

EUROMECH Colloquium 583

"Scientific and technological challenges in offshore vertical axis wind turbines"

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Chairperson: Carlos Simão Ferreira

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After thirty years of successful implementation of Onshore Wind Farms based on Horizontal Axis Wind Turbine (HAWT) technology, the wind energy industry faces new challenges in developing offshore wind farms. Although most of the development is expected to be offshore, our current level of wind turbine technology, based on the HAWT concept, does not yet economically meet the requirements, driving the cost of offshore wind energy 70%-85% larger than onshore wind energy. For floating offshore wind energy, the challenge is even larger. The Vertical Axis Wind Turbine (VAWT) is a promising solution for floating offshore wind energy due to its scalability, robustness, reliability, simplicity of installation, low centre of mass and insensitivity to yaw.

The VAWT is, however, both a scientific and an engineering challenge. Its aerodynamics are defined by a 3D unsteady asymmetric actuator volume, where blade-vortex interaction and dynamic stall are predominant. Currently, validated models at airfoil, blade, rotor, and wake scale are unavailable. The lack of prototypes and test beds at full scale means that the few existing aero-elastic models are yet to be validated. Due to its 3D shape and asymmetric flow field, the design space is still mostly unexplored. This challenge is further increased by the application of a VAWT to a floating concept, where floater design and dynamics, including wave loading and mooring are key.

There is now an emerging community of researchers and industrial developers for floating VAWT, new developments in industrial prototypes, several national and EU funded projects on offshore VAWTs, and an increasing number of publications every year. These developments warranted a meeting of experts to identify key challenges and developments in design, models and scientific research. The colloquium brought together this community for the first time under a dedicated event to VAWT technology, science and research.

Participants travelled from all over Europe, Asia, and the Americas to participate in EUROMECH Colloquium 583. The colloquium was organized by D. Todd Griffith (Sandia National Laboratories), Michael Borg (Technical University of Denmark), and Bruce LeBlanc (Delft University of Technology). The main topics discussed were:

1. Aerodynamics and aeroacoustics, including wake modeling and analysis;
2. Structural design and aero-elasticity; Drivetrains and major components;
3. Offshore support structures;
4. Novel architectures and configurations;
5. System level design studies and optimization;
6. Cost analysis and making a business case for VAWTs;
7. Industry activities and technology demonstrations.

The event was unanimously considered a major success and agreements were made to reconvene in two years time to update research and highlight conclusions of current research and development activities.