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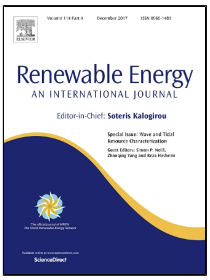

Optimal Wind Power Generation Investment, Considering Voltage Stability of Power Systems

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Optimal Wind Power Generation Investment, Considering Voltage Stability of Power Systems

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Abstract

Studies show that improper sizing and placement of wind farms (*WF*s) lead to undesired investment and operation costs as well as the risk of voltage instability. Thus, optimal placement of *WF*s and enough loading margin (*LM*) are important factors which ensure the voltage stability of system as well as optimal investment and expenditure for *WFs* development. In this paper, modal analysis is used to determine the optimal place of *WF*s from the voltage stability viewpoint. Moreover, a new voltage stability constrained wind energy planning (VSC-WEP) model is proposed to determine the optimal yearly wind power penetration while satisfying voltage stability constraints. A 10-years horizon is considered and the net profit from the energy procurement via the *WF*s' installed optimally, is maximized. Furthermore, the added capacity of *WFs* and the net profit are analyzed by sensitivity analyzes to investigate the impact of various technical and financial factors on the obtained results. The proposed VSC-WEP model is implemented on the IEEE New-England 39-bus test system, and solved by General Algebraic Modeling System (GAMS) optimization package. The simulation results demonstrate the capability of the proposed model for optimal determination of *WF*s capacity while preserving a proper *LM* of system.

Key words: Loading margin (*LM*), Loadability limit (*LL*), Voltage stability, Wind energy planning, Wind farms (*WFs*).

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