ORE Supergen
Offshore Renewable Energy

Briefing Notes

ORE Supergen Challenge Workshop (Offshore Wind)
16-17 October 2017, London, UK

BACKGROUND/CONTEXT

The new Offshore Renewable Energy (ORE) Supergen Hub is a synergistic clustering of the previous Marine and Wind hubs (as recommended by an independent review in 2016). As part of the ORE Supergen Engagement Project, three ORE 'Challenge Workshops' are planned with the objective of promoting engagement with the community, consortium building and the strategic development of the new Hub. These briefing notes represent a summary of existing relevant scoping documents produced following engagement with key stakeholders[i,ii,iii,iv,v] and are designed to inform the discussions in the second Challenge Workshop (aimed at the offshore wind sector).

STATE OF THE INDUSTRY

Offshore wind is a well-developed and commercialised technology. It has already seen considerable cost reduction and the development of gigawatt farms around UK shores, generating a considerable body of knowledge on performance, reliability and environmental interaction. With one of the best offshore wind resources in the world and over 4.5GW of installed capacity, offshore wind contributes approximately 4% of the UK's power, and with continued support this is expected to double by 2020. The cost of offshore wind has seen significant reduction and the UK government has recently awarded three offshore wind projects (scheduled for commissioning in 2022/23) with Contracts for Difference (CfD) in the second round of auctions with strike prices going as low as GBP 57.50/MWh. Furthermore, the first floating offshore wind farm, the 30MW Hywind pilot located off the coast of Scotland, is now under development.

RESEARCH CHALLENGES AND R&D NEEDS

The key challenges facing the offshore wind industry today are: to reduce the cost of energy in order to become competitive with conventional power generation by 2030 and; to move towards large-scale deployment. Many of the key issues are now OPEX related and a summary of the main R&D challenges is as follows:

- Design and technology – a better understanding of aerodynamics phenomena is needed to achieve load tolerant designs and optimal performance. An improved understanding of failure mechanisms is required as well as optimisation of construction materials and improvements in structural integrity. The reliability, efficiency and cost of a wind turbine's electric conversion system need to be further improved including optimised cable designs. For bottom fixed turbines, fully integrated design methods and tools are required, which address the design of the turbine and support structure together. Advances in testing of components, such as blades, and sub-systems, such as nacelles, are required, including highly accelerated lifetime testing. Research into highly innovative and disruptive wind turbine and component concepts, including substructures is needed to enable more OEMs to

become established. Further development of floating offshore wind technology is needed. Design and testing standards need continuous improvements and to be based on extensive research and state of the art methods and technology. A better alignment of different technology certifications and quality systems is needed.

- Resource assessment/forecasting, wake propagations and interactions – For large machines, advances are required in understanding the wind-field inflow and its measurement. Advances are needed to characterise the wind resource, including more accurate wake models and correlation with wave conditions, in order to minimise uncertainty and increase accuracy in predicting array output and availability, improve layouts and reduce the costs of/standardise wind resource assessments. The uncertainty in LiDAR needs reducing.
- Wind farm and turbine control – optimisations between wind turbine performance, noise emission, mechanical loading and component lifetimes need to be further integrated into wind turbine operational control strategies.
- Installation, operation and maintenance – improved metocean tools and support for vessel and access concepts are need as well as a greater understanding of failure mechanisms. Cable installation needs to be lower risk and faster. O&M requirements need to be minimised through advances in reliability analysis, remote sensing/inspection and proactive/integrated condition monitoring.
- Environmental – cost/risk reduction in offshore surveys is required as are improvements in integrated remote sensing/autonomous monitoring systems and avian collision risk models for both fixed and floating platforms. Research is needed to identify and design measures to facilitate potential ecosystem benefits.
- Data and knowledge sharing – The obstacles to obtaining access to operational data and sharing of data between academics need to be overcome including the creation of open access databases of wind farm performance and reliability.
- Socio-economic and public acceptance – The impact of ownership models and planning process on acceptability, the scale of job creation and the impact of electricity market rules on the scale and speed of developments need to be quantified as does the need and level of O&M education. Solutions are needed to the "skill and resource drain" towards high salary sectors.
- Integration into the energy system (including electrical infrastructure) - new methods of planning, operating and managing the grid with high shares of wind power are needed including testing and verification methods, harmonisation, standardisation and interoperability methods and technologies. Electrical systems require increases in efficiency and reliability including advances in new transmission technologies. Large scale energy storage needs to be developed.
- Policy - Policy measures are needed to drive faster European market integration and improve financing conditions. Wind energy requires a stable/long term market and regulatory framework with optimised administrative procedures and a level-playing field in the evaluation of different power generation technologies.

[i] RCUK (2016). Supergen Wind Horizon Scanning Report, Supergen Programme Review, September 2016.
[ii] European Wind Energy Technology Platform (2014). Strategic research Agenda / Market Deployment Strategy (SRA/MDS)
[iii] Royal Academy of Engineering (2014). Wind Energy: implications of large-scale deployment on the GB electricity system
[iv] Matthiesen, J. (2017). Carbon Trust's Offshore Wind activities, 22 Aug 2017, London, UK.
[v] RCUK (2016). Wind Energy: Balancing capability exercise, Supergen Programme Review, September 2016.