

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

{وَسَخَّرَ لَكُمْ الشَّمْسَ وَالْقَمَرَ دَائِبَيْنِ وَسَخَّرَ لَكُمُ اللَّيْلَ وَالنَّهَارَ }

سورة ابراهيم 33

{إِنْ يَشَأْ يُسْكِنِ الرِّيحَ فَيَظْلَنَ رَوَاكِدَ عَلَى ظَهْرِهِ إِنَّ فِي ذَلِكَ لَآيَاتٍ

لِّكُلِّ صَبَّارٍ شَكُورٍ }

الشوري 33

# **Dedication**

To Those Who Gave Us Their Time, Love and Care Our Parents,  
Our teachers and every one inside Sudan University

To Our New Family 31 Batch

# ACKNOWLEDGMENT

All praise and thanks is due to Almighty ALLAH. I wish to thank Him for that entire blessing He has gifted us with, though He can never be praised or thanked enough.

I am heartily thankful to my supervisor, Dr. Khams Arbish, whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the project.

Special thanks also to all my graduate friends, especially to my partners, Mohammed Hassan for sharing the literature, invaluable assistance and team spirit, Mohammed S for His precious and valuable effort which were not but an impressive pillar for presenting the project in this proper appearance.

Deepest gratitude are also due to my respectful eng .Badr Aldin Add Alrahmman at Electrical Loss Reduction Project and eng. Huzifa at the Jabra Distribution Centre; whom their knowledge, assistance and kindness facilitate a lot of difficulties facing me in this project.

I would also like to convey thanks to the Faculty for providing the financial means and technical facilities.

## ABSTRACT

Power losses in electrical system referred to the difference between the magnitude of power generated and power consumed. The need for reducing electrical power losses either in transmission or distribution is came from the high cost that the utility incurs. There are two causes of distribution losses, technical and nontechnical. The causes of each one of them were investigated in this project and corresponding solutions to reduce them were adopted.

In this project study have been done about the distribution transformer and cables losses with power factor effect in these losses by measure the transformer no-load and short circuit test data.

This project objectives successfully met by obtaining the major causes of distribution losses in Sudan and finding out the optimum solutions.

## المستخلص

خسائر الطاقة في المنظومة الكهربائية ترجع إلى الفرق بين مقدار الطاقة المولدة في محطات التوليد والطاقة المستهلكة من قبل الزبائن وتظهر الحاجة إلى تقليل فقودات الطاقة الكهربائية في شبكات النقل والتوزيع بسبب التكلفة العالية التي تتكبدها المصلحة المولدة للكهرباء بسبب وجود هذه الفقودات هنالك نوعان من انواع الفقودات الكهربائية تظهر في شبكات التوزيع وهي الفقودات الفنية والفقودات غير الفنية (التجارية).

في هذا المشروع تمت دراسة مفقودات المحول بإجراء اختبار القصر واختبار اللا حمل لتحديد قيمة المفقودات وتأثير تحسين معامل القدرة عليها كما تم حساب قيمة مفقودات الكيبل المستخدم في جانب الجهد المنخفض

تم التوصل لأهداف المشروع المتمثلة في معرفة أسباب الفقودات الكهربائية في شبكات التوزيع وإيجاد الحلول المثالية للحد منها

# TABLES OF CONTENTS

	Page No.
الاية	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
مستخلص	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	viii
LIST OF TABLES	ix
LIST OF ABBREVIATIONS	ix

## CHAPTER ONE

### INTRODUCTION

Overview	1
Problem Statement	2
Objectives	3
Methodology	3
Project Outline	3

## **CHABTER TWO**

### **OVERVIEW**

2.1 Introduction	4
2.2 sub transmission system	7
2.3 Distribution Substation	10
2.4 Distribution Transformer	13
2.4.1 Transformer Losses	17
2.5 Overhead lines	18
2.6 Cables	21
2.7 Power factor correction	22

## **CHABTER THREE**

### **METHODOLOGY**

3.1 Introduction	23
3.2 Side visit	23
3.3 Transformer losses	23
3.3.1 No load losses	23
3.3.1.1 Hysteresis losses	23
3.3.1.2 Eddy current losses	24
3.3.1.3 Dielectric losses	25
3.3.2 load losses	25
3.3.3 Copper losses	25
3.4 Power Factor correction	26
3.5 Cables Losses	27

# CHAPTER FOUR

## Result

4.1 Introduction	28
4.2 Case Study	28
4.3 Power Factor Correction Calculation:	28
4.3 Cable loss calculations	30
4.4 Result Discussion	32

# CHAPTER FIVE

## Conclusion

5.1 Conclusion	33
5.2 Recommendation	33
5.3 References	34
Appendix	35

## LIST OF FIGURE

FIGURE NO.	TITLE	PAGE NO.
2.1	Shows Overview of the electricity infrastructure	7
2.2	Shows Radial Subtransmission systems	9
2.3	Shows Radial Subtransmission systems	10
2.4	Shows Rural distribution substation	12
2.5	Shows suburban distribution substation	13
2.6	Shows Urban distribution substation	22
2.7	Shows overhead distribution structures	24
2.8	Shows underground cable structure	35
5.1	Transformer's case study preamble	

## LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
2.1	Standard distribution transformers size	16
2.2	Insulation Levels for Distribution Transformers	16
2.3	Thought Fault Capability of Distribution Transformer	18
2.4	Minimum Properties of Conductor Wire Material	23
4.1	shows the cable loss before power factor correction	32
4.2	shows the cable loss after power factor correction	33
4.3	Transformer Short Circuit and No Load Test data	33
5.1	Cable Data	35

## LIST OF APREVIATIONS

I	Line Current
R	Resistance
P	Real Power
L	Cable Length