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Palestine Polytechnic University
Collage of Engineering and Technology
Electrical Engineering department
Electrical Power Engineering

Graduation Project

Power Flow Study and Analysis
For Em Al-Daliah Medium Voltage Substation

Project Team
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Hebron-Palestine

May-2015

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By the guidance of supervisor, this project delivered to department of electrical engineering, to be as a partial fulfillment of the requirement of the department for the Bachelor degree of Electrical Power Engineering.

Supervisors Signature

Testing Committee Signature

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Chair of the Department Signature

May-2015

Abstract:

This project is Studying and Analyzing the electrical power flow for a specific substation " Em Al-Daliah Substation "(33Kv / 11Kv) in electrical company at Hebron city, these studies depend on real data collected from Hebron electric power company-HEPCO and put this Data in ETAP Program.

Then make Estimating of Substation loads for 20 years comes, and how the Substation become from its operation and service which is offer to customers.

The aim of this Project is the using the ETAP Program, which allow us to Study and Analyze the Existing Substation by using the Simulation Property of ETAP.

After Making Study the Network, we found the problems if existed in network like if there a overloaded conductors and high voltage drop and if there is an overloaded transformers, we found that the Power factor is higher than 0.9.

ملخص

يهدف هذا المشروع إلى دراسة وتحليل تدفق الطاقة الكهربائية في محطة فرعية من محطات مدينة الخليل ذات الجهد المتوسط وهي محطة "ام الدالية"(٣٣كيلوفولت / ١١كيلوفولت)، حيث تعتمد هذه الدراسات على بيانات حقيقة تم أخذها من شركة كهرباء الخليل "HEPCO" و وضع البيانات وادخالها على برنامج "ETAP".

ثم عمل تقدير لحمل المحطة خلال ٢٠ سنة قادمة، و كيف ستصبح المحطة من ناحية العمل والتشغيل والخدمات التي توفرها للمستهلكين.

الهدف من هذا المشروع هو استخدام برنامج "ETAP"، والذي يسمح لنا بدراسة وتحليل المحطة الفرعية الموجودة باستخدام خاصية المحاكاة للنظام الكهربائي.

بعد إجراء كافة الدراسات على هذه المحطة ، بالإمكان وجود مشاكل موجودة فعليا ، مثل : وجود موصلات عليها أحمال كهربائية عالية "Overloaded" و كذلك الهبوط العالي في الجهد و محولات حملها الكهربائي عالي جداً، ولقد وجدنا في هذه الدراسة أن معامل القدرة لدى المحطة أعلى من ٠.٩ .

Acknowledgement

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Eng. Ayman Hassona

Our home land Palestine

Our Fathers and Mothers

Our Brothers and Sisters

To Everyone how love Science

LIST OF CONTENTS

Chapter One: Introduction

Chapter Two: Electric Power Concepts

Chapter Three: Hebron City Networks(Substations)

Chapter Four : Hebron City Networks(Substations) after 20 Years

Chapter Five : SCADA System

Chapter Six : Conclusions

LIST OF FIGURES

LIST OF TABLES

LIST OF EQUATIONS

Chapter One

Introduction

1.1 Overview.

1.2 Project Description.

1.3 Project Importance.

1.4 Project Methodology.

1.5 Project Framework.

1.6 Description Of Project Parts.

Chapter One

Introduction

1.1 Overview:

The main idea of this project is studying the medium voltage electric power substation network of Hebron city by using the ETAP program, then making the essential developments and improvements on the network such as reducing the losses , improving power factor , achieving the network stability and increasing its efficiency.

1.2 Project General Description:

As we know, in general, most of the electric power networks in many places in the world suffer from many problems such as low power factor, high losses, voltage drop and many other problems. Usual, in our country these problems are solved by using traditional and uneconomical methods without any calculations of cables or transformers or any device in system, and these methods need long time and hard work in order to solve some of the previous problems.

But this project solves these problems by using a new technique that is the ETAP program, and in this project the problems that found in Hebron city electric power network will solved, specially the medium voltage network problems.

This project adopts investigation and analysis and development of Em al-Daliah Substation in Hebron city electric power network (medium voltage) after plotting it on the ETAP program, the program capabilities and properties allow us to study the network from many sides, show the status of the network components , and solve the existing problems and weakness in the network and develop its operation.

1.3 Project Importance:

This project uses the ETAP program in solving the network problems, but it is not the first project in Palestine polytechnic University that concerns with electric power field.

We know that Hebron city is considered as one of the most important cities specially in west bank, and generally in Palestine industrially and commercially, also the largest consumed energy is consumed by the industrial customers, so the electric power that is fed to these fields by the network must be in Suitable level and in a continuous pattern.

1.4 Project Methodology:

1) Collecting Data and information from HEPCO.

2) Plotting the existing network with its actual values on the ETAP.

3) Studying the network and Specify its problems.

4) Solving the network problems and developing its operation.

5) Estimating the load during 20 years come.

6) Studying the network how it become after 20 years and Specify its problems.

7) Solving the network problems and improving its operation.

8) Monitoring and controlling the network by using SCADA system.

1.5 Project Framework:

The scope of this project is studying the medium voltage part of Hebron city electric power network . And there are many aims for this project that can be summarized as follow:

1) Reducing the network losses and voltage drop.

2) Improving the network power factor.

1.6 Description Of Project Parts.

This Project contains many Chapters and various appendices , and these chapters can be summarized as follow :

Chapter One (Introduction) :

It gives a general idea about the project and its importance.

Chapter Two (Electrical Power Concept):

This Chapter explains many basic electrical power concepts, which required to understand the project.

Chapter Three (Hebron City Network) :

This Chapter describe the status conditions of the network and shows its historical development electrically, and gives some important statistics about it.

Chapter Four (Hebron City Network After 20 Years) :

This Chapter describe the network status after 20 years and how it's become.

Chapter Five (SCADA System) :

This Chapter describe the SCADA System and how it deals with this project.

Chapter Six (Conclusions) :

This Chapter include the conclusions about the project.

Chapter Two

Electric Power Concepts

Chapter Two

Electric Power Concepts

2.1 Representation of an Electric Power system:

Any electric power system can be represented as a one- line diagram , and every element of this system has its own graphical symbol which is known as the symbolic representation of element of power system Figure (2.1)[1].

To understand the one-line diagram representation of power systems, consider the system in Figure (2.2)[1], using generating stations interconnected by a transmission line. From even such an elementary network as this , it is easy to imagine the confusion that would result in making diagrams showing all three phases. The ratings of all generators , transformers and loads are specified and the voltage levels at the buses are assumed to be known.

The advantage of one-line representation is rather obvious in that a complicated system can be represented simply. A concerted effort is made to keep the currents equal in each phase. Consequently, on a Balanced system , one phase can represent all three by proper mathematical treatment. A further advantage of the one-line diagram is in the power flow studies.

The one-line diagram rather become second nature to power system engineers as they attempt to visualize a widespread complex networks.

Single Line Diagram Symbols

(Assume Balanced Operation)

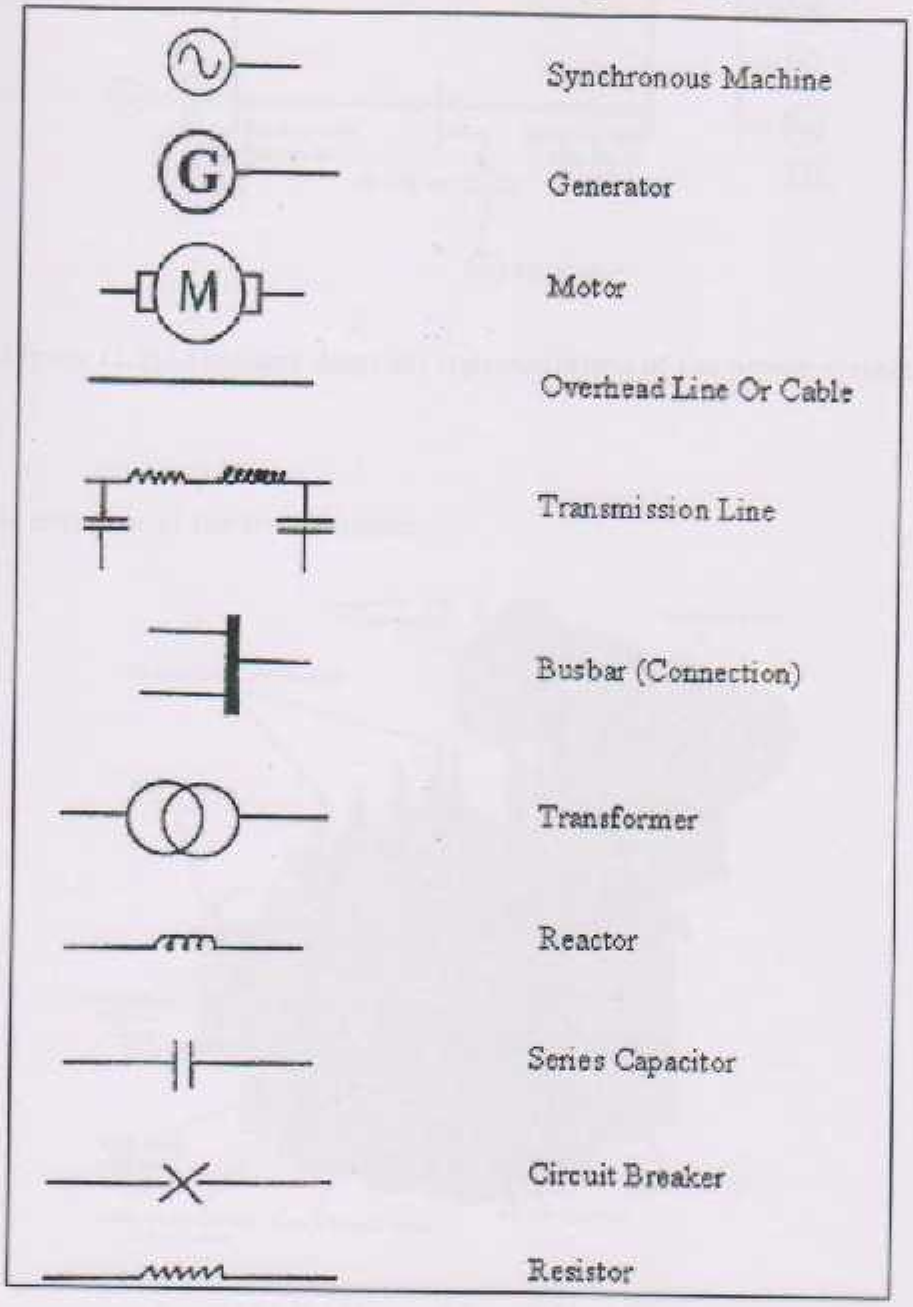


Figure (2.1) : Symbolic representation of elements of power system.

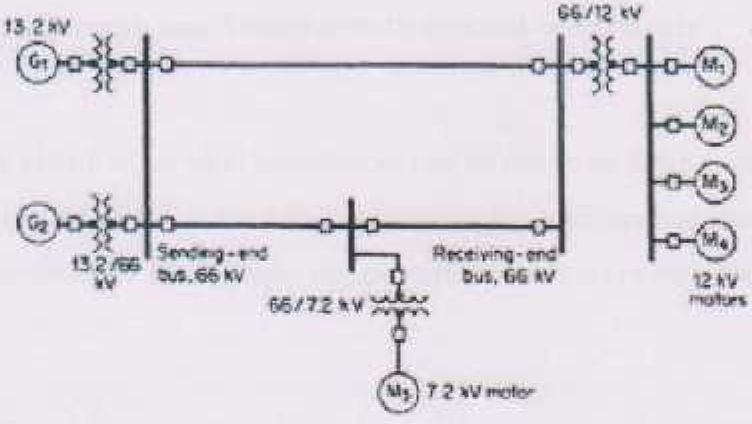


Figure (2.2) : One-line diagram representation of the power system.

2.2 An overview of the transformers:

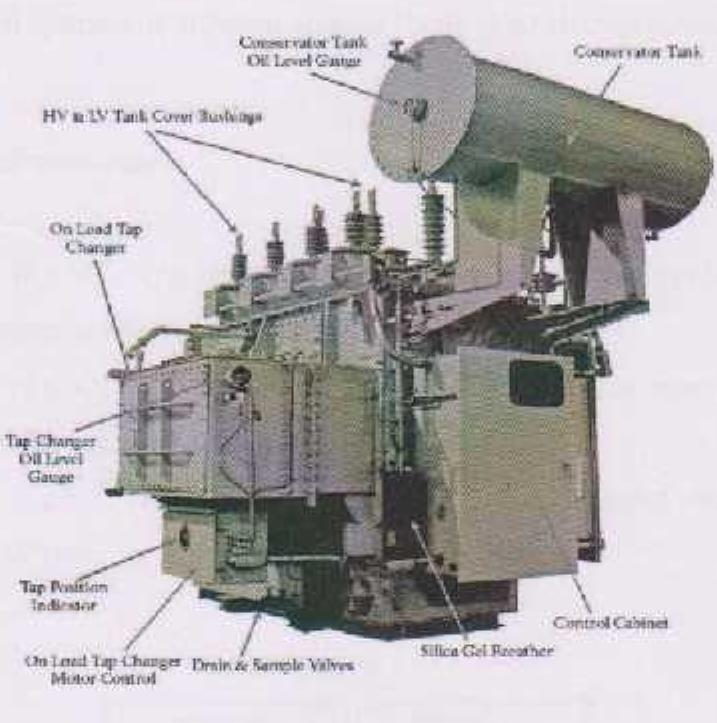


Figure (2.3) : General form of transformer.

A transformer is an electromagnetic device two or more mutually coupled windings. The main parts of a transformer are: iron core, magnetic circuit, high-voltage (HV) and low-voltage (LV) sides, or multiple secondary, windings, and a tank for liquid-immersed transformers and an enclosure for dry-type transformers.

2.2.1 Voltage, Current, and Transformations-ideal transformer :

The equivalent circuit of an ideal transformer can be drawn as follows in Figure(2.4). where the equivalent circuit is used for determining the performance characteristics of the transformer which is The voltage, current transformations in equation(2.1)[2]:

$$\frac{U2}{U1}=\frac{N2}{N1}=a \qquad \text{And} \qquad \frac{I1}{I2}=\frac{N2}{N1}=a \quad \text{......... Equation(2.1)}$$

Where the subscript 1 and 2 corresponds to the primary and secondary sides respectively. This property of a transformer enables us to interconnect transmission and distribution systems of different voltage levels in an electric power system.

The Ideal transformer cases:

- If a < 1: The output voltage is greater than the input voltage and the transformer is called a **step-up** transformer.
- If a > 1: The output voltage is smaller than the input voltage and the transformer is called a **step-down** transformer.
- If a = 1: The output voltage is the same as the input voltage.

  Where: a : turns ratio

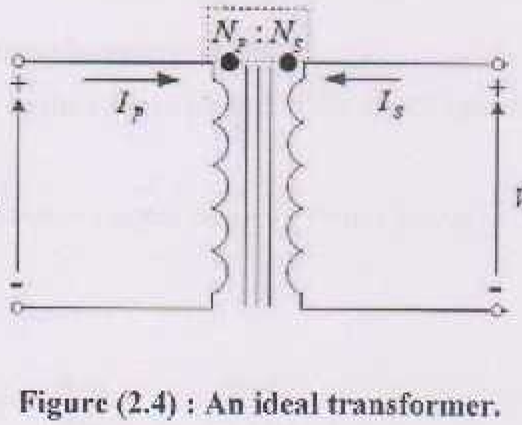


Figure (2.4) : An ideal transformer.

2.2.2 Nonideal Transformer and its Equivalent Circuit:

A nonideal (actual) transformer differs from ideal transformer in that the transformer has eddy currents (core) and hysteresis losses, and has resistive losses (I^2R) losses in its primary and secondary windings. Furthermore, the core of nonideal transformer is not perfectly permeable, and the transformer core requires a finite mmf for its magnetization. Also , not all fluxes link with primary and the secondary windings simultaneously in a nonideal transformer because of leakage.

2.2.3 Transformer Required and Calculated Data:

When we insert a transformer into case to the ETAP, the following parameters of the transformer are needed:

1) Transformer resistance.
2) Transformer reactance.
3) Transformer X/R ratio.
4) Transformer Primary and Secondary Voltages.
5) Transformer apparent power kVA or MVA.
6) we must specify if transformer status is ON or OFF.

2.2.4 Efficiency of transformer:

Efficiency is defined as the ratio of output to the input, equation(2.3)[2] for efficacy:

$$Input\ power = Output\ power + Power\ losses \ldots\ldots \text{Equation(2.2)}$$

$$Efficiency = \frac{Pout}{Pin} = \frac{Pout}{Pout + Plosses} \ldots\ldots\ldots\ldots\ldots\ldots \text{Equation(2.3)}$$

2.3 Transmission Lines:

The Transmission Lines are classified as shirt, medium and long lines. In short line, the shunt effects are negligible. Often this approximation is valid for lines up to 80 km long.

In the medium line, the shunt capacitance are lumped at a few predetermined locations along the line. A medium line may be anywhere between 80 km to 240 km in length. Lines longer than 240 km are considered as long lines which are represented by distributed parameters.

2.3.1 Transmission Line Resistance:

The first transmission line parameter is the resistance of the conductor. Resistance is the cause of I^2R loss in the line and also result in IR voltage drop.

The DC-resistance of a conductor of length L and cross section area A is given in equation (2.4)[1]:

$$R = \rho \frac{L}{A} \quad \text{.................................. Equation(2.4)}$$

Where ρ is the resistivity in Ω.m

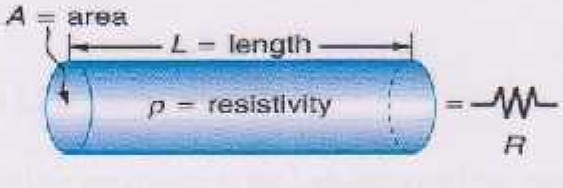


Figure (2.5) : transmission line resistance.

The dc resistance is affected by the temperature of the conductor, linearly increasing by temperature, shown in equation (2.5)[1]:

$$R2 = R1(1 + \alpha\,[T2 - T1]\,) \quad \text{................Equation (2.5)}$$

Where R2 and R1 is the resistances at temperatures T1 and T2 respectively. And α is the temperature coefficient of resistance. The resistivity and temperature coefficient of certain materials are given in the next table (2.1)[6]:

Table 2.1 : Resistivity and Temperature coefficient (at 20 C)

Material	Resistivity, ρ ($\Omega \cdot m$)	Temperature Coefficient, α $(C^\circ)^{-1}$
Conductors		
Silver	1.59×10^{-8}	0.0061
Copper	1.68×10^{-8}	0.0068
Gold	2.44×10^{-8}	0.0034
Aluminum	2.65×10^{-8}	0.00429
Tungsten	5.6×10^{-8}	0.0045
Iron	9.71×10^{-8}	0.00651
Platinum	10.6×10^{-8}	0.003927
Mercury	98×10^{-8}	0.0009
Nichrome (Ni, Fe, Cr alloy)	100×10^{-8}	0.0004
Semiconductors†		
Carbon (graphite)	$(3–60) \times 10^{-5}$	−0.0005
Germanium	$(1–500) \times 10^{-3}$	−0.05
Silicon	0 .1–60	−0.07
Insulators		
Glass	$10^{9} - 10^{12}$	
Hard rubber	$10^{13} - 10^{15}$	

†Values depend strongly on the presence of even slight amounts of impurities.

2.3.2 Transmission Line Inductance:

The next transmission line parameter is the inductance of the conductor. For three phase line, having equilaterally spaced conductors, the per phase inductance is given in equation (2.6)[1] :

$$L = 4*10^{-7} ln[\frac{D}{r}] \text{ H/m} \text{......................Equation (2.6)}$$

Where : D : distance between the centers of conductors.

r' : Radius of the conductors.

In practice, the three conductors of three phase line are seldom equilaterally spaced. Thus the spacing D is replaced by the equivalent spacing D_{eq} given in equation (2.7)[1] :

$$D_{eq} = \sqrt[3]{D_{12}D_{23}D_{13}} \text{ ....Equation (2.7)}$$

Where :

D12 : Distance between phase 1 and phase 2

D13 : Distance between phase 1 and phase 3

D23 : Distance between phase 2 and phase 3

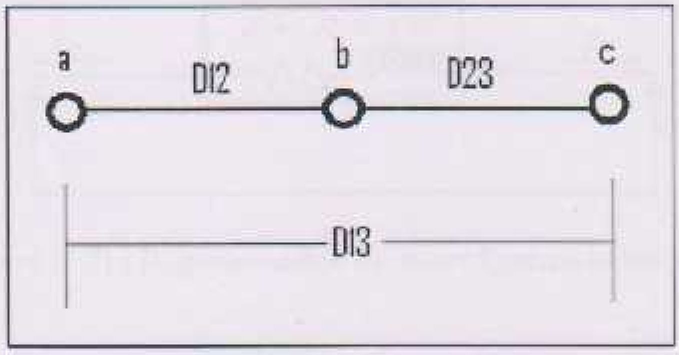


Figure (2.6) : phases distances in transmission line.

X_L will increase if r constant and D increase.

X_L will decrease if r increase and D constant.

2.3.3 Transmission Line Capacitance:

The third transmission line parameter is the shunt Capacitance of the conductor.

For three phase line, having equilaterally spaced conductors, the per phase capacitance is given in equation(2.8)[1]:

$$C = \frac{2\pi\varepsilon_0}{\ln(\frac{D}{r})} \text{ ....Equation (2.8)}$$

Where ε_0 is the permittivity of free space.

Xc will decrease if r constant and D increase.

Xc will increase if r increase and D constant.

2.4 Transmission Lines Representation:

2.4.1 short Transmission Line:

For a transmission line up to 80 km long, shunt effects of capacitance is negligible. And it represented by the lumped parameters R and L as shown in Figure(2.8)[1]:

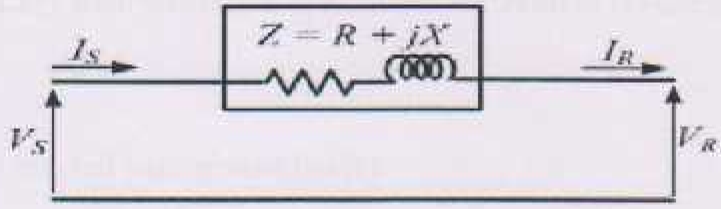


Figure (2.7) : Representation of short Transmission Line

This line has two ends : the Sending and at the generator or at the Power-Transformer and the Receiving end at the load end.

Transmission efficiency is given in equation (2.9)[1] :

$$\%efficiency\,(\eta) = \frac{Power\ at\ reciving\ end}{Power\ at\ sending\ end} * 100\% \quad \text{.................Equation (2.9)}$$

Transmission Regulation :

$$\%VR = \frac{|VR_{NL}| - |VR_{FL}|}{|VR_{FL}|} * 100\% \quad \text{.........................Equation (2.10)}$$

2.4.2 Medium Transmission Line:

Its considered up to 240 km long, where the shunt effects of capacitance is not negligible.

There is two representation of medium-length line :

1) Nominal Π circuit of transmission line[1]:

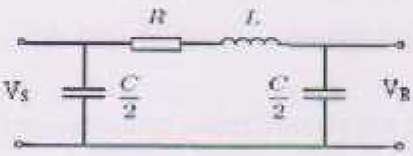


Figure (2.8) : Representation of Nominal Π circuit of transmission line

2) Nominal T circuit of transmission line[1]:

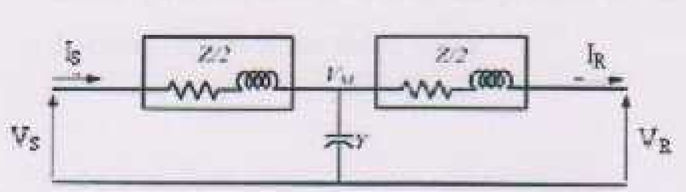


Figure (2.9) : Representation of Nominal T circuit of transmission line

2.4.3 The Long Transmission Line [1]:

Its considered to be over than 240 km long. The parameters of this line is distributed over the entire length of line. As shown in Figure(2.10) :

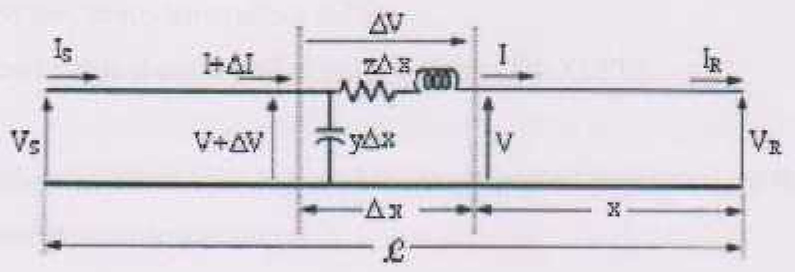


Figure (2.10) : Representation of long transmission line

2.5 Difference between cables and overhead line[6]:

The electrical technical differences between the underground cable and transmission line can be concluded as follows:

1) The cable impedance is less than line impedance, The X/R ratio of cable is much lower than that of line, The series inductance of cable is 30-50% lower than that of line.

2) The cable zero-sequence impedance is not constant and depends on many factors, The cable zero-sequence impedance angle is less than line zero-sequence impedance angle, The shunt capacitance of cable is 30-40 times higher than that of line.

