INTERCONNECTION OF THERMAL AND HYDRO POWER PLANT USING UPFC

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ABSTRACT

The power scenario of India is changing every year. Many power plants contribute to generate electrical energy. Contribution of thermal power plant in India is highest among the all resources of energy. Hydro power plant is also important source of energy. Both power plants provide power for base load as well as peak load. This paper is focuses on Interconnection of thermal and hydro power plant which will improve the performance of whole system by providing continuously power supply without any disturbance. FACTS devices need to be installed to provide control over active and reactive power requirement. UPFC (unified power facts controller) is one of the FACTS devices, which is the combination of shunt as well as series controller control both active power as well as reactive power requirement. In interconnected system UPFC system will improve the performance of whole system with load frequency control. Modeling of interconnected power plant is done without using FACTS device and with FACTS device to understand the problem of interconnected power plant, MATLAB simulation results shows that using UPFC (FACTS device) performance of whole system will be improved.

Keywords— Hydro power plant, Interconnection of power plants, Thermal power plant, UPFC(unified power Facts controller).

I. INTRODUCTION

Energy is required for different purpose like commercial, industrial, day to day activities. Out of which electrical energy play important role to perform various task. It can be generated, transmitted and distributed and utilized at very reasonable cost, but when transmission of electrical energy done in bulk we need an effective system called electric power system. Interconnection of power plant is play important role in power system to provide effective electrical energy without any interruptions. In interconnected system different types of power plants are connected in parallel. When the demand of electrical energy is high and single power plant cannot fulfill the requirement then with the help of another power plant the distribution of electrical energy efficiently done, means at peak load interconnection of power plant will reduce the interruption of power

II. THERMAL POWER PLANT

In India so many power plants are established to meet the requirement of power. India is very rich in coal based thermal power plant. In north east and central India there are the sources of coal are available. Nearly 60% of India's total energy requirement is met from coal. Generation capacity of about 187 GW is based on thermal power plant. Plenty of coal resources are available in India, which contribute in thermal power plant. Although Renewable Energy sector is growing very fast in India and government of India supporting National solar mission via solar parks and other techniques. but it still has a long way to go and until 2030 or even later thermal power plants would still play the major role of supplying electricity throughout the country. The present trend of adding 2000-3000 MW a year is not sufficient enough to achieve the target of 100 GW solar energy by 2022 via rooftop and grid connected solar PV's.

III. HYDRO POWER PLANT

Hydro power plant plays important role to generate electrical energy because it is based on renewable energy resources. India is very rich with hydropower potential. In terms of usable potential India stand fifth in the world, but only 20% has been developed .hydro power plants not only provide power but they also control flooding, store water for irrigation. The hydropower development depends on various factors which environmental concern, land acquisition problem and law and order problem and many other problems are in development of hydro power plant. India ranks third after China, USA and Russia in the world in terms of dam developed. About 5000 dams are completed till date in the country. At present Size of dam also increasing from 22MW to 250MW.

IV. UNIFIED POWER FACT CONTROLLER (UPFC)

UPFC is one of the important FACTS devices which provide simultaneous control of all indispensable power system parameters like transmission voltage, impedance and phase angle. It is a combination of two facts controller the STATCOM and SSSC.UPFC provide simultaneous control over real power and reactive power. It Control all parameter like impedance, transmission voltage, phase angle which determine the transmittable power.

Also flexibility of power transmission can be easily maintained by using UPFC. It will automatically recover the power system oscillation.

A "back to back" AC to DC voltage source converters is the basic structure of UPFC which is operated from a common DC link capacitor. First converter (CONV1) is connected in shunt and the second one (CONV2) in series with the line. Converter 1 generates or absorbs reactive power, and therefore fulfill the independent shunt reactive compensation for the line if it is desired. Converter 2 is injecting a voltage by means of convenient magnitude and phase angle in series with the line via a voltage source. Figure 1.1shows the block diagram of UPFC.

