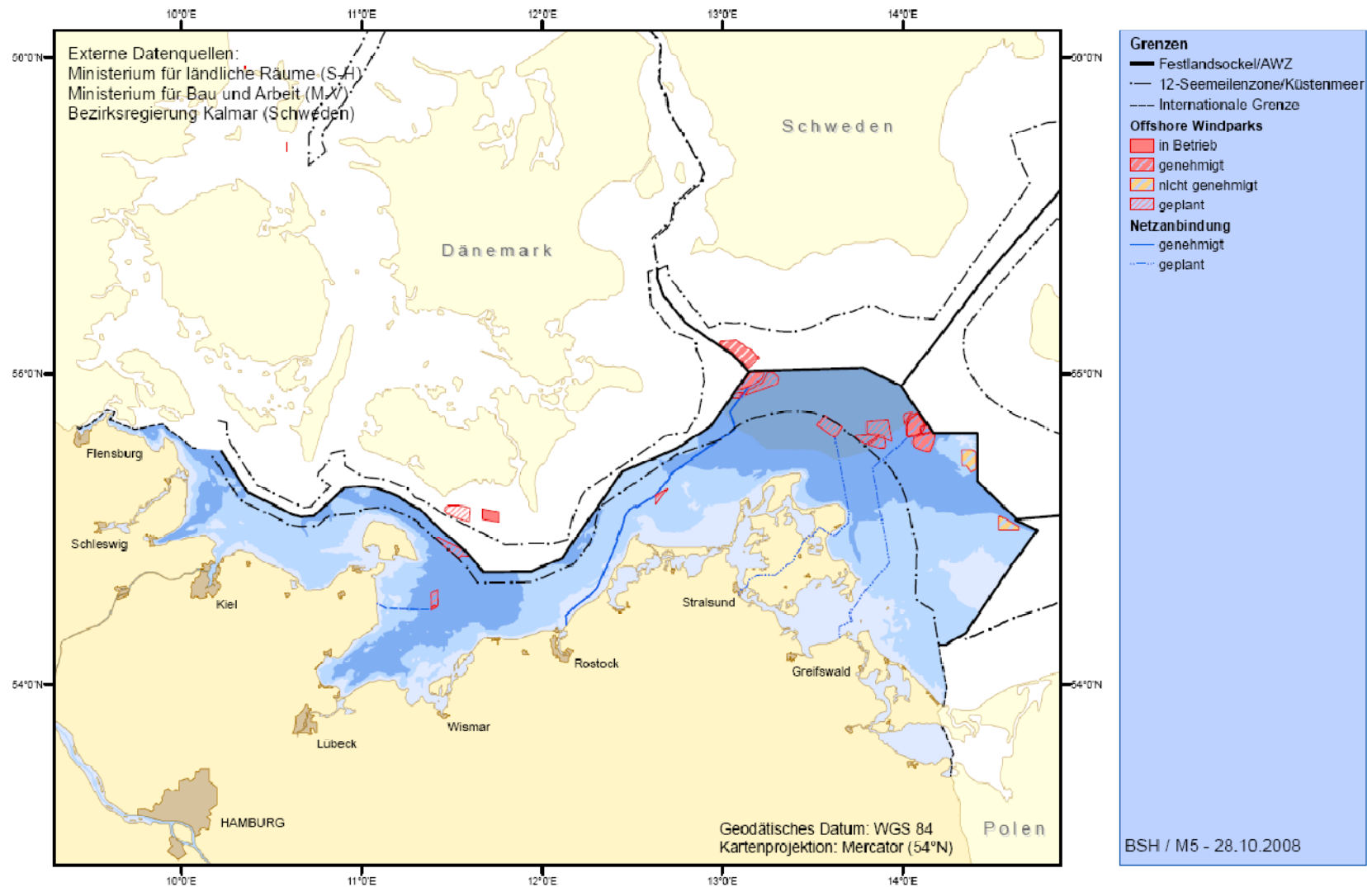
Realized projects							
1	5M	5	120	Brunsbüttel	Onshore	GER	Q4 2004
1	5M	5	89	Beatrice	Offshore	UK	Q3 2006
2	5M	10	117	Cuxhaven	Onshore	GER	Q4 2006
1	5M	5	89	Beatrice	Offshore	UK	Q3 2007
3	5M	15	117	Büttel	Onshore	GER	Q3 2007
2	5M	10	117	Büttel	Onshore	GER	Q4 2007
1	5M	1	120	Bremerhaven	Onshore	GER	Q2 2008
6	5M	30	94,5	Thornton Bank I	Offshore	BEL	Q3 2008
3	6M	18,45	100	Ellhöft/Westre	Onshore	GER	Q1 2009
6	5M	30	92	Alpha Ventus	Offshore	GER	Q4 2009
30	5M	152,25	~ 95	Ormonde	Offshore	UK	2011
2	6M	12,3	112	EPZ II	Onshore	NL	2012
2	6M	12,3	114	Westereems	Onshore	NL	2012
43	6M	295,2	~ 95	Thornton Bank II+III	Offshore	BEL	2013
102	5M and 6M turbines installed already						
Future projects							
5	6M	295,2	~ 95	Thornton Bank III	Offshore	BEL	2013
48	6M	295,2	~ 97	Nordsee-Ost	Offshore	GER	2014
54	6M	332,1	~ 98	Innogy I	Offshore	GER	2015
107	6M turbines to be installed in next 2 years						

