Frequency Regulation For A Power System With Wind Power And Battery Energy Storage

Devendra Kumar Gocher[1], Hemant Kumar Meena[2], Kushaldeep Sharma[3]
[1, 2] Dept of Electrical Engineering
[3]Assistant Professor, Dept of Electrical Engineering
[1, 2, 3]Poornima College of Engineering, Jaipur, Rajasthan India

Abstract- *Conceptual With the expansion of wind control entrance to an eminent level in control frameworks, the prerequisite on recurrence direction administrations has expanded in like manner in late decades. Because of the restricted slope rate and monetary variables of regular generators, just increment the limit of traditional generators may not be a viable answer for giving frequency regulation benefits rapidly. Expansive scale battery energy storage system has been connected as a promising answer for frequency control in some sustainable power source reconciliation ventures. In this paper, a control strategy is proposed for battery vitality accumulate framework to give recurrence direction benefits. The control technique to the energy storage system shown in the traditional two-zone AGC control outline. The impacts of the proposed battery control technique for control framework recurrence control have been recreated and tried. The outcomes additionally demonstrate the likelihood of bringing battery energy storage system into genuine breeze control age ventures.*

Keywords- AGC, frequency regulation, battery vitality storage and optimizing sizing

I. INTRODUCTION

DUE to the "zero pollution" normal for wind control age, it has been viewed as one of the answers for the worldwide power or energy issues [1-5]. With the quick advancement of wind control age innovations, the appraised energy of a solitary turbine has expanded to 10MW out of 2011. It is conceivable that sooner rather than later appraised energy of a seaward breeze homestead could surpass IGW, which is like the biggest regular generators. For this situation, the power yield variance of such a vast breeze fan may cause genuine recurrence strength issue to the framework. Subsequently, negative impacts of wind vitality framework couldn't be ignored as already. The association between wind Vitality and power matrix ought to be more adaptable and stable. In any case, with the quick expanding of Wind control limit, more regular generators should be worked under frequency regulation modes.

New advances are required to bear on the assignment of recurrence direction errand for control lattice. Battery energy storage system could infuse or with draw vitality from the power matrix through power transformation frameworks in seconds. The appraised control and evaluated limit of battery vitality stockpiling have achieved hundred MWh levels with late innovation improvement. The huge number of electrical vehicles later on could give dispersed energy storage to control frameworks. It was suggested that battery vitality stockpiling framework could be utilized for control framework recurrence direction. An investigation on recurrence direction in a separated power framework has been completed.

An ideal control strategy for EV was proposed in this paper to give recurrence direction benefit so as to get the maximal income. An ideal dispatching strategy for battery vitality storage was contemplated in [10, 11]. The works concentrated on the most proficient method to lessen control changes of the breeze cultivate yields. In [12, 13], the battery energy storage systems has been brought into the control circle of AGC framework. The dead band impact and age evaluated obliges are considered. The work is centered on the use of energy storage system in the heap recurrence control. In this paper, the utilization of battery for recurrence control is examined. A control methodology is proposed for the battery energy storage system for the recurrence control reason. The outcomes are acquired for various parameters in light of the proposed technique.

II. SELECTION PARAMETERS FOR ENERGY STORAGE SYSTEM

For the comparison of the energy system different selection criteria have been adopted. Some criteria includes power and energy, response speed and ramping capability It provides fast and extra service.by using these criteria energy system improves the reliability.

The following selection criteria are:

- Delay time (the lesser, the better)
- Sudden change in the power output with term of frequency.
- The technology for ramp rate.
- Life span of the battery which increase the power transfer capacity.
- Energy efficiency and power density.
- Duration(capability to respond for the long time)
- Impacts of energy storage on the environment and surroundings.
- Cost of the battery installment system.
- Control of frequency in system.

III.CONTROL STRATEGY OF FREQUENCY REGULATION

Generally, just steam turbines have partaken in recurrence control by means of the change of their steam valves. AGC gives the control order in light of the recurrence deviation. As expressed in the presentation, with the entrance increment of the breeze age, the SCIG will never again be controlled by the MPPT conspire yet will work in the emptied mode with some edge for recurrence direction, which is generally actualized by pitch point control.

