



# **DESIGN OF CONTROL PHILOSOPHY BETWEEN TRANSFORMER AVR CONTROL AND BSC BANK PFCONTROL**

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by  
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## Abstract

Ceylon Electricity Board (CEB) controls major roll in Generation, Transmission and Distribution of the electrical power in the island. It has hydro-power capacity about 950MW and thermal power capacity 725 MW. The average VAR consumption a day is 650 MVAR. Average power factor of the operation of the system is about 0.95. Almost 80% of the distribution of electrical power is done by CEB. The transmission network totally owned operated by CEB. The CEB transmission system consists of 220k V and 132kV network. It has 44 Grid Substation which convert 132kV/33kV for the distribution of the power to low voltage consumers. In this Grid Substation there is 109 132kV/33kV power transformer each having capacity of 31.5 MVA.

There are Breaker switch capacitors (BSC) bank installed at some places of these GSS. The total installed capacity of the shunt BSC bank is amount to 320MV AR and yet another 70MV AR planning to connect in the near future. In these GSS there are two systems to control 33kV bus voltage at reference 33kV level. One system varies the transformer tap position by controlling 33kV voltage. We called this as On-Load Tap Control of the transformer. For this to be done there is controller (AVR) which sends the command to OLTC to take appropriate action of increasing or decreasing the tap. On the other hand there is a BSC bank which allowed controlling the reactive power of the GSS.

The main intentions of the use of capacitor banks is to give voltage support at the substation level, reduction of losses in power transformers and transmission lines, and to release the capacity constraints in transformers and lines. CEB uses power factor regulation for switching these capacitor banks for above purposes but no studies have been done to evaluate its suitability with transformer AVR.

Even though these two controllers try to maintain VAR and Voltage (Q&V) of the GSS they are operating independently. Because of that We could not achieved maximum effect of these two system i.e., under optimization of the Voltage and Var.



Some time we have observed that these two controllers are hunting with each other by doing the controlling.

If we could coordinate these two controllers to make proper function we indirectly could save the number of tap operations of the transformer and that will help reducing costly maintenance of the OLTC. My main intention is to coordinate these two controllers to achieve above objects. I further try to develop a new system to take care of the both functions in one unit. I have used PSCAD software program for simulation of the GSS.

For the real time data collection I used two data loggers which are property of the CEB. Finally I have found that for controlling the both controllers we need a additional parameter which High Voltage side voltage measurement which could be easily available at the GSS without any additional cost. Taking this new parameter with existing parameters I have develop a control philosophy which coordinates both the transformer AVR controller and BSC bank controller by optimizing voltage and Var. flow through the system.