Dutch offshore wind energy experience and the potential for collaboration between Korea and the Netherlands

Seoul - December 6, 2010

Wind Energy in the Netherlands

- History
- Overview
- Offshore
- Examples
- Conclusions

History of wind energy in the Netherlands

- A windmill is a machine which converts the energy of the wind into rotational motion by means of adjustable vanes called sails
- Autonomous development in Europe that started in the 11th century
- Development in the Netherlands leading to a large variety of mills
- First wind mills for drainage in 1414
- Windmills for energy to saw mills, to mills used for crushing seeds, grains, etc.
- Cheap energy was a major contributing factor to the Golden Age (17th century) of the Netherlands
- Invention of steam engine (1775) signaled the end of wind mills
- 1,000 wind mills left out of a total of more than 10,000

Kinderdijk

Recent history of wind energy in the Netherlands

- A windmill is a machine which converts the energy of the wind into rotational motion by means of adjustable blades made of synthetic material
- Renewed interest in wind energy resulted from the oil crisis in 1973
- Dutch government support from 1976
- Present capacity 2,229MW
- Government objective to have 6GW installed by 2020

Overview wind energy sector in the Netherlands (1)

Turbine manufacturers & developers:

- Lagerwey in difficulties, restarted as Zephyros, acquired by Hara Kosan, now acquired by STX
- Nedwind acquired by NEG-Micon, which in turn acquired by Vestas
- Windmaster discontinued
- Darwind acquired by XEMC (China)
- EWT originally using Lagerwey technology, now developing its own technology
- 2B Energy proto type for +6MW offshore turbine

Overview wind energy sector in the Netherlands (2)

- Marine engineering
- Construction & dredging
- Electrical design & consulting
- Building of specialized vessels

Overview wind energy sector in the Netherlands (3)

Blade manufacturing & testing

- Aerpac and Polymarin discontinued
- Offshoots in blade design, manufacturing & maintenance
- Blade testing facilities at WMC (ECN)
- New turbine and blade testing facility in Lelystad

Offshore - key issues

Advantages:

- Availability of space
- More wind, less turbulence
- Fewer public acceptance issues

Disadvantages:

- High initial investment (turbine development, installation, grid connection)
- Higher maintenance cost

Therefore:

- Design for "***optimized yield***"

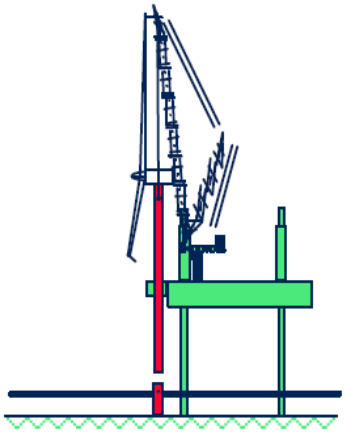
Offshore - wind turbine design

- Dedicated offshore turbines
- Larger turbines & rotors / no transport restrictions
- High reliability
- Redundancy
- Experience still relatively brief

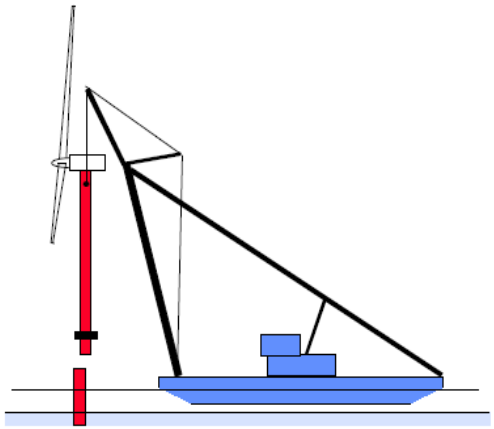
Offshore - wind turbine installation

- Site specific foundation design
- Turbine can be installed via jack-up barge or floating crane vessel
- Method of installation will depend on water depth, crane capacity, vessel availability, turbine type and mass, location of turbine assembly plant, harbours, personnel
- Delays due to weather

Offshore - wind turbine installation



a) Jack-up barge construction



b) Floating crane vessel construction

Offshore - wind turbine O&M

- High cost of unscheduled maintenance
- Emphasis on preventive maintenance
- Condition monitoring
- Attention for cables and sub-station
- Logistics

Offshore wind energy Projects in the Netherlands

- Princess Amalia (Q7)
- 120MW
- 60 x Vestas V80 (2MW)
- Construction about 1 year
- Monopile
- Jack-up barge
- Depth 19-24m
- Distance to shore 26km
- Completed 2008
- Cost Euro 350 mln
- Approval 7 years
- Owner Eneco Energy

- OWEZ
- 108MW
- 36 x Vestas V90 (3MW)
- Construction about 1 year
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- Jack-up barge
- Depth 15-18m
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Prinses Amalia

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OWEZ

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ECN

- Applied research
- Projects
- Industrial support
- Wind turbine testing
- Blades & materials

MECAL

- Wind turbine design for onshore & offshore use
- Technical inspections and consultancy for owners of wind farms (onshore & offshore), banks and insurance companies

Europe's biggest turbine testing centre

- Located in Lelystad / owned by Wageningen University
- Operated by Ecofys Wind Turbine Testing Services
- Infrastructure, wind measurements and wind turbine measurements required for turbine certification
- Operational in 2011
- First turbine will be a prototype for STX Windpower
- Able to service up to 10 turbines with 200m tip heights.

2B Energy

- Rated power 6+MW
- Two bladed
- Downwind
- Emphasis on lowering investment cost and cost of maintenance
- Prototype 2011

Strukton Systems

- Design and engineering of electrical systems
- Telecommunication & data networks
- Cabling
- Joint venture with Hollandia for design, manufacturing, installation and maintenance of Offshore Transformer Platforms

ATS

- Greater hub height resulting in more wind and less turbulence
- Prefabricated hybrid wind tower allowing hub heights 120-180m
- One time incremental cost, increased electricity production during the life time of the turbine
- 133m tower resulting in 25% increase in electricity production (compared to 100m)
- Joint venture between MECAL, JUWI and Hurks

What can we do together?

Korea

- Major Korean companies developing onshore and offshore wind turbines

Netherlands

- Design of wind turbines and components
- Optimization
- Certification support

What can we do together?

Korea

- Ambitious plans for offshore project development in Korea (2.5GW)

Netherlands

- Wind resource assessment
- Wind farm design
- Comparative evaluation for selection of suitable wind turbine
- Consulting during construction, installation and commissioning

What can we do together?

Korea

- Future technology development – EU Roadmap Wind Energy 2030

Netherlands

- High quality basic & applied research
- State of the art turbine design
- Experienced wind farm service providers

- Liaison or design office in the Netherlands

What can we do together?

Korea

- Supply turbines or engineering services to offshore projects in the EU

Netherlands

- Strong marine engineering, construction & dredging companies

- Location as a base for offshore operations

How old and new came together

Fully functional reconstructed wind mill in Schiedam (‘Nolet’), with a modern drive train and polyester blades

Conclusion

Korea and the Netherlands together:

- Companies from the Netherlands → Korea (for turbine design, engineering & consulting for offshore)
- Korean companies → EU, using the Netherlands as their point of entry or operating base

Thank you

대단히 감사합니다