



TALISMAN

E N E R G Y



The Beatrice Windfarm Demonstrator

Part of the European DOWNInD Programme

Distant Offshore Windfarms No Visual Intrusion In Deepwater



DOWNVIInD Programme



- **Programme Objectives**

- **Research**

- » Understand environment and technology

- **Demonstrator**

- » Show windfarms in 50m water are viable

- **Operations**

- » Learn how to operate





World Class Team led from Aberdeen



Universities	Agencies	Public Companies	SME's
<p>Stockholm Lund KTH Strathclyde Aberdeen</p>	<p>ECN RISO</p>	<p>Talisman SSE EdF Airicole Germanischer Lloyd Repower Fabricator Installer Tie-in Contractor</p>	<p>PB Consulting Hammarlund Consulting Teknigruppen Nautilus</p>

Fabricator, Installer and Tie-in selection in progress

Other UK companies and organisations involved in project:

Amec, QinetiQ, Seebyte, Nickelby, DMS, BMT, Redfield, MRI, IPA, HIE

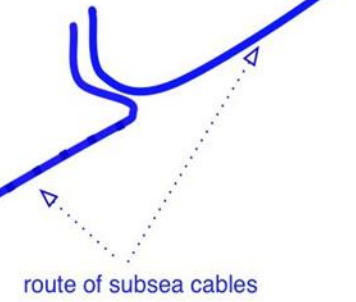
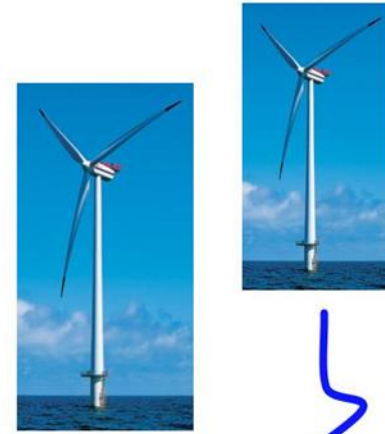
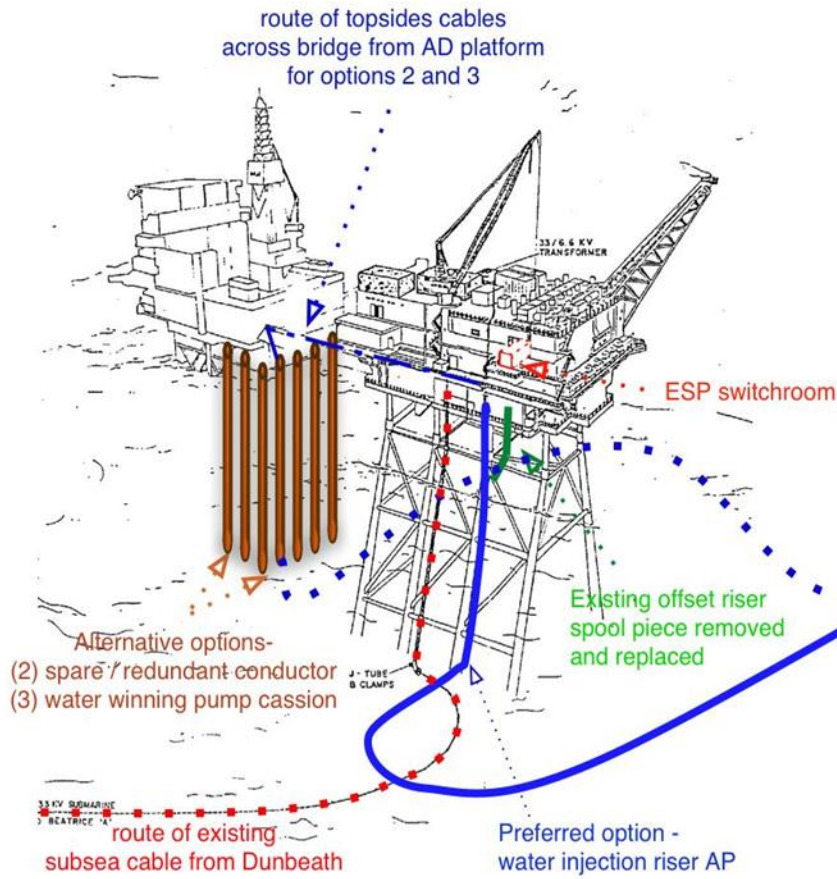




