REACTIVE POWER COMPENSATION USING SHUNT CAPACITOR AND TRANSFORMER TAP CHANGING FOR LOSS MINIMIZATION AND VOLTAGE STABILITY IN POWER SYSTEM

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ABSTRACT

This project describes the effect of reactive power compensation by using shunt capacitor and tap changing transformer in minimizing losses and maintaining the voltage stability of the power system. The size and location of capacitor bank is determined by using stability index (L) method. Then shunt capacitor is installed at weakest bus and reactive load is increased. The shunt capacitor and the transformer tap changing are combined to minimize losses. The proposed method was applied to a 30 bus bar IEEE systems to show its feasibility and capability. All simulation was done using the MATLAB version 7.0 programming.

Keywords:
Reactive power compensation, shunt capacitor, tap changing transformer, stability index (L).

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INTRODUCTION

1.0 INTRODUCTION

Reactive Power Compensation (RPC) in power systems is an important issue in the expansion planning and operation of power systems because it leads to increased in transmission capability, reduced losses and improved power factor. Reactive power compensation is often the most effective way to improve both power transfer capability and voltage stability [9]. One of the techniques is by using shunt capacitors that have been very commonly installed in transmission and distribution networks.

The shunt capacitor is a source of reactive power [1]. Reactive power is required to maintain the voltage to deliver active power (watts) through transmission lines. Capacitors are connected either directly to a bus bar or to the tertiary winding of the main transformer and are disposed along the route to minimize losses and voltage drops. Transformer tap changing is popular in controlling the flow of reactive power since it can be used for controlling voltages at all levels [2]. Tap changing by altering voltage magnitude can control the real and reactive power in order to minimize the losses in the power system. The flow of real power along a transmission line is determined by the angle difference of the terminal voltage while reactive power is determined by the magnitude difference of the terminal voltages [2].

The low voltages in the system would lead to system collapse. It is an established fact that the voltage collapse occurs when the system load (P and/or Q) increases beyond a certain limit. Thus, controlling reactive power, Q, will result in maintaining a bus voltage magnitude, at specified level.

This project presents the variations of capacitor value and tap changing transformer in minimizing losses and improving voltage stability. Power flow