WEG (Q) and the grid voltage (V) for different wind speeds without compensation. It is to be noted that the maximum variations in P,Q and V are respectively 0.862 pu, 0.373 pu and 0.021 pu between 7 m/s and 23 m/s. Grid voltage varies from 387 V to 378.6V.P and Q vary from 31.95kW to 230.8kW and 61.78kVAR to 98.58kVAR respectively. It is found that the maximum reactive power absorbed by the WEG is 1 pu (98.58kVAR) at 14 m/s. This is supplied by the reactive power source at the sending end.

6.Wind Electric Generator connected to Grid with FC and TCR:

Due to the absorption of reactive power by the WEG, the grid voltage has dropped from 400V to 378.8V to prevent this; reactive power has to be compensated at the WEG end. So a fixed capacitor is designed for supplying reactive power to the WEG (as well as to the load) and it is connected at the point of common coupling (PCC) at the receiving end of the transmission line. Fig. 1 shows P, Q and V for different wind speeds with a fixed capacitor 160 kVAR. It is to be noted that the maximum variations in P,Q and V are respectively 0.862 pu, 0.326 pu and 0.018 pu between 7 m/s and 23 m/s. Grid voltage varies from 406.8 V to 399.7 V. Real and reactive power vary from 31.95kW to 230.7kW and 68.12kVAR to 101.1 kVAR respectively. The improvement in grid voltage at PCC with the fixed capacitor compensation is evident.

Block Diagram:

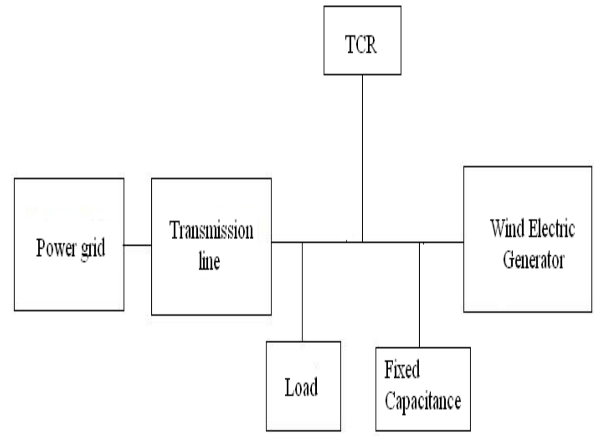

Figure 3 Block Diagram of WEG connected to grid with FC and TCR

Fig.3 shows the variation in grid voltage due to change in load conditions when the wind speed is kept constant at 14 m/sec. It is observed that there is a substantial change of 0.051 pu in grid voltage for the load change from 35% to 115%.Grid voltage varies from 414.7V to 394.5V.The results of the study made so far established that FC compensation improves grid voltage substantially, yet it cannot maintain grid voltage constant when there is variation either in wind Speed or in the load demand. Use of TCR along with FC can regulate grid voltage more precisely.

7. Reactive Power Compensation:

Due to the absorption of reactive power by the WEG, the grid voltage has dropped form 400V to 378.8V To prevent this, reactive power has to be compensated at the WEG end. So a fixed capacitor is designed for supplying reactive power to the WEG (as well as to the load) and it is connected at the point of common coupling(PCC) at the receiving end of the transmission line. It is to be noted that the maximum variations in P,Q and V are respectively 0.862 pu, 0.326

pu and 0.018 pu between 7 m/s and 23 m/s. Grid voltage varies from 406.8 V to 399.7 V. Real and reactive power vary from 31.95kW to 230.7kW and 68.12kVAR to 101.1 kVAR respectively. The improvement in grid voltage at PCC with the fixed capacitor compensation is evident

8.Simulation circuit of the complete system with fixed capacitor:

Fig. 4 shows the simulation circuit of the complete system with fixed capacitor. IN this by varying the capacitor value reactive power, grid voltage & real power of the system is compensate. As such we change the value of capacitor reactive power of the system change i.e. compensate.

