Voltage Profile Improvement Using TCSC for IEEE-6 Bus System Using Trial And Error Method

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Abstract:- This research Paper contains the voltage profile improvement in transmission line to implement FACTS device like TCSC and it's need to maintain the Reactive power and voltage stability. Voltage stability is the ability of a power system to maintain steady state voltages at all buses in the system under normal operating conditions and after being subjected to a disturbance. A system enter, a state of voltage instability when the disturbance increase in load demand or change in system condition causes a progressive and uncontrollable drop in voltage. The main factor causing instability is the ability of the power system in ability of the power system to meet the demand of reactive power. The angle stability it is a balance between reactive & active power that is mechanical input of the turbine or mechanical input from the turbine must be equal to electrical output from the generator, it is a real power balance. But for voltage stability we required the balance between the reactive power that is reactive power generated and the reactive power consumed in a system and in if in case the system is unable to maintain this balance then the problem of voltage instability occurs.In this paper IEEE-6 Bus system simulation has been done in PSAT Tools.

Keywords:- FACTS device,TCSC,Voltage profile ,Voltage Collapse,Voltage Instability

I. INTRODUCTION

Voltage collapses usually occur on power system which are heavily loaded or faulted or have shortage of reactive power. Voltage collapse is a system instability involving many power system components. IN fact, a voltage collapse may involve an entire power system. Voltage collapse is typically associated with reactive power demand of load not being met due to shortage in reactive power production and transmission. Voltage collapse is a manifestation of voltage instability in the system. FACTS devices can be used in series or parallel in the power systems. In this paper, we will have a full survey on the effects of the TCSC on voltage profile,active power and Reactive power. (1,2) The Thyristor Controlled Series Capacitor (TCSC) is the series FACTS devices. It consists of the capacitor bank reactor bank and thyristor as shown in Fig. 1. The thyristors control the reactance or susceptance that dictates the power flow through a line. The TCSC can be applied for improving voltage profile of power system.

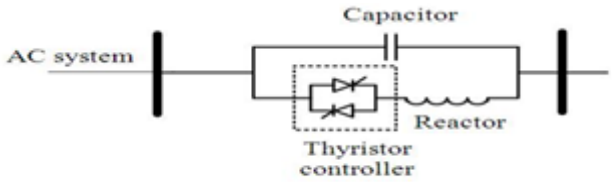

Fig. 1: Schematic diagram of TCSC (3,4)

II. VOLTAGE CONTROL

In power system, control the system voltage play important role to ensure the voltage interruption like swell, sag and harmonic can be minimize and furthermore increase the power quality, reliability and availability. The importance of voltage control can be divided into three main reasons that is:

a) Both customers and power system equipment is design to operate within specific voltage range value. If the equipments be supply by voltage above their range than equipment life time will be shorted, and if the voltage supplied below the specific range the equipment will not function properly.

b) The production of the reactive power in generator can limit the real power be produced.

c) The moving reactive powers in transmission line are one of factor loss of energy in the line. From voltage standard that made by International Electro technical Commission (IEC) the voltage range that be allow to provide to customer are ±6% from the nominal voltage value.

A. Method of Voltage Control (4,5)

The voltage can be control in three ways that is:

a) By inject the reactive power (static shunt capacitors and reactor or by static series capacitors and or by using synchronous compensators.)

b) By using tap changing transformer. (off load tap changer & On load tap changer)

c) By using FACTS devices.

B. Modes of TCSC Operation

There are essentially three modes of TCSC operation.

(1)Bypassed-Thyristor Mode

(2)Blocked Thyristor Mode

(3)Partially Conducting Thyristor or Vernier Mode

C. Applications of TCSC:

The major objective in applying TCSC is to increase power transfer capacity in critical transmission lines (typically tie lines) under contingency conditions. In the restructured electricity supply regime, it is used to increase the Available Transfer Capability (ATC).

III.TEST SYSTEM SIMULATION

This section will discuss about the test system that is used to analyze the work in purpose of studying the effect of TCSC in increasing the voltage stability of the system and its optimal location.