The contribute control plot is clarified this segment. To keep the battery at an ideal working point, with thought to the lifetime and decay perspectives, the SOC flag is given as input to the steam turbine and the SCIG. This control system is likewise clarified in this area.

A. PITCH CONTROL

Different studies investigate the details of pitch control, and the vast majority of them demonstrate to direct the rotor speed. How-ever, the control plot exhibited in this paper is adjusted to take dynamic power as the direction variable, especially for our recurrence direction ponder. The recurrence deviation of the matrix is directed by an alleged hang control plot while utilizing PW F , the dynamic power order, in emptied mode. The dynamic power is managed by a relative necessary (PI) controller and the pitch edge is controlled by a pressure driven framework mounted on the finish of the edge. The repaid dynamic power utilizing this plan is higher than latency control or over speed control yet is as yet restricted, with the end goal that the control neglects to direct the recurrence when expansive load changes happen. The measure of energy that is abridged from the most extreme power point is controlled by the exchange off between the loss of the normal age and the benefit picked up by auxiliary recurrence direction benefit. Another issue with the pitch control plot is that the cutting edges of the WT experience the ill effects of the breeze weight, so visit changes in the pitch point are not suggested.

B. SOC FEEDBACK

The limit of the battery is constrained as a result of its moderately high cost. Notwithstanding, the battery is intended to react rapidly for recurrence deviation, substantially speedier than the pitch control of the WT. Therefore, the battery may work at the upper or lower confine, which is 80% and 20%, individually, amid the pitch control transient or the network recurrence deviation transient. All things considered, the battery will be disengaged by the inverter from the framework, and without the SoC control, it will stay separated even after the lattice transient. All things considered, the pitch control of the WT will be in charge of the quick changes in the breeze speed or the heap;The block diagram of the so called SoC feedback control scheme is in fig.1

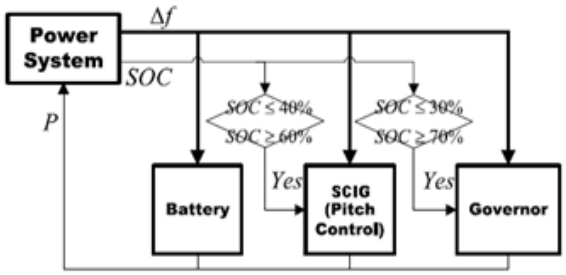

Fig 1 SOC feedback control scheme diagram

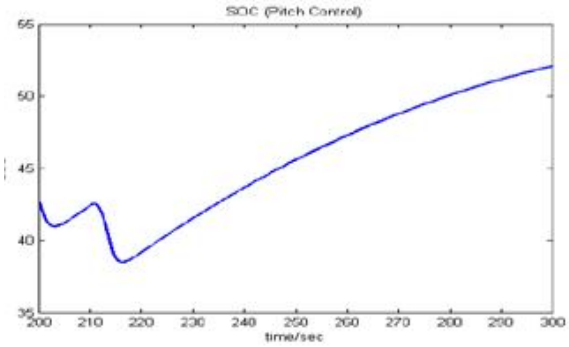

Fig 2 SOC of the battery for small load change

The battery will connect to the grid and be responsible for fluctuations in the grid frequency. Which increase or decrease set control according to the requirement?

C. ROTOR SPEED CONTROL

An imperfect rotor speed summon is connected to the RSC keeping in mind the end goal to give some measure of energy save for use in the event of recurrence deviations. The

rotor speed control is acknowledged in light of the electrical most extreme power– rotor speed bend which uses the connection between the greatest yield power and DFIG rotor speed [3, 4]. To separate the most extreme power for various breeze speeds, the generator rotor speed ought to shift with the breeze speed and keep up an ideal tip speed proportion.

To begin with, the individual breeze plant is displayed with simplified streamlined model; at that point the PAC conspire is created; at that point the RSC is presented. At last, the proposed controllers are connected in a test framework and controller execution is displayed, thought about and broke down for various unsettling influence cases.

