OFFSHORE GRIDS

Reactive power control

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Offshore wind power plants can be clustered into an offshore grid, itself connected to the main onshore grid via a.c./d.c. high-voltage converters and a high-voltage d.c. transmission system. The offshore grids exhibit variable, asymmetrical power flow. The active power is provided mainly by the wind turbines, whereas the reactive power, that is, the portion of a.c. power that does not lead to a net flow of energy, can be injected or absorbed by a variety of components, such as transformers, cables, or converters. Managing and controlling the reactive power is important to ensure secure operation and to limit power losses in the decoupled offshore grid. Now, Kevin Schönleber and colleagues in Spain compare different power control strategies and their effect on power losses, annual energy production and costs in high-voltage d.c.-connected wind power-plant clusters.

The various strategies differ in where the control is applied (for example whether it is centralized or located at the high-voltage converter), in the communications requirements (for example unidirectional or bidirectional) and, importantly, in whether the reference voltage at the point of common coupling of the high-voltage converter is fixed or can be controlled and, therefore, optimized. The losses associated with each reactive power control strategy are benchmarked quantitatively against an ideal, fully optimized case for steady-state operation, which is unlikely to be implemented in practice due to constraints on real-time data access. The best performance in terms of annual energy production and cost is obtained for a cascade-structured control strategy, based on an optimization algorithm, mainly thanks to the optimized reference voltage imposed by the high-voltage converter (higher than in the benchmark strategy). However, the implementation of the proposed strategy is highly dependent on coordinated decision-making of generation and transmission operators.

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