Alexandria University

Faculty of Engineering

Electrical Engineering Department

POWER SYSTEM PLANNING WITH RELIABILITY AND VOLTAGE SAG CONSIDERATION

A thesis submitted to the Electrical Engineering Department,

Faculty of Engineering, Alexandria University

In Partial Fulfillment of Requirements for the Degree of

Doctor of Philosophy

In Electrical Engineering

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June 2011

ABSTRACT

The contradiction between reliability and voltage sag behavior in power systems is thoroughly investigated. Study of the effect of these contradictory features on decision-making-power system reinforcement is the principal point of the present thesis. Reliability study concerns with complete interruption of supply and can be considered as "steady-state" phenomenon. On the other hand, voltage sag concerns with sudden and transient voltage drops and is then considered as "transient" phenomenon. The thesis describes a techno-economic method for tackling the contradicting interaction between reliability and voltage sag in power system planning.

In general, raising power reliability through line addition to the transmission network raises the short-circuit level of this network and consequently worsens the voltage sag immunity of the loads connected to the system busbars. As line addition is crucial in many cases to increase the loadability and to improve the reliability of the power system, the thesis suggests augmented method which takes both reliability and voltage sag into consideration. This method can be considered as a guide to the planning engineers in reaching a judicious reinforcing schedule.

An innovative methodology for reliability calculation of the power systems is introduced. Accuracy, simplicity, and less time of execution have been proved through applications and discussion. The thesis suggests using a "hybrid" cost function which takes into consideration both benefit and loss gained from line addition and can help in decision-making. As this function contains variables and parameters of extremely different nature, the thesis suggests using an adequate expert system in reaching the most appropriate solution.

A case study is presented and solved in details which ascertains accuracy and effectiveness of the proposed methodology.