

# **Power Quality and Stability Improvement of a Wind Farm using STATCOM Supported with Hybrid Battery Energy Storage**

Arulampalam, A., Barnes, M., Jenkins, N. and Ekanayake, J.B.

## **Abstract**

A large penetration of wind generation into the power system will mean that poor power quality and poor stability margins cannot be tolerated from wind farms. This requires that methods to improve power quality and stability for such systems be found. The static compensator (STATCOM) with hybrid battery energy storage (BES) has great potential to fulfil this role, though considerable advances in the control of this system are still to be made. From an economic point of view, rating the STATCOM for steady-state power-quality improvement duty is appropriate. Rating the STATCOM to absorb large amounts of additional power in excess of its transient overload capability during network faults is inappropriate. A hybrid of BES and braking resistor is therefore proposed. A new hybrid STATCOM–BES control technique is developed and discussed in the context of improving the stability and power quality to fixed speed, induction generator, wind turbines. The variation of the network voltage, active and reactive power with the fluctuation of the wind generation is studied. A wind generation system with a STATCOM battery energy storage unit and the new control was simulated and the results demonstrate that both power quality and the stability margin can be improved significantly for wind farms.