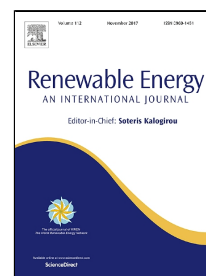


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A Deterministic Approach for Active Distribution Networks Planning with High Penetration of Wind and Solar Power

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Abstract – In this paper, a novel deterministic approach for the planning of active distribution networks within a distribution market environment considering multi-configuration of wind turbines (WTs) and photovoltaic (PV) cells is proposed. Multi-configuration multi-period market-based optimal power flow is utilized for maximizing social welfare taking into account uncertainties associated with wind speed, solar irradiance and load demand as well as different operational status of WTs and PVs. Multi-period scenarios method is exploited to model the aforementioned uncertainties. The proposed approach assesses the effect of multiple-configuration of PVs and WTs on the amount of wind and solar power that can be produced, the distribution locational marginal prices all over the network and on the social welfare. The application of the proposed approach is examined on a 30-bus radial distribution network.

Index Terms — Wind power, active network management, social welfare, market-based optimal power flow, distribution network operators, distribution locational marginal prices.

Nomenclature

A. Sets and Indices

i, j	Index of system buses running from 1 to NB
w	Index of wind turbine
G	Index of substation
D	Index of loads
t	Index of energy block offered by wind turbines running from 1 to NT
q	Index of energy bids submitted by loads running from 1 to NQ

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