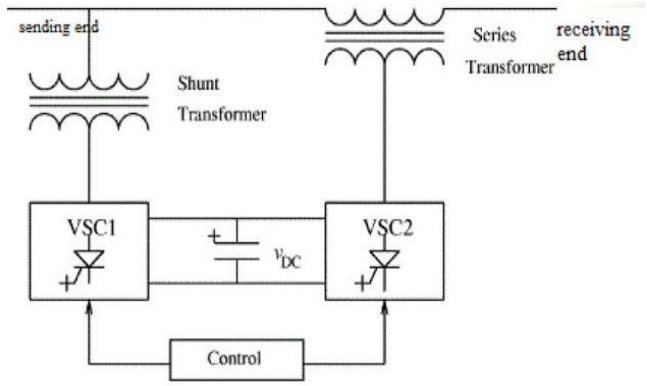

Figure 1.1 Block diagram of UPFC

V. INTERCONNECTION OF THERMAL AND HYDRO POWER PLANT USING UPFC

The performance of the UPFC injection model is experienced on the two area four generator power system. The Plant P1, P2 and P3 having a rating respectively 1000 MW, 1200 MW and 1000 MW. The plant P1, P2, P3 and grid connected through a 100 km line and UPFC. Interconnection makes the system more reliable and optimize. In winter when water flow becomes less than more power supply through the thermal power plant and in summer when water flow increase than output of hydro increase. By using interconnected power plant we also decrease the pollution contents in the overall power supply. For interconnection we used so many techniques but facts controllers are more effective as compared to others. In this work we used the UPFC for interconnection of power plant. The UPFC can provide simultaneous control of all basic power system parameters (impedance, transmission voltage and phase angle). The controller can full fill functions of reactive shunt compensation, series return and phase shifting convention multiple control objectives. From a functional perspective, a boosting transformer is used to injected voltage and an exciting transformer reactive current. For fulfillment of purpose The injected voltage is inserted by a series transformer. Figure 1.2 shows interconnection of thermal and hydro power plant using UPFC.

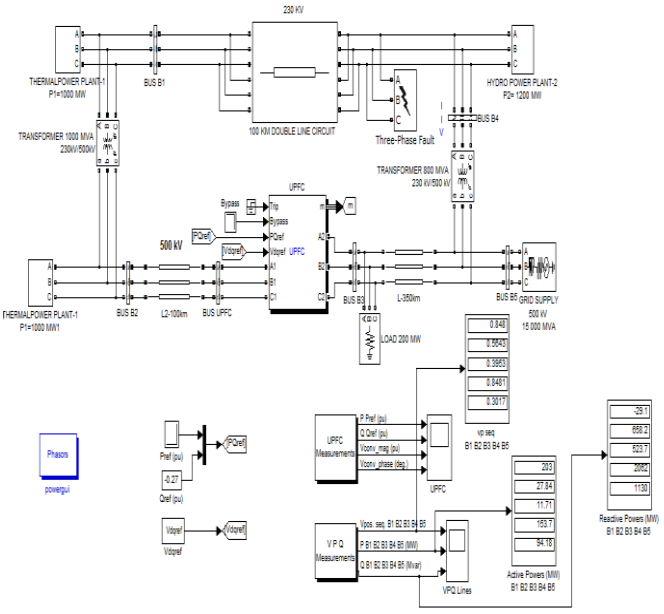

Figure 1.2 Interconnection of power plants using UPFC

VI. OUTPUT RESULTS OF UPFC MEASUREMENT SUBSYSTEM

Simulation result shows that active power, reactive power, voltage magnitude and phase voltage graph of UPFC measurement subsystem. Active power and reactive power graph shows that UPFC will clear the Faults in line clear after some time, and improve the active and reactive power requirement of the system. Magnitude of voltage is also improved after some time and Phase angle is leading most of the time. Results are shown in figure no 1.3.

