

### **Foreseable applications of Distributed Fibre Optic Sensing**

Distributed Fibre Optic Sensing (DFOS) is gradually deployed within the offshore wind industry. Although temperature (DTS) is widely accepted and used, as reported in paper B1-665 (Cluster Wikinger Arkona 1) and B1-667 (Hornsea 1), acoustic/vibration (DAS) and strain/deformation (DSS) are still merely at pilot stage.

A few applications can be foreseen:

- handling on cable load with DTS
- fault localization with DAS
- cable protection system (CPS) investigation with DAS
- installation monitoring with DSS

#### *Cable load*

DTS provides information on the current cable temperature. When combined with a real time thermal rating (RTTR) software, it becomes possible to compute the conductor temperature and also to make simulations of the near future expected temperature. This can be done simply by computing emergency ratings, but also with more accuracy by estimating the potential production of the windfarm over the next 24 hours (wind forecast) whilst making sure that all produced energy can be safely transported to land.

#### *Fault localization*

When distance calibration is done correctly, a DFOS system can accurately (within meters) localize events along the cable route. This is much better than what can be achieved using electrical Time Domain Reflectometry (TDR), especially for long cable length. Reducing the localization time whilst providing a more accurate localization would allow a significant reduction of the repair, and thus a faster recovery of the production.

#### *CPS*

A recent poster at Wind Europe in Bilbao (PO-091) addressed the possibility of identifying damaged CPS in a wind farm. The pilot project demonstrated a good correlation between DAS based measurements and surveys whilst discussing way forward for a better deployment.

#### *Installation monitoring*

Root cause analysis of cable failure is reported in paper B1-538. A significant proportion of failures is due to the installation, and has mechanical causes (over loading, over bending etc.). A DSS system is foreseen as a means of measuring deformation during installation, and also during operation, providing information on the amplitude of the mechanical stresses applied on the cable. Although it seems unlikely that DSS allows preventing a failure, at least it offers a log of the issue that can be monitored during operation using DTS. A hot spot in a location identified during installation by the DSS as faulty would be a good indication of a possible future failure.

At this stage, it seems that, although DFOS itself is available, using the outcome of DFOS data in order to make decision or to take actions is not widely accepted by the operators. Some work is certainly required on the DFOS manufacturer size to communicate the possible applications

and to build more trusts in the technology. Simultaneously, there is work on the operator and end-user of wind farms for pilot projects, but also for accepting that fibre-based data is trustworthy and valuable for the safe operation and maintenance of an asset.