

# Power Fluctuation of the Large Scale Wind Farm is controlled Using Energy Storage Application

B. Neelamegan<sup>1</sup>, A.Ezhil Mathy<sup>2</sup>, M.Shanmugam<sup>3</sup>, B.Thulasibrindha<sup>4</sup>

P.G. Student, ME (POWER SYSTEM ENGINEERING), Kingston Engineering College, vellore, India

P.G. Student, ME (POWER SYSTEM ENGINEERING), Kingston Engineering College, vellore, India

P.G. Student, ME (POWER SYSTEM ENGINEERING), Kingston Engineering College, vellore, India

Associate Professor, Department of Electrical Engineering, Kingston Engineering College, vellore, India

**Abstract**—This paper proposes an application of battery energy storage system to compensate the power fluctuation of the large scale wind farm. Wind farm are having unstable output because the nature of wind is not constant, so we are having some problems like power fluctuation to control the power fluctuation we are going for energy storage device. The power fluctuation caused by the nature of wind form cause uncontrollable output characteristic may create voltage problem for electrical system. To solve those problems, we are going for the application of the large-capacity battery energy storage system (BESS). By using battery energy storage system we are having charging rates and discharging rates, charging rates is called state of charging and discharging rates is called state of discharging, by means of charging the excess power from wind farm is stored by means of discharging power from battery is given to grid for the purpose of compensation of power fluctuation. Hence by using battery as compensation of power we can able to control power fluctuation and we can get the optimal power and also uninterrupted power supply.

**Index Terms**—BESS, compensation, power fluctuation, wind generation, State of charging, state of discharging.

## I. INTRODUCTION

Due to reduction in availability of coal and increase in cost of fuels it's difficult to use them for electrical generation. But now the possibility of using renewable energy is increased. So we are using solar and wind energy for the power generation [2]. so the renewable energy is used to generate the electrical energy which helps to reduce the pollution and prevent the ozone layer from the emission of green house emission[4]. That will prevent the ozone from the emission of green house gasses. So the renewable energy like wind and solar farm is been increased in modern days these plant increased in number this recent days.

However, nature of wind is not constant the nature of wind speed varies with different period[6]. So we can't predict the nature of wind and also we can't predict the demand also so the generation of power by means of for the power fluctuation. if the nature of wind varies means then the power generation also varies so this cause the damage to our electrical equipment, and due to the variation in power supply cause interrupted power supply, if the wind speed is high means power production is high, due to high power production, power produced by wind form is high so because of this power produced higher then demand. If the wind speed is low means then this cause low power generation in wind so the power generated will not equal to the demand. So due to the generation of low power will cause shut down in some region to compensate the power fluctuation or we need to go for ancillary services to compensate the problem by means of ancillary only we can able to make up the demand to prevent the user from interrupted power supply because this will cause our work to stop for particular period. So we need to overcome this problem we are going for energy storage devices like battery energy storage device.

In battery energy storage device they are two modes of energy storage device. Charging mode is for charging of power from output of wind which helps to charge the power when the wind speed is high, the battery will store the excess energy with respect to demand so this way of charging is called charging rate or state of charging. If the wind seed low means then the demand is high at that time the supply to battery for charging from the wind is neglected then from the battery there may be discharge of power to the load this is called discharge rate or state of discharge. By means of battery storage system we can able to give the uninterrupted power supply. Thanks to battery because they are

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keep on working to increase the efficiency, charging rate and discharging rate. At present the efficiency of battery is increased then previous year.

This paper proposes to compensate power fluctuation in wind form, power fluctuation in wind form is done by battery energy storage.

## II WIND FARM

Wind power plant is used to convert wind energy into kinetic energy and into electrical energy. Here, wind is a renewable energy which is forms from sun. In wind plant SCIG is used because for variable power speed because of variable wind speed. For that purpose of generation of large power with respect to variable wind speed which is shown in fig 1 The torque is under control if Direct Torque Control, This does not allow the generator to be overloaded. Gear box is not required with a multi-pole synchronous machine. It is difficult to maintain the stable output from the wind because speed of wind is not predictable it varies in nature, so it will create voltage problem for electrical system. fig 2 shows the energy storage battery model. To prevent electrical system we are going for energy storage.

