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Impact of wind on secondary regulating power and energy in the Spanish system

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Abstract— The objective of this paper is to assess if high penetrations of wind power influence regulating secondary reserve requirements in the Spanish power system including three different topics: (i) needed ramps of variation of regulating power, (ii) amount of total regulating power and (iii) regulating energy. The results (both technical and economical) derived in this paper are based on the net load curve, defined as the difference between the load curve of the system and the wind generation curve. Since wind power does not provide yet secondary regulating reserve, net load represents the load that must be balanced by units providing the AGC service. Thus, the comparison of the three topics (ramps, regulating power and regulating energy) required by the net load with the ones required by the load curve represents the influence of wind on AGC requirements. Historical values of total demand and wind production with a 1 min resolution of the Spanish power system, collected for 2010 (when the wind share was close to 20%), are employed to derive significant conclusions. The analysis of this paper concludes that the main impact of wind in the Spanish system lies on the secondary regulating energy, while the required ramp rate and secondary reserve nearly not affected.

Index Terms— wind power generation; wind power penetration; ancillary services; frequency control

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