V120-4.5 MW
Leadership in Offshore

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Content of Presentation

V120-4.5 MW: introduction

- Technical figures
- Technical elements
- Foundation figures
- Launching plan

Design Criteria and Performance

V120-4.5 MW
Wind class: IECs $v_{10\ min.\ avg.}$ < 10 m/s $v_{10\ min.\ ext.}$ < 47 m/s $v_{3\ sec.\ ext.}$ < 63 m/s Turbulence intensity of 14 %
Climate versions Standard -20º C to +30º C
Annual energy production 8 m/s 9 m/s 10 m/s 16 GWh 19 GWh 21.5 GWh

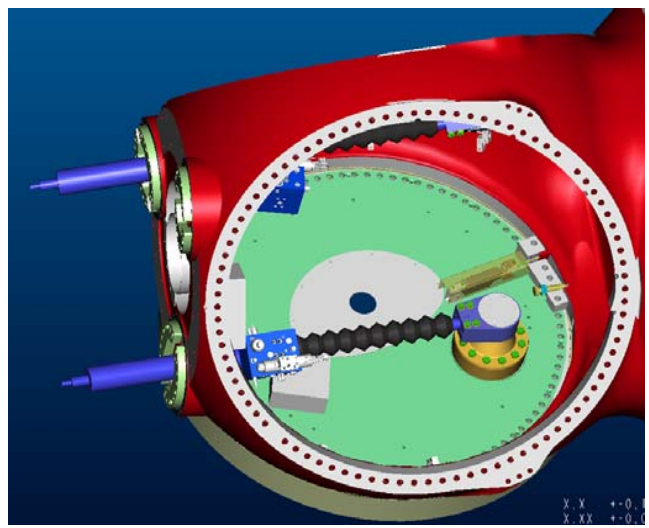
Development

V120 is based on proven concepts

- Blades in Wood – Carbon - Epoxy
- Hub design as V90-3.0 MW
- Nacelle based on the structure from NM110
- Controller from V90-3.0 MW
- Tower design concept as V90-3.0 MW

