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Sudan University of Science & Technology

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Investigation and Analysis of Technical Losses in Distribution Network-(case study , Khalil Osman substation)

دراسة و تحليل المفاقيد التقنية في شبكة التوزيع- (دراسة لمحطة خليل عثمان)

A Thesis Submitted in a Partial Fulfillment for the Degree of Master of Science in Electrical Power Engineering

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DEDICATION

I dedicate this research to my Mather,

My Father,

and my Brother

For their unstinting support

ACKNOWLEDGMENTS

First and foremost thanks to Allah. Without his help and blessing I would not have been able to finish this work.

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ABSTRACT

Losses consideration is a key aspect of power system design and planning and has been an area of active research for some time now . Losses studies are performed to minimize the energy losses of an electric power grid. In many cases, losses studies will include a site visit to assess factors such as: type of load, capacitor condition at load location, confirm information's parameters of network such as: line length , conductors size, type of conductors , transformer capacities , voltage drop and line loading. And following the site visit a comprehensive report is submitted discussing the finding and suggestion ways to minimize overall losses of the system.

This thesis presents basic concepts of power system technical losses assessment techniques using NEPLAN power analysis software in distribution system.

الـمـلـخص

حسابات الفقد الكهربائي هو احد الجوانب الرئيسية لتخطيط و تصميم نظم القوى الكهربائية. و اصبح البحث في الفقد من مجالات البحث النشطة الان . تجري دراسات الفقد لتحقيق اقل قدر من الفقد في الشبكة . و في كثير من الحالات ، دراسة الفقد تشمل زيارة للشبكة لتقييم بعض العوامل مثل : نوعية الاحمال، حالة المكثفات في مواقع الاحمال ، تأكيد معلومات بيانات الشبكة مثل اطوال الخطوط ، مساحة مقاطع الكوابل ، نوع الكوابل ، سعة المحولات ، هبوط الجهد و تحميل الخطوط ، و بعد زيارة المواقع يعد تقرير شامل يقدم فيه نتائج بحثه و اقتراح الطرق المناسبة لتقليل الفقد الكهربائي واضعا في الاعتبار النواحي الاقتصادية.

قدم هذا البحث المفاهيم الاساسية لحسابات الفقد التقني باستخدام برنامج تحليل الشبكة نيبلان و العوامل المؤثرة فيها . تركزت دراستنا في نظام شبكة التوزيع و مقارنتها بالمواصفات العالمية (IEEE)

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List OF ABBREVIATIONS

khalil osman 1 izb l4	Name of the incoming feeder connecting between Alizba substation to Khalil Osman distribution substation
TR1	Transformer (1) in khalil Osman (33/11)
TR2	Transformer (2) in khalil Osman (33/11)
(Z605 KUKU L10)	Name of the incoming feeder connecting between Kuku substation to Khalil Osman distribution substation
Neplan	power system analysis tool for applications in transmission distribution, generation, industrial, renewable energy systems, Smart Grid
ID	ID number of element (generated by NEPLAN)
ID number of element	(generated by NEPLAN) : The name of element given by Neplan user for each ID
P	Active energy
Q	Reactive energy
SEDC	Sudanese Electrical Distribution Company
R(1)	Positive sequence resistance in Ohm/km or see Units.
R(0)	Zero sequence resistance in Ohm/km or see Units.
X(1)	Positive sequence reactance in Ohm/km or see Units
X(0)	Zero sequence reactance in Ohm/km or see Units
C(1)	Positive sequence capacitance in µF/km or see Units
C(0)	Zero sequence capacitance in µF/km or see Units
G(1)	Positive sequence conductance in µS/km or see Units
Ir max	Maximum rated current in A, highest, medium, lowest value. The loading of the line can be calculated according to all three values (see Load Flow calculation parameters).
Un1	Nominal voltage of the primary winding node (just for information).
Un2	Nominal voltage of the secondary winding node (just for information).
Ur1, Ur2	Rated voltage of the primary and secondary winding, based on the transformation ratio.
Sr	Rated power in MVA.
Sk" max, min	Maximum and minimum initial symmetrical short-circuit power in MVA (Sk" = SQRT(3)·Un·Ik").
Ik" max, min	Maximum and minimum initial symmetrical short-circuit currents in kA (Ik" = Sk"/(SQRT(3)·Un)).
R(1)/X(1) max, min	Maximum and minimum ratio of positive sequence resistance of Network Feeder to its positive sequence reactance
Z(0)/Z(1) max, min	Maximum and minimum ratio of zero sequence impedance to its

	positive sequence impedance
R(0)/X(0) max, min	Maximum and minimum ratio of zero sequence resistance of Network
	Feeder to its zero sequence reactance.
C	Capacitance of network in µF
LF-Type	Node type for Load Flow calculation

ORIGINALITY DECLARATION

The author declares that thesis submitted is research works and results obtained by the author under the guidance of his supervisor. As far as the author known, this thesis does not contain any research result published or written by other individual or group unless the content has been indicated in the thesis clearly . The author is fully aware of the legal consequences of this statement to me.

Thesis Author Signature :

Date :