3) The magnetic coupling exists among phase currents in cables, High steady-state charging current, High transient charging and discharging currents caused by the process of energization and de-energization when faults occur.

2.6 Cable Insulation

A very important parameter in cable selection is the insulation type. Insulation selection should be based on service life, dielectric characteristics, resistance to flame, mechanical strength and flexibility, temperature capability, moisture resistance, and the type of location where the cable is to be installed. Common insulation types applicable to medium-voltage cables are[8]:

a) Cross-linked polyethylene (XLPE).
b) Ethylene propylene rubber (EPR).
c) Tree-retardant cross-linked polyethylene (TR-XLPE).

These insulation materials have replaced the impregnated-paper designs that may still be found in some older installations.

2.7 Loads:

Load is any device that utilizes electric power , All loads can be classified as Resistive, Inductive, Capacitive or some combination of them. Load may be time variant.

The composite load on a system has a predominant resistive component and small net inductive component. Inductive loads like induction motors are far more prevalent than capacitive load. Consequently, to keep the resultant of current as small as possible, capacitors are usually installed in quantities adequate to balance most of inductive current.

2.8 Capacitors:

The main aim of the capacitor in the power systems is to reduce the inductive current "Power Factor Correction". Capacitors can be groped into either transmission or distribution classes. In either case, they should be installed electrically at near to the load as possible for maximum effectiveness.

When applied properly, capacitors balance out most of inductive component of current to the load, leaving essentially a unity Power Factor Load. The result is to reduce the size of the conductor required to serve a given load and a reduction of I^2R losses.

2.9 Power Flow Study:

Power Flow studies "Load Flow studies", which is extremely important in evaluating the operation of power systems, controlling them and planning for future expansions.

Basically, a power flow study yields the real and reactive power and phasor voltage at each bus on the system, although a wealth of information is available from the print out of a digital computer solution of typical power flow conducted by a power company.

As a consequence of a power flow study, we can optimize the system operation with regard to system losses and load distribution. The effect of temporary loss of generator capacity or transmission circuits can also be investigated via a power flow study.

The principle of power flow study are straight forward, a realistic study relating to a power system can be carried out only with digital computer.

Numerical computation are carried out in a systematic manner by an iterative procedure. Two of the commonly used numerical methods are the Gauss-Seidel method and the Newton-Rapson method[1][9].

Common Load Flow using Newton Raphson Technique :

Gauss Seidel was the first popular load flow method, then Newton Raphson was used. In certain circumstances Newton Raphson gives a greater assurance of convergence and is also economical in computer time.

Newton Raphson solves the polar form of the power flow equations until the ΔP and ΔQ mismatches at all buses fall within specified tolerances.

The basis for the Newton Raphson method is a Taylor's series expansion for a function of two or more variables.

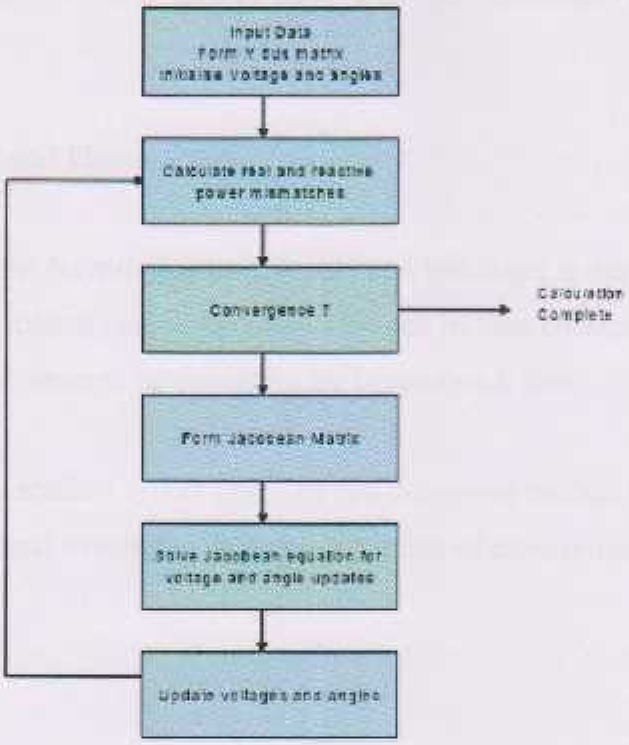
The number of iterations required is practically independent of the number of buses in the network to be studied. However, computing elements of the Jacobean is time consuming.

Newton Raphson has a much longer time period per iteration, but requires many less iterations than the Gauss Seidel technique (4 is typical).

Gauss Seidel requires at least 30 iterations and the number increases with the size of the network being studied.

Acceleration factors can be used for Newton Raphson as well.

Figure(2.11)[9] is a flow chart showing how the Newton Raphson technique is applied to load flow problems



Figure(2.11): Newton Raphson technique flow chart.

The Jacobean is re – calculated and inverted after each iteration, which makes it computationally intensive.

The process is often started with what is called a flat start, this assumes that all voltages are 1 per unit and that all angles are zero.

The key equations are:

$$P_i = \sum_{k=1}^{k=n} \left[V_i V_k \left(g_{ik} \cos\theta_{ik} + b_{ik} \sin\theta_{ik} \right) \right] \quad \text{.....................Equation (2.11)}$$

$$Q_i = \sum_{k=1}^{k=n} \left[V_i V_k \left(g_{ik} \sin\theta_{ik} - b_{ik} \cos\theta_{ik} \right) \right] \quad \text{.....................Equation (2.12)}$$

$$Y = \frac{1}{Z} = \frac{1}{R + jX} = G + jB \quad \text{....................................Equation (2.13)}$$

Input Data Form Y bus matrix Initialize Voltage and angles Calculate real and reactive power mismatches Convergence ? Form Jacobean Matrix Solve Jacobean equation for voltage and angle updates Update voltages and angles Calculation Complete.

Fast Decoupled Load Flow:

The draw back of the Newton Raphson Load Flow technique is that it requires the Jacobean to be calculated at each iteration. This can be time consuming for large systems. This is the same as recalculating the tangent each time.

The fast decoupled method avoids this. The fast decoupled method simply uses the same tangent over and over again. It makes a number of assumptions to simplify the computational task.

Assumptions :

a) It ignores the M and N terms in the Jacobean as it deems them insignificant. It assumes that the X/R ratio is very large and therefore P and Q can be decoupled completely. M refers to Q and angle and N refers to P and V.
b) It assumes that the angular differences between the buses are small.
c) In this case the Jacobean is constant and is made up of elements of the Y bus matrix.
d) Bik many times larger than Gik.
e) Reactive power injected into any bus is much less than the reactive power which would flow if all lines from that bus were shorted to earth.

There are potential problems with this algorithm if $R > X$. It requires more iterations than the Newton Raphson technique but is much quicker to converge.

Therefore the Fast decoupled load flow technique may be more appropriate for studies of large portions of transmission network.

Each bus k is categorized into one of the following three bus types:

1. Swing bus (Slack bus) : There is only one swing bus, the swing bus is a reference bus for which $V_1 \angle \delta_1$, typically $1.0 \angle 0$ per unit.

2. Load (PQ) bus : P_k and Q_k are input data. The power-flow program computes V_k and δ_k. Most buses in a typical power-flow program are load buses.

3. Voltage controlled (PV) bus : P_k and V_k are input data. The power-flow program computes Q_k and δ_k [9].

The Newton-Raphson load flow technique is very long and complicated way, and to solve this problem, we used ETAP-Program, which acceptable for 400,000 busbars And it shows the results easily and quickly without any problems.

2.10 Fault Analysis:

Under normal conditions, a power system operate as a balanced three phase ac system. A significant departure from this condition is often caused by a fault. A fault may occur on a power system for many reasons, some of the common ones being lightning, high winds, snow, ice, and frost. Fault give rise to abnormal operating conditions, usually excessive currents and voltages at certain points on the system. Protective equipment is used on the system to guard against abnormal conditions.

For example, the magnitudes of fault currents determine the interrupting capacity of the circuit breakers and settings of protective relays. Fault may occur within a generator or at the terminals of a transformer. However, in this project we will be mostly concerned with faults on transmission lines[1].

The balanced three phase short circuit is the least common but most sever fault, and therefore determines the ratings of the circuit breaker. Consequently , it is almost invariably included in fault studies. In summary, a fault study includes the following :

1) Determination of Maximum and Minimum three phase short circuit currents.

2) Determination of asymmetrical fault currents, as in single line-to-ground, double line- to- ground, line- to- line, and open circuit faults.

3) Determination of voltage levels at strategic points during the fault.

4) Determination of ratings of circuit breakers.

5) Investigating schemes of protecting relaying.

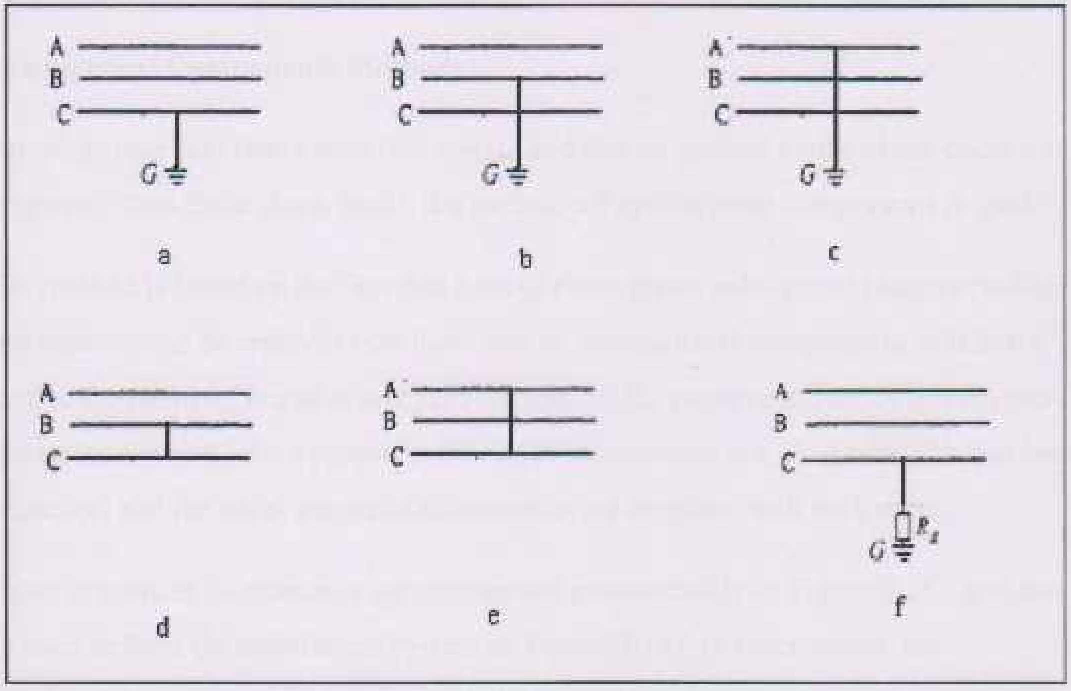


Figure 2.12 : various types of faults

Where :-

a : line-to-ground fault

b : double line-to-ground fault

c : three-phase-to-ground fault

d : double line fault(line-to-line fault)

e : balanced three-phase fault

f : line-to-ground through resistance

2.10.1 Balanced Three Phase Short Circuit:

Balanced three phase fault calculations is the easiest calculations because it can be carried out on a per phase basis so that only single phase equivalent circuit are used. The circuit constants are expressed in per unit, and all calculation are made on a per unit basis. In short circuit calculations, we often evaluate the short circuit MVA, which is equal to $(\sqrt{3}*V_L*I_F*10^6)$

where :

V_L is the nominal line voltage.

I_F is the fault current.

2.10.2 Unbalanced Faults:

Symmetrical Components Method:

For unsymmetrical faults such line-to-line and line-to-ground faults(which occur more frequently than three phase fault), the method of symmetrical components is used.

The method is based on the fact that a set of three-phase unbalanced phasors (voltage and current) can be resolved into three sets of symmetrical components, which are termed the positive, negative and zero sequences, the positive-sequence is a counter-clockwise rotation (abc-sequence), the negative-sequence is a clockwise rotation (acb-sequence) and the zero- sequence components are in-phase with each other.

These sequences components are represented geometrically in Figure(2.15), and can be used to form the unbalanced system of Figure(2.16). In other words, the unbalanced system can be resolved into its symmetrical components. In some books, the positive sequence component is represented by subscribe "1". The subscribe "2" and "0" are used for a negative and zero sequences respectively.[1]

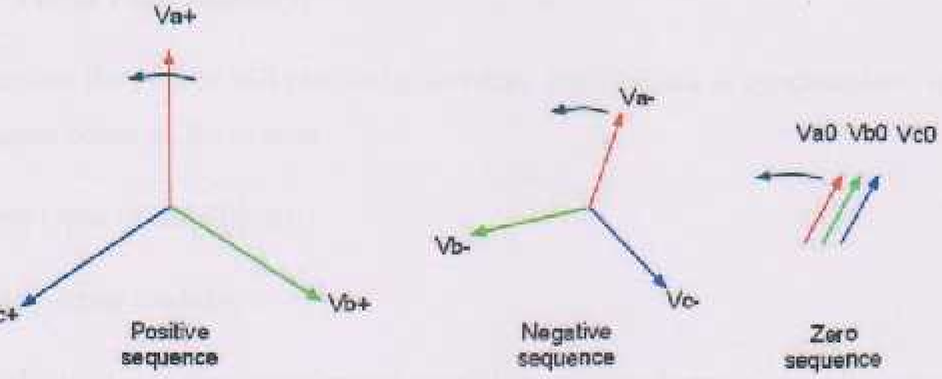


Figure 2.13 : positive and Negative and Zero Components.

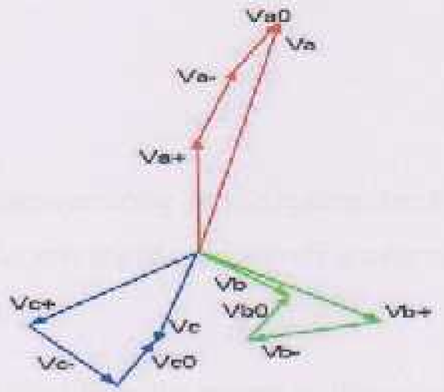


Figure 2.14 : Three-phase unbalanced system and its symmetrical components

2.11 Voltage Regulator:

To provide a constant voltage to customer, a voltage regulator is usually connected to the output side of step-down transformer.

It is a special type of 1:1 transformer with several discrete taps of a fractional percent each over-voltage range of 10%. A voltage sensing device and automatic control circuit will position the tap contacts automatically to compensate the low-side voltage for variation in transmission voltage.

In many cases the same effect is accomplished by incorporating the regulator and its control circuits into the step-down transformer, resulting in a combination device called a load tap changer(LTC).

2.12 Power Flow Stability:

Its mean that the system will remain in operating equilibrium, or synchronism, while disturbance occur on the system.

The three types of stability are :

1) Steady-State Stability:

Essentially relates to maximum power capability of a synchronous machine when the load on the machine is gradually increasing, until the machine pulls out of synchronism. The power angle characteristics of the cylindrical-rotor and salient-rotor machines help to obtain the steady-state stability limit.

2) Dynamic Stability:

Relates to small disturbances occurring on the system, there by producing oscillations. If these oscillations are of successively smaller amplitudes, the system is considered dynamically stable.

If the oscillations grow in amplitude, the system is dynamically unstable. The source of this type of instability is usually an interaction between control systems, and may be slow in becoming apparent. Times of the order of 10 to 30 sec are considered sufficient to assess the dynamic stability of the system.

3) Transient Stability:

Relates to sudden change of the load, introducing a large disturbance in the system. A large disturbance on the system causes rather large change in rotor speed, power angle, and power transfers.

The stability of this transient response is usually evident in less than 1sec for a generator close to disturbance.

Chapter Three

Hebron City Networks(Substations)

3.1 Introduction.

3.2 Description of the Existing system.

3.3 Assessment of the project.

Chapter Three

Hebron City Networks(Substations)

3.1 Introduction:

Hebron lies 35Km south of Jerusalem in among mountains in the heart of southern Palestine. The population of Hebron city is about 300,000 thus if include the surrounding towns and villages the population of the district becomes 770,000 citizen [4].

The total area of Hebron city is $30Km^2$ and the district is 1105 km^2. The areas served by the Municipality in terms of electric power is about 80 km^2.The electric power system and service are under the reasonability of Hebron Municipality since 1948.The Municipality has a flexibility in its mandate to generate, transmit and distribute electricity to different areas in the district including ; Hebron city , Farsh Al Hawa, Beit Ainon, Sinjer, Halhoul , Wadi Al Samen, Taphouh...etc. The estimated number of people served by the Municipality in regard to electricity is about 500,000 inhabitant [4].

In the early of 1973 the Municipality started to deliver the Israeli generated power through distribution network owned by the Municipality The electric power delivered increased from 24.5 MW in1995 to 46 MW in 2004 to 90MW in 2014 due to the normal modernization industrialization increase[4].

3.2 Description of the Excising system.

3.2.1 Entered Network

Hebron electricity company provide us with a single line diagram. Which contains cables and lines types and length, transformers locations and sizes. The representation of single line diagram is shown in **Appendix A**.

3.2.2 Loads Data

Hebron electricity company provide us with a tables contains the load currents , shown in **Appendix B**, which represent the actual current for each feeder.

3.2.3 Medium Voltage System :

Hebron Medium Voltage network is fed from seven main substations which are Alras Substation , Alfahs Substation, Alduhdah Substation, Alharayek Substation, Algarbiah Substation, Em Aldaliah Substation and alhosen Substation, and these Substations have a various range of apparent power (MVA) , and these Substations can be shown by the following table(3.1) [4]:

Table 3.1 :Main Substations

Substation	20 MVA	2 transformers of 10 MVA	33/11 kV
Substation	30 MVA	3 transformers of 10 MVA	33/11 kV
Substation	20 MVA	2 transformers of 10 MVA	33/11 kV
Substation	20 MVA	2 transformers of 10 MVA	33/11 kV
Substation	20 MVA	2 transformers of 10 MVA	33/11 kV
Substation	20 MVA	2 transformers of 10 MVA	33/11 kV
h Substation	20 MVA	2 transformers of 10 MVA	33/11 kV

Hebron electric power network has three tie points that connected it with the Israeli electrical Company ; as follow:

Abu Ayash Tie Point : serves Alras & Alduhdah & alhosen Substations.
Alhawooz Tie Point : serves Alharayek and Em Aldaliah Substation.
Alfahs Tie Point : serves Alfahs Substation.

<u>In this project, we take the Em Al-Daliah Substation as case Study</u>

3.2.4 Distribution Transformers :

Hebron electrical network includes a big number of transformers around 700 transformer, and these transformers have a wide range from (100-1000)kVA , and the transformers that fed by Em Al-daliah Substation can be shown as follow in Table(3.2)[4]:

Table 3.2 : Distribution Transformers in Em Al-Daliah Substation

Transformers Ratings Network (kVA) (11KV/0.4kv)	Number of Transformers
630	3
400	10
250	16
160	10

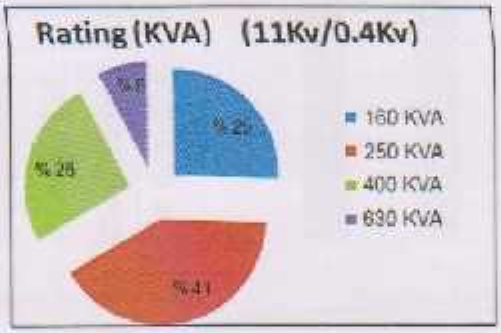


Figure (3.1) : Em Al-Daliah Substation Transformers Rating

The Figures in **Appendix C** show the Hebron city Substations and its Feeders.

Substation Feeders can be represented in Figure (3.2) & Figure (3.3), which contain:

Al-Akasha Feeder : contain 4 transformers.

Al-Saheb Feeder : contain 8 transformers.

Al-Polytechnic Feeder : contain 7 transformers.

Dstribution Feeder : contain 1 transformer.

Zallom Feeder : contain 9 transformers.

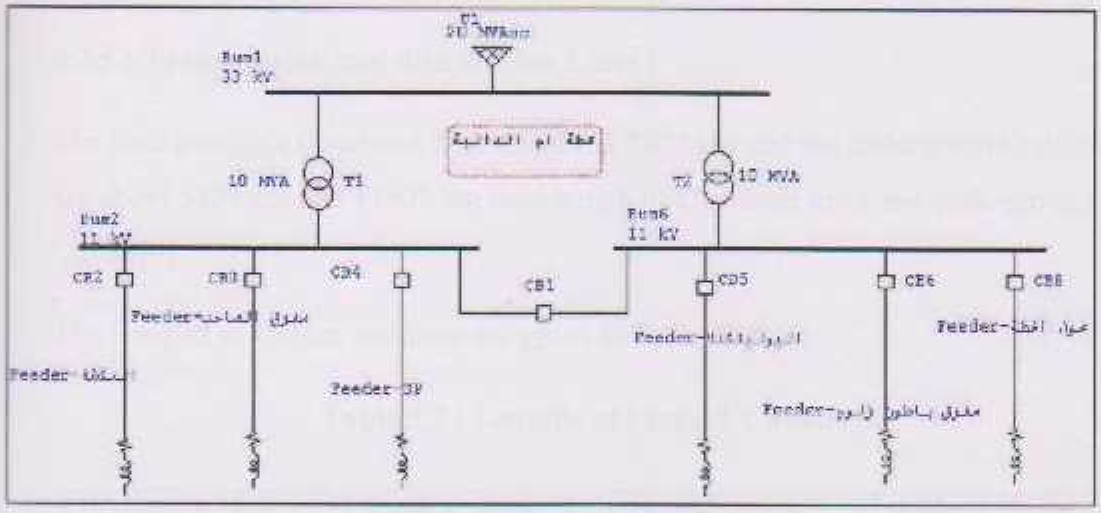
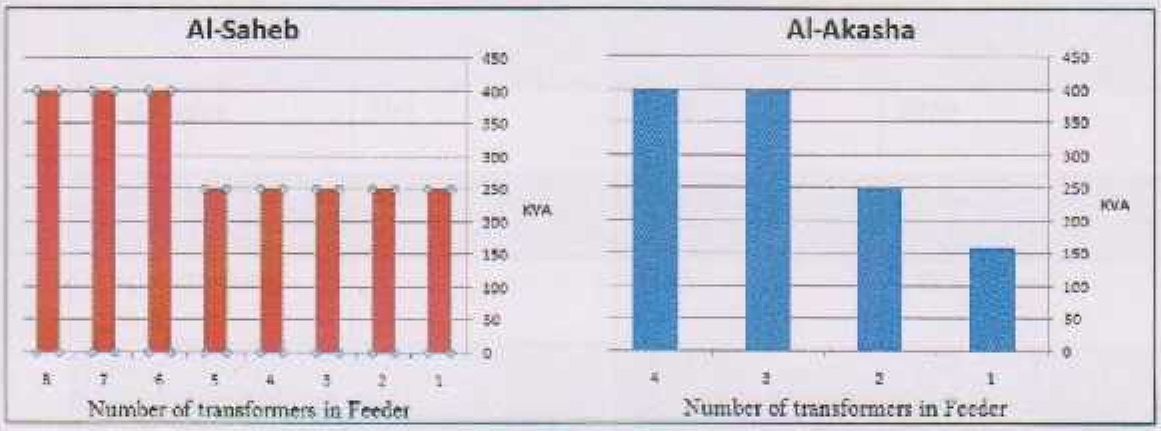


Figure (3.2)Em Al-Daliah Substation Feeders.



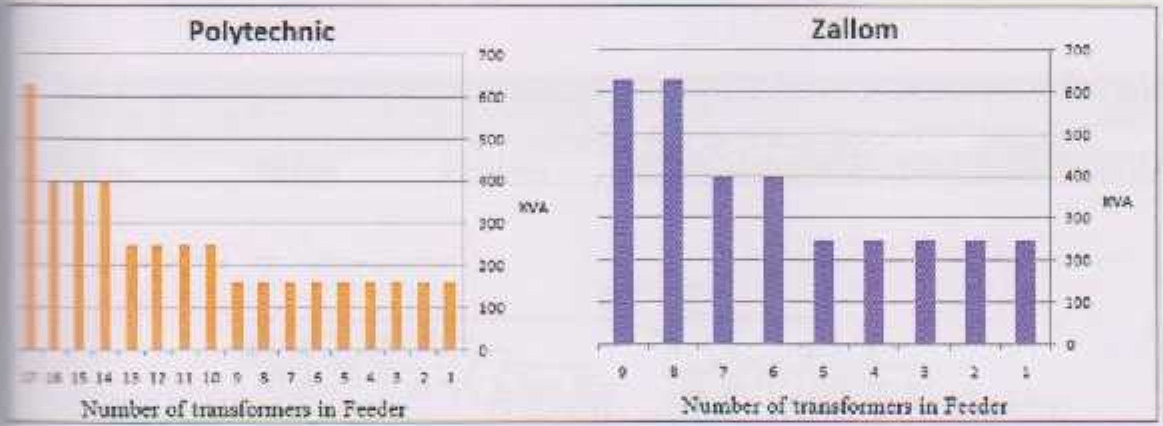


Figure (3.3) : Em Al-Daliah Substation Feeders and transformers

3.2.5 : Transmission and distribution Lines :

The total available Overhead lines are about 2800 km and the underground cables are about 8809 km and 11609 km total length of Overhead lines and underground Cables[4].