Rotor

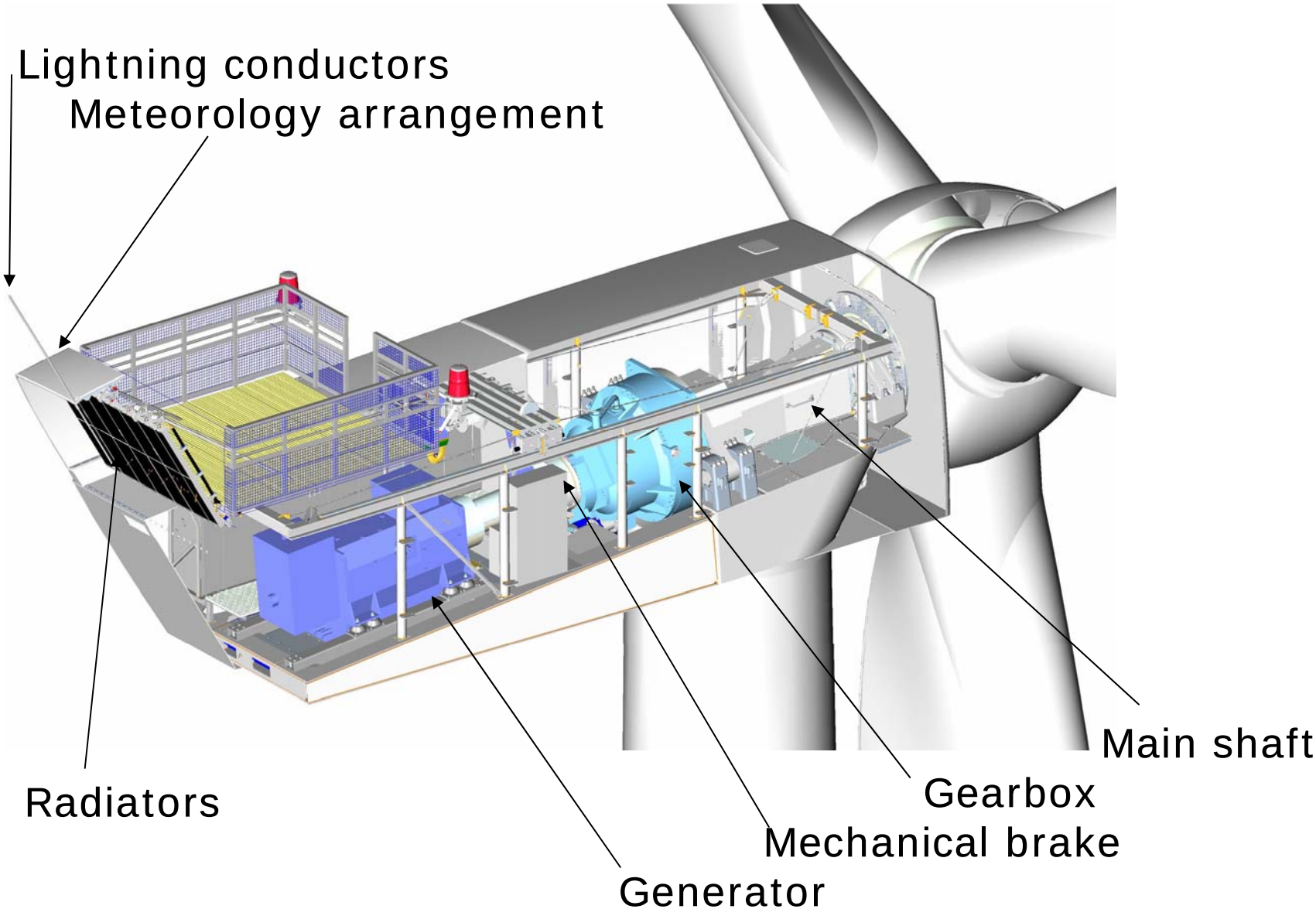
- Blades of Vestas design and fabrication in wood-carbon-epoxy technology
- Estimated blade weight 12.6 tons (LM 54: 13.7 T)
- High lift RISØ blade profile
- Hub with hydraulic blade pitch based on the design in V90-3.0 MW



Nacelle

- Doubly fed induction generator 6 kV
- Closed nacelle and tower concept. External radiator on top of the nacelle
- Advanced lightning protection according to TR IEC 61400-25
- One year service interval design
- Nacelle crane system

Nacelle Design



Electrical System

- Vestas system 6000 controller coming from V90-3.0 MW
- Advanced pitch algorithms are used to reduce the loads
- Transformer is placed at the tower base
- Fault ride through to fulfill the E.on requirement August 2003
- Power factor from 0.95 inductive to 0.95 capacitive for the full power range