Beatrice Windfarm Demonstrator



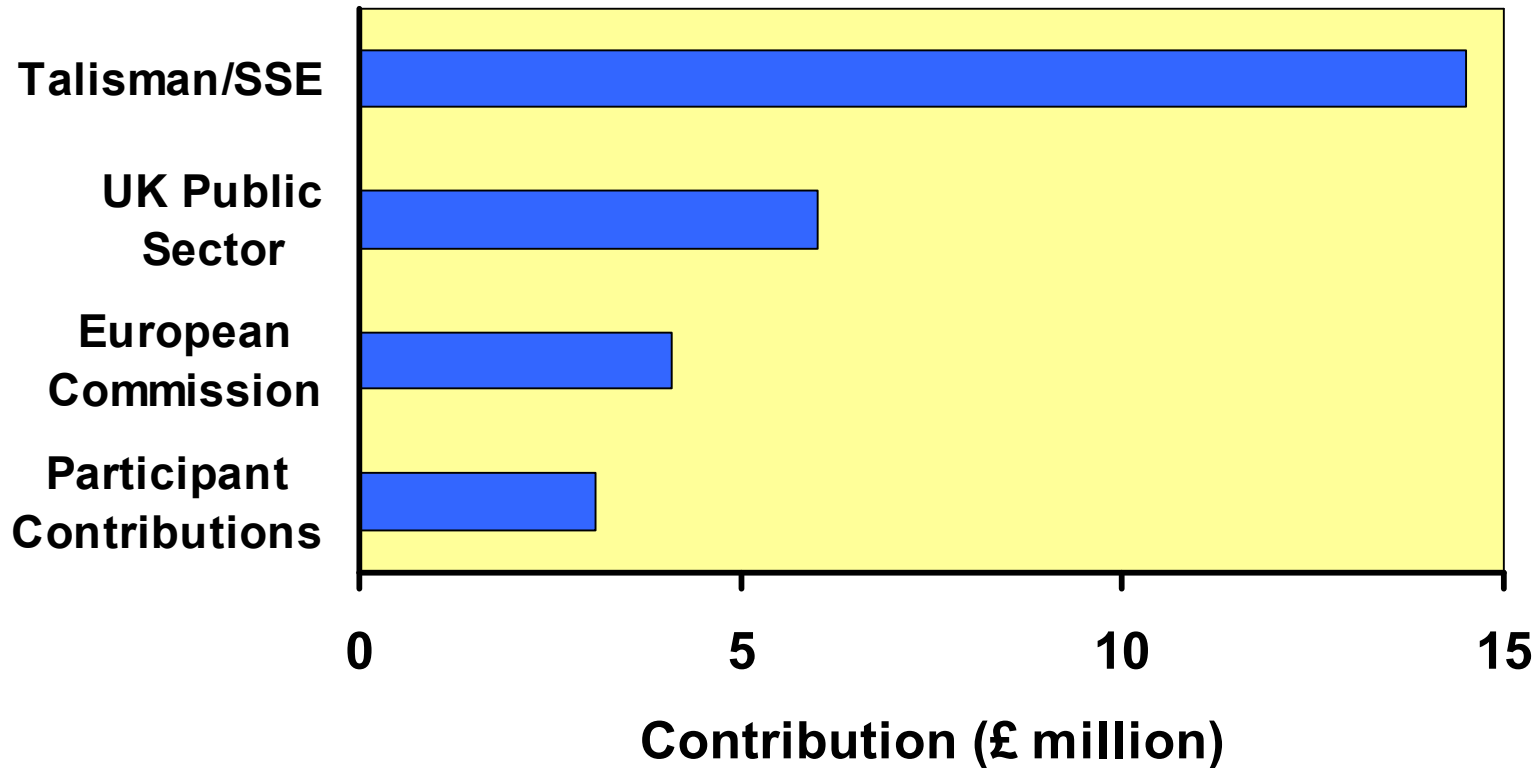
Water depth 44 m LAT at turbines



- **Demonstrator targeted to:**
 - Transform water depth envelope
 - Pioneer deepwater windfarms
