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System planning with demand assets in balancing markets

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Abstract-

Balancing markets will become more and more relevant with the increased volatility in the electricity system due to the increase in the renewable quota. New policies are paving the way for customers flexibility participation as demand response in reserve products. This paper contributes with an assessment of the impact of demand response participation in the reserve market when planning the electricity system’s operation and investment in new technologies. The model used has been conveniently upgraded and a set of scenarios have been raised to conduct the analysis. The residential and services sectors' consumption for heating, cooling, hot water, and electric vehicles are considered as sources of flexibility. Each one has their own modeling to represent their nature. Main findings show that demand response receives and offers more benefits for the system on the wholesale market than in balancing services, although their participation in them is quite relevant. This is due to the decrease in firm capacity investment needs thanks to reducing systems’ peak technologies and the decrease of spillages from renewables. Additionally, increasing demand response percentages in the systems lead to cost reduction. However, there is a limitation associated with an increase of CO2 emissions due to the usage of existing polluting technologies to avoid investments in storages. Finally, flexibility providers are compared to determine their flexible capabilities.

Index Terms- Demand responseReservesFRROptimizationFlexibility

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