The Lengths of Cables and lines are given in Table (3.3)[4]:

Table 3.3 : Lengths of Lines & Cables

Feeder Name	Total Length on over head lines (m)	Total Length of Underground Cables (m)	Total Length of all Lines and Cables (m)
Al-Akasha	390	1660	2050
Al-Saheb	1385	2065	3450
Al-polytechnic	–	2475	2475
Baton Zallom	1025	2574	3599
Distribution	–	35	35

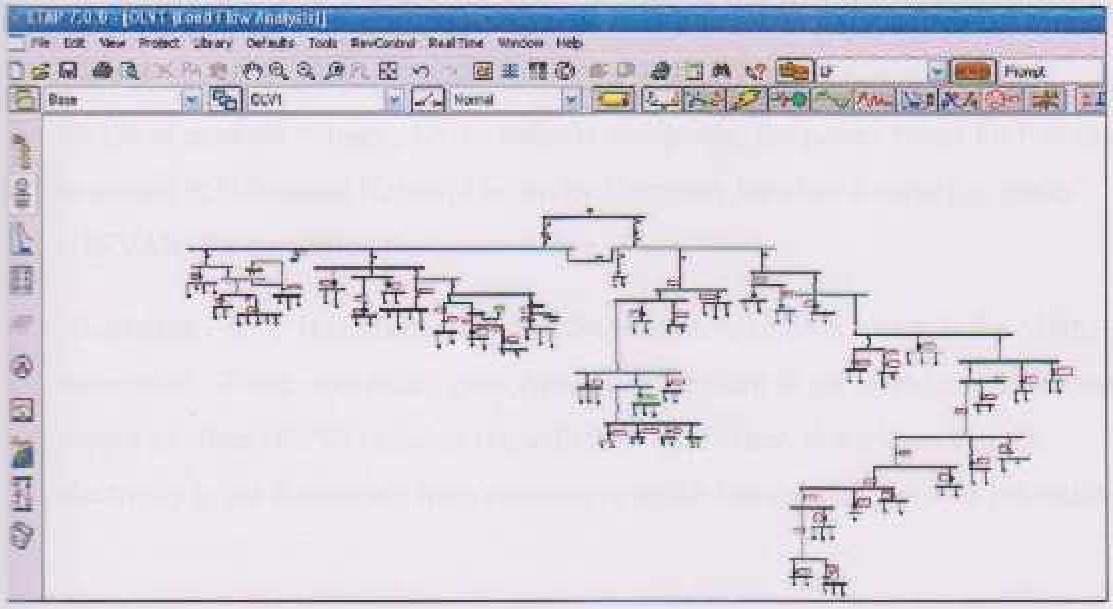


Figure (3.4) The General form of Em Al-Daliah Substation in ETAP

Figure (3.5) show the details of Al-Akasha Feeder from its cables and lines (Type and Length) and its transformers from its kVA and how the loading of each it.

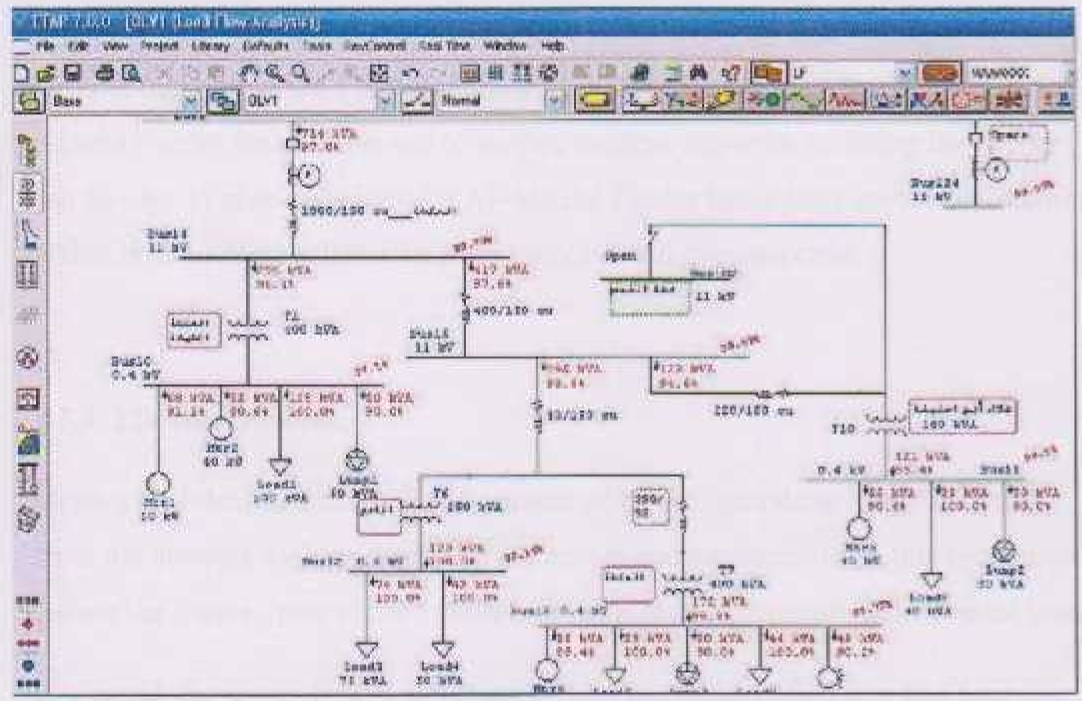


Figure (3.5) Zoom in for Al-Akasha Feeder

For example, transformer number one (T1: 400 kVA) voltage is 99.73% of nominal voltage, that's means the busbar voltage of this transformer is acceptable.

The transformers number ten deliver a factory, the voltage at factory busbar is 98.1% of nominal voltage, i.e. its value is acceptable, the power factor for this factory is around 95% because Hebron Electricity Company installed a capacitor banks (10kVAR) for correction the power factor.

Al-Akasha Feeder is connected to other Substation in Hebron which is the Alfahs Substation. When something goes wrong and we want to get electricity from another source or when HEPCO need to rehabilitation the Feeder, that means that the electricity is not disconnect from consumers which increase the network reliability.

To see other Feeders with zoom-in see **Appendix E.**

3.3 Assessment of the project:

3.3.1 Status condition of Hebron Electricity Grid:

From the status and the actual condition of Hebron city medium voltage network , we note that half of the 11kV system is ready for ring system. That's mean if Al-Akasha Feeder for example out of service because any error or fixing the Feeder , it can be easy to give electricity for Al-Akasha Feeder loads from another substation which is the Alfahs Substation from switches and disconnectres.

3.3.2 Electricity losses:

Hebron city electrical network has amount of losses , and these losses resulted from the network various fields and customers and its elements. In this project we will reduce the losses from existed value to a value around international standard losses.

In general, the power loss in electrical system can be classified into two main categories [1],[2]:

1) Technical losses.

2) non-technical losses.

1- **Technical losses:**

a) The technical power loss: is the loss resulted from the generator, transformer. transmission and distribution of electricity to customers.

b) The loss resulted from the inaccuracy of kWh meters with the well known meters manufactures.

c) The important loss: comes from penalty added to the customer invoice, due to the low power factor (P.F). The inductive loads connected to the electric supply, like motors and fluorescent lamps, cerate low P.F.

The acceptable power factor to the electricity supply is 0.90 or 85. When P.F is less than 90 or 85, the customers penalize by a certain percentage depend upon the connected P.F.

d) This losses is classified into [2]:

Load losses ($3I^2R$) And No load losses.

2- **Non-technical losses:**

This loss resulted from illegal methods that the consumers use it to avoid paying the cost of electricity they consumed [4].

This problem can be avoid by :

a) Hiding the connection to the consumers kWh meters in a way that the consumers cannot get an access to the cable.

b) Securing the kWh meters by fixing the meter in a secured box.

c) Employing a technical staff for the periodic check up of the kWh meters and the connection to consumers.

A- The total losses in Em Al-Daliah are around **1.11%** and this losses divided as shown in Figure (3.7), where Lines & Cables represent the larger percent of this losses.

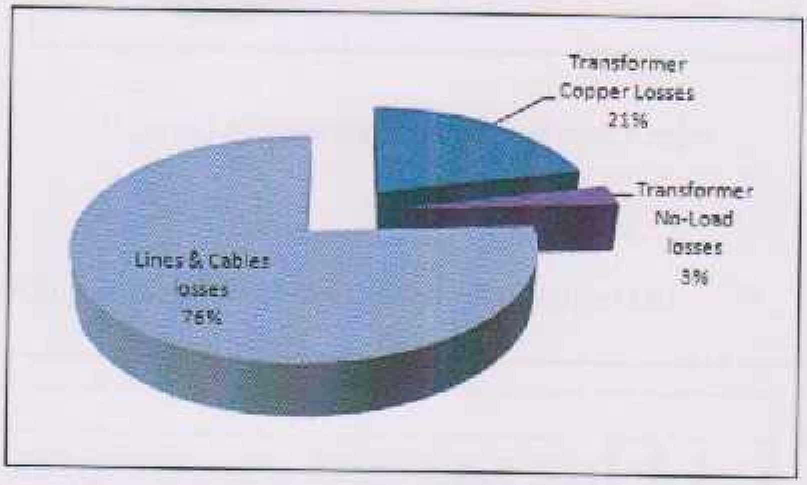


Figure (3.6): Total losses in Substation

B- The losses in Lines & Cables represent **76 %** of total Losses of Substation (Substation Losses is **1.11 %**) i.e. = **0.84 %** , these Losses are divided into for main Feeders and as follow in Figure (4.3):

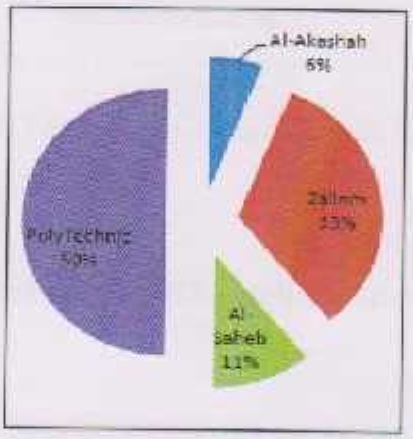


Figure (3.7) Lines & Cables losses

C- The Loading of each Feeder is shown in Figure (3.8)

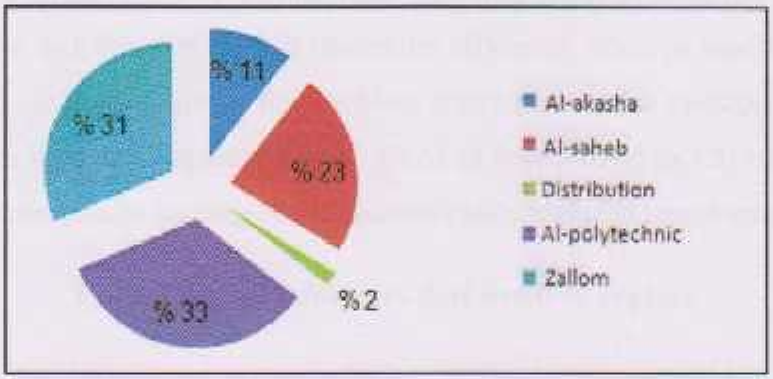


Figure (3.8) Percentage Loading of each Feeder

D- The Loading of each Transformer is shown in Figure (3.9)

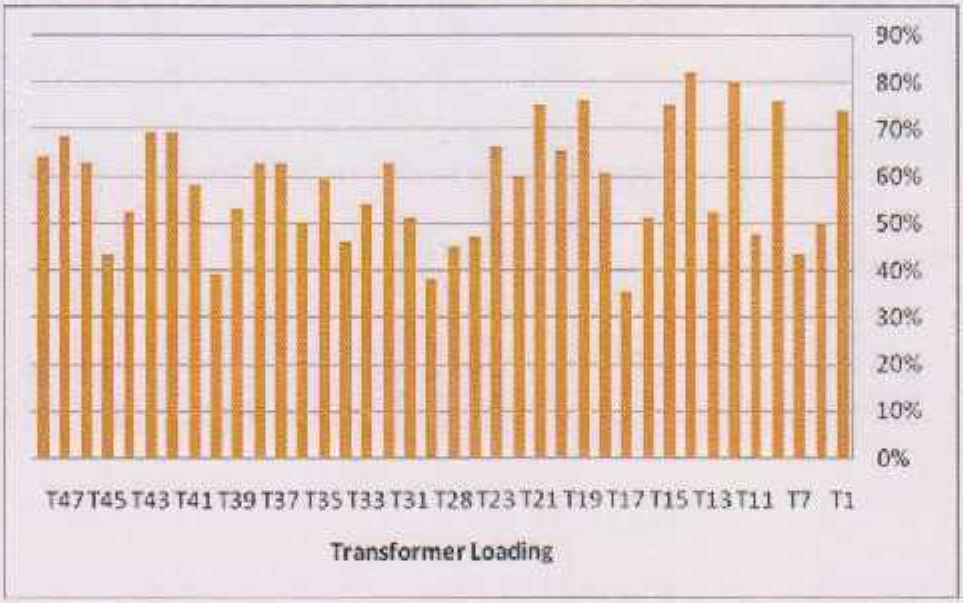


Figure (3.9) Percentage Loading of each Transformer

Transformers Losses represent **24 %** of Substation Losses, i.e. = **0.2664 %** of total losses in Substation.

To see the details of each transformer from its number and in which feeder is presence and how its loading percentage see **Appendix D**.

From this table we see that most of transformers in yellow color have high losses because its loading below 60% , this make high iron losses in these transformers, and we know that transformers work at maximum efficiency when its loading is around (65%-75%) , so the solution of this Problem is to replace these transformers to transformers with less Apparent Power(kVA) as follow in table(3.5) where the green color is the percentage loading of transformers after replaced transformers :

Table 3.5 : transformers that needs to replace

Feeder Name	Transformer Number	Transformer Apparent Power (kVA)	Percentage Loading	New Transformer (kVA)	New Percentage Loading
...ASHAH	T7	400	43.3 %	250	69.3 %
...ANCE	T11	400	47.5 %	250	76 %
...BUTION	T12	250	35.2 %	160	55 %
...TECHNIC	T24	400	47 %	250	75 %
	T28	400	45 %	250	73 %
	T29	250	38 %	160	60 %
	T34	250	46 %	160	72 %
	T45	250	43.2 %	160	67.5 %
	T40	400	39 %	250	62 %

These Transformers (Which loading is below 60%) represent **66.15%** of all transformers losses ; i.e. **0.176 %** of all losses in Substation.

When Replace these transformers as shown in Table (3.5), Losses decrease by **5.55%**, That means its losses become **0.165 %** of all losses. The **Appendix F** show the Losses in transformers and Lines & Cables in Substation on ETAP program.

Chapter Four

Hebron City Networks(Substations) after 20 Years

4.1 Estimating load for future.

4.2 Description of the network after 20 years.

4.3 Specify the network problems and solving it.

Chapter Four

Hebron City Networks(Substations) after 20 Years

4.1 Estimating load for future.

To estimate load , we use this equation

$$FV = PV * (1+r)^n \quad \text{..................equation(4.1)[8]}$$

Where :

FV : Future value.

PV : Present value.

r : Percentage in %.

n : Number of years.

We take $(1+r)^n$ as a percentage (%).

The Annual load growth in Hebron city is 8 %[4], and the Em-AlDaliah Substation represent 10 % of Total load of Hebron city [4].

To calculate the future value of Em-Aldaliah Substation for 20 years come , we follow these steps:

r = 8 % * 10 % = 0.8 % = 0.008

n = 20

$(1+r)^n = (1+0.008)^{20} = 1.2 = 120\%$

So each feeder in substation is multiply by this factor "1.2" to give load after 20 years .

4.2 Description of the network after 20 years.

For Five Feeders in Substation the loads become as follow in next table :-

Table 4.1 : Loads in Ampere and kVA after 20 years

Feeder Name	Load (Ampere)			Feeder Name	Load (kVA)		
	Max	Min	Average		Max	Min	Average
Al-Akasha	78	30	54.5	Al-Akasha	860	330	600
Al-saheb	168.2	6	87	Al-saheb	1850	66	960
Al-polytechnic	240	66	153	Al-polytechnic	2640	725	1680
Baton Zallom	240	48	146	Baton Zallom	2640	528	1600
Distribution	10	4.5	7.77	Distribution	106	48	85

The table(4.2) in **Appendix D** show the details of each transformer from its number and in which feeder is presence and how its loading after 20 years.

From this table we see in Figure (4.1) that some of transformers in red color is overloaded because its loading is more than 90 %, so the solution of this Problem is to replace these transformers to transformers with large Apparent Power(kVA).

Figure (4.1) show the details of Al-Akasha Feeder from its cables and lines (Type and Length) and its transformers from its kVA and how the loading of each it. And We see from ETAP program that the overloaded transformer will change its color to red.

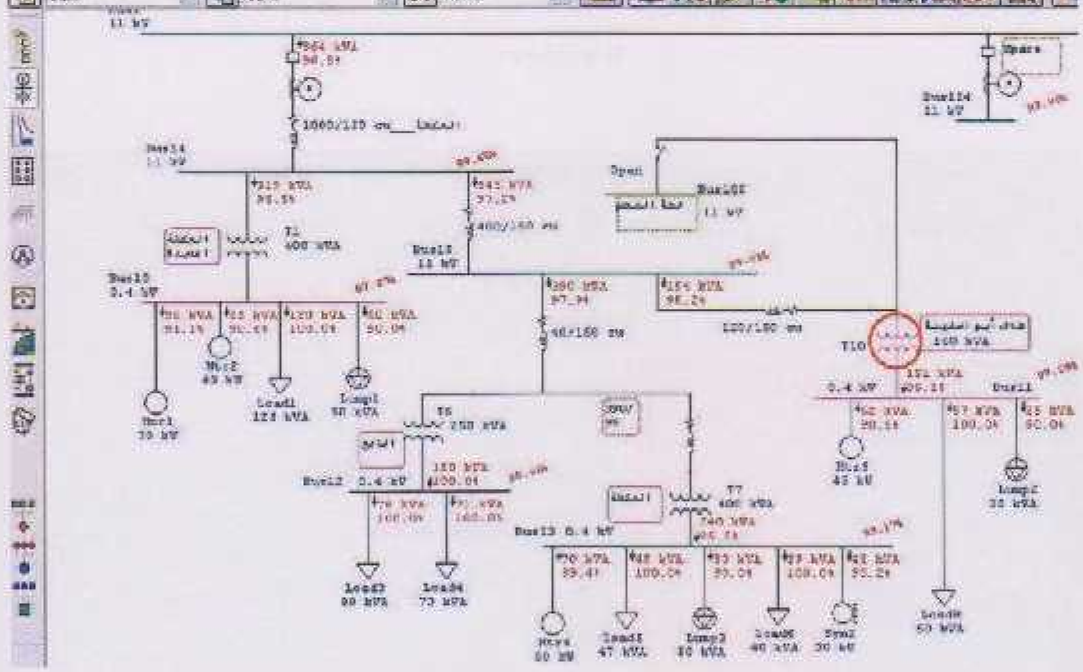


Figure (4.1) Zoom in for Al-Akasha Feeder after 20 years

4.3 Specify the network problems and solving it:

Most of transformers after 20 years have a percentage loading more than (60-70)%, that's mean its efficiency is increase, then its losses will decrease, this make its operation more beneficial, most of factories in this Substation don't produce harmonic because its operation depend on resistive loads such as Heating like a Nylon factories.

But before replace transformers , we make a comparison between existing network and network after 20 years in table (4.4) in **Appendix D**.

From this table we see that most of transformers which is loading below 60 % (yellow color) will become more than 60 % after 20 years, so the transformers will be replaced as follow table(4.3) where the blue color is the percentage loading of transformers after replaced it :

Table 4.3 : Percentage of Loading of each transformer after 20 years after replace it

Feeder Name	Transformer Number	Transformer Apparent Power (kVA)	Percentage Loading	New Transformer (kVA)	New Percentage Loading
AL-AKASHAH	T10	160	94.4 %	250	60.4 %
AL-SAHEB	T12	250	98.8 %	400	63%
	T14	400	92.5 %	630	61 %
	T15	250	93.2 %	400	60 %
DISTRIBUTION	T17	250	35.2 %	160	58 %
AL-POLYTECHNIC	T17	250	42 %	160	57 %
	T32	160	92.5 %	250	59 %
	T37	160	94 %	250	60 %
BATON ZALLOM	T19	250	96 %	400	61 %

A-The Total losses in network is a round **2%** after 20 years and its divided into 3 components as shown in Figure(4.2).

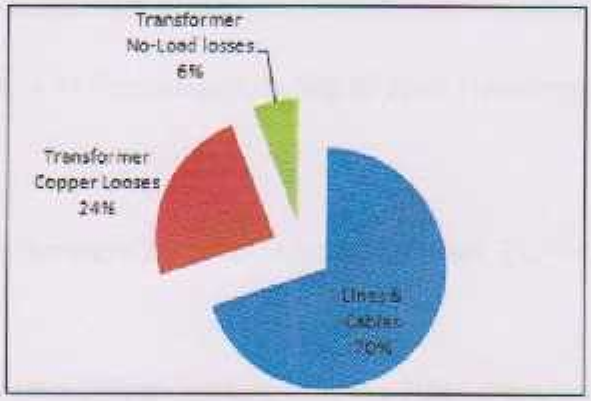


Figure (4.2): Total losses in Substation

B- The losses in Lines & Cables represent **70 %** of total Losses of Substation (Substation Losses is **2%**) i.e. = **1.4%** , these Losses are divided into for main Feeders and as follow in Figure (4.3):

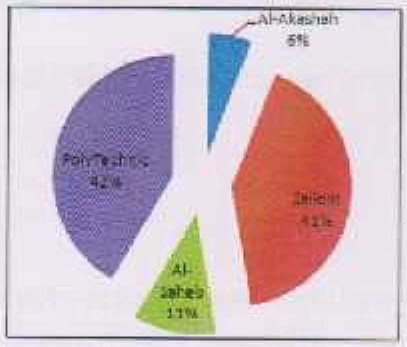


Figure (4.3) Lines & Cables losses

C- The Loading of each Transformer is shown in Figure (4.4):

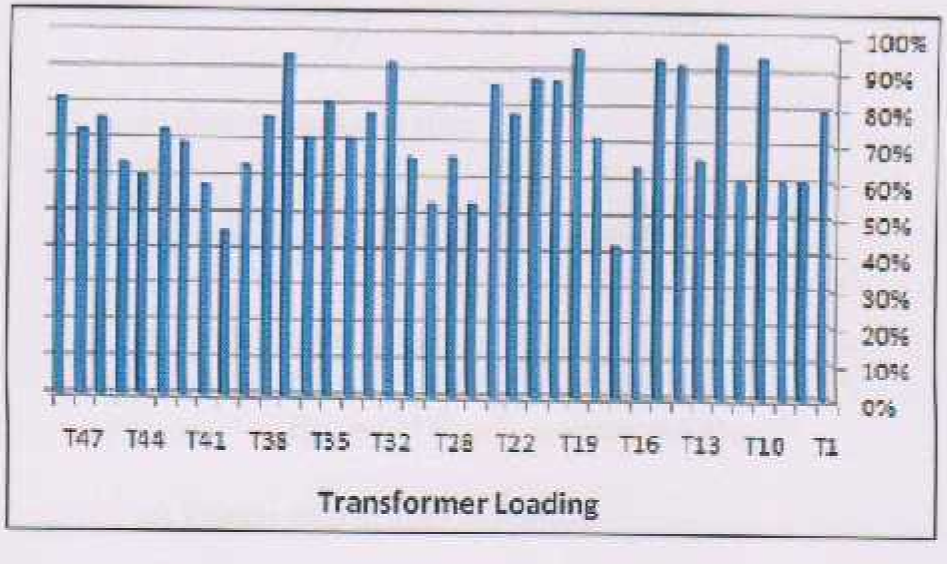


Figure (4.4) Percentage Loading of each Transformer

Transformers Losses represent **30 %** of Substation Losses, i.e. = **0.6 %** of total losses in Substation.

Overloaded Transformers (Which loading is above 90%) represent **25%** of all transformers losses ; i.e. **0.15%** of all losses in Substation.

When Replace these transformers as shown in Table (4.3); that means increase transformers Loading, Losses decrease by **3.35%**, That means its losses become **0.145%** of all losses. The **Appendix F** show the Losses in transformers and Lines & Cables in Substation on ETAP program.

The resistance of underground Cables is less than twice of Overhead Lines, this make losses to reduce too.

4.3.1 We can summarize network problems as follow:

1) Low Power factor in some Factories:

Low Power factor has disadvantages like :

a) Large kVA rating (Transformers and Grid-Power):

$$S = \frac{P}{PF} \quad \text{.................equation(4.2)}$$

b) Greater conductor size:

$$I = \frac{P}{\sqrt{3} * PF * V} \quad \text{......equation(4.3)}$$

c) Large Copper Losses:

$$P_{Loss} = I^2 * R \quad \text{.........equation(4.4)}$$

e) Voltage drop in lines and cables:

$$V_{Drop} = I * R \quad \text{........equation(4.5)}$$

f) Poor voltage regulation.

2) Losses at Consumers Side.

3) Voltage Drop.