 - Establish safe operating practices
 - Improve operating performance



DOWNVIInD Funding



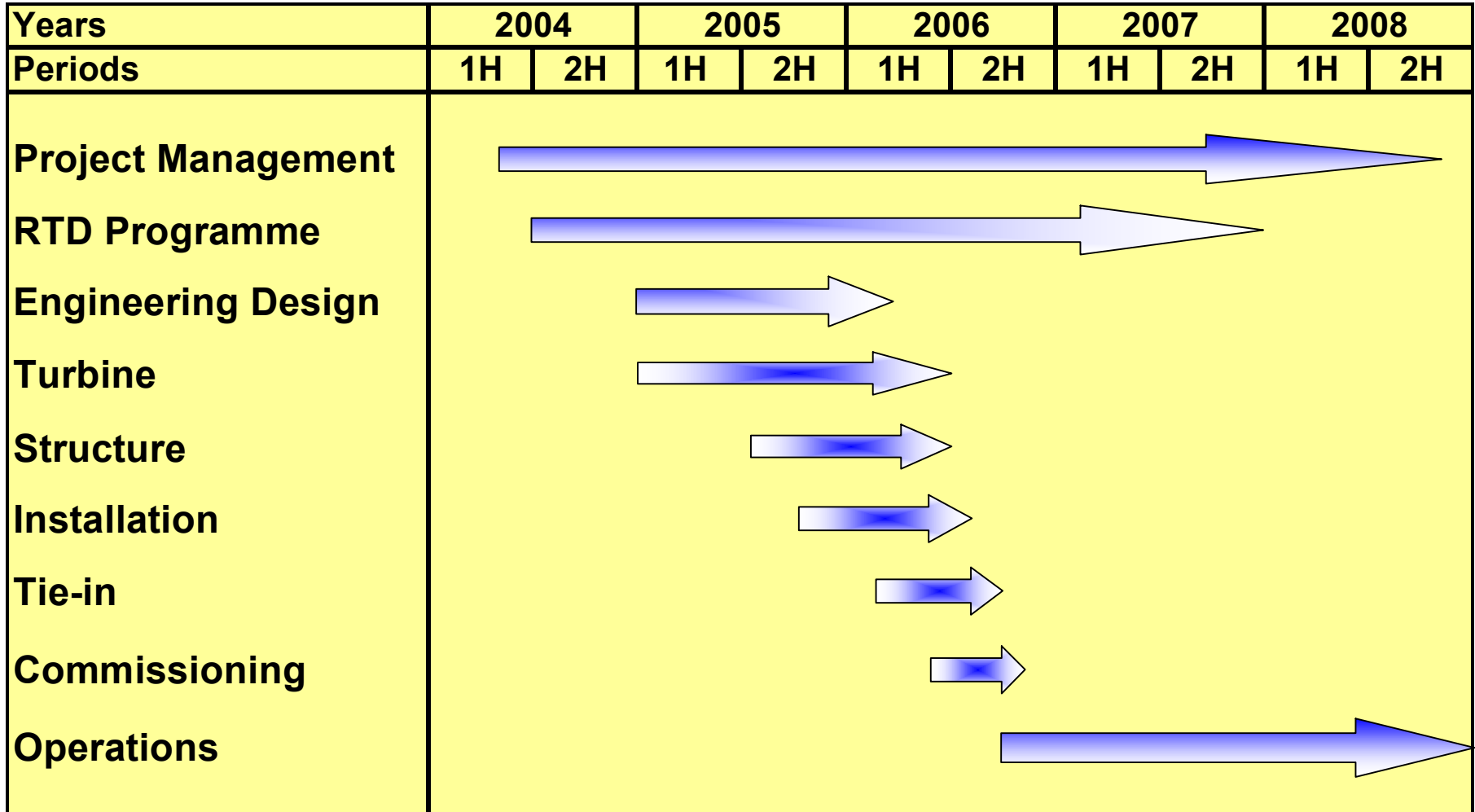
Capital Cost £28.6 million (€41.5 million)