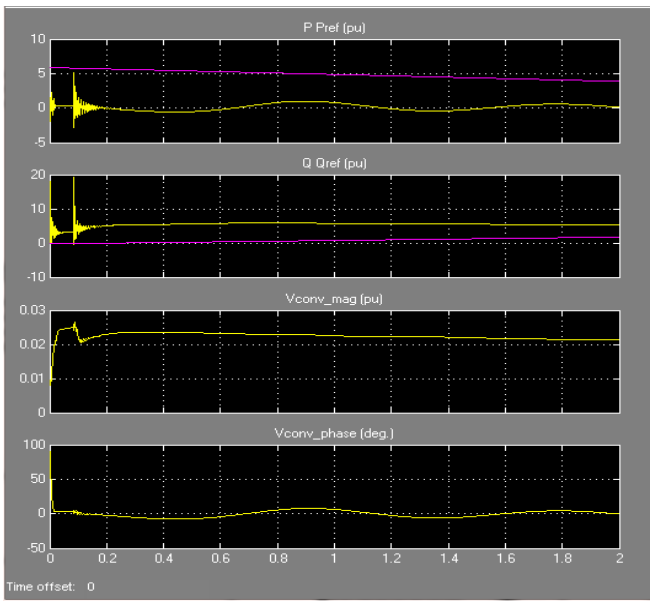

Figure 1.3 Output results of UPFC measurement system

VII.SCOPE OUTUT OF VOLTAGE,ACTIVE POWER,REACTIVE POWER MEASUREMENT

Simultion graph shows that positive sequence voltage,active power and ractive power at different bus B1 B2 B3 B4 B5 of the system.Graph shows that fault will be clear after some time. Results are shown in figure no 1.4.

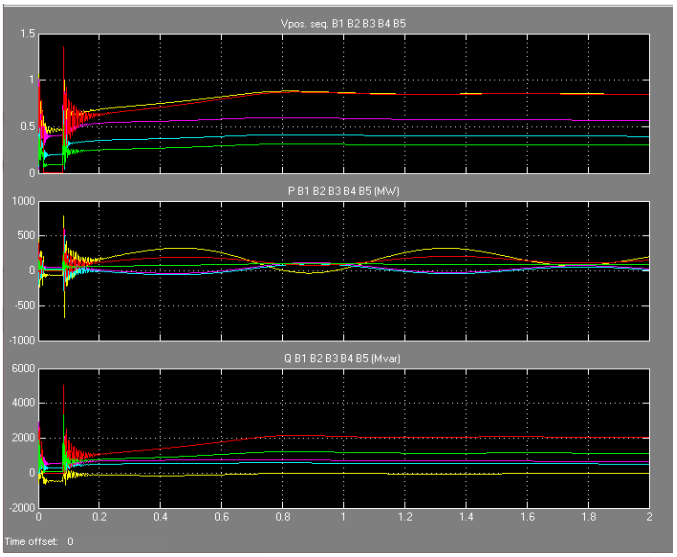

Figure 1.4 Scope outputs of voltage, active power and reactive power measurement

VII. DISPLAY OUTPUT RESULT OF VOLTAGE, ACTIVE POWER AND REACTIVE POWER MEASUREMENT

Output result shows that positive sequence voltage, active power and reactive power of different bus system. Results shows that active power and reactive power requirement at different bus system. Table 1.1 shows display output of voltage, active power and reactive power measurement of the system.

Table 1.1 Voltage, active power and reactive power measurement

S.N.	BUS	Vp seq	Active Power	Reactive Power
1.	B1	0.848	203	-29.1
2.	B2	0.5643	27.84	658.2
3.	B3	0.3953	11.71	523.7
4.	B4	0.8481	153.7	2062
5.	B5	0.3017	94.18	1130

VIII. CONCLUSION

In this paper interconnection of thermal power plant and hydro power plant is done without using UPFC and with UPFC.MATLAB/SIMULINK software is used to analyze the performance of the system. Results shows that UPFC will increase the power transfer capability by connected through different bus at different power plant. Voltage, Active power, reactive power at different bus system will be display also

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