SERVICE RESTORATION WITH THE PRESENCE OF DISTRIBUTED GENERATION IN A DISTRIBUTION SYSTEM

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ABSTRACT

This project studies the influence of distributed generation during service restoration and to identify the optimal network reconfiguration at the power distribution systems for loss reduction and voltage profile improvement under fault condition with the installation of distributed generation. It is assumed that after the occurrence of fault at particular section of a distribution network, the loads get disconnected and are left unsupplied. Service should be restored to the affected loads through a network reconfiguration procedure. The simulation was conducted by applying three phase fault at an identified location. In this study, network reconfiguration was implemented using the TOPO application in the power system simulation programme for planning, design and analysis of distribution system (PSS/Adept). This application determines the optimal sectionalizing-tie switch pairs based on minimum losses configuration and at the same time, all nodes are assured for the supply. The location of the distributed generation was identified by finding the minimum bus voltage. The results show that installing distributed generation at the suitable location with appropriate sizing has able to provide lower loss level and higher voltage profile in fault condition as compared to that obtained before installed distributed generation and network reconfiguration. The proposed study was conducted on the IEEE 69 bus distribution system.

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CHAPTER 1

INTRODUCTION

1.1 Background of Studies

An electrical power system consists of three principle divisions namely generating stations, transmission lines and distribution systems. The distribution system is part of the system between transmission lines and the consumer service point. Distributed generation (DG) is defined as energy resources of limited sizes (15 MW or less) connected to the substation, distribution feeder or customer load levels. There are many technical issues to be considered when connecting distributed generation (DG) to the distribution system such as thermal rating of equipment, system fault levels, stability, reverse power flow capabilities of tap-changers, line drop compensation, steady-state voltage rise, power losses, power quality (such as flickers and harmonics) and protection [1]. However, depending on the system's operating condition and the DG's characteristics and location, DGs installation may impose either be positive or negative impact. Several techniques have been developed in determining the optimal location and sizing of DG as described in references [2] and [3] in order to minimize the total distribution losses and improve voltage profile in the system.

The unsuitable location and sizing of the DG unit will result in an increasing of power losses and in a reducing of reliability levels [4]. Forces and scheduled outages are commonplace in distribution system. The occurrence of fault will results in the isolation of some portion (branches) of the feeder downstream from the affected area. Therefore the service should be restored to these branches via network reconfiguration [5]. System reconfiguration problem concerns with identifying the suitable tie-line switches to be closed in replacement of opening sectionalizing switches. Distribution system reconfiguration can be considered as a combinatorial optimization problem, involving distribution system planning, loss minimization and supply restoration [6]. Many