Conference Conclusions - Copenhagen Offshore Wind 2005

This note contains the overall conclusions from most of the conference sessions as submitted by the session moderator(s) as well as suggestions for future work.

Wind Technology

Wind Resources & Wake Effects

1. Satellite imaging techniques for assessment of offshore wind resources are becoming increasingly interesting.
2. Meso-scale modelling will contribute to the improvement of prediction of offshore wind resources and engineering tools for the assessment of offshore "external conditions" are being implemented.
3. Important progress is made on the modelling of large offshore wind farms.

Future work

Due to the economy-of-scale, the areas of progress mentioned above will need further scrutinizing to bring down uncertainties.

Large offshore wind turbines

1. LM demonstrated that there are ways to improve the lightning protection of especially large wind turbine blades.
2. Delta called for the industry to draw up standard / specifications for the offshore environment (mechanical impacts) which we fully support.
3. DNV had made an in depth analyses of industrial capabilities and code of practice in aviation and put it in their new design rules(certification)
4. TU Dresden and SKF shoved the latest development in dynamic modelling of wind turbine systems, and validation of the results.

Positive outlook for the future→ to increase the reliability of the machine!

Future work

1. Standard / specification for description of the offshore environment (Mechanical impacts)
2. Guidance / discussions (ISO/IEC?) on a platform for the use of dynamic modelling of drive trains

Offshore Technology

Design Basis

1. Early planning of site data assessment necessary. Investigations' planning is a dynamic process.
2. Investing money in early analysis may save a lot of cost
3. Early involvement of certifying bodies is essential for smooth project development.

Future work
Follow-up in common standard development for offshore wind technology. E.g. total statistical analysis, the associated simulation scenarios.

Design Calculations and Risks

1. Integrated wind turbine tower and foundation dynamics codes have now been generalised to include more types of foundations than just mono-piles, but further validation is required.
2. More comprehensive soil/foundation interaction models need development.
3. Frequency domain methods can have value for preliminary optimisation and design, but detailed time domain simulations will continue to be required for final design verification.

Low-Cost Foundations

1. The best low-cost foundation solution is very much site specific (distance from shore, sheltered water/open sea, water depth, soil conditions etc.) and also very much project specific, i.e. the project tradition or previous project solutions used by the specific EPC contractor or specific Owner for similar projects.
2. Increased steel prices, and cost optimal- and successful reference projects like the Middelgrunden and Nysted Offshore Wind Farms proofs concrete to be a highly competitive foundation solution for water depth 0-30 (40) m.
3. Innovation is the key to cost optimal foundation solutions, e.g. the hammered mono-pile solution used in Scroby Sands Offshore Wind Farm, suction bucket foundation types etc.

Future work
Concrete foundation solutions for larger water depths, e.g. 40-50 m water depth in non-sheltered waters.

Critical Design Aspects

1. Design of appurtenances and transit loads can be captured by modern simulation techniques.
2. Wind and waves shall usually be combined with their max. values, if correlation is not known or weak.
3. In wave dominated regions it will be conservative to use scour models based on currents only.

Future work
Scour development in waves in combination with currents. Better understanding of combined wind and wave loading.

Business

Offshore Wind Markets

1. Costs are the main problem. Especially cost related to the grid issue.
2. Political approval and systems are still way behind markets requirements to move business. Finance and contracts must change – we can learn from oil & gas.
3. On the technical side- we need closer co-operation with the oil & gas sector – learn/best practice.

Future work

Closers ties to oil & gas.

Finance Forum

1. Balanced distribution of risks among project partners is a key to success
2. Stability of legal framework with respect to planning, access to the grid, prices/ tariffs is a precondition for the development of the sector
3. Long-term investment needs state guarantees in the kick-off phase, rating and certification while maturing. Export Credit agencies will have an important role to play in helping the Commercial Banks to get comfortable to lend.
4. Tightening terms in the turbine supply market will contribute to the challenges to be met for the Offshore Industry.
5. Scenario playing tools need to be deployed to understand project and cash flow stresses, particularly in absence of deep experience.

Future work

1. How to establish project rating and rely on well developed certifying procedures, work on calculation tools
2. The Insurers' Appetite and structures for risk/gain sharing when the Offshore Industry is still very new with many uncertainties and thin experience.
3. Equity Gap. How to make up for the gap caused by higher capital costs and lower project finance gearing

Tender & contracts

1. Full turnkey projects are not likely to be possible over the next few years and multi contracting will be normal (unless a new type of turnkey contractor, non OEM, enters the market).
2. Although more complicated for the owner, well managed multi contracting does reduce cost, although the exact amount is difficult to quantify – it could be in the region of 5-15%.
3. Project owners should be well prepared and talk to suppliers in detail in advance of planning a contracting strategy.

Operation & Grids

Operation & Maintenance

1. Access of personnel proves to work well in practice (Horn Rev), although additional systems like helicopters are necessary. The industry warns not to develop systems for very high wave heights.
2. The repair of main systems is now very well arranged. Purpose build vessels (from A2SEA) clearly follow the market.
3. O&M was recognized as one of the largest bottlenecks +/- five years ago for offshore wind energy. The operational experiences and the new innovation show that O&M can be overcome.

Future work
Collect and share O&M experience.

Grid Connection

1. The data on component reliability appear to be insufficient to make an accurate assessment of the economic feasibility of HVDC transmission solutions.
2. The cost/benefit of accommodating HVDC solutions on offshore platforms needs to be included in feasibility studies.
3. Benefits of HVDC VSC are needed cost for onshore grid reinforcements.

Future work
Systematic collection of data on components and system reliability.

Cases – Lessons Learned

1. Do your homework onshore. Offshore is not the place for testing installation. Use proven technology and preassemble as much as possible.
2. A combination of multi contracting with strong involvement of the utility is very important, especially for risk management.
3. Involve the local community as far an as soon as possible, also at the cabling of the offshore grid. Use artifice elements to educate the public. Don't neglect environmental aspects. Birds do matter! Acceptance is crucial and profitable.

Future work
1. Develop concepts also for coastal offshore projects
2. Meet the challenges of risk management, multi contracting and project finance
3. Find solutions financing and constructing the offshore grid

Synergies & Risks

Offshore & Wind Synergies

1. HSE: The wind energy could benefit by using HSE standards developed by oil & gas, taking into account wind specific risks.
2. FEED: Front end engineering and design is a best practice by oil & gas industry that should be adopted by wind.
3. THECNOLOGY: New ways of thinking need to be developed to deploy technology. The timing for development of new technology versus development commitments should be considered.

Future work
Technology development and use of demonstration projects.

Technology & Risks

1. Beginning of bath-tub curve: Henrik Stiesdal's isolation between small improvements in availability and relatively large improvement in profit.
2. Two analyses and experiences concerning right end of bath tub curve.
3. Conclusion: Experiment results (Horns Rev, Risø) from perfect input for validation of models (Risø, TUDelft) e.g. within the framework of IP "Upwind".

Future work
More work on reliability (availability) - Not only on fatigue (wear& tear) induced phenomena, but also on sensor reliability.

Policy & Planning

Environment – latest results

1. How to transfer experience to other developments
2. Migration results can be used in other development
3. Effects on marine mammals in operation period aren't dependent on the period of construction – even if the construction period is 2-3 years.

Future work
How to transfer all result between developers?

Copenhagen Strategy on Offshore Wind Power Deployment

Find the strategy at http://offshore.windpower.org/