German Potential – North Sea



Potential Germany – Baltic Sea

Ostsee: Offshore-Windparks



Germany as an example

1999: First request for an offshore wind farm permit

1999 until today: Develop a regulatory framework for permits in EEZ and 12sm zone

2000: First political targets for offshore wind installations

2005: German Government bought the license for a permitted 60 MW offshore wind farm

2006: Offshore grid law in place (Infrastrukturplanungsbeschleunigungsgesetz)

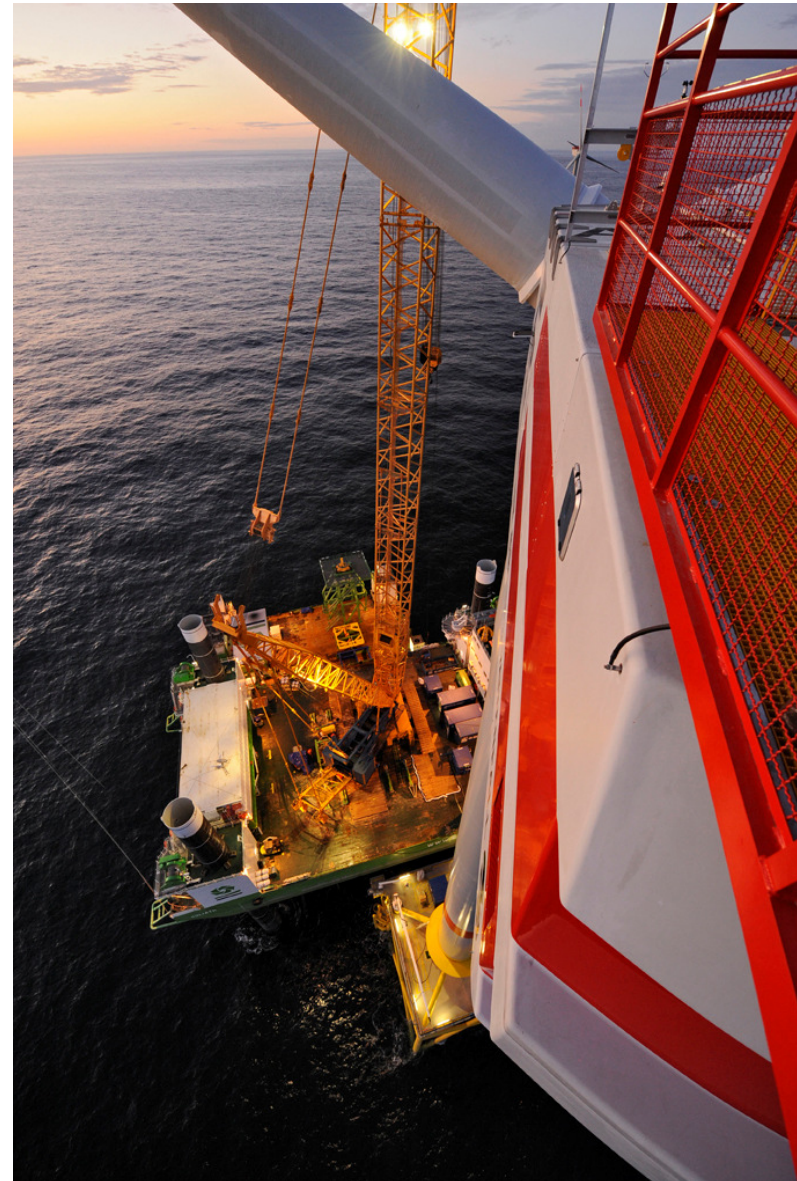
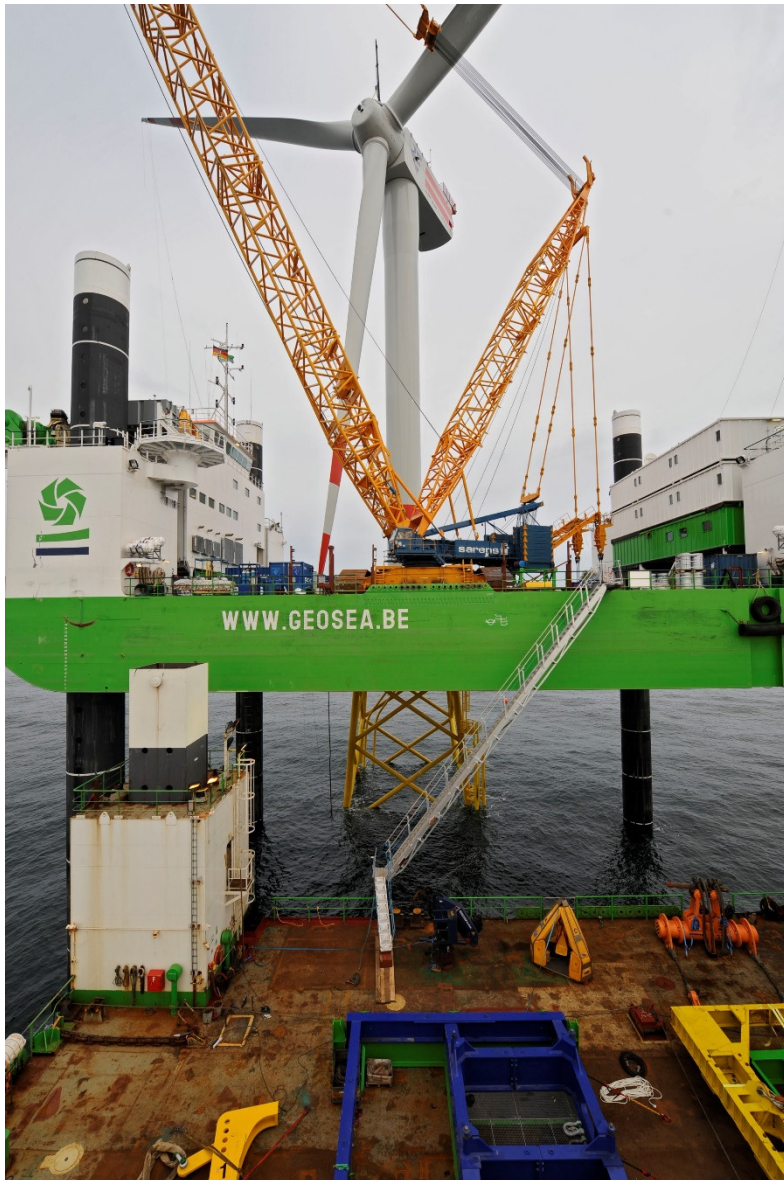
2009: Feed in tariff for Offshore wind in place

