OVERCURRENT RELAY FOR GENERATION DISTRIBUTION UTILIZATION

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OVERCURRENT RELAY FOR DISTRIBUTED GENERATION UTILIZATION

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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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ABSTRACT

Distributed Generation (DG) is the production of electricity from a variety of renewable energy sources that is closer to the customer and load. The addition of distributed generation sources to the distribution networks alters the characteristics of distribution system and has an influence on its protection coordination. Relay protection plays a critical function in protecting a power system from various problems. Relay protection coordination reduces relay operating time and avoids relay failure. As a result, a fault analysis of the distribution network with and without distributed generation installation is required to determine the effects of installing DG at the radial system on overcurrent relay protection. The software programme ETAP version 19.0 was used to represent an actual distribution system in this research paper. The consequences on the overcurrent protection relay were discovered as a result of the analysis. Simultaneously, the presence of an overcurrent relay following the installation of DG may no longer be dependable. As a result, it is critical to assess the effects of DG installation in order to verify that the protective zone can be properly protected.

ABSTRAK

Penjanaan Teragih (DG) ialah pengeluaran tenaga elektrik daripada pelbagai sumber tenaga boleh diperbaharui yang lebih dekat dengan pelanggan dan beban. Penambahan sumber penjanaan teragih kepada rangkaian pengedaran mengubah ciri sistem pengedaran dan mempunyai pengaruh ke atas penyelarasan perlindungannya. Perlindungan geganti memainkan fungsi kritikal dalam melindungi sistem kuasa daripada pelbagai masalah. Penyelarasan perlindungan geganti mengurangkan masa operasi geganti dan mengelakkan kegagalan geganti. Akibatnya, analisis kerosakan rangkaian pengedaran dengan dan tanpa pemasangan penjanaan teragih diperlukan untuk menentukan kesan pemasangan DG pada sistem jejari pada perlindungan geganti arus lebih. Program perisian ETAP versi 19.0 digunakan untuk mewakili sistem pengedaran sebenar dalam kertas penyelidikan ini. Akibat pada geganti perlindungan arus lebih telah ditemui hasil daripada analisis. Pada masa yang sama, kehadiran geganti arus lebih selepas pemasangan DG mungkin tidak lagi boleh dipercayai. Akibatnya, adalah penting untuk menilai kesan pemasangan DG untuk mengesahkan bahawa zon perlindungan boleh dilindungi dengan betul.

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LIST OF ABBREVIATIONS

DG	-	Distributed Generation
MW	-	Mega Watt
IDMT	-	Inverse Definite Minimum Time
IEEE	-	Institute of Electrical and Electronics Engineers
RES	-	Renewable Energy Resources
CT	-	Current Transformer
FC	-	Fault Current
DT	-	Discrimination Time Interval
PS	-	Plug Setting
PSM	-	Relay Plug Setting Multiplier
RSI	-	Relay Setting Current
RCOT	-	Relay Characteristic Operating Time
TSM	-	Time Setting Multiplier
ROT	-	Real Relay Operating Time

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CHAPTER 1

INTRODUCTION

1.1 Problem Background

The rapid development of new technologies in today's period has sparked engineer's curiosity in building distribution generation (DG) from renewable sources with great efficiency. The ever-present oil problem has piqued the interest of electrical power experts in developing high efficiency distributed generation (DG) from renewable sources. Therefore, the approaches of DG have encouraged environmental sustainability and pollution free living. The installation of distributed generation, on the other hand, would have a variety of effects on the performance of a distribution network system. It may render the existing protection mechanism ineffective. Short circuit levels escalate to the point that the selectivity of the relay is impaired when the DG units are connected to the distribution system, resulting in miss-operations. [1].

In general, fault occurrences occur in all power systems, which may be caused by open circuits, short circuits, unbalanced situations and other undesired conditions. Majority fault occurrences come from the strike of lightning on overhead lines and it is called as transient faults as it is temporary faults. As a result, it's critical to guarantee that the protection zone can be protected again and that equipment doesn't suffer damage or downtime as a result of the protection system's failure to work. This protection coordination also can reduce the maintenance cost, behavior of systems operational is becoming more reliable and distribution networks becoming more secure.

1.2 Problem Statement

A protection system is a mechanism that is used in a power system to defend against any problems that may arise. The installation of dispersed generation may result in the passage of fault current in an unanticipated direction. Additional fault current generated by distributed generation (DG) might cause relays to under or over reach, rendering the protection system non-compliant with the protection policy's criteria. When completing proper DG analysis, there are a few things that must be addressed, including as:

- The connection of DG may alter the functioning.
- When the system is operational, this may have an impact on voltage regulation, the protective system, and the system's safety.
- As a consequence of the increased fault current provided by DG, the relays may under or over reach.

As a consequence, further research is needed to understand the influence of DG on the distribution network. In this scenario, fault analysis was done on the distribution network with and without distributed generation (DG) installation to demonstrate the effect of putting DG at the distribution network. This study addressed some of issue arise when designing overcurrent protection coordination between protective devices when there is various size bus bar of distribution system.

1.3 Objectives

The purpose of this paper is to look at the influence of DG technologies on the operation and their capacity to connect DG units to the power system, with an emphasis on the protection system. To make sure this project aims are achieved, the following are the objectives of the project:

1. To understand the fundamentals of distributed generation and the overcurrent relay.
2. To investigate the effect of fault current when installing distributed generation at radial system with three different cases studies bus bar.
3. To investigate the impact of different relocation of DG on the overcurrent protection of radial distribution network.

4. To compare the overcurrent protection coordination system between without and with distributed generation.
5. To observe the power losses occur before and after added distributed generation.

1.4 Scope of work

1. To analysis of the overcurrent and protection coordination systems.
2. The value of the Distributed Generation power rating is based on IEEE standard requirements.
3. The circuit of radial system is built with three different cases studies which are with 4 bus bars, 14 bus bars and 31 bus bars.
4. The analysis only includes three phase balanced faults at each bus bar.
5. To compare the time it takes for a relay to operate in a circuit with and without Distributed Generation.

1.5 Thesis Outline

This thesis is divided into five chapters. The first chapter will go through the study's history, problem description, aim, and scope of work for this project. The second chapter will go into further depth on the theory and literature study that were completed for this project. The third chapter will address methodology, which will compare several methodologies from past research publications based on simulation and manual computation. While in chapter four, results, verifications, analysis and discussions will be focused. Last but not least, the last chapter provides the conclusions and also the recommendation for future analysis.

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