IEEE 6 bus system is use in the project simulation and it is done by using Power System Analysis Toolbox (PSAT) using trial and error method with implémentation of TCSC between each and every bus.Then compare the result of without TCSC and with TCSC and show the results.

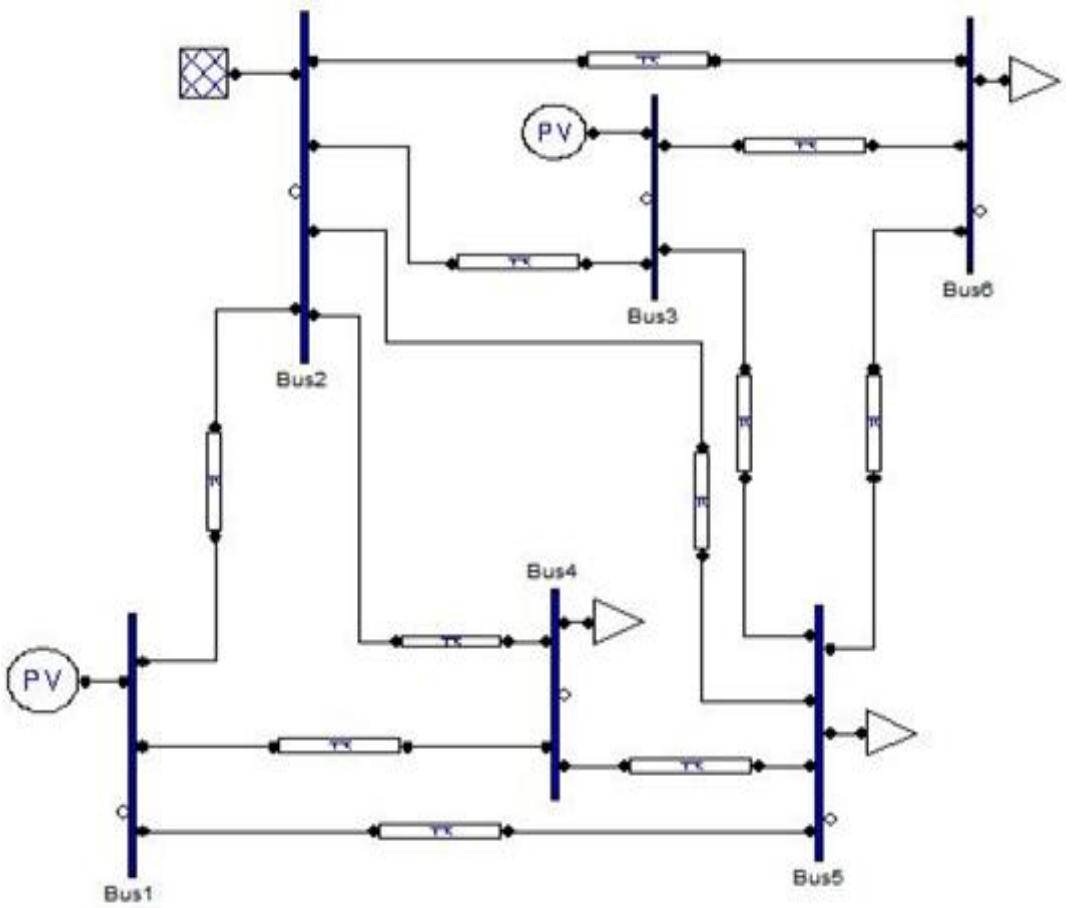

Fig. 2: IEEE 6 bus system without TCSC

A. Analysis Of IEEE-6bus

BUS	V[P.U]
BUS 1	1.05
BUS 2	1.05
BUS 3	1.05
BUS 4	0.98592
BUS 5	0.96854
BUS 6	0.96854

TABLE-1 Bus Data

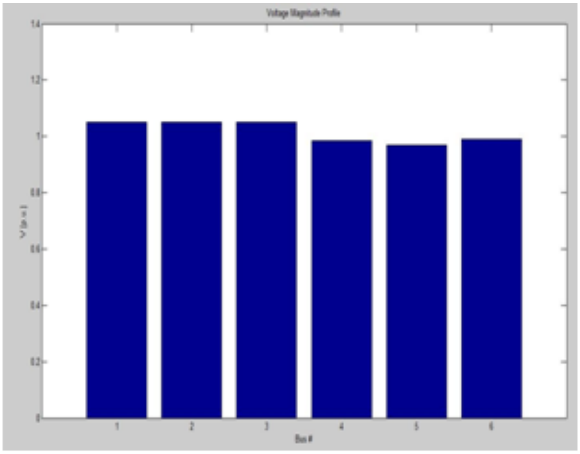

Fig.3.Result of IEEE-6 Bus system without TCSC

IV. IMPLEMENTATION OF TCSC BETWEEN BUS 2 AND BUS 6

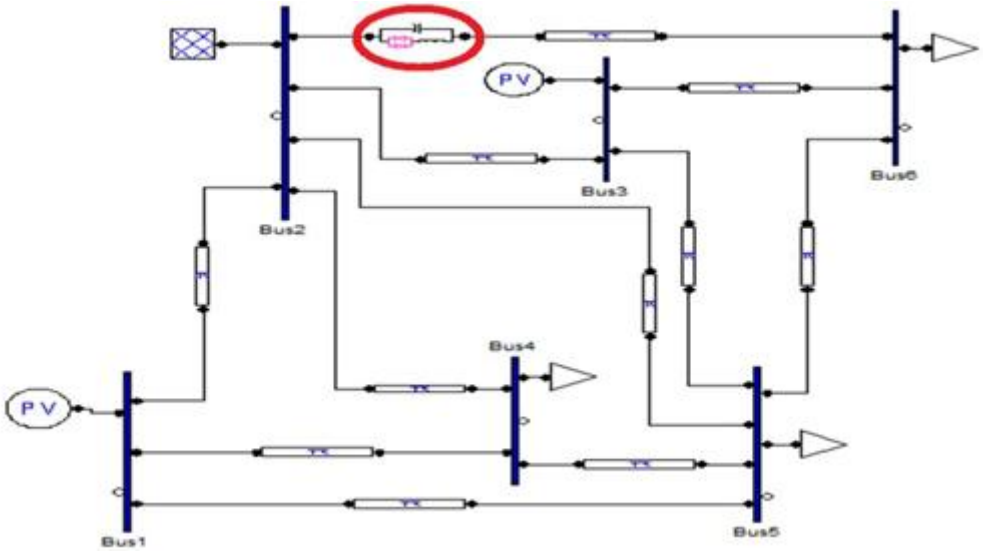

FIG.4 IEEE 6 System with implementation of TCSC between bus 2 and 6.

A. Result Analysis Of TCSC Between Bus 2-6

WITHOUT TCSC		WITH TCSC	
BUS	V[P.U]	BUS	V [P.U]
BUS 1	1.05	BUS 1	1.05
BUS 2	1.05	BUS 2	1.05
BUS 3	1.05	BUS 3	1.05
BUS 4	0.98592	BUS 4	**0.98624**
BUS 5	0.96854	BUS 5	**0.97062**
BUS 6	0.96854	BUS 6	**1.0003**

Table-2 Bus Data without TCSC and With TCSC

B. Analysis Of TCSC Between Bus 2-6

TOTAL ACTIVE POWER GENERATED [P.U]	TOTAL REACTIVE POWER GENERATED[P.U]	TOTAL ACTIVE POWER LOSS [P.U]	TOTAL REACTIVE POWER LOSS[P.U]
WITHOUT TCSC		**WITHOUT TCSC**	
2.8988	1.6675	0.09875	-0.23248
WITH TCSC		**WITH TCSC**	
2.9003	**1.7516**	**0.07244**	**-0.22288**

Table-3 Result Analysis of total active,reactive power generated and total active,reactive power loss.

V. CONCLUSIONS

From Above Discussion We Can Conclude That the applicabilité of TCSC in power system for voltage profile improvement. For Implementation Purpose IEEE 6 Bus System Is Selected And Using PSAT Tools. Simulation Is Carried Out With And Without Tcsc And Comparison Is Made. The Output Is Clearly Indicating That Voltage Profile Is Effectively Improved.

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