A tower/foundation for offshore wind farms
OWEC Jacket Quattropod
The Design and Application on Beatrice and elsewhere
OWEC Jacket Quattropod
OWEC Jacket Quattropod - UNIQUE Features

• 40-50% of weight (hence cost) can be saved compared to current “State-of-the-Art” design
• Increasing water depth with a minimum of extra steel
• Offshore water depths of more than 50 m can be made economically feasible
• OWEC Tower will – through local licensees – offer locally manufactured substructures
• Technology protected by pending patent
• Comprehensive and unique experience through the DOWNVInD project and studies for Developers/Utilities
Comparison on Cost vs. Water Depth (Example)
OWEC Jacket Quattropod
For ice
Why realise wind energy projects?

- Has been based upon subsidies - is now competitive with new gas
- Independence on import – the wind is free!
- To provide "green" energy - to fulfil "Kyoto" obligations
Why Offshore Wind Power?

Advantages
• Energy proportional (wind speed)$^3$
• Onshore 2000 - 3000 h/year
• Offshore 3000 - 4500 h/year
• Large scale projects facilitated
• Can be below horizon

Challenges
• Cost must be reduced
• Availability and maintenance
Wind - FASTEST GROWING energy source

Market growth 25% p.a.
Cost reduction
Some projects under way (examples)

• **UK**
  – Talisman Energy- Beatrice wind farm (demonstrators in 2006)
  – Gwynt y Mor

• **Germany**
  – Nordsee Ost
  – Borkum Riffgrund
  – Baltic 2
  – Kriegers Flak I

• **Sweden**
  – Utgrunden II
  – Kriegers Flak II
Further market development

• A driving force is reduced cost
• OWEC Tower will ensure future cost reductions
  - will provide premises for the developers
The Beatrice demonstrator project

- Managed by Talisman Energy in Scotland supported by Scottish and Southern Energy
- Supported by EU’s 6th Framework Program and British authorities
- Total budget including scientific program: 40 mill €
- OWEC Jacket Quattropod was selected after screening and comprehensive studies on various concepts
- Two full scale demonstrators will be installed July 2006
Beatrice field

OWEC Tower AS
Beatrice- Visual Impact
Noise from hammer
(Beatrice)
Bird study
(Beatrice)
Lidar for measurement of wind speed and direction
Beatrice with two prototypes
Beatrice oil installation and demonstrator
Deck structure and transition jacket/tower
(Beatrice)
Construction at BiFab
Part of Transition
Construction at BiFab
Deck

OWEC Tower AS
Jacket under construction
(Beatrice)
Construction at BurntIsland
Tower/nacelle/blades preinstalled onshore
(Beatrice)
Load out at quay
(Beatrice)
Beatrice with OWEC jacket Quattropod
(Beatrice)
Soft landing system
(Beatrice)
Transport of tower/nacelle/blades

(Beatrice)
Development, Analyses and Design

• Basic Design developed by OWEC Tower since 2001
• Studies with turbine manufacturers
• Comprehensive detail design studies (AMEC) for the DOWNVInD project verified by turbine manufacturers and DnV
• Dynamic fatigue analyses based on integrated model with turbine
• Details checked by comprehensive F.E.M. analyses
• In addition comprehensive analyses of installation etc.
Structures compared (REpower)

OWEC Jacket Quattropod (OJQ)

Centre Column Tripod (CCT)

Flat Face Tripod (FFT)

(ref: Marc Seidel, REpower Systems AG and Gunnar Foss, OWEC Tower AS: “Impact of different substructures on turbine loading and dynamic behaviour for the DOWNVInD Project in 45m water depth”, EWEC Conference in Athens 2006)

OWEC Tower AS
Model with turbine and blades
(REpower/Beatrice)

(Ref: Marc Seidel and Gunnar Foss)
Local eigen frequencies

(REpower/Beatrice)

Local eigenfrequencies

(Ref: Marc Seidel and Gunnar Foss)
Fatigue loads - comparison with tripod structures

(REpower/Beatrice)

Impact of substructure on tower top fatigue loads

Impact of substructure selection (including waves) on tower top fatigue loads (DELS)

Impact of substructure on tower bottom fatigue loads

Impact of substructure selection (including waves) on tower bottom fatigue loads (DELS)

(Ref: Marc Seidel and Gunnar Foss)
Business Model

- **Licences** – nominated fabricators will produce the **OWEC Jacket Quattropod** in the framework of a licence agreement
- **Engineering** – project adaptation and detailed design to the individual contracts will be provided
- **Key components** – Cost effective fabrication of key components will be arranged by **OWEC Tower** and supplied to the Licensees under a single source agreement
OWEC Tower – what we can offer to the market

• A well documented concept based on long engineering experience, 5 years of dedicated development and testing through the DOWNVInD project
• A complete package of Design, Engineering and Fabrication
• Logistics and Installation has also been studied, and complete installation solutions can be offered in cooperation with major contractors
Some studies

- Erndterbrücker Eisenwerk
- General Electric
- REpower
- Hydro
- Technova
- Talisman Energy
- Havsul
- npower renewables
- Essent
- E.ON
OWEC Tower AS: Our Goal

Together with dedicated construction yards supply the best tower/foundation structures for the growing offshore wind energy market