4.3.2 Solutions of network problems:

1) Improvement Power factor :

A) Static Capacitors:

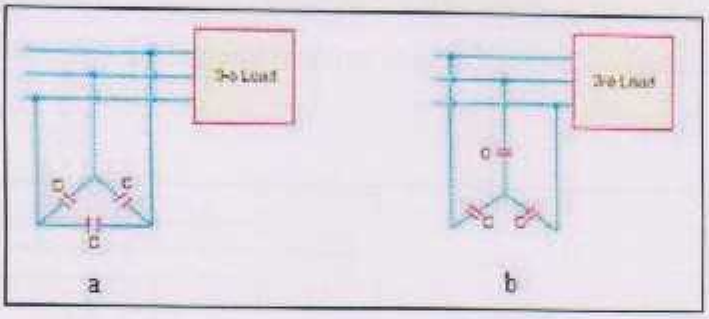


Figure (4.5) Static Capacitors(a : Delta connection , b : Star connection)

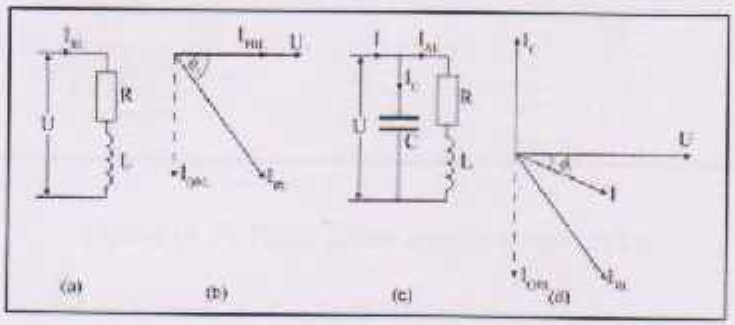


Figure (4.6) Phasor diagram for power factor correction

The advantages if it :

- Low Losses.
- Require Little maintenance.
- Easily installed.

The Disadvantages if it :

- Short service life (10-15)years.
- Easily damaged if voltage increase to unwanted value.
- Uneconomical to repair it.

B) Synchronous Motor (Condenser):

Synchronous motor running at No-Load & Over-excited; that make current to lead voltage (small current angle)and its behavior as Capacitor.

When such a machine is connected in parallel with supply, it takes a leading current which partly neutralizes the lagging reactive components of the Load; thus the power factor is improved.

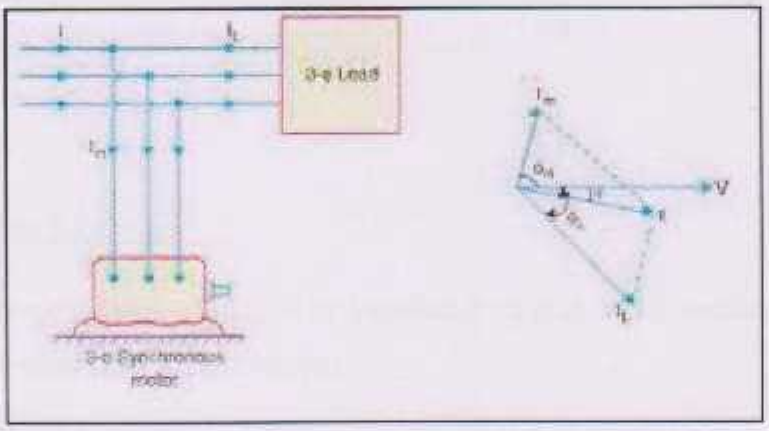


Figure (4.7) Three phase synchronous motor

The advantages if it :

- Step less control of PF.
- motor windings have high stability at short circuit.
- Easily to disconnect when fault is occur.

The Disadvantages if it :

- Maintenance is high and Produce noise.
- Losses in motor-windings.
- Cost is greater than Static-Capacitor except if it rating > 500kVA.

C) Phase advancer :

Used for induction- motors and connect at rotor circuit as (current source), so the motor providing ampere-turns to rotor circuit , then the induction-motor can be made to operate on Leading power factor like Synchronous-motors.

2) Reduce Losses at Consumers Side:

By improving power factor >> current decrease and Losses decrease:

$$I = \frac{P}{\sqrt{3} * PF * V}, P_{Loss} = I^2 * R$$

3) Voltage Drop Reduction:

a) Step type voltage regulators by installed it on grid, and it consist of Auto-transformers and a Tap-changer.

b) Shunt Capacitors (The most widely used method).

c) Voltage drop reduced automatically when improving power factor;

$$I = \frac{P}{\sqrt{3} * PF * V} >>> V_{Drop} = I * R$$

Chapter Five

SCADA System

5.1 SCADA System Description.

5.2 Functions of SCADA System.

5.3 SCADA System Hardware and Software.

Chapter Five

SCADA System

5.1 SCADA System Description.

SCADA (Supervisory Control And Data Acquisition) is a category of software application program for process control, the gathering of data in real time from remote locations in order to control equipment and conditions.

SCADA is used in power stations and substations as well as in oil and in gas refining, telecommunications, power distribution, energy management, transportation, and water and waste control.

Figure (5.1) : SCADA System for Controlling and Monitoring

5.2 Functions of SCADA System:

The SCADA system linked together the city's power options to use the most efficient power option to meet the power demands on the city municipal power system. The SCADA system is also used by neighboring communities to control their power systems.

SCADA system has many functions, and modern SCADA systems may be incorporate the following functions :

A) System Control:

1) Electrical circuit breaker control.

2) Voltage regulation.

3) Capacitor control.

4) Load management.

5) Tap changer control.

6) Service restoration.

7) Loss reduction.

8) Fault isolation.

9) Miscellaneous device control.

B) System Monitoring:

1) Remote status(Digital).

2) Remote status(Analog).

3) Status sequence of events.

4) Analog sequence of events.

C) Demand Side Management:

1) Voltage control.

2) Optimal heat rate/unit commitment.

3) Load shedding/duty cycle.

4) Supply side management.

D) System Management:

1) System data/ status archiving.

2) Activity analysis.

3) Sequence of events analysis.

4) System loss reduction.

5) System analysis.

E) Advantages of SCAD system:

1) The electrical network will become more flexible and controllable.

2) We can receive signals tell us if hazards occurred in the system.

3) Allow us to connect two or more electric systems together, and control them.

4) Allow us to monitoring and controlling the networks from far distances.

5.3 SCADA System Hardware and Software:

SCADA system include hardware and software components. The hardware gathers and feeds data into a computer that has SCADA software installed. The computer then processes this data and present it in a time manner. SCADA also records and logs all events into a file stored on a hard disk or sends them to a printer.

5.3.1 Unity Pro Program :

The software used for SCADA System is the Unity-Pro Program where the Unity-Pro is connected with PLC-devices to downloaded programs on it, we can Control and Monitoring Systems by this program.

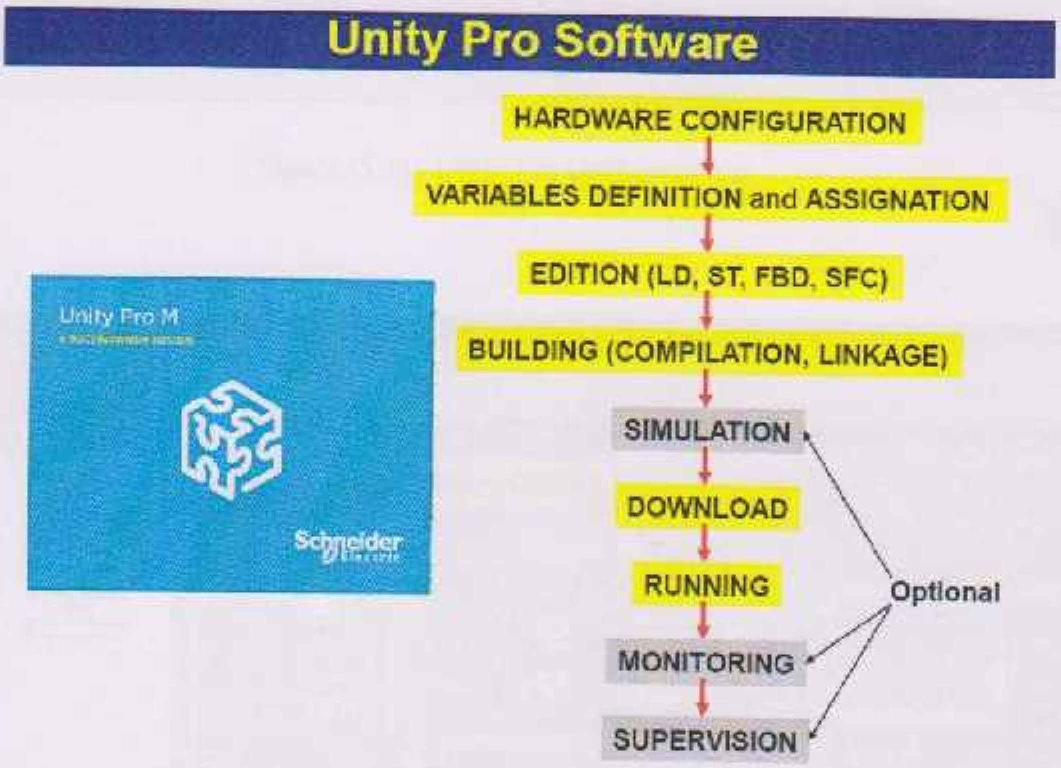


Figure (5.2) : Unity Pro software

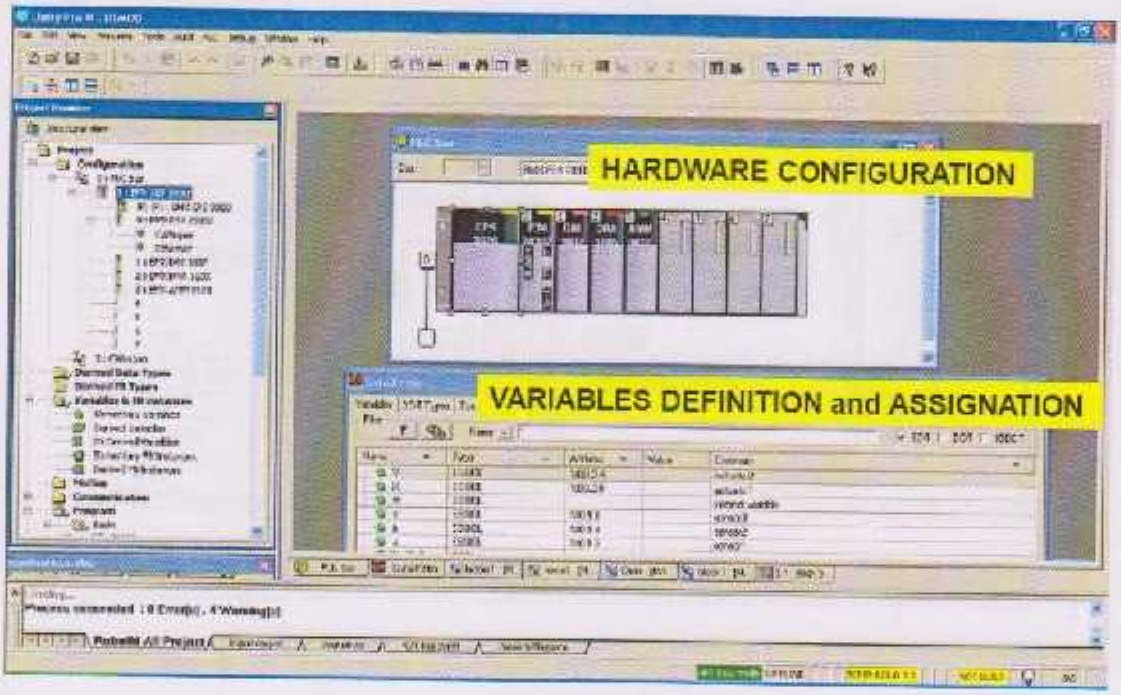


Figure (5.3) : Unity Pro configurations

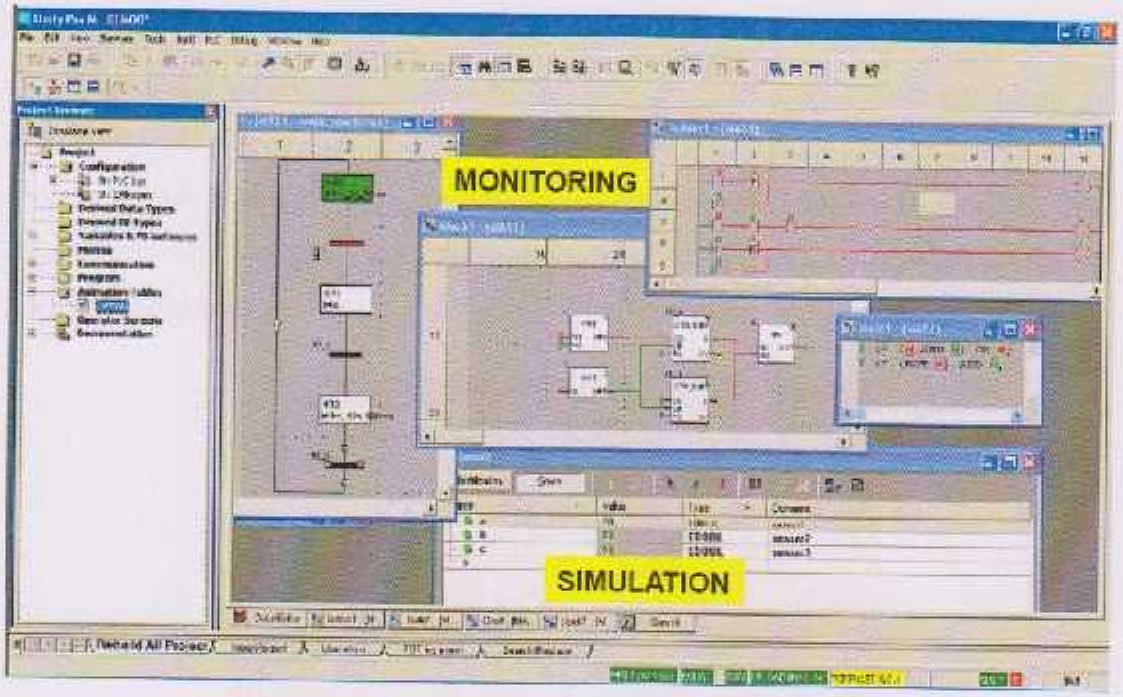


Figure (5.4) : Unity Pro Monitoring & Simulation

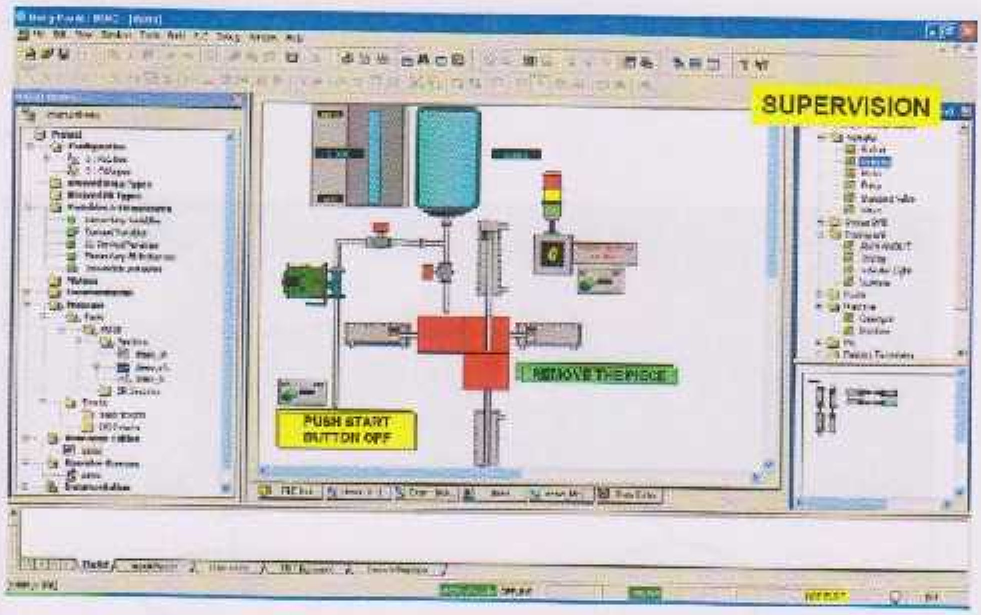


Figure (5.5) : Unity Pro Supervision

5. 3.2 Vijeo Citect Program :

This software used for SCADA System where the Unity-Pro is connected with it. we can Control and Monitoring Systems by this program for Huge factories and plants converting and distribution of electricity That needed to monitor and control every moment. Vijeo Citect Program is Controls and monitors the long-distance up to a few kilometers while Unity Pro software used for Medium-sized factories and does not need long distances.

Figure (5.6) : Vijeo Citect Program

For example, in Figure (5.7) we can control and monitor for a push-button switch, when the switch M0 is off the circle color is red, and when switch M0 is on the color change to green.

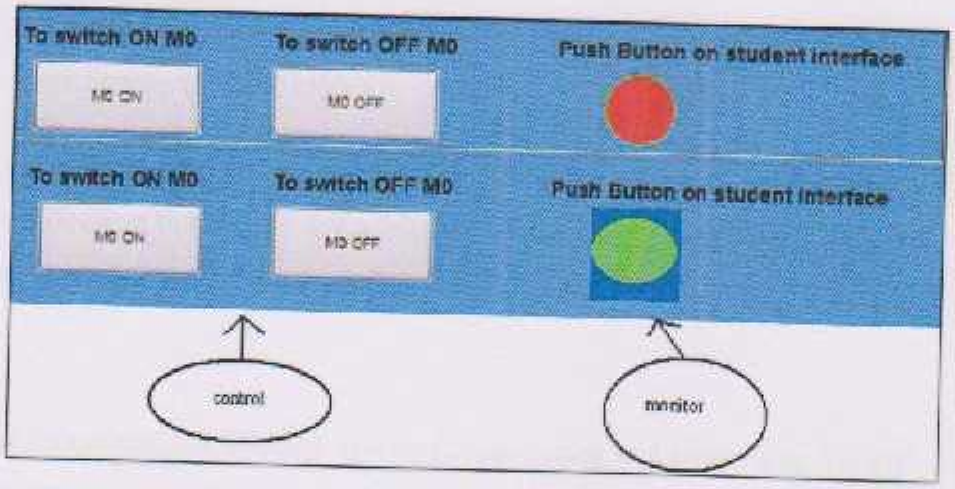


Figure (5.7) : control and monitor for a push-button switch

In the same way, we can control and monitoring for Em-Aldaliah substation, where the substation general form as follow in Figure (5.8):

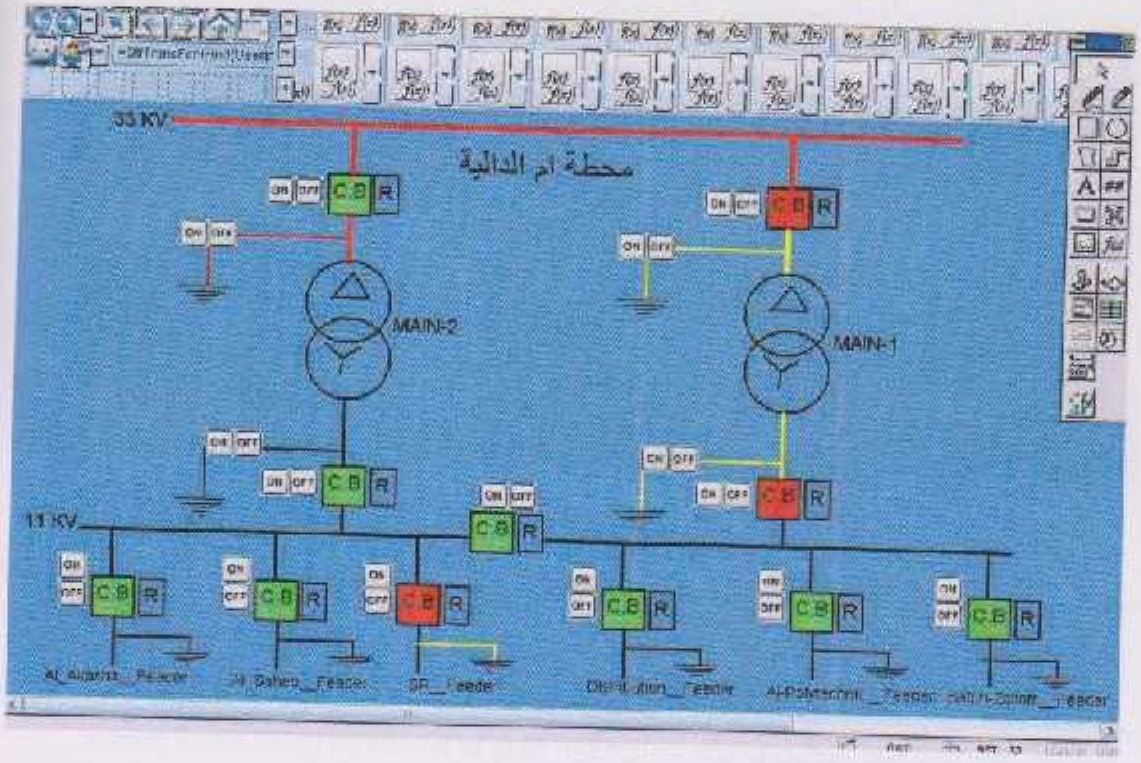


Figure (5.8) : General form for Em-Aldaliah substation in SCADA System

From this SCADA system we can control with Push-buttons (Circuit-Breaker) to switch it ON or to switch it OFF, the relays used for monitoring the Feeders loading and Main transformer loading.

We can control for main-Feeders only (Five Feeders in Substation) and for main two transformers (33 kV /11kV).

For example if the Al-Akasha feeder electrical load exceeds a specified value, or if fault occur at this feeder, the relay can Senses this imbalance and It gives a signal to the Circuit-Breaker to switch OFF.

We development the SCADA system to monitoring and controlling for any transformer in each Feeder.

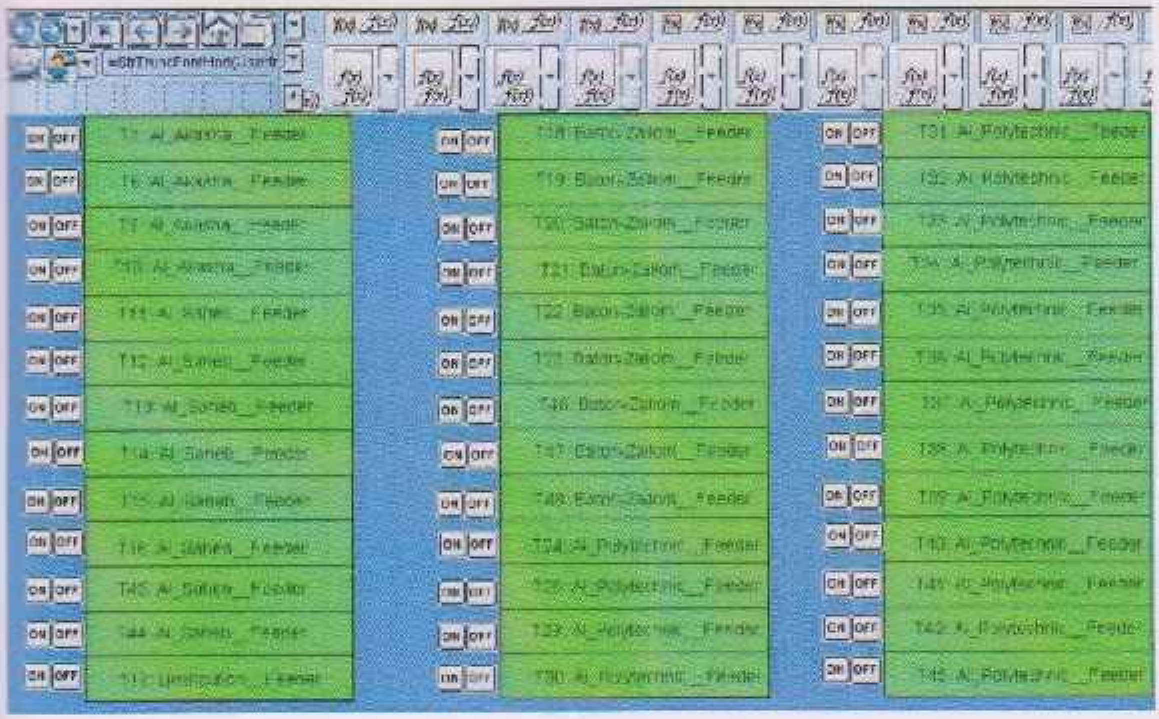


Figure (5.9) : Monitoring and Controlling for substation Transformers

if transformer electrical load exceeds suddenly with unexpected value, Alarm appear in the SCADA screen to give indication and a signal that this transformer where something goes wrong.

This alarm appear as a Rectangular inside it there are transformer number and Feeder name surrounded by red color indicates that there is something wrong and if repaired this wrong, the red color changed to green.

Figure (5.10) : Alarm appear as red color rectangular

As shown in Figure (5.9), all transformers are working (In Service), when one of these transformers go out of service or more than one, its appear as Rectangular with red color as shown in figure (5.10).

Same alarm appear if transformer Switch-OFF and go out of service, this make easy to know where the wrong is happen (Number of transformer and Feeder-name).

SCADA warns when conditions become hazardous by sounding alarms, SCADA system are successful multipurpose utility management and control tools. The state of art in SCADA has advance so rapidly, that even experienced utility engineers are not fully aware of all functions provide by SCADA.