2009: Construction of the 60 MW Offshore wind demonstrator “alpha ventus”

2013 summer:

- 300 MW Offshore wind online
- 2.700 MW Offshore wind under construction
- 6.200 MW unconditioned Offshore wind grid connection is ordered

alpha ventus: The Installation 30.09. until 20.11.2009



Ormonde Project – Shipping of Jackets



Ormonde Project – Shipping of Nacelles Bremerhaven-Belfast

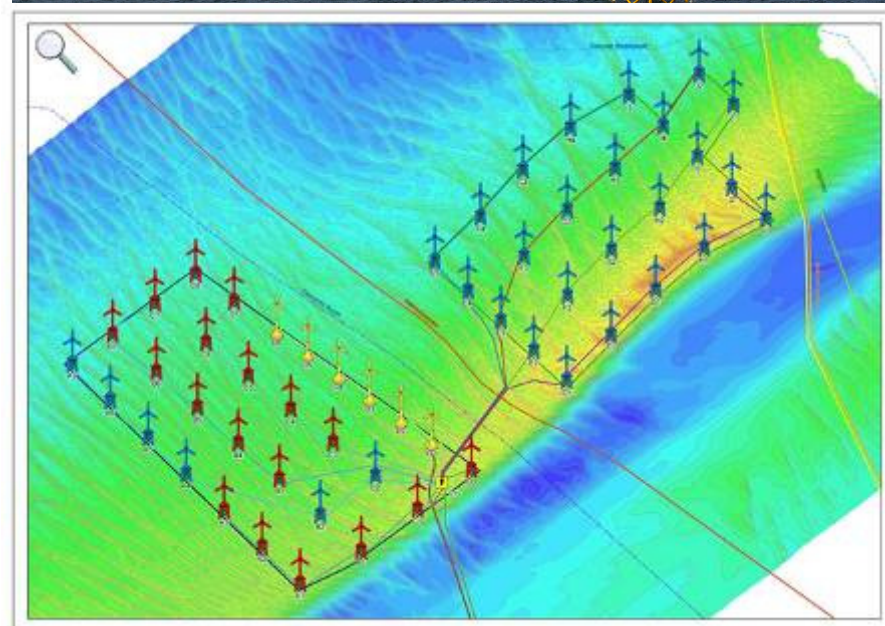


Ormonde Project – Installation of the first turbine
was 23rd of March 2011, last turbine 1st of August 2011



Thornton Bank Wind Farm – Key Facts

- Three Phases:
 - Phase 1: 6 x 5M (2008)
 - Phase 2: 30 x 6M (2012)
 - Phase 3: 18 x 6M (2013)
- Total Capacity: 325,2 MW
- Annual production: ~1000 GWh, enough to provide power to 600.000 inhabitants
- Location 30 km from the Belgian coast line, 12 – 27 m deep sea
- Client C-Power



Thornton Bank Logistics:

Nacelles + Towers by sea transport, Blades by truck



Nacelles, Hubs, Towers



- Like Ormonde, use of harbours Cuxhaven and Bremerhaven
- 3 sets of components per trip:
 - 6 tower sections
 - 3 nacelles
 - 3 hubs

Blades



- Road transport from Padborg / Denmark directly to Oostend, Belgium
- Most cost-effective solution
- Additionally: most efficient quay usage



Thornton Bank: Two Jack-up barges



Offshore Wind Industry could grow, based on:

- **Political willingness and targets**
- **Right site conditions, i.e. wind speed, seabed ...**
- **Regulatory for permits/licenses in EEZ and 12sm zone**
- **Regulatory for a grid connection. AC/DC?**
- **Offshore experience on both sites: Wind turbine and Balance of Plant**
- **Investors with the right financial and technical background**



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