Usage of STATCOM to interface hybrid power system (HPS) to grid

K Sanjay1, K Sravan Kumar2, Chandan K Shiva3 & M.Shyam Sunder4

1Assistant Professor, Department of EEE, Sumathi Reddy Institute of Technology for Women, Warangal, India.
2Assistant Professor, Department of EEE, Sumathi Reddy Institute of Technology for Women, Warangal, India.
3Assistant Professor, Department of EEE, SR Engineering College, Warangal, India.
4Assistant Professor, Department of ECE, Sumathi Reddy Institute of Technology for Women, Warangal, India.

Corresponding E-Mail: sanjay.kummari@gmail.com

Abstract. Here we discuss about connecting HPS to grid with through STATCOM. Here HPS refers to solar and wind power generation. The power from these two sources is not fixed for entire operation and cannot be connected directly to grid. Here we propose the use of STATCOM to maintain the output of hybrid power system to be constant. Input to STATCOM is not constant but output is made fixed with the help of Icosφ controller.

Keywords: Static Compensator (STATCOM), Hybrid Power System (HPS), Wind Energy Source (WES)

1. Introduction

Load is increasing from time to time but extent of power supplied by source is not increasing. Depending on power demand source cannot meet demand and reason for this condition is limitation of cost for power generation. In power stations we use fossil fuels to generate power. Cost of these materials is more. Availability of these materials is also limited. So to rectify this issue we use renewable energy resources to generate electric power. Here we use solar energy source and wind energy source.

HPS refers to a system with two or more than two energy sources are connected to a single bus system. Here we connect solar and wind energy sources to a single bus system, but the output from these two renewable energy sources is not constant. In PV system, if light intensity changes then output also changes. Similarly in wind mill, if wind speed changes then output of wind mill also changes [5]. This altering output cannot be connected to grid as it results in power quality problems in grid. As a solution for such issue we are proposing STATCOM for interfacing of HPS to grid.

Here we are proposing Static compensator (STATCOM) as it is very efficient over other FACT devices. STATCOM is fast and economical. The output from HPS is connected to STATCOM. STATCOM takes this input and develops fixed output with the impact of Icosφ controller. Icosφ controller acts as sensor which senses current and voltage levels and generates pulses. These generated pulses are provided to STATCOM which develop fixed output. This fixed output is interfaced to the grid [1].
Here we include two loads. The load is made variable by altering among load1 and load2 and this will affect the source side current [6]. Static compensator is mainly used to consume or provide reactive power to the grid. When load is changing respectively reactive power also changes. In implemented system, STATCOM will alter reactive power and maintain constant source current. Fig. 1 shows proposed system.

![Fig.1 Interfacing of HPS to Grid Using STATCOM](image)

2. Static Compensator (STATCOM)

STATCOM is series FACT device. STATCOM is used to provide or consume reactive power depending upon system condition. HPS output is usually not constant; this altering output is provided to STATCOM's input. STATCOM control this altering input with the help of Icosϕ controller and develop fixed output. This fixed output is supplied to grid [2].

3. Control Technique

![Fig. 2 Control Technique of Proposed System](image)

Here we use Icosϕ controller. The Icosϕ controller generates control pulse which is given to STATCOM. Control schematic of the implemented system is shown in figure 2. Fourier block is used to develop fundamental current magnitude and respective cosine displacement. Similarly PLL develops active component of voltage [3].

This reference signal compares itself with source current and detects error and develops a signal which is given to PWM generator. PWM generator generates pulses and these pulses are provided to switching devices present in STATCOM circuit. According to pulse input, switches can be operated and STATCOM output can be controlled [4].
4. Simulation and Results
Here we use 415V, 50Hz three phase supply system and two loads are connected. Load 1 is connected to grid from the very beginning and after a time lapse of 0.5 sec load 2 will be switched on into grid. System is made to run for 1 sec and we observe the source current waveforms with and without STATCOM. We also observe the STATCOM output voltage and output current. The respective observations are furnished in below figures.

![Fig. 3 Source Side Current Waveform without STATCOM](image)

From Fig. 3 we can observe that after 0.5 sec when load 2 is connected to the grid we can see that there is change in source current when we doesn’t use a STATCOM

![Fig. 4 Source Side Current Waveform with STATCOM](image)

From Fig. 4, we can observe that even though when load 2 is connected after 0.5sec there is no change in source current as we are using STATCOM

![Fig. 5 Output Waveforms of STATCOM](image)

From Fig.5, we can observe that the current and voltage of STATCOM are constant over the entire course of operation.
5. Conclusion
In this proposed system the use of STATCOM enables us to maintain constant output from HPS. The interfacing of HPS to grid with the help of static compensator enables us to synchronize with the grid easily. In system, load is not constant but we need to maintain constant source current thus grid power quality is maintained. Using Icosϕ controller to generate control pulse and control STATCOM is feasible method to attain constant source current.

6. References
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