Public sector contribution 35% of capital costs





Demonstrator Timeline





The Beatrice Environment



- **Moray Firth home to**
 - Internationally important seabird populations
 - One of two UK populations of bottlenose dolphins
 - Multiple designated conservation areas

- **Seascape**

- Beatrice infrastructure has minimal impact
- Turbines:
 - » Distant offshore location: >23 km
 - » Smaller scale
 - » Further from coast

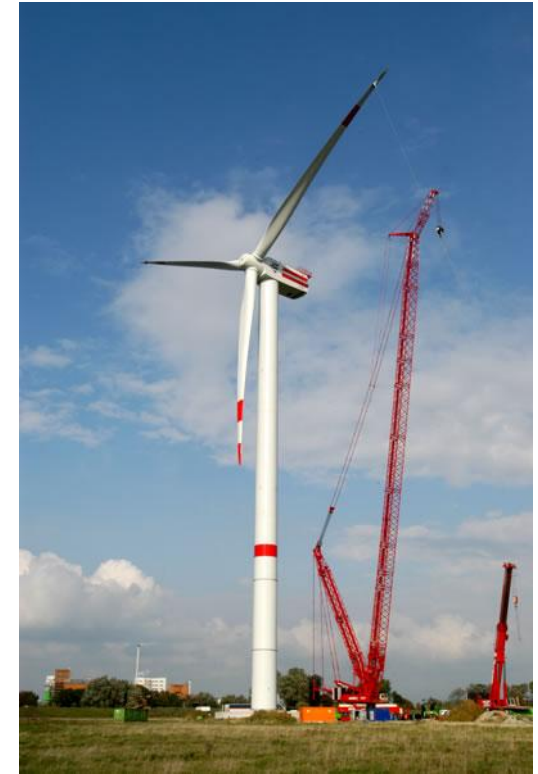
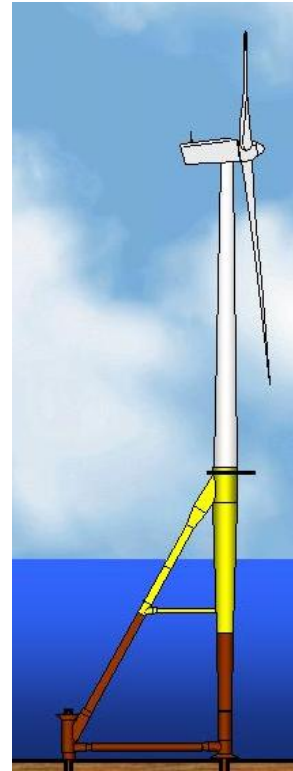




Technology Challenges



- **Turbine**
 - Repower 5M prototype
- **Substructure**
 - E-centred tripod or light-weight jacket
 - Suction piles
- **Installation**
 - Striving for unitary installation
- **Tie-in**
 - Diverless





• Repower 5M

– Prototype in Germany

- » Installed October 2004
- » Operational December 2004
- » Inaugurated February 2005

