Distribution Network Capacity Assessment: Variable DG and Active Networks

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Increasing connection of variable distributed generation, like wind power, to distribution networks requires new control strategies to provide greater flexibility and use of existing network assets. Active Network Management (ANM) will play a major role in this but there is a continuing need to demonstrate the benefit in facilitating connection of new generation without the need for traditional reinforcements. This paper proposes a multi-period AC Optimal Power Flow (OPF)-based technique for evaluating the maximum capacity of new variable distributed generation able to be connected to a distribution network when ANM control strategies are in place. The ANM schemes embedded into the OPF include coordinated voltage control, adaptive power factor and energy curtailment. A generic UK medium voltage distribution network is analysed using coincident demand and wind availability data derived from hourly time-series. Results clearly show that very high penetration levels of new variable generation capacity can be achieved by considering ANM strategies compared to the widely used passive operation (i.e., ‘fit and forget’). The effects on network losses are also discussed.