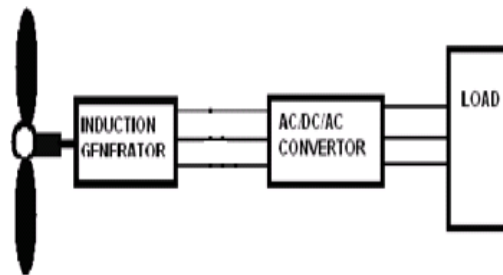


FIG 1: SCIG model of wind turbine

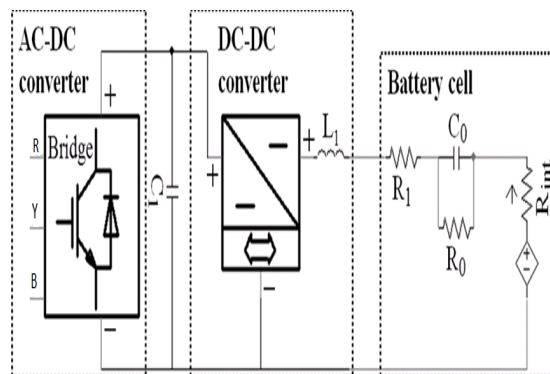


FIG 2: battery model and control set

### a) BATTERY ENERGY STORAGE MODEL

Battery energy storage have slow charging rate and we use for long purpose for that purpose only we are going for battery energy storage system. Battery energy storage system helps to Stores excesses energy from the wind by means of charging and preserve it for re-use. it like an ancillary service, which helps us in critical period, it helps by means of discharge rate. Fig 2 shows the model of battery with the control circuit which is used to store energy in the battery model and also shows the controller set [2] Which is to control when the battery is going to charge and when the battery is going to discharge. FIG 3 shows the inverter circuit with pulse generator inverter is used to convert dc from battery to load. From the battery dc circuit is boosted by means of boost converter. This boost converter used to

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boost the dc from the battery and from that it is given to inverter with pulse generator. Pulse generator is used to give the pulses to for maintenance of ac, for that purpose they are used pulse generator. Then they are connected to load.

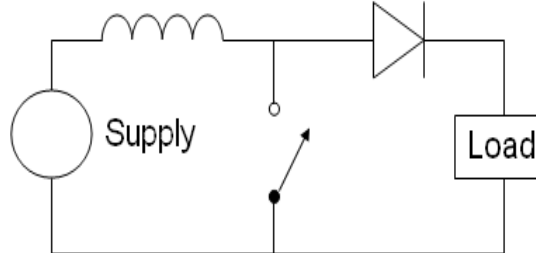


FIG 3: Boost converter.

### III DISCUSSION ABOUT SIMULATION

Excess power produced in the wind is stored in the energy storage system. when the wind power is production reduces means power fluctuation and frequency problem will happened to the electrical equipments, so to prevent the electrical equipment from damage we are using energy from energy storage device to prevent damage and power fluctuation by wind power.

So energy from energy storage device is boost by means of boost converter and then given to the inverter circuit. Then by means of pulse generator giving pulse to the dc to generate the proper square wave to the inverter. The Pulse Generator block generates square wave pulses at regular intervals fig4. The block's waveform parameters, Amplitude, Pulse Width, Period, and Phase delay, determine the shape of the output waveform.

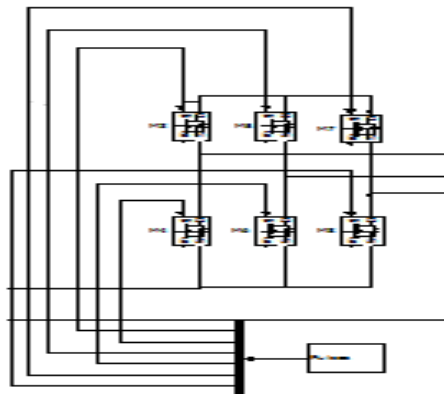


FIG 4: Inverter circuit

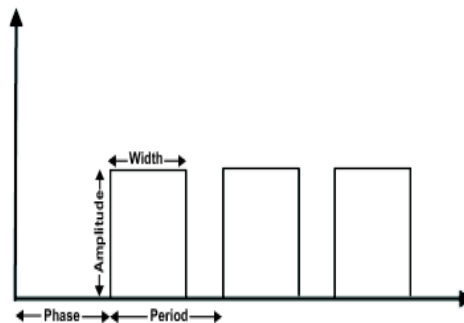


FIG 5: pulse generator

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In FIG 5 shows the pulse generator which is explained in detail above and FIG 6 shows wind model with squirrel cage induction generator here squirrel cage induction generator is used for variable speed induction generator because wind speed is not predictable. For that purpose only we are going for SCIG.