Chapter Six

Conclusions

The Conclusions of the project can be summarized as follow:

1) Hebron electric power network has losses, which is the technical losses. But its value is acceptable.

2) The Load flow results of Em Al-Daliah substation show that the Power factor is higher than 0.90.

3) Most of regions has a Nominal voltage with acceptable voltage drop.

4) The most Feeders has balanced Loads.

5) There is no overloaded conductors.

6) Losses from transformers are reduced by replace its capacity or increase its loading unit equal to (60-70)%.

7) There is no Harmonics in Network; because most of loads is resistive-loads.

8) Replace Overhead lines by Underground Cables reduce losses because cable resistance is less than twice of overhead line resistance.

9) HEPCO at present not need to replace transformers which is percentage loading is less than 60 % because this percentage will increase by time.

10) We make development of SCADA system by monitoring for all transformers in substation.

Appendices

Appendix A

Appendix B

Appendix C

Appendix D

Appendix E

Appendix F

Appendix A

Single Line Diagram Of Medium Voltage For Hebron City

Appendix B

Table Of Load(Ampere) Values For Em-AlDaliah Substtaion

estamp	07.01_MAIN2			07.03_POLYTECNIC		
	I a (A)	I b (A)	I c (A)	I a (A)	I b (A)	I c (A)
	151.10	163.10	150.60	36.40	40.10	37.60
014 00:05:00	150.40	162.60	147.30	36.30	39.70	38.40
014 00:10:00	147.60	159.80	147.60	35.80	39.00	36.60
014 00:15:00	146.30	158.20	146.00	34.80	38.50	36.60
014 00:20:00	141.50	153.40	139.70	35.50	37.40	35.90
014 00:25:00	141.50	152.10	138.70	34.70	37.60	37.20
014 00:30:00	135.90	146.80	134.60	32.90	36.40	34.70
014 00:35:00	133.80	144.00	132.50	31.80	35.30	33.30
014 00:40:00	135.10	143.70	132.30	32.90	35.00	33.20
014 00:45:00	132.50	141.50	128.20	33.00	36.20	33.80
014 00:50:00	131.00	138.40	127.00	30.80	34.80	31.40
014 00:55:00	128.00	137.90	126.70	31.90	35.80	31.90
014 01:00:00	134.30	143.20	132.00	30.80	35.70	32.40
014 01:05:00	128.20	136.60	125.20	29.60	33.60	31.70
014 01:10:00	127.20	134.60	124.20	29.90	32.10	30.40
014 01:15:00	126.20	133.10	123.10	30.30	33.40	31.40
014 01:20:00	125.70	133.10	123.90	30.30	34.30	31.70
014 01:25:00	123.10	129.70	120.60	29.50	32.50	30.80
014 01:30:00	123.90	128.00	119.80	29.20	31.90	30.30
014 01:35:00	121.90	127.50	118.60	27.90	33.20	30.50
014 01:40:00	119.60	126.70	116.60	27.30	32.50	30.30
014 01:45:00	116.80	123.90	115.20	28.00	32.20	29.90
014 01:50:00	118.60	123.90	116.50	26.90	31.40	29.70
014 01:55:00	117.00	123.40	114.00	27.60	30.70	28.30
014 02:00:00	117.00	122.90	114.20	27.30	31.20	28.80
014 02:05:00	114.00	121.10	111.20	28.50	30.30	27.70
014 02:10:00	112.70	120.10	110.70	25.50	28.90	27.80
014 02:15:00	113.00	119.10	109.40	26.30	29.20	27.40
014 02:20:00	114.50	121.40	110.90	26.00	30.10	28.50
014 02:25:00	117.00	122.60	111.70	26.90	29.60	27.70
014 02:30:00	111.40	118.80	109.10	26.80	31.30	29.30
014 02:35:00	110.90	116.50	107.90	26.50	29.70	27.40
014 02:40:00	108.90	115.50	108.10	25.10	28.00	26.30
014 02:45:00	110.40	115.80	109.70	25.40	28.60	27.30
014 02:50:00	110.90	117.00	109.10	25.80	29.20	27.50
014 02:55:00	110.40	118.30	110.40	26.50	29.90	29.10
014 03:00:00	109.90	116.00	107.40	28.40	28.80	27.50
014 03:05:00	113.00	119.60	111.20	26.90	29.90	29.10
014 03:10:00	109.70	118.30	108.10	25.60	29.10	28.10
014 03:15:00	113.00	120.10	111.70	25.60	28.70	26.60
014 03:20:00	108.10	115.80	107.90	24.70	28.70	26.40
014 03:25:00	108.90	116.00	107.90	25.20	29.80	28.40
014 03:30:00	108.90	116.30	106.90	25.10	29.60	28.10
014 03:35:00	114.50	121.90	113.20	27.20	30.80	29.20
014 03:40:00	108.60	117.00	109.10	25.40	30.30	28.10
014 03:45:00	108.40	115.50	106.30	25.90	29.20	27.50
014 03:50:00	108.60	117.80	109.90	25.10	29.30	27.00
014 03:55:00	111.40	118.30	110.90	25.20	29.30	27.20

2014 04:00:00	106.10	113.00	104.60	25.60	29.10	27.40
2014 04:05:00	107.10	114.70	107.60	26.00	29.20	27.10
2014 04:10:00	106.30	115.00	106.10	25.00	29.30	28.00
2014 04:15:00	105.60	115.80	109.40	25.30	30.10	28.80
2014 04:20:00	112.20	119.10	113.00	25.50	29.70	27.40
2014 04:25:00	106.60	114.70	107.90	26.90	30.70	28.80
2014 04:30:00	109.90	115.20	110.20	25.40	28.60	27.50
2014 04:35:00	107.60	115.50	107.60	28.40	29.90	27.80
2014 04:40:00	108.90	119.30	111.40	25.20	30.30	28.70
2014 04:45:00	115.00	122.40	113.00	25.30	30.70	29.00
2014 04:50:00	118.30	125.90	115.00	26.40	30.40	28.60
2014 04:55:00	116.80	125.90	116.30	26.10	30.60	28.40
2014 05:00:00	114.50	126.10	113.50	26.60	30.80	29.10
2014 05:05:00	118.30	126.20	114.20	27.40	31.90	29.20
2014 05:10:00	128.70	134.10	120.30	34.70	38.00	34.60
2014 05:15:00	130.50	138.70	125.70	34.70	39.20	35.00
2014 05:20:00	130.00	136.10	125.20	33.90	38.60	34.70
2014 05:25:00	132.00	138.90	128.50	34.90	39.80	35.80
2014 05:30:00	129.50	139.20	128.70	32.60	38.60	35.60
2014 05:35:00	130.50	140.20	129.20	32.70	38.40	36.50
2014 05:40:00	130.50	139.70	128.70	32.00	36.40	33.70
2014 05:45:00	131.30	136.60	124.90	31.00	35.30	32.10
2014 05:50:00	132.80	139.20	128.50	31.60	37.40	34.30
2014 05:55:00	132.00	140.90	130.80	31.40	35.80	33.00
2014 06:00:00	129.70	140.90	128.20	29.40	36.00	32.70
2014 06:05:00	136.10	147.30	133.10	35.90	40.80	35.90
2014 06:10:00	156.50	164.90	155.20	40.50	45.40	42.60
2014 06:15:00	160.00	170.20	157.70	42.70	49.00	44.30
2014 06:20:00	159.80	165.40	157.70	44.20	47.10	43.90
2014 06:25:00	151.10	160.30	152.60	39.20	43.60	41.20
2014 06:30:00	149.30	157.20	151.60	39.20	44.00	40.80
2014 06:35:00	148.30	153.90	148.80	38.30	41.90	39.70
2014 06:40:00	149.80	166.00	148.60	37.60	43.10	40.10
2014 06:45:00	149.30	155.70	150.40	39.10	42.70	42.60
2014 06:50:00	157.50	168.20	157.70	38.00	44.60	41.80
2014 06:55:00	153.90	160.30	152.90	41.90	46.80	46.00
2014 07:00:00	158.00	166.10	156.70	41.40	45.80	45.30
2014 07:05:00	157.50	164.30	156.00	44.60	45.60	45.90
2014 07:10:00	159.00	168.90	162.10	42.60	45.00	44.20
2014 07:15:00	160.30	165.60	162.10	42.90	44.70	44.90
2014 07:20:00	164.90	173.50	165.40	46.40	48.70	49.20
2014 07:25:00	170.50	179.60	171.20	49.80	52.20	51.30
2014 07:30:00	173.30	180.80	170.60	50.80	52.80	51.90
2014 07:35:00	176.60	181.40	173.30	52.20	53.10	53.80
2014 07:40:00	179.90	185.00	178.80	55.60	57.50	57.70
2014 07:45:00	181.40	189.30	180.90	50.40	54.70	53.60
2014 07:50:00	178.90	186.20	178.30	52.60	54.70	55.70
2014 07:55:00	190.70	207.90	198.90	56.40	62.50	60.90
2014 08:00:00	195.10	208.40	195.60	58.80	63.70	61.30
2014 08:05:00	197.70	212.40	200.50	58.50	63.20	60.60

2014 08:10:00	212.20	223.40	215.70	59.30	62.50	61.90
2014 08:15:00	210.90	222.80	213.40	64.20	66.40	65.50
2014 08:20:00	210.90	226.20	213.20	61.50	66.40	65.20
2014 08:25:00	219.80	236.10	224.10	65.10	69.50	68.50
2014 08:30:00	221.80	239.90	226.40	66.40	71.50	69.50
2014 08:35:00	226.20	247.00	230.70	65.70	72.80	68.90
2014 08:40:00	222.40	241.40	225.40	66.20	70.30	70.90
2014 08:45:00	229.20	251.80	234.30	67.20	74.50	73.70
2014 08:50:00	226.70	247.80	233.00	66.10	75.40	70.30
2014 08:55:00	242.50	260.30	243.50	68.80	75.90	72.40
2014 09:00:00	239.10	254.20	239.90	69.90	74.70	73.00
2014 09:05:00	236.60	256.40	242.70	69.60	77.00	75.30
2014 09:10:00	244.20	251.00	248.80	70.20	75.40	75.00
2014 09:15:00	244.70	259.20	249.80	68.80	74.80	75.00
2014 09:20:00	251.90	262.00	252.10	70.00	74.70	74.60
2014 09:25:00	252.40	258.50	252.10	75.00	79.10	77.20
2014 09:30:00	251.90	264.10	252.60	78.50	83.90	82.30
2014 09:35:00	256.20	272.70	258.20	74.90	81.60	77.50
2014 09:40:00	260.50	273.20	261.50	74.20	80.90	78.50
2014 09:45:00	251.10	262.60	249.30	75.60	80.50	78.00
2014 09:50:00	250.60	264.30	251.10	72.30	76.90	75.40
2014 09:55:00	263.10	274.80	260.00	83.50	86.90	83.90
2014 10:00:00	257.70	270.40	253.90	80.90	85.20	79.20
2014 10:05:00	267.10	276.00	265.10	77.30	81.40	79.80
2014 10:10:00	258.50	267.60	258.20	75.30	78.80	76.70
2014 10:15:00	263.10	272.20	262.30	78.10	81.70	78.60
2014 10:20:00	275.00	287.00	275.00	83.90	87.80	83.10
2014 10:25:00	271.50	277.80	272.20	84.50	88.70	86.10
2014 10:30:00	266.90	278.30	268.90	84.30	87.50	83.80
2014 10:35:00	270.90	282.40	272.70	84.60	88.50	84.50
2014 10:40:00	272.20	282.40	276.00	87.60	89.50	87.00
2014 10:45:00	267.40	276.50	268.90	83.10	86.20	82.90
2014 10:50:00	266.60	278.30	268.40	83.60	85.30	82.80
2014 10:55:00	274.00	281.90	270.20	84.20	86.50	83.40
2014 11:00:00	270.70	276.80	269.20	85.10	86.20	84.90
2014 11:05:00	271.50	283.40	275.50	90.30	94.30	89.40
2014 11:10:00	270.40	281.60	275.30	86.60	91.20	87.10
2014 11:15:00	262.60	275.00	266.80	79.10	86.60	81.90
2014 11:20:00	262.80	273.20	263.80	81.90	86.80	83.60
2014 11:25:00	262.60	267.90	260.80	84.20	91.20	87.00
2014 11:30:00	270.20	282.40	269.20	86.50	92.50	89.20
2014 11:35:00	265.10	275.30	264.80	84.20	89.40	84.20
2014 11:40:00	257.70	271.20	258.20	84.30	90.20	82.60
2014 11:45:00	254.40	264.80	254.40	83.10	89.20	83.40
2014 11:50:00	266.10	280.60	264.80	88.90	93.20	88.60
2014 11:55:00	252.60	263.10	252.90	82.00	87.20	83.60
2014 12:00:00	258.00	269.20	254.70	78.40	83.60	77.90
2014 12:05:00	253.60	260.80	249.30	79.70	81.90	77.10
2014 12:10:00	249.30	256.70	247.00	76.10	80.50	74.60
2014 12:15:00	245.00	257.70	240.20	82.50	88.60	81.80

14 13:05:00	244.00	259.80	241.40	79.30	86.40	78.40
14 13:10:00	241.70	249.10	239.70	79.50	83.60	81.20
14 13:15:00	250.10	258.50	248.60	78.50	85.10	79.70
14 13:20:00	240.90	258.20	243.00	79.70	89.50	80.90
14 13:25:00	246.50	259.50	248.30	79.50	82.80	80.10
14 13:30:00	249.10	255.40	248.60	78.90	85.30	81.10
14 13:35:00	242.20	258.20	244.00	76.90	83.10	78.60
14 13:40:00	236.60	252.90	244.00	78.70	83.90	81.40
14 13:45:00	246.00	258.70	247.30	79.30	80.70	80.30
14 13:50:00	243.70	252.10	247.50	75.40	78.00	74.80
14 13:55:00	241.40	249.80	243.20	75.30	78.20	77.50
14 14:00:00	240.40	249.10	240.40	72.50	78.60	74.00
14 14:05:00	231.00	246.50	233.50	73.90	76.80	75.30
14 14:10:00	228.50	241.20	234.30	75.00	76.10	76.40
14 14:15:00	240.90	251.10	243.50	77.50	81.70	78.40
14 14:20:00	245.50	258.20	250.60	82.70	64.20	63.50
14 14:25:00	234.10	247.50	236.90	77.60	64.10	78.90
14 14:30:00	244.70	260.30	247.50	73.90	80.40	75.20
14 14:35:00	239.70	254.90	247.50	77.70	80.90	79.30
14 14:40:00	239.10	256.90	247.30	74.70	80.20	77.90
14 14:45:00	235.60	256.40	241.70	80.00	82.10	82.60
14 14:50:00	258.70	267.60	261.00	78.30	81.90	80.60
14 14:55:00	248.60	261.00	252.10	80.30	82.40	82.40
14 15:00:00	241.40	258.70	247.80	76.60	80.90	77.80
14 15:05:00	246.00	258.00	250.10	75.70	79.00	78.50
14 15:10:00	250.80	258.50	254.70	77.00	80.80	75.10
14 15:15:00	254.40	254.20	256.70	75.70	80.40	79.20
14 15:20:00	246.80	258.20	245.50	82.00	82.40	82.80
14 15:25:00	254.70	261.00	257.00	78.90	80.50	79.80
14 15:30:00	243.70	260.30	245.50	74.20	81.40	75.70
14 15:35:00	252.10	262.80	252.10	76.60	78.20	79.70
14 15:40:00	252.90	256.20	249.80	79.40	81.90	81.20
14 15:45:00	242.20	261.30	241.70	74.20	81.50	76.00
14 15:50:00	241.70	255.70	240.70	73.60	78.80	74.50
14 15:55:00	243.00	258.70	241.70	72.10	80.70	74.20
14 16:00:00	248.00	263.10	248.30	77.50	82.40	78.20
14 16:05:00	243.50	258.20	245.00	73.70	79.80	75.30
14 16:10:00	240.20	263.10	242.70	73.90	76.90	73.50
14 16:15:00	246.00	262.30	248.00	78.70	82.60	79.90
14 16:20:00	247.30	261.00	249.60	77.10	82.80	77.20
14 16:25:00	247.80	258.70	248.00	76.50	80.30	77.50
14 16:30:00	241.40	255.20	239.70	77.50	81.20	77.50
14 16:35:00	243.50	257.20	245.30	74.70	81.50	75.30
14 16:40:00	242.50	259.80	243.20	74.70	81.90	74.50
14 16:45:00	254.70	262.60	254.90	77.70	81.60	78.00
14 16:50:00	251.40	261.80	250.10	81.50	82.30	81.20
14 16:55:00	252.50	267.40	251.40	75.30	79.90	74.00
14 17:00:00	255.20	270.20	255.40	77.90	81.60	76.90
14 17:05:00	264.30	283.90	281.30	79.70	83.40	78.30
14 17:10:00	268.90	264.90	266.40	80.30	87.00	80.70

2014 17:15:00	280.60	297.20	280.60	83.40	88.60	83.40
2014 17:20:00	286.00	301.70	283.70	85.30	86.10	85.70
2014 17:25:00	289.50	305.50	293.10	83.30	87.50	85.50
2014 17:30:00	296.60	310.90	295.90	86.60	90.70	85.00
2014 17:35:00	293.10	307.30	295.90	84.70	88.20	84.10
2014 17:40:00	298.20	318.00	301.70	84.70	88.60	85.60
2014 17:45:00	303.30	320.00	306.10	86.30	92.50	86.50
2014 17:50:00	306.30	321.60	313.20	82.80	89.60	85.30
2014 17:55:00	307.10	323.90	311.10	87.80	93.90	88.60
2014 18:00:00	309.10	327.40	311.10	87.70	92.60	87.60
2014 18:05:00	306.80	322.80	312.70	88.90	94.10	90.30
2014 18:10:00	311.10	328.70	314.70	92.20	94.00	93.00
2014 18:15:00	305.50	323.10	309.90	88.40	92.10	87.10
2014 18:20:00	311.70	327.40	314.70	90.00	93.40	89.90
2014 18:25:00	307.10	319.50	311.10	92.60	92.70	91.50
2014 18:30:00	308.60	319.30	312.20	88.40	92.10	86.80
2014 18:35:00	303.30	316.50	304.30	88.60	95.20	87.60
2014 18:40:00	309.10	324.90	310.90	90.50	92.20	88.10
2014 18:45:00	304.30	319.30	301.60	87.10	89.90	88.80
2014 18:50:00	306.30	318.00	305.80	88.30	89.70	87.80
2014 18:55:00	303.30	321.60	304.00	85.30	88.00	84.30
2014 19:00:00	301.00	318.00	302.00	88.00	90.30	86.60
2014 19:05:00	308.90	327.40	310.10	89.40	95.70	88.60
2014 19:10:00	298.20	319.80	303.30	87.20	91.30	86.80
2014 19:15:00	301.70	324.90	308.10	86.10	92.00	88.30
2014 19:20:00	296.40	317.00	304.80	88.10	91.70	86.30
2014 19:25:00	295.40	312.90	304.30	84.30	88.60	83.40
2014 19:30:00	293.30	314.60	302.50	82.40	87.60	82.50
2014 19:35:00	291.00	315.20	301.50	85.80	89.60	85.80
2014 19:40:00	289.80	313.20	298.70	84.70	89.10	85.30
2014 19:45:00	293.60	311.90	302.20	84.60	87.10	85.90
2014 19:50:00	289.50	310.90	297.90	83.30	88.60	85.50
2014 19:55:00	297.20	315.50	303.80	86.50	91.00	86.10
2014 20:00:00	295.10	317.50	301.70	84.20	89.50	84.90
2014 20:05:00	300.20	316.50	304.00	84.70	93.10	86.50
2014 20:10:00	298.20	317.20	304.00	85.20	90.60	85.30
2014 20:15:00	290.80	307.80	294.10	86.40	87.70	87.10
2014 20:20:00	289.30	304.50	293.80	88.90	87.60	85.60
2014 20:25:00	288.20	308.30	293.30	82.90	91.00	83.70
2014 20:30:00	286.20	308.30	295.10	83.30	88.10	83.60
2014 20:35:00	284.90	303.60	292.10	85.20	90.00	86.90
2014 20:40:00	290.00	309.10	297.20	86.60	88.50	89.20
2014 20:45:00	281.90	298.90	289.30	84.00	88.40	85.50
2014 20:50:00	280.10	300.50	288.00	83.50	86.40	83.80

stamp	07.02_BATONZALOOM			07.03_ALAKASHA		
	I a (A)	I b (A)	I c (A)	I a (A)	I b (A)	I c (A)
	33.10	33.30	33.50	20.30	29.30	23.10
2/2014 00:05:00	33.10	32.50	33.80	20.90	28.80	22.90
2/2014 00:10:00	32.20	31.50	33.90	20.30	29.70	23.00
2/2014 00:15:00	33.80	33.10	33.90	19.90	28.80	23.10
2/2014 00:20:00	33.50	34.20	33.90	19.40	27.70	22.90
2/2014 00:25:00	31.80	31.60	31.90	19.90	27.80	22.10
2/2014 00:30:00	29.50	29.60	30.20	18.40	26.50	21.10
2/2014 00:35:00	28.70	29.20	30.30	18.40	25.80	20.30
2/2014 00:40:00	28.60	27.50	29.00	17.70	26.20	20.30
2/2014 00:45:00	28.00	27.50	27.80	17.50	24.20	19.00
2/2014 00:50:00	29.20	27.70	29.10	17.20	24.00	16.80
2/2014 00:55:00	27.40	28.60	27.40	17.50	23.60	18.10
2/2014 01:00:00	33.40	32.00	33.40	18.40	24.20	18.70
2/2014 01:05:00	28.00	25.70	27.60	18.30	23.60	18.10
2/2014 01:10:00	28.30	28.40	28.50	17.50	23.10	18.10
2/2014 01:15:00	27.50	25.90	27.30	17.50	22.50	17.50
2/2014 01:20:00	27.70	26.00	27.90	16.90	22.00	16.90
2/2014 01:25:00	27.20	25.10	26.60	16.70	21.50	16.40
2/2014 01:30:00	27.80	26.10	27.20	16.90	21.30	17.00
2/2014 01:35:00	27.40	25.60	26.40	16.30	21.20	16.40
2/2014 01:40:00	27.40	25.60	25.90	15.40	20.30	16.30
2/2014 01:45:00	27.00	26.40	26.80	17.00	20.70	16.90
2/2014 01:50:00	27.50	25.90	26.90	18.00	20.10	16.30
2/2014 01:55:00	27.40	25.90	26.50	15.70	20.40	16.70
2/2014 02:00:00	26.90	25.40	25.30	16.30	20.40	16.20
2/2014 02:05:00	26.20	24.50	24.60	15.30	20.80	16.30
2/2014 02:10:00	26.20	24.60	25.70	14.80	20.00	15.20
2/2014 02:15:00	26.00	24.70	24.40	14.40	19.50	14.90
2/2014 02:20:00	27.10	24.80	25.40	16.00	20.40	15.50
2/2014 02:25:00	30.30	28.60	28.60	15.00	19.50	14.00
2/2014 02:30:00	26.40	24.40	24.80	14.50	19.20	14.50
2/2014 02:35:00	25.90	23.10	25.30	15.00	20.10	14.90
2/2014 02:40:00	25.20	23.10	24.20	14.70	18.70	13.70
2/2014 02:45:00	25.30	23.80	24.40	14.50	18.80	14.30
2/2014 02:50:00	25.60	23.90	24.00	14.70	19.00	14.80
2/2014 02:55:00	25.30	24.20	23.80	14.20	18.50	15.10
2/2014 03:00:00	23.90	24.00	23.60	15.70	19.50	15.00
2/2014 03:05:00	25.90	24.70	24.20	15.30	19.40	14.80
2/2014 03:10:00	25.80	23.90	24.20	13.90	18.70	14.50
2/2014 03:15:00	28.50	28.00	28.00	13.40	18.60	14.60
2/2014 03:20:00	25.60	23.30	25.20	15.20	19.20	15.00
2/2014 03:25:00	25.50	23.10	23.80	13.90	18.70	14.40
2/2014 03:30:00	25.40	23.80	24.70	13.90	18.70	14.50
2/2014 03:35:00	29.90	29.40	28.80	13.70	18.40	13.80
2/2014 03:40:00	25.90	24.80	24.60	14.00	17.90	14.80
2/2014 03:45:00	25.70	24.20	24.40	14.30	18.20	14.20
2/2014 03:50:00	25.90	24.90	25.00	14.30	17.80	15.10
2/2014 03:55:00	30.50	28.70	28.70	14.10	17.70	14.30

