Ess grid connection

Ess grid connection

An Energy Storage System (ESS) is a specific type of power system that integrates a power grid connection with a Victron Inverter/Charger, GX device and battery system. It stores solar energy into your battery during the day, for use later on when the sun stops shining.

The quality of electric power depends on the balance between supply and demand and this balance must be maintained [1]. This frequency variation is very dangerous to the different parts of the power system. Energy storage systems give power to the different loads when there is a shortage of power supply from the grid so that the stability of the power system is maintained due to its fast response.

If the frequency severely deviates from the standard frequency, then many of the instruments connected to the power system can be damaged. The high speed of the turbine due to an increase in frequency will result in its destruction. With the rapid advancement of battery technology, it has gained the capability of fast controlling the active and reactive power even at the high switching frequency.

To compensate for the mismatch of generation-load, an advanced energy storage system is proposed in the paper so that the nominal frequency of the power system is maintained. The fast ramping merit of the energy storage system is a feat to give regulation of the frequency. During the extra power supply, the energy storage system actions as a load and gets itself charged whereas during the power shortage the energy storage system supplies power to keep the balance in demand and supply, and hence it lessens the frequency fluctuation.

On the other hand, if the power generated from the system than the demand then system frequency decreases. So, in modern power systems, if the system frequency increases then the system output is reduced, so to maintain the frequency proper control strategy is required [26,27,28,29].

This technique reduces the burden on the coal-based plant by dividing the frequency control signal between the energy storage system and coal-based plant. The coal-based system is restricted in its capacity to give the frequency control due to the limitation of the power ramp rate. Therefore, this advanced energy storage system is suited to high-frequency operation. The main aim of this system is to lessen the maintenance and fuel necessities of the coal-based plant and to join the different generation resources that could enhance the frequency control necessities.

Therefore, this paper provides an assessment to perform the frequency regulation with and without an energy storage system connected to the power system in the MATLAB/Simulink platform. The fast response of the energy storage system with the change in load makes it a better option for frequency regulation of the system.

In the present paper, the system modeling is described with a typical energy storage system in Sect. 2. Results and discussion are provided in Sect. 3. Finally, the concluding comments are given in Sect. 4.

Synchronous generator (SG) supplies the discrepancy power to the load to maintain a balanced condition of supply and demand. The generator may be a diesel-driven generator or turbine-driven generator. It consists of a speed governor and turbine system which can be represented by its transfer function as [30, 31]

where Tg and TT are the time constant of governor and turbine respectively. The default value of Kg and KT is equal to 1. The speed regulation of the governor is around 5% from zero to full load.

where KSYS is constant. A time delay exists between frequency and power variation. So, the transfer function of system frequency deviation per unit power deviation can be represented as

The advanced energy storage system is very effective for decreasing the peak deviations of frequency by giving quick power compensation. If extra frequency happens, this system may absorb the power during this period and supply the power to the utility grid for low-frequency periods. Therefore, in case of within frequency changes, the power absorbed and supplied is zero. The energy level of this system varies with the addition of different elements.