World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:10, No:01, 2016

Wind Generator Control in Isolated Site

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Abstract : Wind has been proven as a cost effective and reliable energy source. Technological advancements over the last years have placed wind energy in a firm position to compete with conventional power generation technologies. Algeria has a vast uninhabited land area where the south (desert) represents the greatest part with considerable wind regime. In this paper, an analysis of wind energy utilization as a viable energy substitute in six selected sites widely distributed all over the south of Algeria is presented. In this presentation, wind speed frequency distributions data obtained from the Algerian Meteorological Office are used to calculate the average wind speed and the available wind power. The annual energy produced by the Fuhrlander FL 30 wind machine is obtained using two methods. The analysis shows that in the southern Algeria, at 10 m height, the available wind power was found to vary between 160 and 280 W/m2, except for Tamanrasset. The highest potential wind power was found at Adrar, with 88 % of the time the wind speed is above 3 m/s. Besides, it is found that the annual wind energy generated by that machine lie between 33 and 61 MWh, except for Tamanrasset, with only 17 MWh. Since the wind turbines are usually installed at a height greater than 10 m, an increased output of wind energy can be expected. However, the wind resource appears to be suitable for power production on the south and it could provide a viable substitute to diesel oil for irrigation pumps and electricity generation. In this paper, a model of the wind turbine (WT) with permanent magnet generator (PMSG) and its associated controllers is presented. The increase of wind power penetration in power systems has meant that conventional power plants are gradually being replaced by wind farms. In fact, today wind farms are required to actively participate in power system operation in the same way as conventional power plants. In fact, power system operators have revised the grid connection requirements for wind turbines and wind farms, and now demand that these installations be able to carry out more or less the same control tasks as conventional power plants. For dynamic power system simulations, the PMSG wind turbine model includes an aerodynamic rotor model, a lumped mass representation of the drive train system and generator model. In this paper, we propose a model with an implementation in MATLAB / Simulink, each of the system components off-grid small wind turbines.

Keywords : windgenerator systems, permanent magnet synchronous generator (PMSG), wind turbine (WT) modeling, MATLAB simulink environment
Conference Title : ICECECE 2016 : International Conference on Electrical, Computer, Electronics and Communication Engineering
Conference Location : Jeddah, Saudi Arabia
Conference Dates : January 26-27, 2016

Open Science Index, Electrical and Computer Engineering Vol:10, No:01, 2016 publications.waset.org/abstracts/40503.pdf