2/2014 04:00:00	24.80	23.90	24.50	13.80	18.20	13.90
2/2014 04:05:00	24.70	24.30	25.80	14.90	18.20	15.00
2/2014 04:10:00	25.00	24.60	24.50	14.40	18.40	14.40
2/2014 04:15:00	24.20	23.60	24.90	13.60	18.50	14.50
2/2014 04:20:00	29.20	28.30	29.20	13.80	17.90	14.90
2/2014 04:25:00	25.00	24.70	25.60	14.10	17.50	13.80
2/2014 04:30:00	26.00	25.30	27.00	15.20	18.10	14.70
2/2014 04:35:00	26.10	24.70	26.60	14.90	18.50	14.30
2/2014 04:40:00	25.90	25.50	26.80	15.50	20.00	16.00
2/2014 04:45:00	28.30	27.60	28.40	15.00	19.70	15.60
2/2014 04:50:00	30.30	28.60	28.70	15.10	19.50	16.30
2/2014 04:55:00	29.60	28.70	28.60	16.00	19.80	16.90
2/2014 05:00:00	29.70	27.00	27.40	15.70	19.20	16.20
2/2014 05:05:00	30.60	28.90	28.50	16.00	19.10	15.50
2/2014 05:10:00	33.10	31.30	29.80	16.00	18.60	16.00
2/2014 05:15:00	33.70	32.40	30.30	16.90	20.30	16.80
2/2014 05:20:00	32.90	31.10	30.40	16.10	19.70	16.40
2/2014 05:25:00	33.30	30.70	30.00	17.50	20.40	17.60
2/2014 05:30:00	32.70	31.40	31.20	16.80	19.60	16.90
2/2014 05:35:00	32.40	30.90	30.40	17.30	21.00	17.30
2/2014 05:40:00	32.80	32.30	32.70	17.00	21.10	17.70
2/2014 05:45:00	32.00	30.90	31.40	16.90	20.40	17.60
2/2014 05:50:00	30.90	28.70	29.20	18.10	20.80	17.70
2/2014 05:55:00	31.90	31.40	30.70	17.20	21.90	18.10
2/2014 06:00:00	34.90	33.80	33.20	16.90	21.20	18.90
2/2014 06:05:00	33.40	31.00	30.50	15.60	21.10	17.10
2/2014 06:10:00	47.00	44.20	46.60	17.60	21.70	17.90
2/2014 06:15:00	46.40	46.20	47.90	17.30	21.40	18.90
2/2014 06:20:00	47.50	43.80	47.50	16.50	20.80	17.30
2/2014 06:25:00	46.00	44.10	46.50	15.70	21.40	17.90
2/2014 06:30:00	45.00	42.60	45.80	16.90	20.80	17.80
2/2014 06:35:00	43.70	41.70	44.40	16.90	20.60	18.10
2/2014 06:40:00	46.90	43.30	47.30	17.00	20.30	17.00
2/2014 06:45:00	41.40	38.90	42.20	17.50	21.40	17.80
2/2014 06:50:00	48.40	46.20	50.00	17.80	22.40	17.90
2/2014 06:55:00	43.10	40.00	42.20	18.00	21.80	17.60
2/2014 07:00:00	46.20	43.30	45.00	18.80	22.40	17.60
2/2014 07:05:00	43.70	43.60	44.10	18.90	22.20	18.70
2/2014 07:10:00	44.90	45.30	47.00	18.20	22.50	18.50
2/2014 07:15:00	44.70	43.00	45.20	18.20	22.10	18.60
2/2014 07:20:00	45.80	44.50	45.20	19.00	23.80	19.40
2/2014 07:25:00	46.50	45.40	47.30	18.70	24.30	19.40
2/2014 07:30:00	48.70	46.40	48.00	19.20	24.60	19.20
2/2014 07:35:00	47.20	45.70	47.40	19.20	24.50	20.00
2/2014 07:40:00	45.80	45.30	48.20	18.50	23.60	19.70
2/2014 07:45:00	51.10	49.50	52.00	19.20	24.60	19.90
2/2014 07:50:00	48.10	48.40	49.20	18.70	24.70	20.30
2/2014 07:55:00	60.30	58.90	60.30	19.20	26.40	21.20
2/2014 08:00:00	52.80	51.10	53.80	19.60	28.50	23.80
2/2014 08:05:00	59.60	58.80	61.80	18.70	26.90	22.30

2014 08:10:00	64.00	65.00	66.40	19.40	27.90	23.70
2014 08:15:00	59.40	59.50	61.30	19.40	28.00	23.40
2014 08:20:00	61.10	60.40	61.70	19.80	27.50	22.60
2014 08:25:00	66.10	65.30	67.50	20.90	29.90	25.30
2014 08:30:00	65.80	64.20	66.90	20.70	29.70	24.90
2014 08:35:00	73.20	70.30	72.80	21.30	30.80	24.50
2014 08:40:00	65.70	64.40	63.40	20.80	26.80	24.40
2014 08:45:00	72.20	72.90	72.40	20.10	28.20	24.70
2014 08:50:00	71.40	71.40	73.10	20.20	29.90	25.50
2014 08:55:00	76.90	74.80	76.10	20.50	29.20	25.00
2014 09:00:00	74.00	72.90	73.30	20.80	29.20	24.10
2014 09:05:00	71.20	71.40	72.10	21.10	29.20	25.20
2014 08:10:00	78.20	78.00	79.20	22.10	30.90	25.60
2014 09:15:00	78.80	78.90	78.90	22.00	30.10	25.30
2014 09:20:00	79.80	79.10	79.00	23.10	32.00	26.00
2014 09:25:00	73.40	73.40	74.70	23.30	31.10	25.10
2014 09:30:00	71.20	65.70	74.10	25.40	32.50	26.40
2014 09:35:00	73.80	75.50	76.80	25.90	33.80	27.10
2014 09:40:00	77.00	76.00	79.20	26.40	33.80	26.80
2014 09:45:00	69.30	67.00	68.50	26.20	33.80	26.70
2014 09:50:00	74.00	71.90	74.20	27.30	35.90	28.80
2014 09:55:00	76.70	78.00	77.80	26.30	33.90	26.90
2014 10:00:00	69.30	70.30	71.10	26.70	34.30	27.50
2014 10:05:00	79.70	78.30	80.80	27.10	33.70	26.60
2014 10:10:00	72.60	72.10	73.80	26.60	32.50	25.90
2014 10:15:00	75.50	75.10	75.60	25.70	32.10	25.80
2014 10:20:00	76.40	78.40	78.10	25.80	32.40	26.90
2014 10:25:00	77.20	76.40	78.90	24.70	32.80	26.40
2014 10:30:00	76.30	74.60	77.50	25.10	31.40	26.30
2014 10:35:00	79.20	77.00	80.80	25.00	31.60	25.70
2014 10:40:00	78.40	75.50	80.80	24.40	32.40	26.80
2014 10:45:00	76.00	75.20	80.50	24.30	30.00	24.70
2014 10:50:00	76.80	75.70	81.10	24.20	30.00	25.80
2014 10:55:00	78.60	77.30	80.80	23.10	27.50	23.80
2014 11:00:00	80.30	78.90	83.10	23.50	28.10	24.00
2014 11:05:00	75.00	74.70	78.00	23.40	29.20	24.40
2014 11:10:00	76.90	77.10	81.40	24.50	29.80	24.90
2014 11:15:00	80.80	79.50	82.70	25.30	30.50	25.00
2014 11:20:00	76.70	76.70	78.30	25.00	30.80	25.30
2014 11:25:00	74.20	73.30	74.10	25.30	29.70	25.50
2014 11:30:00	80.50	79.40	79.50	25.60	29.70	25.10
2014 11:35:00	77.40	76.80	77.60	25.20	30.10	25.30
2014 11:40:00	72.10	72.70	74.50	23.60	30.50	26.10
2014 11:45:00	66.00	65.80	67.20	23.00	30.40	25.60
2014 11:50:00	70.90	71.60	71.90	22.20	30.30	25.70
2014 11:55:00	70.40	70.30	71.20	21.70	28.20	24.70
2014 12:00:00	71.70	70.50	72.40	22.90	29.50	23.90
2014 12:05:00	69.70	67.70	70.80	22.20	28.60	23.30
2014 12:10:00	68.10	66.80	70.20	23.20	28.70	24.00
2014 12:15:00	62.00	60.60	62.70	21.90	27.60	21.90

2/2014 13:05:00	63.00	62.50	64.20	22.00	28.50	23.10
2/2014 13:10:00	62.00	58.20	61.90	22.10	28.90	23.90
2/2014 13:15:00	65.50	66.10	67.60	22.70	29.60	24.90
2/2014 13:20:00	65.30	64.50	67.20	23.00	29.10	24.50
2/2014 13:25:00	65.90	68.70	67.70	21.60	29.00	24.10
2/2014 13:30:00	62.40	61.20	63.30	21.50	30.30	25.20
2/2014 13:35:00	59.00	63.70	60.60	22.70	30.30	25.10
2/2014 13:40:00	60.20	61.00	61.90	23.40	31.00	24.70
2/2014 13:45:00	67.60	70.70	69.70	22.40	29.70	24.70
2/2014 13:50:00	66.70	67.20	67.40	21.80	30.50	25.60
2/2014 13:55:00	66.20	62.70	65.80	22.50	30.70	24.70
2/2014 14:00:00	68.10	64.60	68.60	22.40	30.00	24.20
2/2014 14:05:00	64.20	64.20	64.00	22.60	30.80	24.30
2/2014 14:10:00	57.20	59.60	58.60	21.80	30.00	24.90
2/2014 14:15:00	61.90	63.40	63.20	21.40	28.70	23.40
2/2014 14:20:00	56.40	68.70	70.40	21.60	28.70	23.20
2/2014 14:25:00	60.60	58.90	62.50	21.40	29.00	23.90
2/2014 14:30:00	70.80	74.20	73.80	23.10	29.40	25.00
2/2014 14:35:00	67.90	67.30	70.30	21.40	28.50	24.40
2/2014 14:40:00	67.40	71.20	69.10	22.30	28.60	24.40
2/2014 14:45:00	66.30	68.60	69.00	22.60	29.20	24.50
2/2014 14:50:00	76.70	76.00	78.60	23.10	30.50	26.40
2/2014 14:55:00	71.30	69.30	71.50	23.60	30.30	26.00
2/2014 15:00:00	68.90	69.30	71.10	23.60	30.80	26.70
2/2014 15:05:00	68.10	71.70	68.50	23.10	30.30	25.90
2/2014 15:10:00	69.30	66.60	71.30	23.10	29.40	25.90
2/2014 15:15:00	69.80	63.90	71.90	23.80	29.80	25.10
2/2014 15:20:00	68.20	67.00	68.50	23.90	29.80	25.50
2/2014 15:25:00	73.90	67.20	74.40	23.80	31.80	26.70
2/2014 15:30:00	65.60	64.60	66.40	24.70	31.60	27.50
2/2014 15:35:00	71.10	72.10	70.10	24.70	31.90	27.10
2/2014 15:40:00	69.70	64.80	69.10	24.80	31.00	26.20
2/2014 15:45:00	68.60	66.40	68.40	24.40	31.90	25.70
2/2014 15:50:00	65.20	63.60	65.60	24.70	32.60	26.40
2/2014 15:55:00	66.10	64.80	65.80	24.70	31.90	26.50
2/2014 16:00:00	69.90	67.60	68.60	23.20	31.60	26.20
2/2014 16:05:00	62.40	64.10	64.90	24.80	33.00	28.60
2/2014 16:10:00	61.00	63.60	62.50	24.00	33.60	29.70
2/2014 16:15:00	65.30	65.20	67.20	25.20	34.00	28.60
2/2014 16:20:00	61.20	62.50	61.40	25.90	34.70	30.00
2/2014 16:25:00	62.80	64.10	64.30	26.50	34.20	29.40
2/2014 16:30:00	55.80	58.10	58.00	26.40	34.70	30.40
2/2014 16:35:00	58.60	61.50	62.00	27.50	34.50	30.80
2/2014 16:40:00	57.30	59.70	60.30	26.90	34.90	29.70
2/2014 16:45:00	58.40	61.20	60.40	27.50	35.00	29.60
2/2014 16:50:00	58.40	58.10	58.10	27.10	35.20	29.30
2/2014 16:55:00	60.70	64.10	63.50	27.50	34.80	30.30
2/2014 17:00:00	60.00	61.10	61.20	29.10	36.90	33.30
2/2014 17:05:00	67.20	69.70	67.30	30.30	38.60	32.70
2/2014 17:10:00	61.60	63.40	61.50	30.80	40.40	34.70

2014 17:15:00	66.30	65.40	66.40	31.40	41.40	36.50
2014 17:20:00	66.10	67.70	67.40	32.50	42.20	37.20
2014 17:25:00	66.40	68.60	68.10	32.30	42.20	37.40
2014 17:30:00	69.10	69.70	68.70	32.50	43.90	38.30
2014 17:35:00	71.10	69.70	74.70	33.10	44.70	39.60
2014 17:40:00	71.70	73.80	74.70	35.30	44.70	40.80
2014 17:45:00	73.40	75.30	76.20	34.40	44.00	40.70
2014 17:50:00	79.70	77.00	83.40	35.80	45.10	42.60
2014 17:55:00	71.20	73.10	78.00	35.30	44.70	41.40
2014 18:00:00	76.40	76.90	80.80	35.30	46.40	41.40
2014 18:05:00	71.40	70.70	74.90	36.40	48.70	42.40
2014 18:10:00	77.40	78.10	81.60	37.10	47.50	41.90
2014 18:15:00	71.40	72.00	75.50	37.60	48.50	43.30
2014 18:20:00	74.60	76.40	76.40	38.50	49.50	43.60
2014 18:25:00	69.70	70.20	71.50	37.00	47.90	42.90
2014 18:30:00	69.20	70.00	71.10	36.90	48.50	43.00
2014 18:35:00	70.00	71.10	72.10	38.00	48.50	42.80
2014 18:40:00	71.50	78.30	75.10	37.20	47.90	41.80
2014 18:45:00	72.40	73.10	72.70	36.50	49.20	42.20
2014 18:50:00	68.40	71.00	69.50	36.90	48.60	42.90
2014 18:55:00	74.70	78.00	75.70	37.00	48.90	42.70
2014 19:00:00	67.50	71.40	69.70	36.40	46.80	42.60
2014 19:05:00	73.00	75.90	74.70	35.50	48.60	42.80
2014 19:10:00	68.70	71.50	71.90	36.10	48.20	42.30
2014 19:15:00	74.10	74.60	77.50	35.30	47.20	42.70
2014 19:20:00	64.60	70.00	69.70	34.20	46.80	42.00
2014 19:25:00	67.00	69.40	70.70	33.80	46.40	42.40
2014 19:30:00	66.70	70.90	70.30	33.60	47.10	42.30
2014 19:35:00	68.50	71.60	72.20	33.90	47.20	42.40
2014 19:40:00	66.30	69.20	71.60	33.70	46.80	41.00
2014 19:45:00	66.50	68.00	71.10	34.60	48.40	42.30
2014 19:50:00	66.60	68.00	70.90	34.10	47.40	41.30
2014 19:55:00	65.90	68.00	69.80	34.60	47.50	41.00
2014 20:00:00	72.70	74.60	77.10	35.40	47.30	40.80
2014 20:05:00	66.30	69.70	70.90	35.00	49.00	41.40
2014 20:10:00	69.70	73.20	75.20	34.20	47.40	41.10
2014 20:15:00	65.30	67.10	70.60	34.10	47.80	40.10
2014 20:20:00	63.60	66.20	68.70	33.60	47.60	40.80
2014 20:25:00	65.40	66.10	71.40	33.80	46.60	40.50
2014 20:30:00	71.00	74.20	75.90	32.10	45.80	40.20
2014 20:35:00	63.60	65.30	68.60	33.00	45.30	39.50
2014 20:40:00	68.10	70.80	70.90	32.90	45.80	40.10
2014 20:45:00	61.60	63.60	65.30	31.40	45.80	39.60
2014 20:50:00	61.40	63.70	66.80	32.80	46.30	40.50
2014 20:55:00						

	07.04_ALSAHEB			07.04_DISTRIBITION		
Timestamp	I a (A)	I b (A)	I c (A)	I a (A)	I b (A)	I c (A)
	60.70	59.20	54.70	2.60	4.10	2.6
01/02/2014 00:05:00	60.00	58.50	53.50	2.60	4.40	3.0
01/02/2014 00:10:00	59.40	57.60	53.20	2.60	4.30	3.0
01/02/2014 00:15:00	58.10	56.60	51.30	2.60	4.20	2.9
01/02/2014 00:20:00	56.70	55.40	49.90	2.30	3.70	2.5
01/02/2014 00:25:00	54.80	54.20	47.30	2.30	3.40	2.3
01/02/2014 00:30:00	54.30	53.60	47.80	2.50	3.60	2.4
01/02/2014 00:35:00	54.60	53.90	48.20	2.20	3.20	2.3
01/02/2014 00:40:00	55.80	54.90	49.00	2.00	3.20	2.3
01/02/2014 00:45:00	54.00	52.80	47.10	2.20	3.30	2.3
01/02/2014 00:50:00	54.30	51.70	47.50	2.00	3.00	2.2
01/02/2014 00:55:00	52.40	51.10	48.60	1.90	3.20	2.4
01/02/2014 01:00:00	52.50	51.00	47.50	2.00	3.30	2.2
01/02/2014 01:05:00	53.00	53.30	47.70	2.00	3.20	2.2
01/02/2014 01:10:00	52.50	52.80	47.10	1.80	3.00	2.2
01/02/2014 01:15:00	51.20	49.50	46.70	2.00	3.10	2.0
01/02/2014 01:20:00	51.20	49.70	47.40	2.10	3.30	2.3
01/02/2014 01:25:00	50.30	48.60	46.40	2.20	3.20	2.1
01/02/2014 01:30:00	49.80	47.80	45.20	2.20	3.30	2.3
01/02/2014 01:35:00	50.30	46.70	44.50	2.30	3.20	2.1
01/02/2014 01:40:00	49.70	47.70	45.00	2.00	3.00	2.0
01/02/2014 01:45:00	47.00	45.30	41.90	2.00	3.20	2.2
01/02/2014 01:50:00	48.40	46.60	43.20	1.90	3.00	2.0
01/02/2014 01:55:00	47.00	45.50	42.50	2.00	2.90	2.0
01/02/2014 02:00:00	48.50	45.70	44.10	1.80	2.70	2.0
01/02/2014 02:05:00	46.90	45.60	43.00	1.80	2.80	1.9
01/02/2014 02:10:00	46.50	46.10	41.80	1.80	2.70	2.0
01/02/2014 02:15:00	46.30	44.70	41.80	2.10	2.90	2.0
01/02/2014 02:20:00	46.10	45.50	41.90	1.80	2.80	2.1
01/02/2014 02:25:00	45.70	44.70	40.50	1.80	2.70	1.9
01/02/2014 02:30:00	44.20	43.10	39.50	2.20	3.40	2.2
01/02/2014 02:35:00	43.10	42.40	40.20	2.30	3.30	2.0
01/02/2014 02:40:00	44.90	45.30	41.10	2.10	3.10	2.0
01/02/2014 02:45:00	45.70	44.70	42.50	1.70	2.90	2.1
01/02/2014 02:50:00	45.70	45.30	42.50	1.70	2.70	2.0
01/02/2014 02:55:00	44.70	45.40	42.10	1.70	2.60	2.1
01/02/2014 03:00:00	44.50	43.40	40.30	2.00	2.70	2.0
01/02/2014 03:05:00	46.30	46.00	43.00	1.70	2.60	2.0
01/02/2014 03:10:00	44.70	44.60	40.80	1.70	2.70	2.0
01/02/2014 03:15:00	44.90	44.30	42.00	1.70	2.60	1.8
01/02/2014 03:20:00	43.80	43.10	40.70	1.80	2.80	2.0
01/02/2014 03:25:00	44.50	44.30	40.80	1.60	2.80	2.0
01/02/2014 03:30:00	45.60	44.30	41.40	1.70	2.70	2.1
01/02/2014 03:35:00	43.70	42.80	39.90	1.70	2.70	2.0
01/02/2014 03:40:00	43.60	44.20	40.90	1.70	2.70	2.1
01/02/2014 03:45:00	43.20	43.90	38.70	1.70	2.40	1.9
01/02/2014 03:50:00	44.20	46.10	43.10	1.80	2.60	2.0
01/02/2014 03:55:00	41.70	41.60	39.60	1.60	2.70	2.1

01/02/2014 04:00:00	41.70	42.40	38.90	1.50	2.50	1.9
01/02/2014 04:05:00	41.80	42.60	38.80	1.70	2.70	2.1
01/02/2014 04:10:00	42.50	43.40	38.80	1.60	2.50	1.9
01/02/2014 04:15:00	42.50	43.80	41.00	1.60	2.60	2.1
01/02/2014 04:20:00	44.10	43.80	41.30	1.60	2.40	1.9
01/02/2014 04:25:00	41.80	42.50	40.20	1.80	2.70	1.9
01/02/2014 04:30:00	44.00	44.50	41.40	2.10	3.00	1.8
01/02/2014 04:35:00	41.40	42.00	39.00	1.80	2.40	1.8
01/02/2014 04:40:00	42.90	43.00	39.60	1.60	2.60	2.0
01/02/2014 04:45:00	46.00	44.70	39.90	1.80	2.70	1.7
01/02/2014 04:50:00	46.70	47.20	40.90	1.80	2.80	2.0
01/02/2014 04:55:00	44.60	46.10	42.10	2.10	3.00	1.9
01/02/2014 05:00:00	43.10	43.30	40.30	1.70	2.40	1.9
01/02/2014 05:05:00	45.40	45.60	40.30	1.70	2.40	1.9
01/02/2014 05:10:00	45.90	46.40	40.70	1.60	2.30	1.7
01/02/2014 05:15:00	46.30	45.90	42.30	1.90	2.70	1.9
01/02/2014 05:20:00	47.70	46.30	44.00	1.60	2.60	1.7
01/02/2014 05:25:00	46.80	47.10	44.80	1.60	2.80	2.0
01/02/2014 05:30:00	47.80	48.60	45.00	1.80	2.70	2.0
01/02/2014 05:35:00	48.20	49.30	45.00	1.90	2.70	1.9
01/02/2014 05:40:00	49.10	49.10	44.60	2.00	2.90	2.0
01/02/2014 05:45:00	51.20	49.70	44.20	1.90	2.60	1.7
01/02/2014 05:50:00	52.20	51.40	46.90	1.90	2.80	1.8
01/02/2014 05:55:00	51.80	51.20	46.50	1.80	2.80	2.0
01/02/2014 06:00:00	49.70	48.80	44.70	2.00	2.90	2.0
01/02/2014 06:05:00	51.60	52.10	47.80	1.90	2.90	2.1
01/02/2014 06:10:00	51.40	52.80	47.60	1.90	2.80	1.9
01/02/2014 06:15:00	53.30	53.10	48.40	2.20	3.20	2.2
01/02/2014 06:20:00	51.20	51.40	48.50	2.40	3.30	1.9
01/02/2014 06:25:00	49.20	50.30	47.20	2.40	3.40	2.0
01/02/2014 06:30:00	49.60	50.00	47.00	2.50	3.40	2.1
01/02/2014 06:35:00	49.20	48.60	46.00	2.20	3.10	1.9
01/02/2014 06:40:00	48.60	48.10	44.60	2.30	3.20	2.0
01/02/2014 06:45:00	50.60	49.70	46.20	2.10	2.90	1.6
01/02/2014 06:50:00	52.60	51.50	47.20	2.30	3.30	2.1
01/02/2014 06:55:00	50.10	50.30	46.30	2.00	3.00	2.0
01/02/2014 07:00:00	53.10	52.60	48.60	1.90	2.80	1.8
01/02/2014 07:05:00	50.20	51.40	46.90	1.90	3.00	2.1
01/02/2014 07:10:00	52.30	53.90	51.10	2.10	3.10	1.7
01/02/2014 07:15:00	53.70	54.10	52.00	1.90	2.90	1.9
01/02/2014 07:20:00	53.60	54.60	50.70	2.00	3.10	1.9
01/02/2014 07:25:00	54.20	55.60	50.20	2.10	3.10	1.8
01/02/2014 07:30:00	53.40	54.40	49.40	2.10	3.20	2.0
01/02/2014 07:35:00	57.60	55.30	50.30	2.20	3.40	2.2
01/02/2014 07:40:00	57.90	55.20	50.60	2.50	3.50	1.9
01/02/2014 07:45:00	59.20	57.50	54.00	2.30	3.40	2.0
01/02/2014 07:50:00	59.90	56.30	52.60	2.20	3.40	2.1
01/02/2014 07:55:00	61.40	58.10	53.10	2.30	3.60	2.3
01/02/2014 08:00:00	66.00	63.60	57.20	2.00	3.30	2.6
01/02/2014 08:05:00	64.30	64.30	56.20	2.10	3.40	2.8

