Voltage Regulation using FACTS Device

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***Abstract*— In this paper we can regulate the voltage in the Transmission line by using STATCOM and it also gives the information about reactive compensation. Also try to analyze transient stability of power system and analysis is helpful to determine the behavior of system under fault condition. To understand better three bus system example is taken. These three bus system is studied with and without STATCOM [1] .The result of fault is seen in this system and to analyze effect of STATCOM on bus system with voltage regulation.**

***Keyword* —Reactive Power, STATCOM, Stability, Faults**

I. INTRODUCTION

It has been seen that there is rapid increase in power demand in last few decades but expansion of power generation and transmission has been limited due to limited resources and environmental restrictions. As result, many of the transmission lines are heavily loaded and stability of system becomes a limiting factor in the power transfer. Due to fault in power system the voltage has drops and efficiency also get reduces Power system steady state control problems are solved by use of Flexible AC transmission systems (FACTS) controllers. FACTS are devices which allow the flexible and dynamic control of power systems. Voltage instability problems increasing day by day because of demand increase. It is very important to analyze the power system with respect to voltage stability.

The system's reactive power [3]handling capacity can be improved using Flexible AC Transmission System (FACTS) devices. In this paper, the effect of FACTS controllers on voltage stability improvement has been studied. The objective of this paper is to keep the power system to remain in voltage stable condition when it experiences a load change and contingency. In the research field of advance controlled technology and power electronics switching devices, FACTS technologies [4] become the choice in the field of transient stability, reactive / active power flow control and voltage control. That improves the function and operation of existing power distribution and transmission system. The achievements of the studies minimize the operating cost, enlarge the efficiency of existing generation unit and reduce the overall fuel consumption and generation capacity.

II. VOLTAGE STABILITY

Voltage stability[2] is an major issue in our power system which cause because of shortage of reactive power , heavy load condition and different types of faults. The trouble of voltage stability is related to power system has large participation in crucial area of power system. Generally electrical energy is remained in AC form at every stage such as generation, transmission, distribution. So in AC has there is some considerable disadvantage such as inevitability of reactive power. We know that there is always need of reactive power with active power, the nature of reactive power can be leading or lagging. This reactive power does not give any contribution of energy but it is creating problem for flowing of total power. Active power has a big contribution to the energy transmission.

In AC system every circuit branch has two component reactance and resistance. Reactance has also divided into two parts of either capacitive or inductive load. In day to day life we generally used of inductive type where we need to compensate these loads by lagging reactive power. So in order to control all the problems related to voltage stability we have to use FACTS devices.

In today's generation of technological development every day brings the rapid changes in demand of the electrical field of solid state electrical switching devices. One of such triggers is the invention of FACTS devices. Idea of FACTS is basically depend on power-electronic based controllers. We can use the FACTS capacity to improve the value of transmission networks. The operating speed of controllers is very high, they extend their life as well as safe operating limits of a transmission system without any risk. Day by day increasing use of the FACTS was given birth to new era of controlling systems.

III. STATCOM

STATCOM is classified under shunt-connected static synchronous compensator group, whose capacitive or inductive output current will be controlled without the AC voltages of

system. FACTS controller is used for compensation of reactive power of system but economical point of view STATCOM is better than that of other FACTS controller because of their improvement in voltage stability and at the same time this can compensate the reactive power such as SVC and at the same time it will overcome the technical limitations of SVC such as less transient stability. The STATCOM controller composed of a solid-state voltage source converter with transformer or GTO (Gate Turn- Off) Thyristor switches, other high performance semi-conductor switches and a DC capacitor. In power system, the shunt converter of transformer and solid-state voltage source converter is connected in parallel.

Thyristor devices over the past decade improve the power handling capabilities of GTO which lead to the development of utilizing electronic switching converter technology for manufacturing of controllable reactive power sources. Additionally, these technologies is more advantageous in terms of performance and space reductions. It based on the switching converter technology the solid-state shunt reactive compensation equipment is designed which will be enable by GTOs.

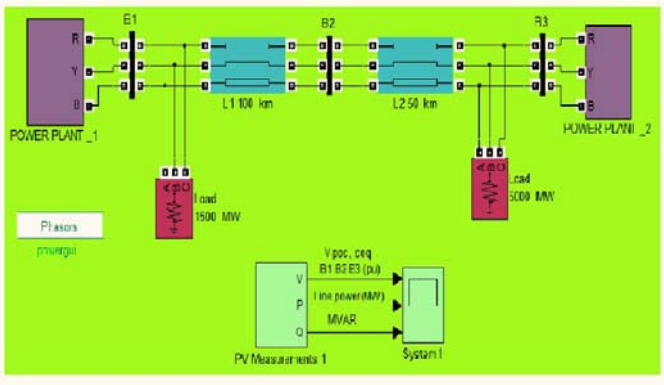

Figure 1.Simulink model without STATCOM

In Figure 1 power plant 1 and power plant 2 was connected by 3 phase transmission line, where bus1 bus2 and bus3 are connected in between this two power plant. L1 is the length of transmission line which is present between B1 and B2 and L2 is the l length of transmission line which is present between B2 and B3.load of 1500 MW is connected between B1 and B2 and load connected between B2 and B3 is of 5000MW

