# Using intense computing to investigate coastal wind farm

Hartree Centre
Science & Technology Facilities Council


**Intense computing at the STFC Hartree Centre has enabled the University of Liverpool to gain environmental insights of real value to both the offshore wind energy industry and local communities.**

## Challenge

The environmental benefits of offshore wind energy are well established, with their use increasing as the world shifts toward greener energy sources. Optimising the management and siting of offshore wind farms demands a detailed understanding of the local environmental impacts. A key issue is the potential impact on water flow and sedimenttransport, which can affect coastal flooding, shoreline erosion and dredging requirements for shipping channels.

The 25-turbine Burbo Bank Offshore Wind Farm in Liverpool Bay stands close to a coastline especially vulnerable to sediment changes. Working with the National Oceanography Centre and STFC's Hartree Centre, the University of Liverpool has simulated the wind farm's effects using TELEMAC3D software developed by EDF Energy, who funded the work in conjunction with the Engineering and Physical Sciences Research Council (EPSRC). Producing the required level of detail and reliability, however, demanded far greater computational power than the university's own infrastructure could deliver.

## Solution

To enable the impact of individual wind turbines to be modelled accurately down to metre scale, and shorten runtimes to allow longer simulations, the research team harnessed the power of the Hartree Centre's Blue Joule. Utilising over 2.25 million Central Processing Unit (CPU) hours on one of the top 30 supercomputers in the world, the team successfully simulated the wind farm's impact on timescales ranging from weeks to years. They were also able to use physical tests to validate TELEMAC3D's ability to build detailed and reliable models of water flow and sediment transport.

## Benefits

Initial indications from the simulations showed that the wind farm's long-term contribution to large-scale sediment movement may be much greater than previously estimated – highlighting the potential need for mitigation measures in the future. If confirmed by further work, these insights could aid the siting and construction of coastal defences and tidal or wave energy devices, as well as offshore wind farms. They could also be of value to local authorities, local industries and the coastal science community, while providing the basis for new research proposals to EPSRC on the effects of offshore wind farms on UK coastal waters.

*"Large-scale offshore wind energy developments have a relatively short pedigree in the UK, so the Hartree Centre's ability to model impacts with greater accuracy and speed is a significant development for the offshore wind industry and its various stakeholders."*

**– Dr Ming Li, School of Engineering, University of Liverpool**

### Work with us

**We collaborate with industrial clients and research partners on projects that create insights and value using high performance computing, big data analytics, simulation and modelling.**

**By combining our world-class facilities with access to our specialists and computational scientists, we can enable your organisation to produce better outcomes, products and services more quickly and cost-effectively than through conventional R&D workflows.**

**With our partners we are developing the next generation of supercomputing architectures and software, combining existing best practice with innovation to deliver faster, cooler and more sustainable solutions capable of meeting the challenges of data intensive computing.**

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