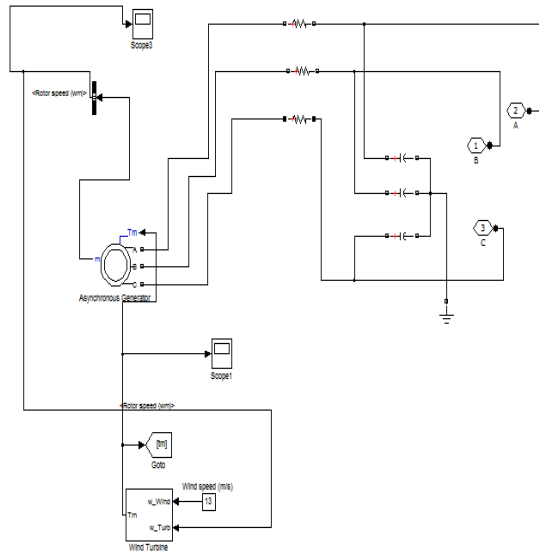


FIG 6: SCIG MODEL

Fig 7 is the output power of the wind for our wind model and fig 8 and fig 9 shows the output of grid connected voltage and grid connected power

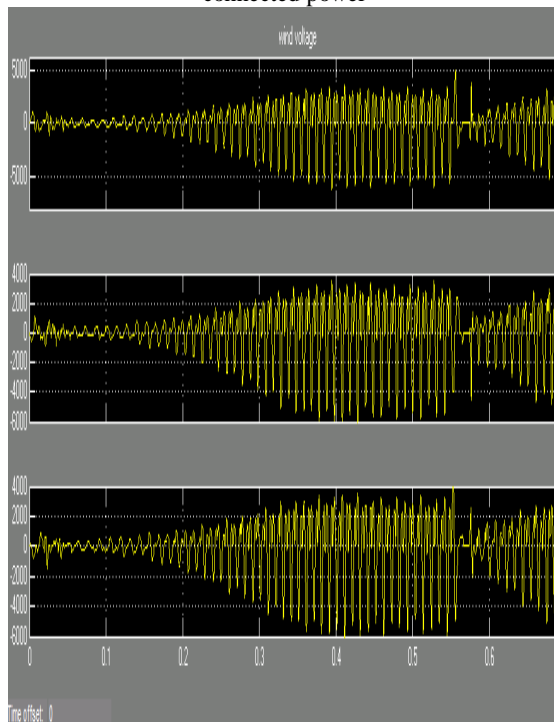


FIG 7: Output power of wind

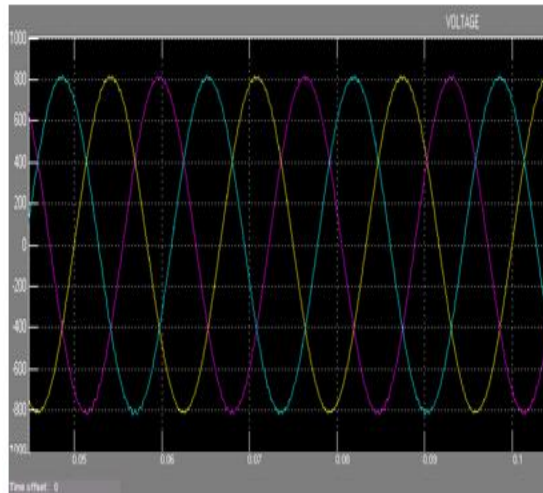


FIG 8: Grid connected voltage without problem

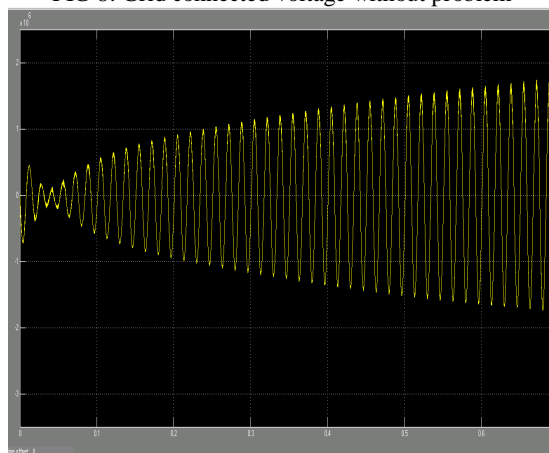


FIG 9: Grid connected output power

#### IV CONCLUSION

The power produced by the wind is not predictable so we going energy storage device like battery energy storage device. By means of energy storage device like battery which helps our electrical system to prevent from voltage problem and power fluctuation. This voltage problem and power fluctuation will cause problem in electrical equipments.

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