Weights and Dimensions

Dimensions

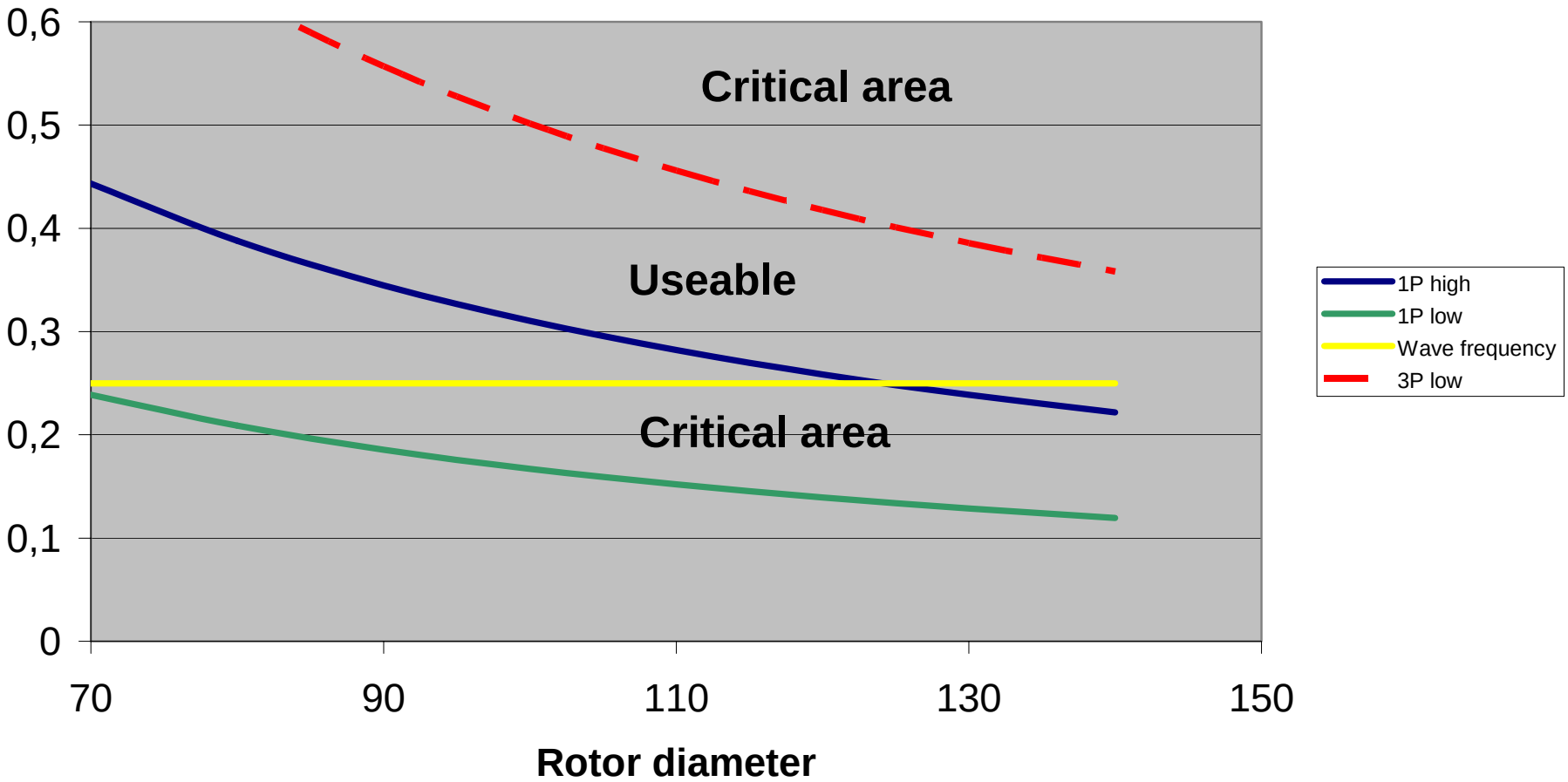
• Rotor diameter	120 m
• IEC2b 90m tower bottom diameter	5.5 m