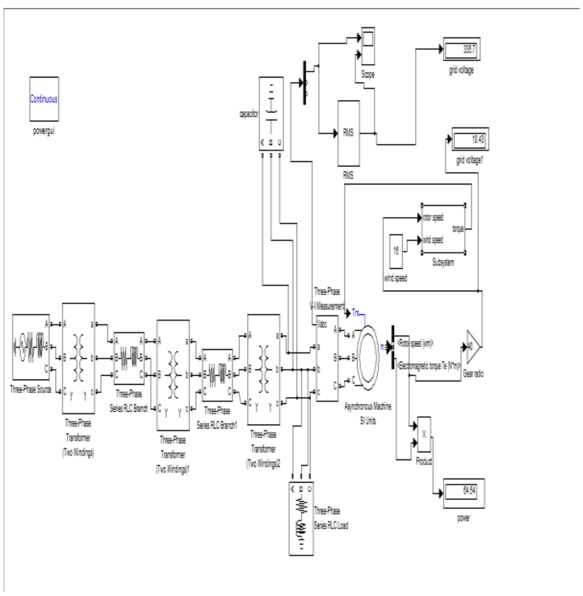

Fig 4: Simulation circuit of the complete system with fixed capacitor:

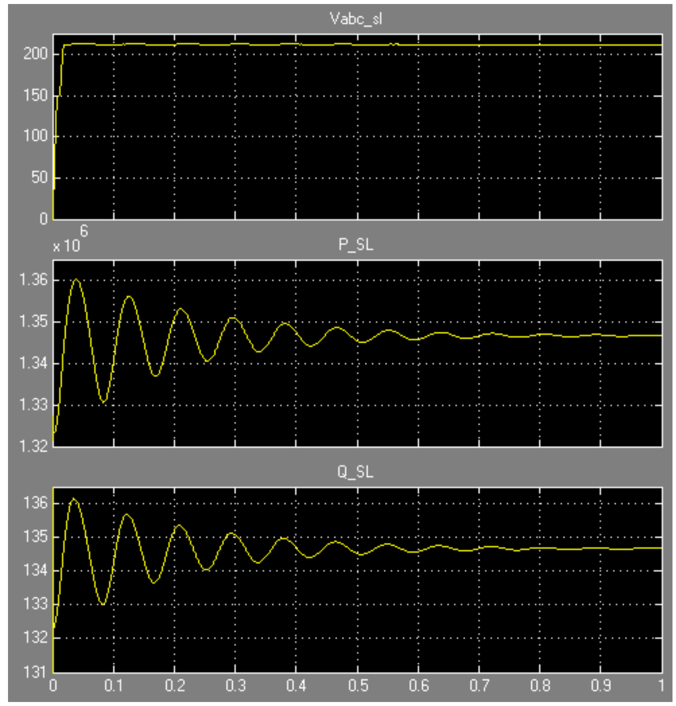

Fig 5 Output of Real Power, Reactive Power, & Grid Voltage.

Fig 5 shows the output of real power, reactive power, & grid voltage i.e. 1.346, 134.6, 211.9. respectively at wind speed 16 m/s. It show that after some fluctuation grid voltage & power in system is constant.

9.Conclusion:

A methodology to investigate the wind power influences on the power system is presented in this paper. The voltage stability was analysed with loadability curves to the power system. The voltage stability was influenced by the wind power integration, where the reactive power was the main factor. A loadability computation tool was developed in this paper and a static model to the wind power on the voltage stability was presented. Modifications of the wind turbine characteristics, i.e. application of power electronics, were simulated improving the voltage stability.

The main conclusions for the voltage stability are that although the wind power alleviates the active power fluxes in the network, the reactive power flux to the wind farms will reduce the voltage stability limits. Wind turbine technologies with power converters that can actively control the reactive power consumption increased the voltage stability (i.e. extended the power limit of the voltage collapse) of the power system. The power system stability and power quality were investigated with dynamic simulations.

In addition, the problems for the power systems stability that are mainly related to power oscillations were studied with modal analysis to identify the most relevant characteristics. The applications of the modal analysis with the dynamic simulations are recommended in order to assess possible power system stability problems

The reactive power absorbed by the wind electric generator for various wind speeds is studied and found to be increasing with increasing wind speed. Maximum value of Q is found to be 134.2 kVAR for 250 kW WEG.A fixed capacitor is designed to provide full reactive power compensation to the WEG as well as to the load connected (under maximum demand condition). A voltage boost of 16V is achieved after connecting the fixed capacitor.The grid voltage drop caused by wind speed variation with a single WEG connected to grid is not as high as what observed with variation in Q demand of load. However a windfarm with several WEGs connected to grid at PCC the grid voltage drop can be quite large.

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