IV. EFFECT OF BESS ON FREQUENCY REGULATION

For the performance of the BESS a series of calculations were carried out using measured power disturbance. for power discharged by the BESS facility. Generating units power response, battery energy and the variance of the frequency. The BESS energy was calculated according to the following equation.

$$E(t) = \int p(t)dt + E_0$$

Where:

P (t) = the instantaneous power discharged by the BESS
E_0= the initial energy stored in battery

The BESs office is intended to work at a normal vitality level of 70% of Its vitality limit and ought not be released lo a level underneath 40% of its competently. In this way, the scope of typical release Is 30% of the vitality limit. Since the battery office would have extra capacities other than recurrence. By using the energy storage system for different areas the fluctuation or deviation can be reduces which maintain the gap between demand and supply. The operation of the Battery energy storage system facility was analyzed through a series of computer simulations. The results indicate that the Battery energy storage system facility reduces drastically the frequency deviations resulting from sudden demand variations and graph of fluctuation in the output power is suddenly decreases.

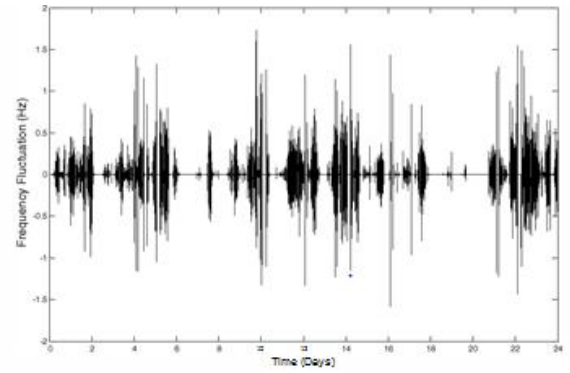

fig 3 Deviations without battery energy storag system

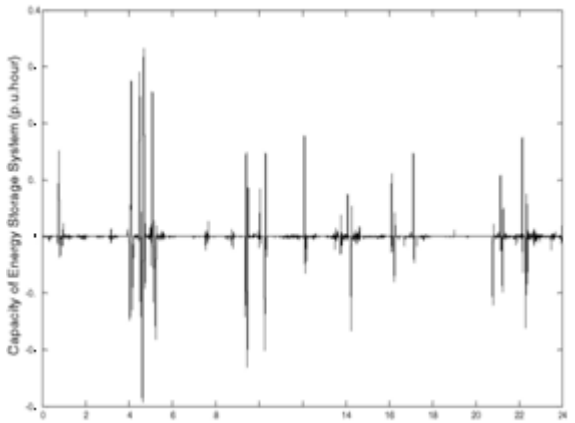

Fig 4 Deviation with the battery energy storage system

Frequency regulation is major factor in the wind power energy transfer because it reduces or decreases the efficiency of the power system. Battery energy storage system can be used for single area and also two areas. Different type's batteries are used in power system according to the capacity and fluctuation. Samsung SDI batteries of lithium-ion which is high in energy density, voltage, discharge rate and life span. Lead acid and natrium sulfur battery have low life span and these are not ecofriendly compare to lithium ion battery.

Battery energy storage system manages the nominal value after the disturbance which is most important parameter in power system control. It work between tie line power and frequency due to the quick response and reduces the large deviations which decreases the efficiency up to 20% which make sure that system frequency is constant for maintain the each units of generation at the most economic value.

V. CONCLUSION

In order to decreases the frequency regulation, which is caused by wind control ages in control frameworks, a control technique is proposed in this paper for battery energy storage system for recurrence control. The outcomes bolster battery energy storage is reasonable for giving recurrence control administrations to repay the variance caused by wind

control ages. Battery vitality storage could altogether diminish frequency changes in single-region and two-region control frameworks.by control strategy of pitch control, state of charge and rotor speed the frequency deviation could be decreased to fewer than 10% of the first one. As appeared in the recreation comes about, the prerequisite to the battery energy storage system is conceivable to be acknowledged utilizing present battery producing advances. Some selection parameter are also introduce in the paper on the basis of them BESS can be selected for increase the efficiency.

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