AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTERICAL POWER AND MACHINES DEPARTMENT

CONFIGURATION MANAGEMENT OF ELECTRIC DISTRIBUTION NETWORKS EQUIPPED WITH DISTRIBUTED GENERATION

A Thesis Submitted
In Partial Fulfillment
of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

In Electrical Engineering

BY

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Statement

This thesis is submitted to Ain Shams University in partial fulfillment of the requirements for PH.D Degree in Electrical power Engineering.

The included work in this thesis has been carried out by the author in the department of electrical power and machines department, faculty of engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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DEDICATION

Thesis PH.D is dedicated, to the spirit of my parents, to my beloved family, my brothers, my husband, my daughter Rabab and my son, Khaled.

ACKNOWLEDGMENTS

My Allah, I will give you thanks forever

First, and foremost, praise and thanks to Allah, the most Gracious, the Most Merciful, for helping me to accomplish this work.

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ABSTRACT

CONFIGURATION MANAGEMENT OF ELECTRIC DISTRIBUTION NETWORKS EQUIPPED WITH DISTRIBUTED GENERATION

This thesis contains a strategy to management electrical energy of electrical distribution network. In order to develop the strategy, a model was constructed to simulate an electrical distribution network, and different parameters was included that help in estimation of technical losses, voltage drop and overload in medium voltage of electrical distribution network.

Due to the deregulation trend in electric power system networks, many factors have to be taken into consideration such as lack of supplying electric power, system reliability, power quality, electric system losses and voltage disturbance and profile problems. The excessive growing needs for electricity force electrical researchers to implement new approaches through the electric system. Introducing Distributed Generation (DG) in the distribution network is considered to be a promising new approach to solve these problems. DG is capable of providing some, or all of the required power for the demand increase and at the same time improves system's performance.

This work focused on introducing a new approach to generate power in the distribution network and in addition enhance the distribution system's voltage profile and reduce the electric system losses and overload equipped with DG in the distribution system. Results of computer simulations are presented to confirm the proposed ideas. This work investigates the loss-related statistics of one specific power system market. The magnitude and characteristics of energy losses as

well as the distribution companies' measures to curb such losses were included in the information presented here. Other topics were discussed include the estimated power losses, voltage drop and overload in an electrical distribution network to compromise with DG. The strategy are applied on two different networks; the first network is the 66/11 kV (Gharb El Mahala substation feeding four distribution panels (D.P)) and 66/11 kV (Shoubra substation (S/ST) feeding El Zeraa D.P). The two network segments consist of different network busses delivering electrical energy to different customers. In these networks, the load supplied by for one bus is a varying load for different times especially at maximum load conditions.

The planning of MV distribution networks involves loops configuration design, location of medium-voltage (MV) / low-voltage (LV) substations, and minimum cost. In this work, the suggested strategy takes into account different conductor sizes, voltage drop and conductor capacity constraints, power losses in the network, and concentrated loads in the electrical distribution network. The existing planning methods of distribution network are designed for cases where a voltage drop & overloads limit the utilization of the network. The proposed planning method takes into account the combined voltage drop and rise of loads based on the worst network conditions, and proposes two complementary planning considerations for distribution networks.

The results of the present research work have proven that consequence of maneuvers equipped with DG includes three main measures, these are: minimization of overload, voltage drop and power losses. A suitable constrained multi objective formulation of the maneuvers

problem is therefore used for aiming at the minimal power losses operation and new approach to solve these problems by using DG technique, providing some the verification of safety at distribution substations and the load balancing among the MV/LV transformers while keeping the voltage profile regular. The application carried out uses an algorithm whose performance is based on multi criteria objective evolutionary algorithm. this method's main advantage is the accurate treatment of voltage and current constraints, including the effect of control action.

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