01/02/2014 08:10:00	67.50	67.50	60.50	1.80	3.30	2.40
01/02/2014 08:15:00	71.20	69.70	63.50	2.20	3.60	2.70
01/02/2014 08:20:00	70.60	70.90	63.20	2.50	3.50	2.40
01/02/2014 08:25:00	66.50	68.30	61.50	2.20	3.30	2.10
01/02/2014 08:30:00	68.40	71.30	64.40	2.70	3.50	2.30
01/02/2014 08:35:00	66.70	71.20	63.00	2.60	3.50	2.60
01/02/2014 08:40:00	70.00	74.50	65.60	2.30	3.60	2.50
01/02/2014 08:45:00	70.80	73.60	65.10	2.50	3.80	2.70
01/02/2014 08:50:00	70.60	72.50	66.20	2.60	4.20	3.10
01/02/2014 08:55:00	76.40	76.80	69.10	3.00	4.20	2.90
01/02/2014 09:00:00	74.70	74.50	67.40	3.10	4.10	2.60
01/02/2014 09:05:00	74.20	76.60	70.30	3.20	4.00	2.50
01/02/2014 09:10:00	75.20	76.00	68.60	2.90	4.00	2.50
01/02/2014 09:15:00	75.30	78.20	70.60	3.00	3.70	2.60
01/02/2014 09:20:00	75.80	78.30	70.90	2.90	3.70	2.60
01/02/2014 09:25:00	76.50	74.70	70.30	3.30	4.00	2.60
01/02/2014 09:30:00	79.60	79.00	71.60	3.20	4.20	3.00
01/02/2014 09:35:00	79.40	78.60	73.00	3.30	4.50	3.00
01/02/2014 09:40:00	81.30	78.50	73.80	3.90	4.90	3.20
01/02/2014 09:45:00	78.40	78.30	74.10	3.50	4.50	2.80
01/02/2014 09:50:00	78.10	76.60	71.40	3.40	4.40	2.60
01/02/2014 09:55:00	81.10	80.00	74.90	3.50	4.60	2.80
01/02/2014 10:00:00	79.20	76.90	74.10	3.50	4.80	2.70
01/02/2014 10:05:00	83.70	80.30	76.10	3.40	4.50	2.50
01/02/2014 10:10:00	82.80	79.10	79.20	3.10	4.70	3.10
01/02/2014 10:15:00	83.60	80.70	80.10	2.80	4.50	3.30
01/02/2014 10:20:00	85.80	84.20	81.70	2.90	4.20	2.7
01/02/2014 10:25:00	83.30	81.00	78.20	2.80	4.40	3.1
01/02/2014 10:30:00	85.10	84.00	82.60	2.80	4.20	2.9
01/02/2014 10:35:00	81.90	79.40	78.90	3.30	4.90	3.1
01/02/2014 10:40:00	82.30	81.80	78.30	3.20	4.50	3.0
01/02/2014 10:45:00	81.80	81.80	77.80	3.40	4.70	2.9
01/02/2014 10:50:00	84.20	87.80	80.30	3.40	4.30	3.0
01/02/2014 10:55:00	82.20	82.50	75.30	3.00	3.90	2.6
01/02/2014 11:00:00	80.80	81.40	77.40	3.90	4.60	2.8
01/02/2014 11:05:00	81.90	83.20	80.80	3.60	4.30	2.5
01/02/2014 11:10:00	80.80	82.90	81.60	3.30	3.70	2.4
01/02/2014 11:15:00	76.90	76.60	75.30	3.70	4.20	2.7
01/02/2014 11:20:00	77.90	77.00	75.00	3.00	3.50	2.4
01/02/2014 11:25:00	80.80	77.00	75.30	2.70	3.40	2.8
01/02/2014 11:30:00	78.30	78.10	75.30	2.80	3.70	2.8
01/02/2014 11:35:00	80.20	79.80	78.70	2.90	3.80	3.0
01/02/2014 11:40:00	76.90	77.00	72.70	3.10	3.90	2.9
01/02/2014 11:45:00	81.30	80.10	76.10	2.70	3.20	2.7
01/02/2014 11:50:00	82.80	83.60	76.50	3.10	3.70	3.3
01/02/2014 11:55:00	78.40	78.50	72.80	2.70	3.30	2.8
01/02/2014 12:00:00	82.80	82.40	79.40	3.50	4.00	3.2
01/02/2014 12:05:00	82.60	81.60	77.20	3.00	3.30	2.9
01/02/2014 12:10:00	83.30	88.10	80.40	3.70	4.10	3.0
01/02/2014 12:15:00	79.00	77.20	74.90	2.60	3.80	2.7

01/02/2014 13:05:00	76.80	78.10	72.30	3.00	4.10	3.2
01/02/2014 13:10:00	79.70	75.10	74.50	2.50	3.90	2.7
01/02/2014 13:15:00	78.20	78.10	72.80	3.10	4.10	3.4
01/02/2014 13:20:00	75.90	76.90	72.10	2.90	3.70	3.0
01/02/2014 13:25:00	78.80	76.00	75.20	3.10	3.90	3.2
01/02/2014 13:30:00	80.10	78.50	72.70	3.10	3.70	3.4
01/02/2014 13:35:00	78.00	80.40	73.60	2.50	3.40	2.6
01/02/2014 13:40:00	76.50	74.90	73.00	2.60	3.60	2.6
01/02/2014 13:45:00	78.60	77.40	74.00	2.20	3.20	2.6
01/02/2014 13:50:00	78.10	77.00	74.30	2.20	3.30	2.9
01/02/2014 13:55:00	75.40	77.80	72.30	2.30	3.40	3.0
01/02/2014 14:00:00	74.70	74.40	71.00	2.30	3.60	2.8
01/02/2014 14:05:00	75.20	72.10	71.00	2.30	3.50	2.8
01/02/2014 14:10:00	76.40	73.00	71.90	2.50	3.40	2.7
01/02/2014 14:15:00	78.50	76.70	73.50	2.60	3.60	2.8
01/02/2014 14:20:00	77.00	78.60	74.20	2.90	4.10	3.0
01/02/2014 14:25:00	75.60	74.00	70.50	2.60	3.70	3.2
01/02/2014 14:30:00	75.60	75.40	72.10	2.30	3.40	2.9
01/02/2014 14:35:00	72.30	76.10	69.70	2.40	3.90	3.4
01/02/2014 14:40:00	73.90	74.20	71.30	2.40	3.80	3.1
01/02/2014 14:45:00	76.20	74.70	72.20	3.10	4.30	3.4
01/02/2014 14:50:00	78.90	76.60	75.40	2.50	4.30	2.8
01/02/2014 14:55:00	75.90	76.50	72.40	2.80	4.30	3.4
01/02/2014 15:00:00	70.70	75.00	68.10	2.70	4.00	3.1
01/02/2014 15:05:00	75.50	76.20	72.50	2.80	4.00	3.1
01/02/2014 15:10:00	80.30	80.80	76.80	2.20	3.50	2.6
01/02/2014 15:15:00	77.60	78.20	73.10	2.70	3.80	2.9
01/02/2014 15:20:00	77.30	78.20	73.20	2.90	4.00	2.8
01/02/2014 15:25:00	79.80	79.60	74.70	3.10	4.40	3.0
01/02/2014 15:30:00	78.10	80.00	73.00	2.90	4.10	3.1
01/02/2014 15:35:00	79.20	78.20	73.10	3.10	4.10	3.3
01/02/2014 15:40:00	77.20	76.20	73.10	3.30	4.40	3.4
01/02/2014 15:45:00	79.40	78.60	74.00	2.70	4.10	3.4
01/02/2014 15:50:00	78.60	78.80	73.10	3.00	4.70	3.9
01/02/2014 15:55:00	81.20	79.60	73.10	3.00	4.50	3.3
01/02/2014 16:00:00	78.90	78.00	73.20	3.10	4.70	3.5
01/02/2014 16:05:00	79.90	78.60	74.10	3.00	4.40	3.2
01/02/2014 16:10:00	76.90	77.00	72.40	3.20	5.00	3.6
01/02/2014 16:15:00	77.70	78.60	73.50	3.00	4.70	3.3
01/02/2014 16:20:00	82.00	79.40	78.00	3.10	4.70	3.5
01/02/2014 16:25:00	81.20	80.20	75.50	2.90	4.40	3.0
01/02/2014 16:30:00	80.80	78.20	74.70	2.70	4.30	3.0
01/02/2014 16:35:00	80.40	78.30	74.80	2.80	4.20	3.2
01/02/2014 16:40:00	82.30	80.70	76.40	3.00	4.80	3.4
01/02/2014 16:45:00	82.90	82.50	77.70	3.00	4.40	3.5
01/02/2014 16:50:00	84.40	83.60	78.40	3.10	4.40	3.3
01/02/2014 16:55:00	87.00	86.10	80.20	3.20	4.30	3.6
01/02/2014 17:00:00	87.70	88.50	83.10	2.60	4.10	3.4
01/02/2014 17:05:00	90.10	90.70	84.20	3.00	4.40	3.3
01/02/2014 17:10:00	93.70	91.60	86.70	3.20	4.70	3.5

01/02/2014 17:15:00	98.40	98.80	90.80	3.70	5.00	3.5
01/02/2014 17:20:00	103.10	101.30	94.40	3.40	4.70	3.3
01/02/2014 17:25:00	103.60	104.50	96.00	3.60	5.00	4.0
01/02/2014 17:30:00	106.30	102.20	101.20	3.60	5.30	4.1
01/02/2014 17:35:00	104.80	103.40	98.40	3.20	5.00	3.8
01/02/2014 17:40:00	107.30	105.10	99.30	4.20	5.90	4.4
01/02/2014 17:45:00	103.90	104.60	95.80	4.40	5.60	4.5
01/02/2014 17:50:00	106.00	106.80	100.00	3.70	5.90	4.7
01/02/2014 17:55:00	108.40	108.30	100.80	4.00	5.90	4.9
01/02/2014 18:00:00	107.50	109.30	101.30	3.70	5.70	4.5
01/02/2014 18:05:00	105.70	108.40	100.10	3.80	6.10	4.9
01/02/2014 18:10:00	105.30	104.20	98.70	3.70	6.50	5.3
01/02/2014 18:15:00	108.20	106.40	102.10	4.10	6.60	5.4
01/02/2014 18:20:00	105.70	103.60	100.40	3.90	6.60	5.7
01/02/2014 18:25:00	108.00	104.60	102.80	3.70	5.60	4.9
01/02/2014 18:30:00	106.80	104.20	101.90	4.00	6.00	5.1
01/02/2014 18:35:00	103.80	99.30	98.90	3.90	5.60	4.6
01/02/2014 18:40:00	105.50	102.40	100.60	4.50	6.30	5.0
01/02/2014 18:45:00	107.40	103.30	99.90	4.50	6.10	4.4
01/02/2014 18:50:00	106.10	104.20	101.00	4.20	6.10	4.8
01/02/2014 18:55:00	107.30	104.40	100.80	4.30	6.40	5.1
01/02/2014 19:00:00	106.10	103.70	100.40	4.50	6.10	5.0
01/02/2014 19:05:00	104.10	103.60	98.20	4.20	5.80	4.9
01/02/2014 19:10:00	105.90	103.60	100.80	4.10	6.30	5.0
01/02/2014 19:15:00	104.90	106.80	100.40	4.50	5.90	4.9
01/02/2014 19:20:00	104.70	104.40	100.80	4.80	6.10	5.0
01/02/2014 19:25:00	105.10	106.20	101.90	4.30	5.80	5.1
01/02/2014 19:30:00	104.90	106.20	100.60	4.10	6.10	4.8
01/02/2014 19:35:00	103.10	103.60	99.30	4.70	6.10	5.1
01/02/2014 19:40:00	103.80	103.90	100.20	5.10	6.30	4.6
01/02/2014 19:45:00	106.30	105.00	102.40	4.80	6.40	4.9
01/02/2014 19:50:00	103.60	102.80	100.30	5.10	6.50	4.5
01/02/2014 19:55:00	105.80	103.80	101.20	4.90	6.50	4.6
01/02/2014 20:00:00	103.60	101.60	100.30	5.10	6.90	5.1
01/02/2014 20:05:00	105.40	100.80	99.40	5.40	7.10	5.1
01/02/2014 20:10:00	105.50	101.80	97.20	5.20	6.50	5.0
01/02/2014 20:15:00	103.00	101.40	98.60	5.00	6.80	4.8
01/02/2014 20:20:00	102.80	98.30	97.50	5.40	6.60	4.7
01/02/2014 20:25:00	103.20	99.80	97.10	5.60	6.80	4.8
01/02/2014 20:30:00	101.90	97.40	97.10	5.10	6.30	4.6
01/02/2014 20:35:00	103.20	98.50	97.30	4.50	6.30	4.7
01/02/2014 20:40:00	102.80	99.30	95.80	4.70	6.40	4.7
01/02/2014 20:45:00	101.30	98.80	95.70	4.50	6.30	4.7
01/02/2014 20:50:00	101.40	99.70	94.60	4.40	6.40	5.0
01/02/2014 20:55:00						

Appendix C

Hebron City Substations

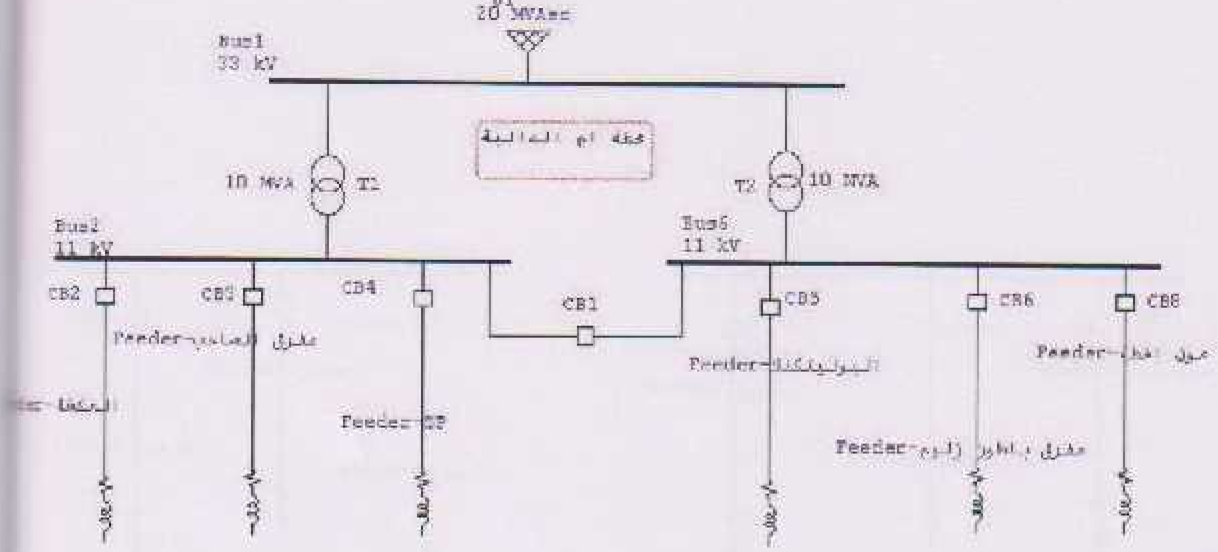


Figure (4.7)Em Al-Daliah Substation.

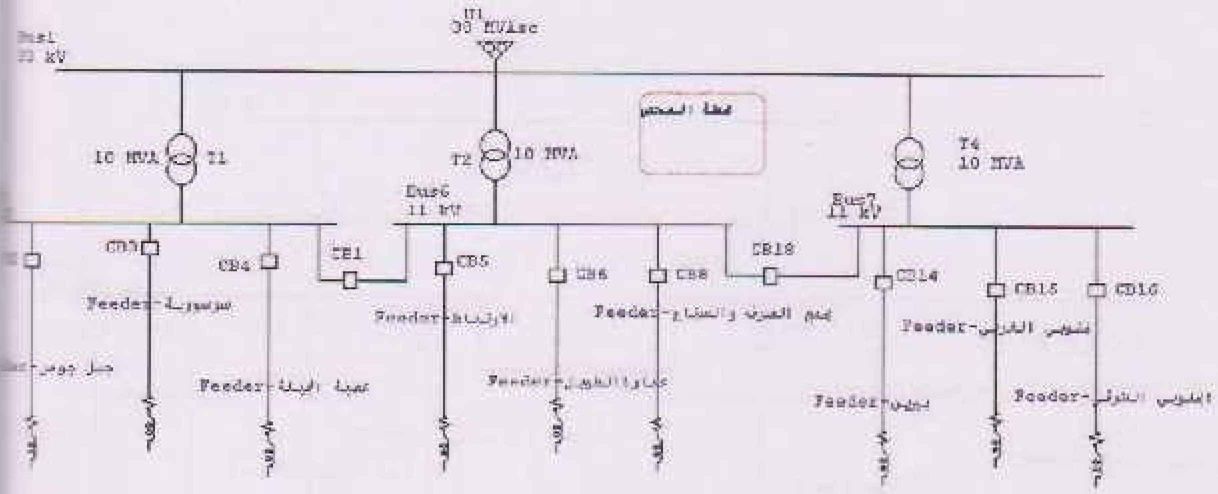


Figure (4.8) Al-Fahs Substation.

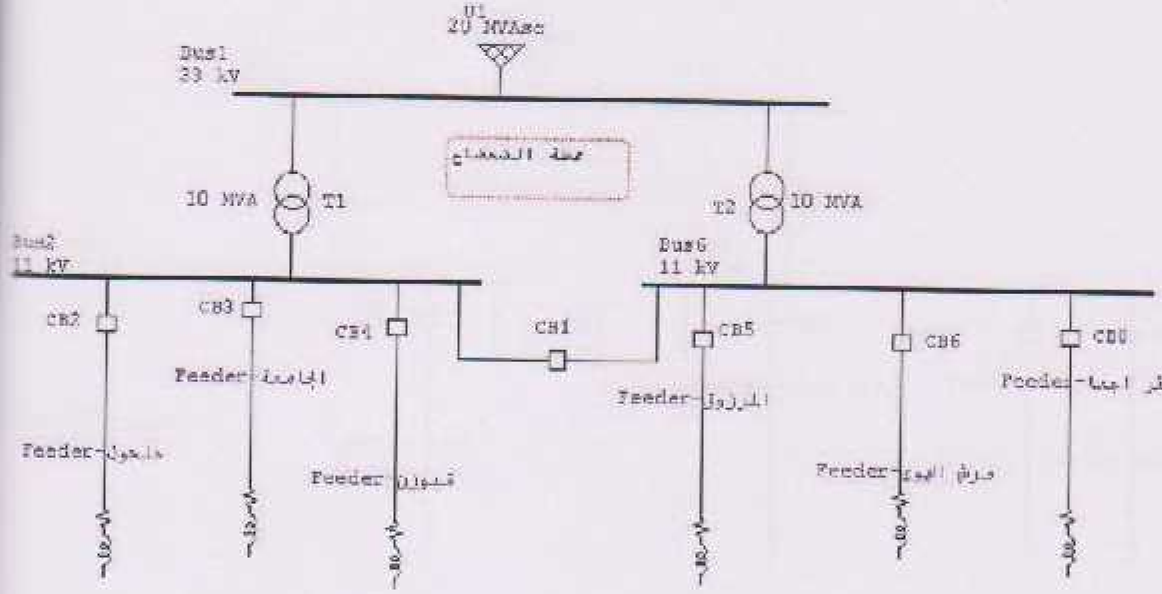


Figure (4.9) Al-Duhdah Substation.

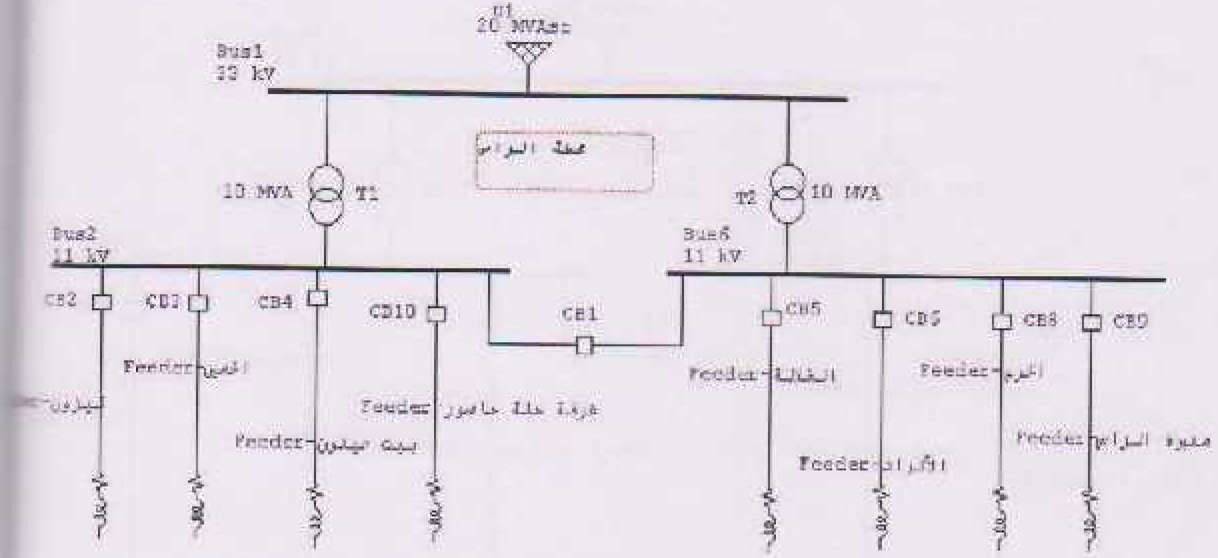


Figure (4.10) Al-Ras Substation.

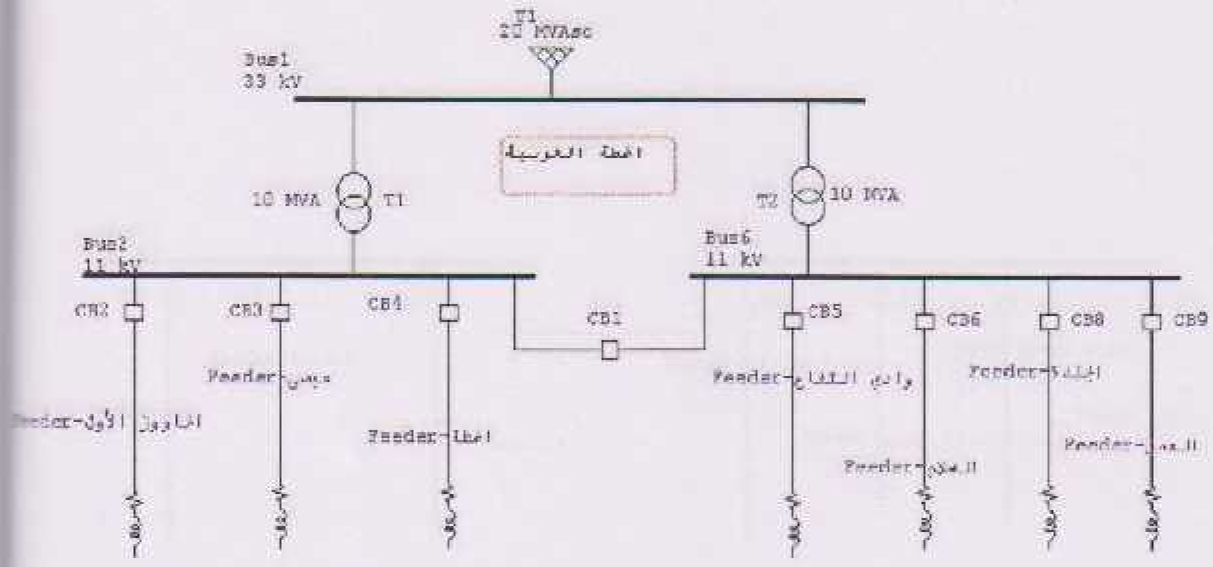


Figure (4.11) Al-Garbiah Substation.

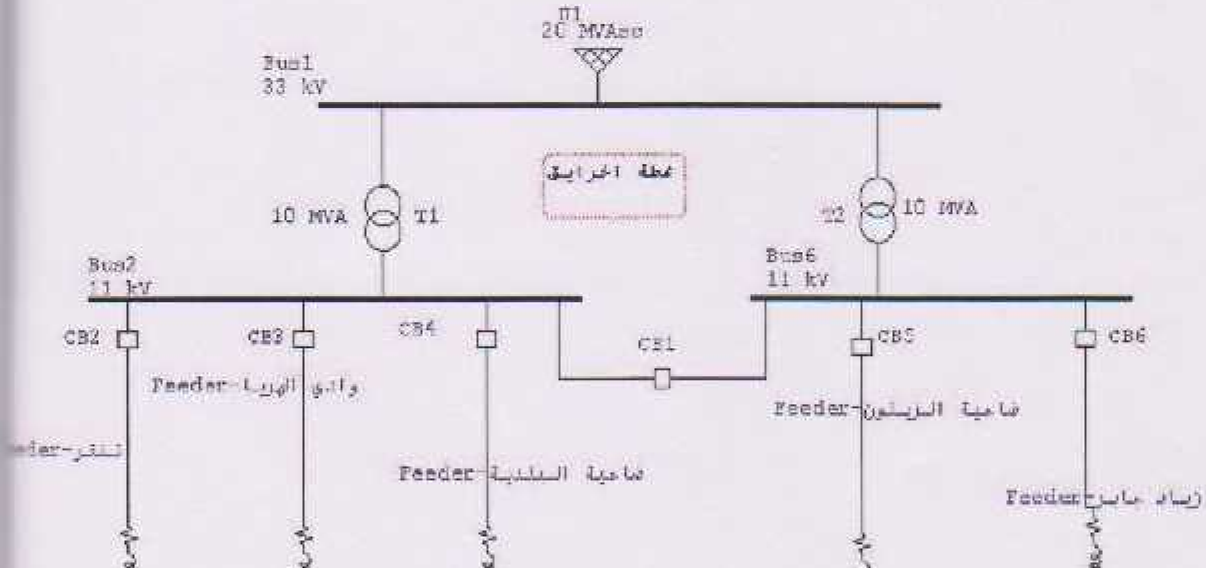


Figure (4.12) Al-Harayek Substation.