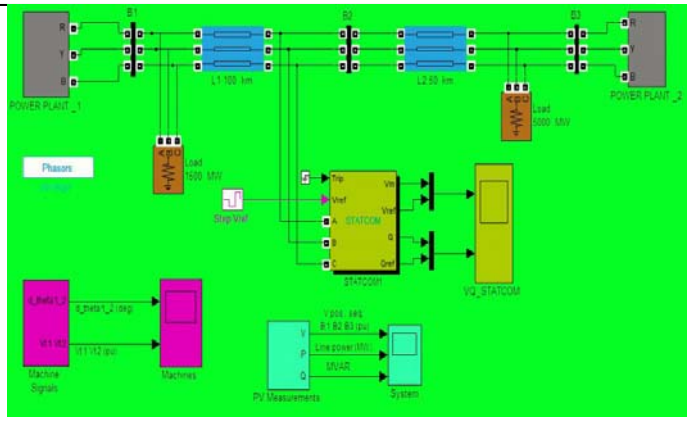

Figure 2: Simulink model with STATCOM

In Figure 2 we connect the STATCOM between B1 and B2 to improve the voltage of system as well as reactive power and remaining arrangement is keep same as that of Figure 1. STATCOM connected here will absorb the reactive power when it is present in excess and in case of shortage of reactive power will provide the same to transmission line.

IV. Experimental Results

In this section, we give a results of experiments carried out on a MATLAB simulink platform with windows 7 as an operating System. We plot the voltage of BUS1 BUS2 and BUS3 respectively in Figure 3 without STATCOM. At the same time in Figure 4 we plot the voltages of BUS1 BUS2 and BUS3 when we connected the STATCOM between B1 and B2.

Table 1: Voltage at BUS B1, B2 & B3 without STATCOM.

Time (sec)	Voltage of BUS1	Voltage of BUS2	Voltage of BUS3
0.5	0.967	0.92	0.891
1	0.956	0.923	0.902
1.5	0.935	0.937	0.933
2	0.925	0.936	0.94
2.5	0.942	0.947	0.944
3	0.952	0.953	0.948
3.5	0.957	0.959	0.956
4	0.963	0.966	0.963

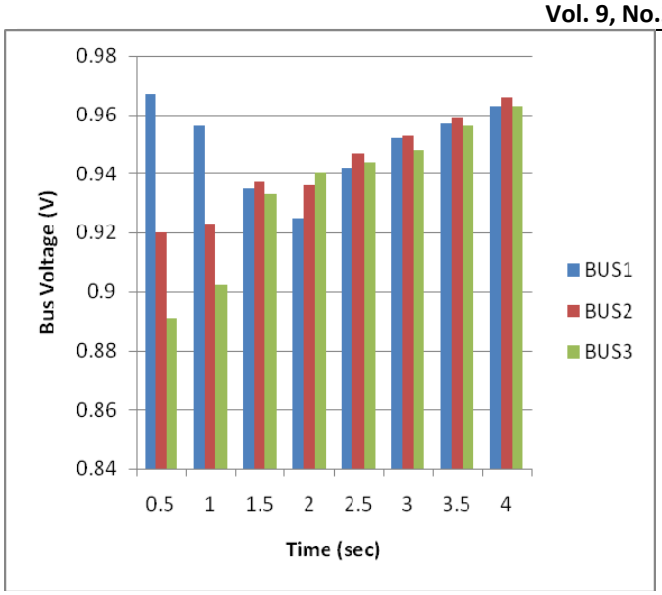

Figure 3: Bus voltages without STATCOM

Table 2: Voltage at BUS B1,B2 & B3 with STATCOM.

Time (sec)	Voltage of BUS1	Voltage of BUS2	Voltage of BUS3
0.5	0.969	0.98	0.941
1	0.965	0.974	0.945
1.5	0.96	0.977	0.94
2	0.962	0.978	0.947
2.5	0.96	0.982	0.948
3	0.963	0.985	0.956
3.5	0.966	0.987	0.962
4	0.975	0.993	0.968

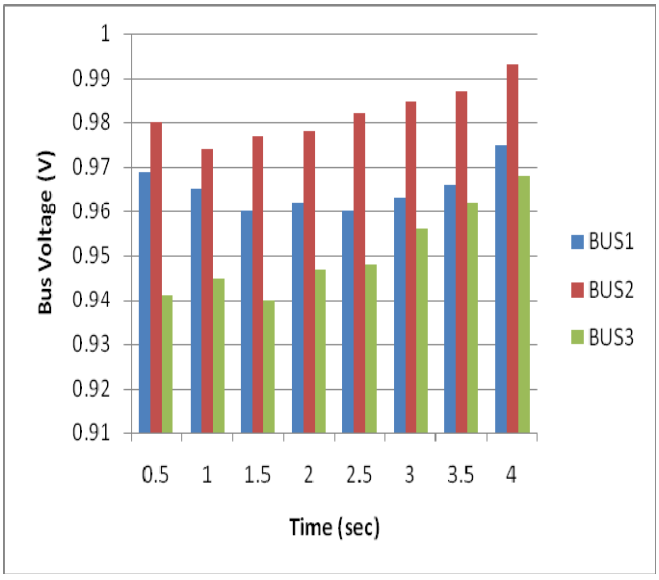

Figure 4: Bus voltages with STATCOM

V. Conclusions

From the paper we can observe that voltage of three bus system is Regulate with the help STATCOM. in any situation that is low load or full load condition. we can also say that STATCOM is use full to obtained different voltage in specified limit and also help full in Reactive calculation .

As for New Transmission we can place STATCOM to Regulate the Voltage at particular location .we can also place STATCOM on present transmission line and because of this STATCOM device we can regulate reactive power flow and can maintain Transient stability.

VI. References

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