Applied Sciences, vol.9, no.21, pp.4685-1-4685-20, November, 2019.

Security-constrained day-ahead operational planning for flexible hybrid ac/dc distribution networks

A.A. Ibrahim; B. Kazemtabrizi; J. Renedo Anglada

Abstract-

A new active network management framework is presented based on a multi-period optimal power flow problem that is bounded by security constraints at the distribution level for upholding the security of supply. This can be achieved through active engagement with flexible demand and distributed generation to prepare for contingency events in day-ahead operational planning. This framework is coupled with a flexible hybrid AC/DC medium voltage (MV) distribution network topology. It contains an integrated multi-terminal medium voltage DC (MVDC) interface for a seamless interaction and integration of the flexible demand and generation on both AC and DC sides of the hybrid network. The active energy management framework when coupled with a flexible hybrid AC/DC topology provides unprecedented degrees of flexibility as well as security of operation under a variety of conditions. To this end, the 75-bus UK generic distribution network has been modified and converted into a hybrid AC/DC network using the integrated MVDC interface. This framework is then deployed to minimise operational costs to the network operator, considering costs of schemes such as distributed generation curtailment and flexible demand shifting, as well as network losses. Results show a significant improvement in operational costs when the network operates as a flexible hybrid when compared to a pure AC or a more conventional AC/DC hybrid.

Index Terms- distribution-security optimal power flow; energy management; flexible demand and generation; integrated AC/DC system

Citation:
Ibrahim, A.A.; Kazemtabrizi, B.; Renedo, J. "Security-constrained day-ahead operational planning for flexible hybrid ac/dc distribution networks", Applied Sciences, vol.9, no.21, pp.4685-1-4685-20, November, 2019.