– Production History

- » Generated 1 million KW Hrs since inauguration in February 2005

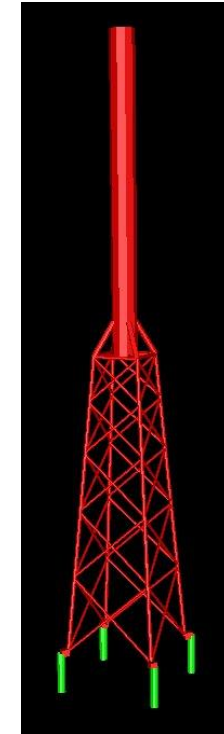
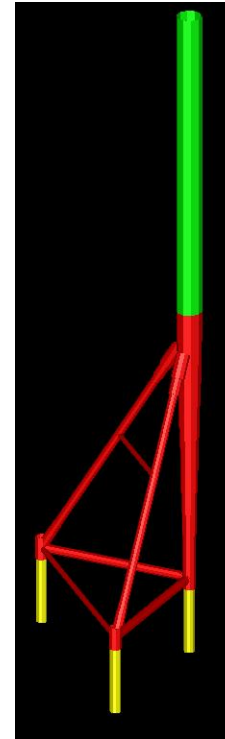


Type	Rated power	Rotor diameter	Hub heights	Power control	Rotor speed
<i>5M</i>			100 – 120 m Onshore		6.9 – 12.1 1/min
	5 MW	126.0 m	90 – 100 m Offshore	Pitch (electrical)	(+15%)





- **Fabrication**
 - Rolled
 - Maximise automated processes
 - One Piece fabrication
- **Substructure**
 - Novel design concept
 - Light Weight
 - Load transfer
 - Favourable cost
- **Foundation**
 - Seek to use Suction Piles
 - Environmentally friendly
 - Removable

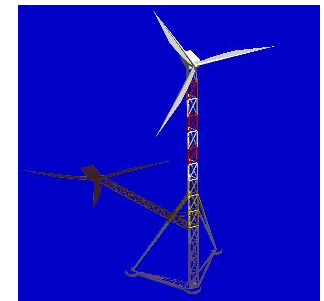
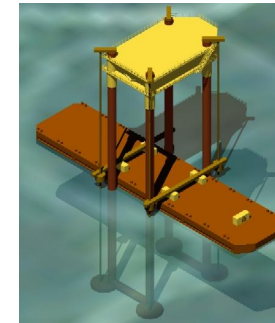
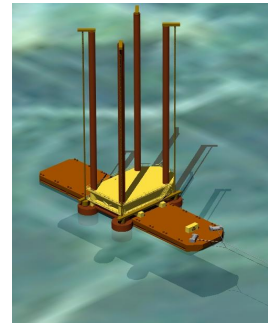




Installation



- **Objective**
 - Challenge windfarm norm
 - » Minimise offshore work
- **Base programme**
 - Minimum piece installation
 - » Substructure and tower
 - » Turbine
 - » Rotor / Blades
 - » Tie-in
- **Aspiration**
 - Unitary installation
 - » Assemble structure / turbine / blade in yard
 - » Move to site in one piece
 - » Conditional on suction piles and installation vessel
 - » Tie-in