Weights

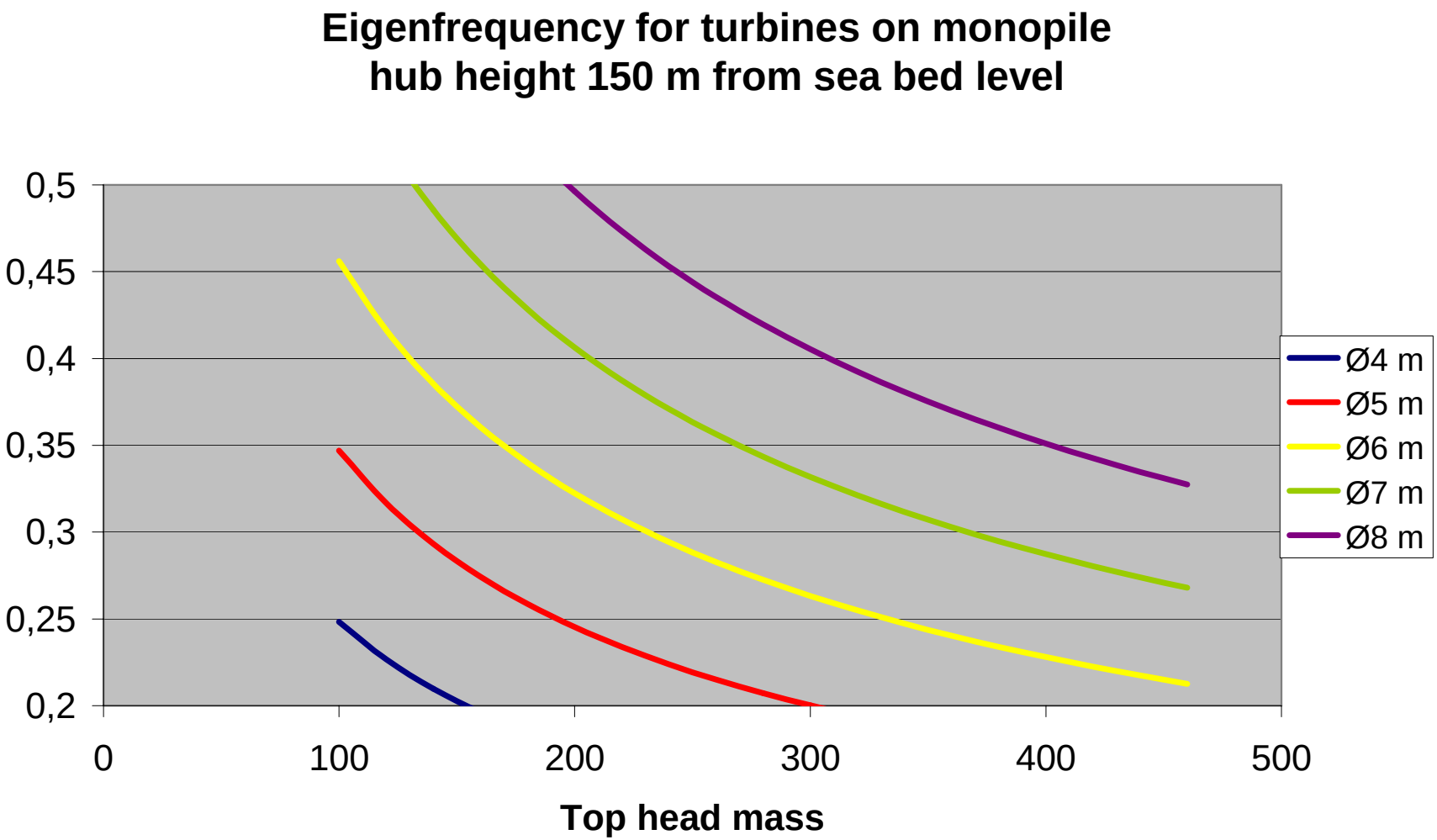
• Nacelle weight	145 tons
• Rotor weight	65 tons
• IEC2b 90m tower	220 tons

