Abstract

Most growing countries in Africa are facing serious challenge of high power demand which is not matched with expansion of power generating units, power transmission network and Power distribution lines. This trend has led to frequent power outages due to over stressed transmission and distribution networks. Most countries have resorted to increase the number of thermal power plants to address the growing power demand. These power plants are highly reliable and secure but are faced by the ever increasing fuel prices. In order to maintain constant power supply and minimize the frequent power outages, it's important to carryout optimal power flow in power system networks. Optimal power flow is an optimization method used to determine the most economical load flow in transmission lines that can address the existing power demand. In this research, minimization of fuel cost was used as the objective function. The generator power limits, voltage level limits and loadability limits of the transmission line were used as the constraints. The gradient method and co-ordination equations were used in determining the optimal power flow in the network that was adequate to address the power demand. A case study of Juja-rabai line was used in this analysis. The Rabai thermal power plant, Kipevu thermal power plant and Thika thermal power plant were used to supply the loads.The research considered existing loads along the transmission line, currently being supplied by existing conventional substations. The typical transmission line parameters were used in this study. Economic load dispatch neglecting line losses was first calculated followed by economic load dispatch considering transmission line losses. The power network was later modeled and simulated in PowerWorld software. This study revealed that generator one should supply 20 MW, generator two 37.5 Mw and generator three 12.5 MW. The study revealed the loadability limit of the line under economic load dispatch