Tie-in and Toppers Modifications

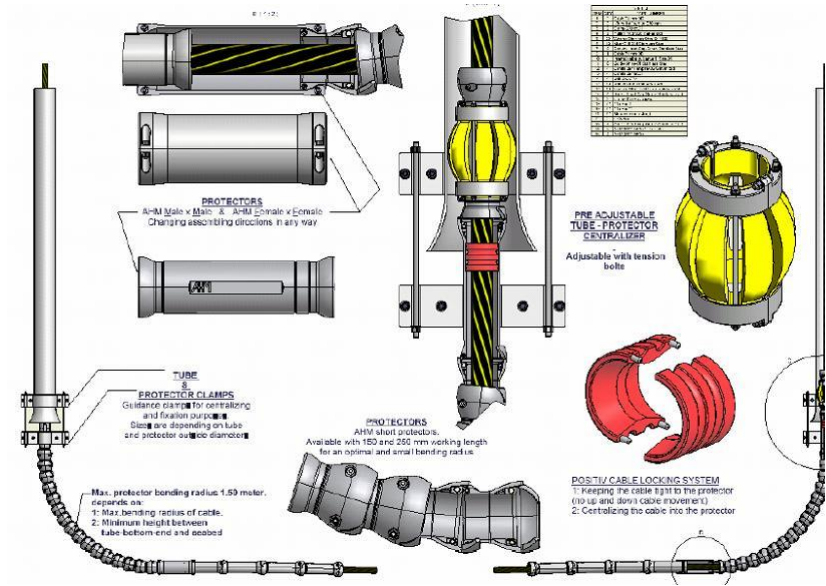


- **Tie-in**

- **Diverless operation**
 - » **Apply O&G expertise**
- **Plug-in connectors**
 - » **From defence industry**
- **Protection**
 - » **Trenching / matting etc.**

- **Toppers Modifications**

- **Electrical stability**
 - » **Protect platform and turbine**
- **New 33Kv Switchgear**
 - » **Protection systems**
- **Windfarm Metering**
- **Control and Monitoring**
 - » **Platform Interfaces with Windfarm**





- **Health and Safety**
 - **Access and egress**
 - » **Define operating window**
 - » **Develop safe access system**
 - » **Demonstrator based on ERIC**
- **OPEX Reduction**
 - **Windfarm OPEX is too high**
 - » **Frontier O&MA study**
 - **Drive down OPEX**
 - » **Critical to viability**
 - » **O&G has shown it can be done**
 - **Demonstrator will:**
 - » **Apply TLM / SSE and partners expertise to improve operations**
 - » **Provides experience needed to achieve this**





- **Wind Measurement Strategy**
 - **Traditional met-mast**
 - » Expensive offshore
 - » Difficult to maintain
 - » Difficult to access
 - **Solution LIDAR**
 - » ZephIR system from QinetiQ
 - » Laser wind speed monitoring
- **Other UK Opportunities**
 - **Condition Monitoring**
 - » Seebyte
 - **Knowledge Management**
 - » Nickelby
 - **Radar**
 - » DMS
 - **Engineering and Consultancy**
 - » AMEC, Nautilus, Redfield, MRI

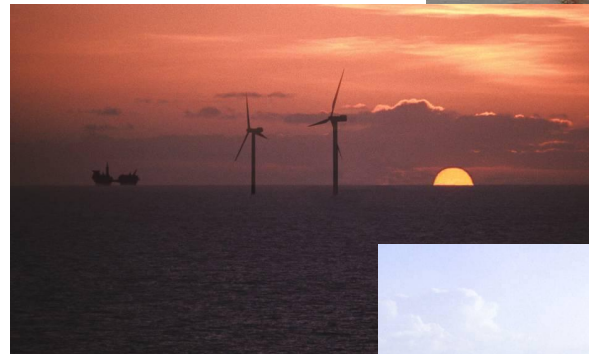




UK Jobs and Opportunities



- **Flagship Project**
 - Transforming offshore wind
 - » Transferring UK O&G skills
 - » Creating a UK niche in offshore wind
 - Creating opportunities for UK companies
 - » Learning about wind
 - » Applying old skills in new ways
 - » Showcasing technology
- **Demonstrator**
 - Delivering more than
 - » 300 job years of work in Scotland
- **Full-scale Development**
 - Equivalent to building 50 jackets
 - Delivering more than
 - » 16,000 job years to UK
 - » Kick starting a new industry





The Beatrice of Tomorrow



**2 turbines today leading to 200 tomorrow
providing 1GW of installed power**