Eigenfrequencies

Critical frequencies - offshore

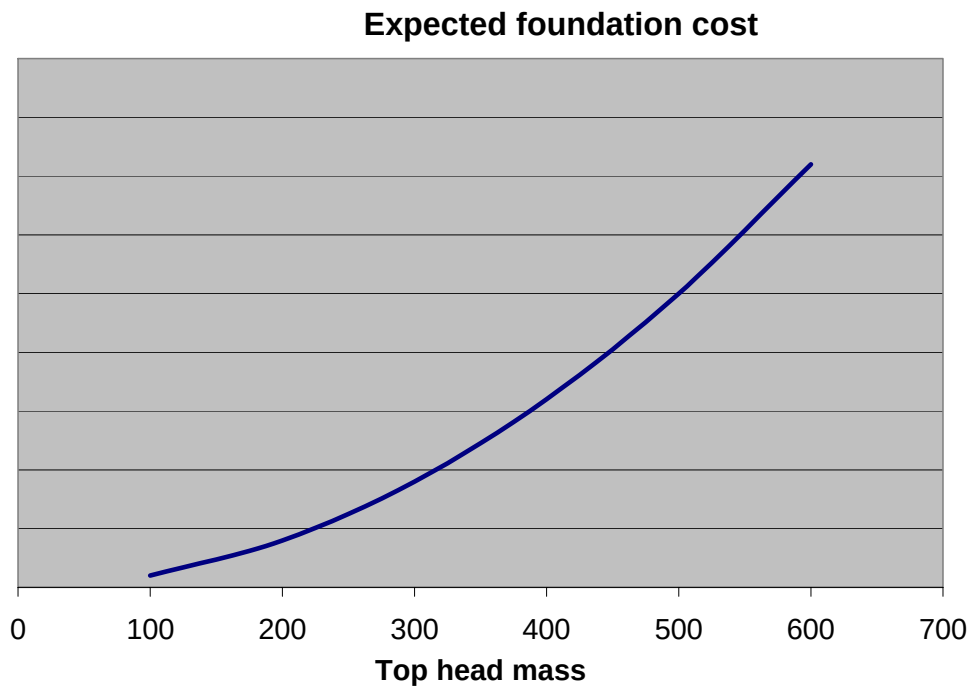


Tower Frequencies



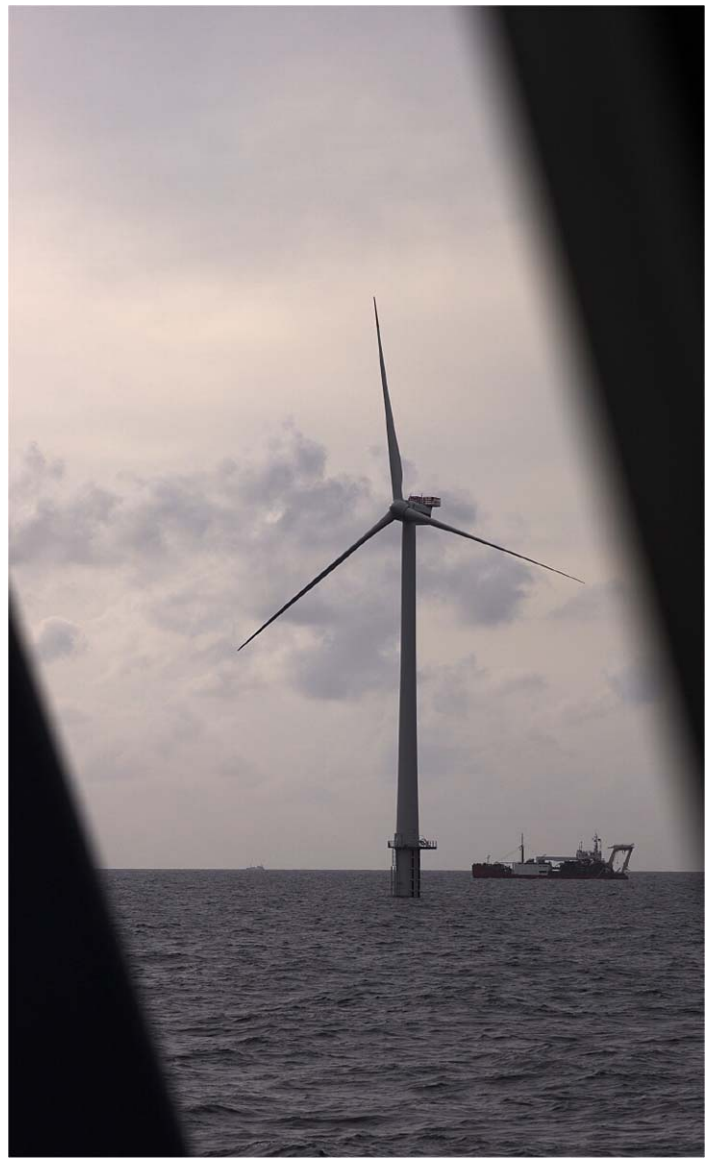
Foundation Costs

- Increased demand for foundation stiffness increases the costs
- Large diameter monopile becomes costly to install
- Tripod and other advanced foundations increase the costs



Launching Plan

- Prototypes/0-series can be delivered from Q4-2005
- Serial deliveries 2006 onshore and 2007 offshore



Questions