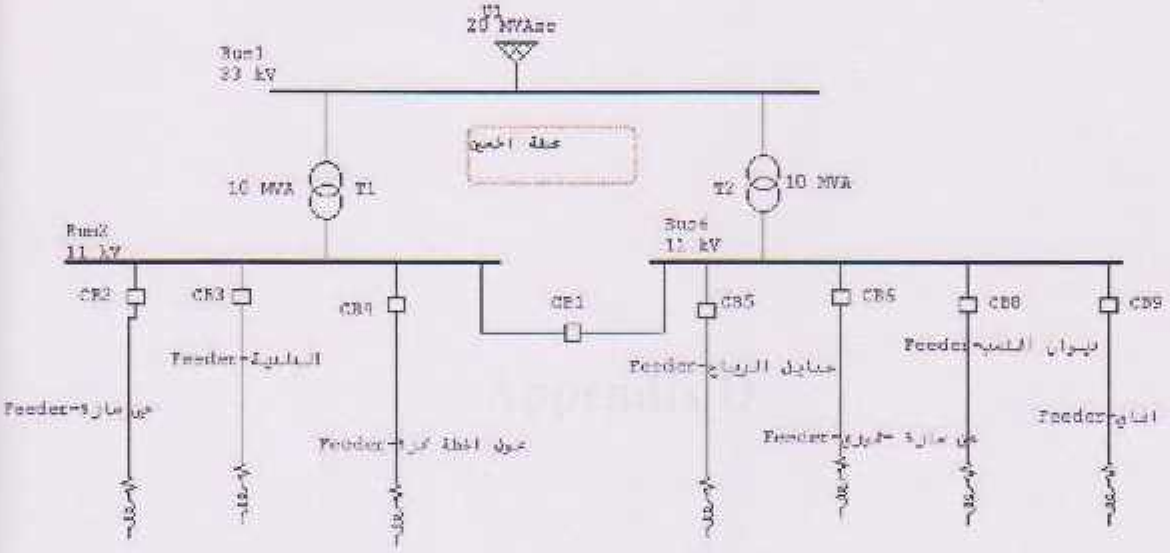


Figure (4.13) Al-Hosen Substation.

Appendix D

Table Of Percentage Loading For Each Transformer In Em-AlDaliah Substation

Table 3.4 : Percentage Loading of each Transformer

Feeder Name	Transformer Number	Transformer Apparent Power (KVA)	Loading Percentage
AL-AKASHAH	T1	400	74 %
	T6	250	50 %
	T7	400	43.3 %
	T10	160	75.63 %
AL-SAHEB	T11	400	47.5 %
	T13	250	52 %
	T12	250	80 %
	T14	400	82 %
	T15	250	75 %
	T16	400	51 %
	T43	250	64.4 %
	T44	250	52 %
DISTRIBUTION	T17	250	35.2 %
AL-POLYTECHNIC	T24	400	47 %
	T28	400	45 %
	T29	250	38 %
	T31	160	51 %
	T32	160	62.5 %
	T30	630	62.2 %
	T34	250	46 %

	T33	160	54 %
	T45	250	43.2 %
	T36	250	50 %
	T35	160	59 %
	T37	160	62.5 %
	T38	160	62.5%
	T39	160	53 %
	T40	400	39 %
	T41	160	58 %
	T42	160	69.4 %
BATON ZALLOM	T18	630	60.4 %
	T19	250	76 %
	T20	250	65.2 %
	T21	400	75 %
	T22	250	60 %
	T48	250	64 %
	T47	630	68.3 %
	T46	400	62.5 %
	T23	250	66 %

Table 4.2 : Percentage Loading of each transformer after 20 years

Feeder Name	Transformer Number	Transformer Apparent Power (KVA)	% Loading
AL-AKASHAH	T1	400	80%
	T6	250	60 %
	T7	400	60%
	T10	160	94.4%
AL-SAHEB	T11	400	60%
	T13	250	65.6%
	T12	250	98.8 %
	T14	400	92.5 %
	T15	250	93.2 %
	T16	400	63.5 %
	T43	250	72 %
	T44	250	59%
DISTRIBUTION	T17	250	42 %
AL-POLYTECHNIC	T24	400	52%
	T28	400	65.5 %
	T29	250	53 %
	T31	160	65.6 %
	T32	160	92.5 %
	T30	630	83.5 %
	T34	250	71 %
	T33	160	78 %

	T45	250	64 %
	T36	250	70.5 %
	T35	160	81 %
	T37	160	94 %
	T38	160	77 %
	T39	160	62.5 %
	T40	400	44.3%
	T41	160	58 %
	T42	160	69.4 %
BATON ZALLOM	T18	630	72 %
	T19	250	96 %
	T20	250	87 %
	T21	400	88 %
	T22	250	78 %
	T48	250	82 %
	T47	630	72.2 %
	T46	400	76 %
	T23	250	86 %

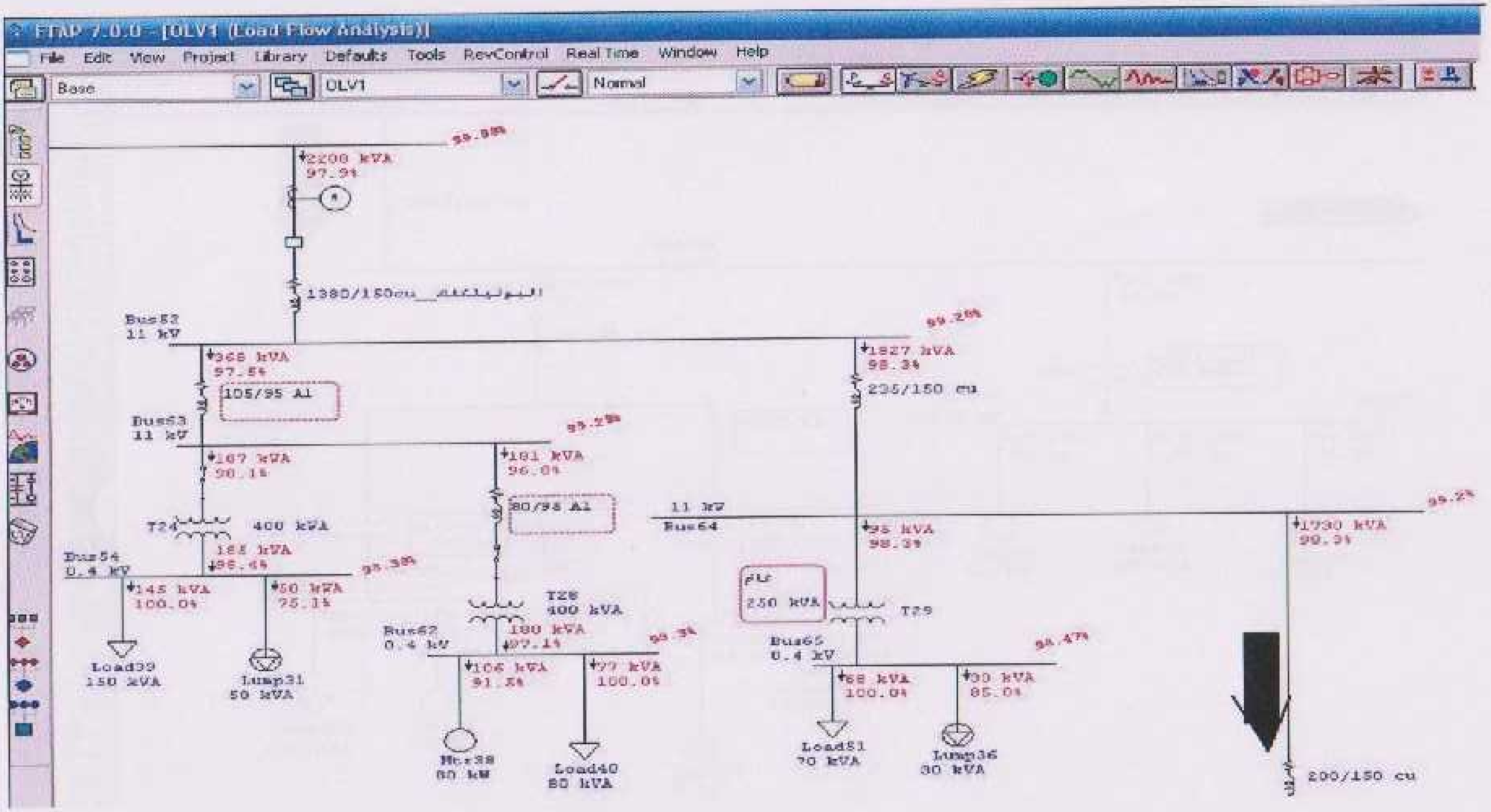
Table 4.4 : Comparison between loading of transformers Now & After 20 years

Feeder Name	Transformer Number	Transformer Apparent Power (KVA)	Percentage Loading	Percentage Loading after 20 Years
AL-AKASHAH	T1	400	74 %	80%
	T6	250	50 %	60 %
	T7	400	43.3 %	60%
	T10	160	75.63 %	94.4%
AL-SAHEB	T11	400	47.5 %	60%
	T13	250	52 %	65.6%
	T12	250	80 %	98.8 %
	T14	400	82 %	92.5 %
	T15	250	75 %	93.2 %
	T16	400	51 %	63.5 %
	T43	250	64.4 %	72 %
	T44	250	52 %	59%
DISTRIBUTION	T17	250	35.2 %	42 %
AL-POLYTECHNIC	T24	400	47 %	52%
	T28	400	45 %	65.5 %
	T29	250	38 %	53 %
	T31	160	51 %	65.6 %
	T32	160	62.5 %	92.5 %
	T30	630	62.2 %	83.5 %
	T34	250	46 %	71 %
	T33	160	54 %	78 %

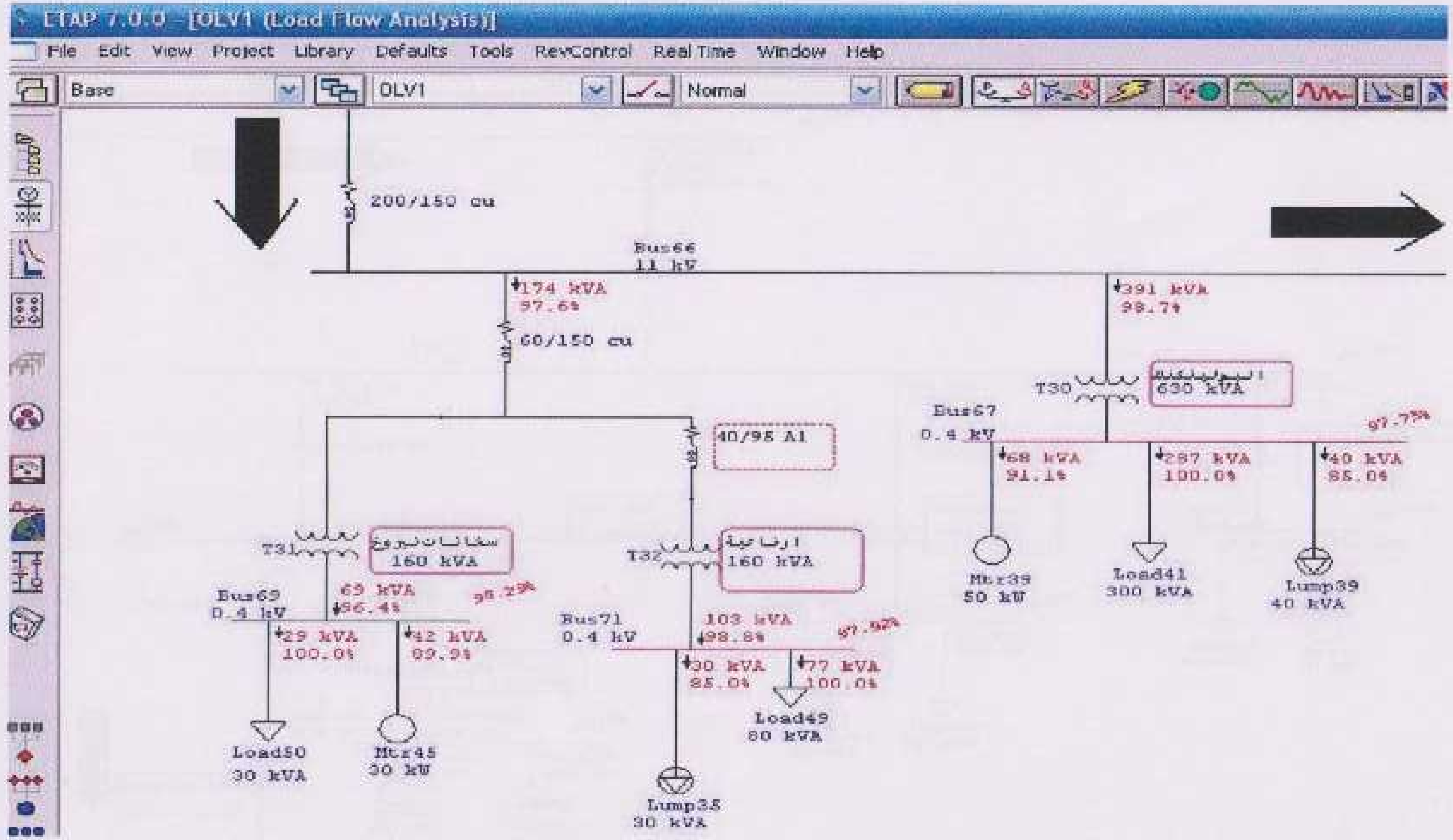
	T45	250	43.2 %	64 %
	T36	250	50 %	70.5 %
	T35	160	59 %	81 %
	T37	160	62.5 %	84 %
	T38	160	62.5%	77 %
	T39	160	53 %	62.5 %
	T40	400	39 %	44.3%
	T41	160	58 %	58 %
	T42	160	69.4 %	69.4 %
BATON ZALLOM	T18	630	60.4 %	72 %
	T19	250	76 %	98 %
	T20	250	65.2 %	87 %
	T21	400	75 %	88 %
	T22	250	60 %	78 %
	T48	250	64 %	82 %
	T47	630	68.3 %	72.2 %
	T46	400	62.5 %	76 %
	T23	250	66 %	86 %

Appendix E

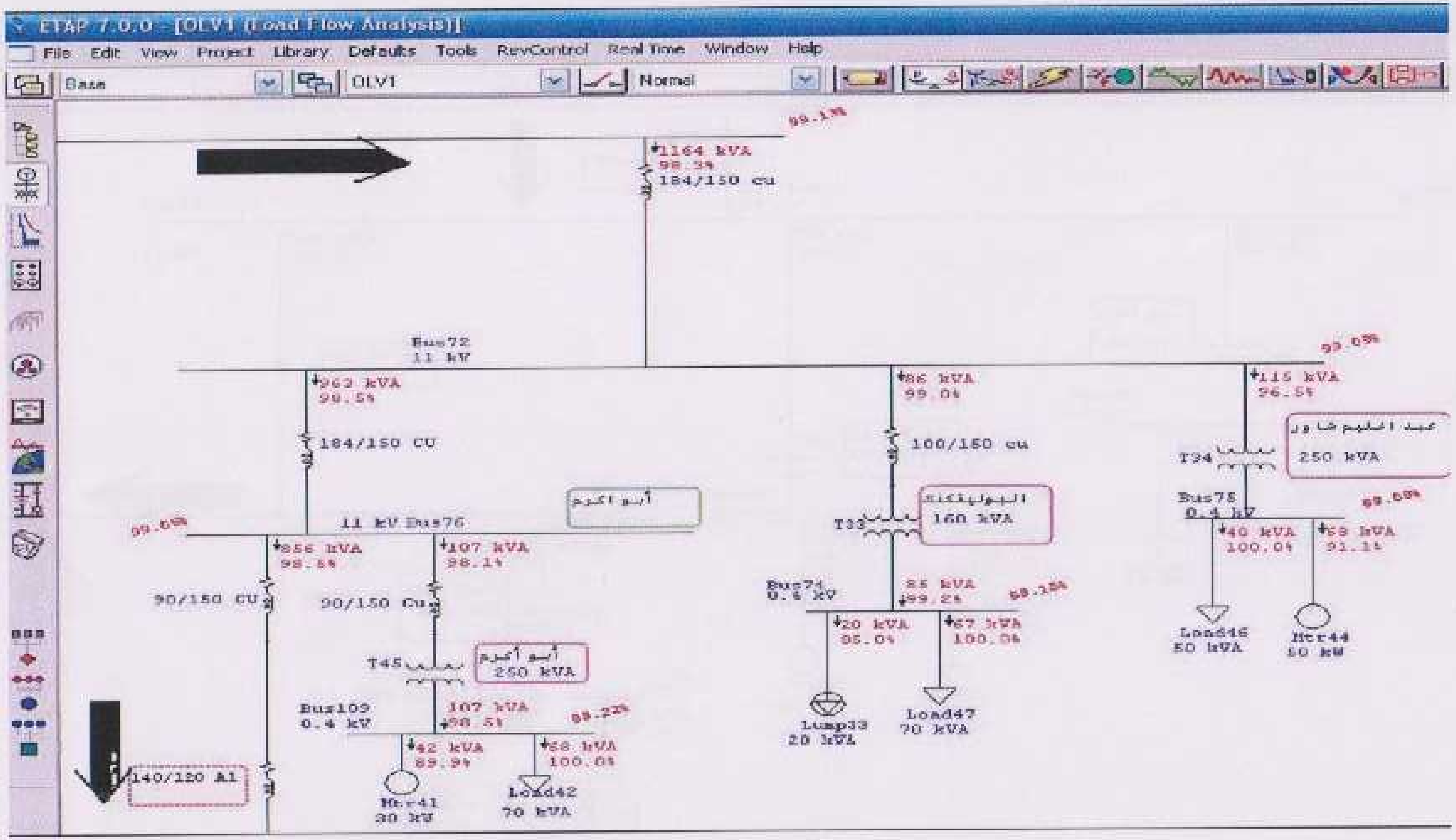
Em-AlDaliah Substation Feeders



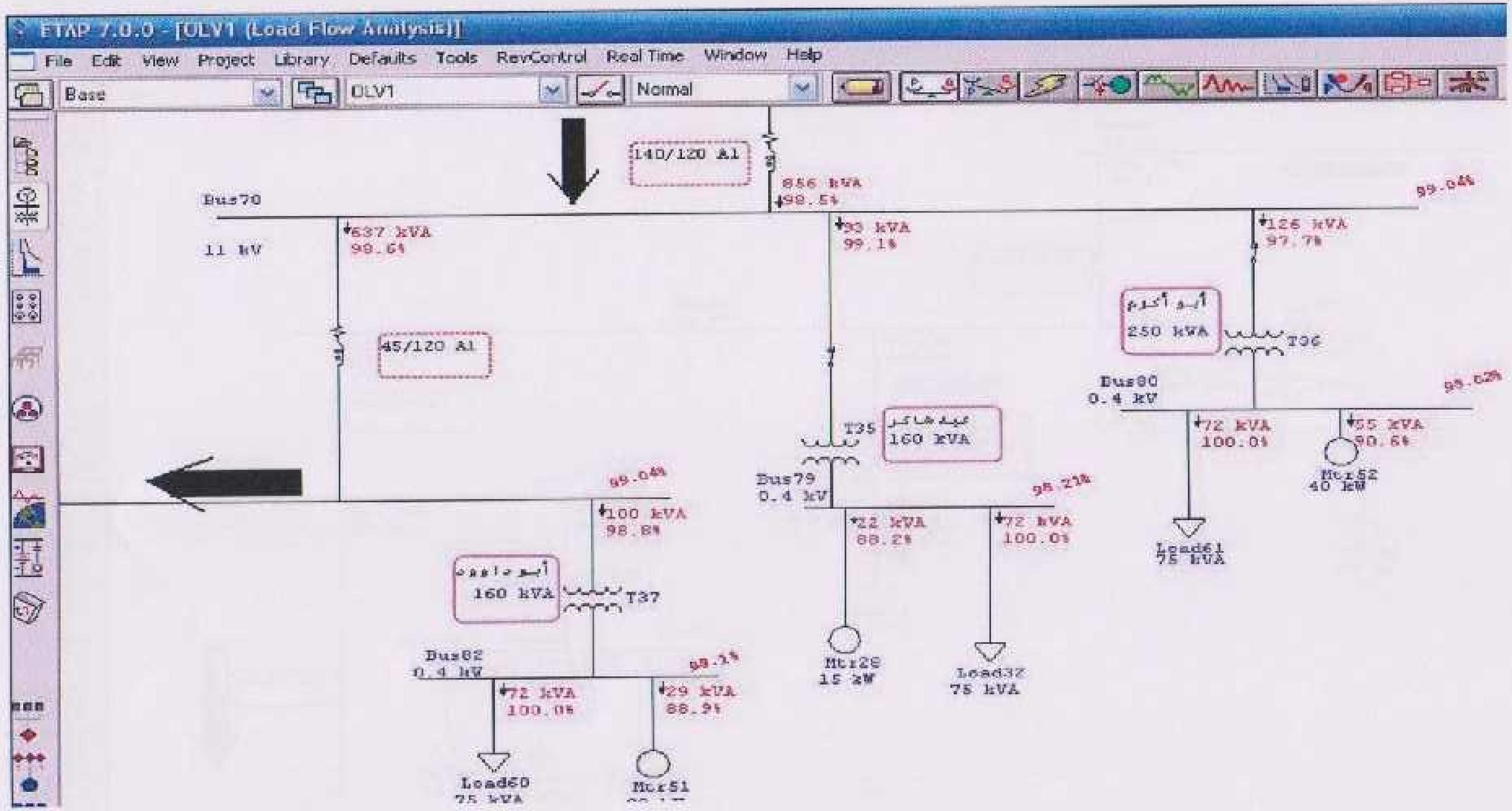
Zoom in for Al-Polytechnic Feeder (A)



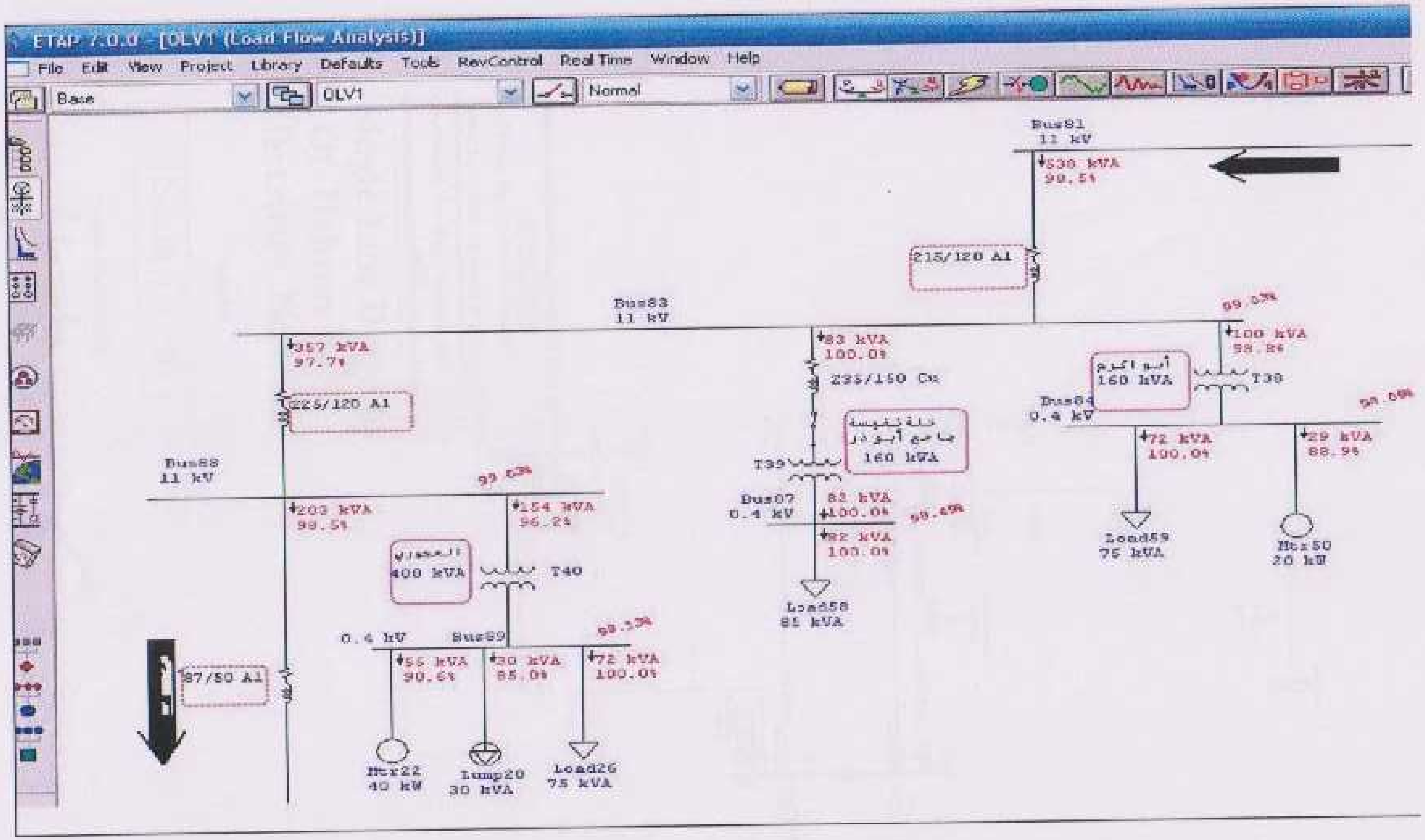
Zoom in for Al-Polytechnic Feeder (B)



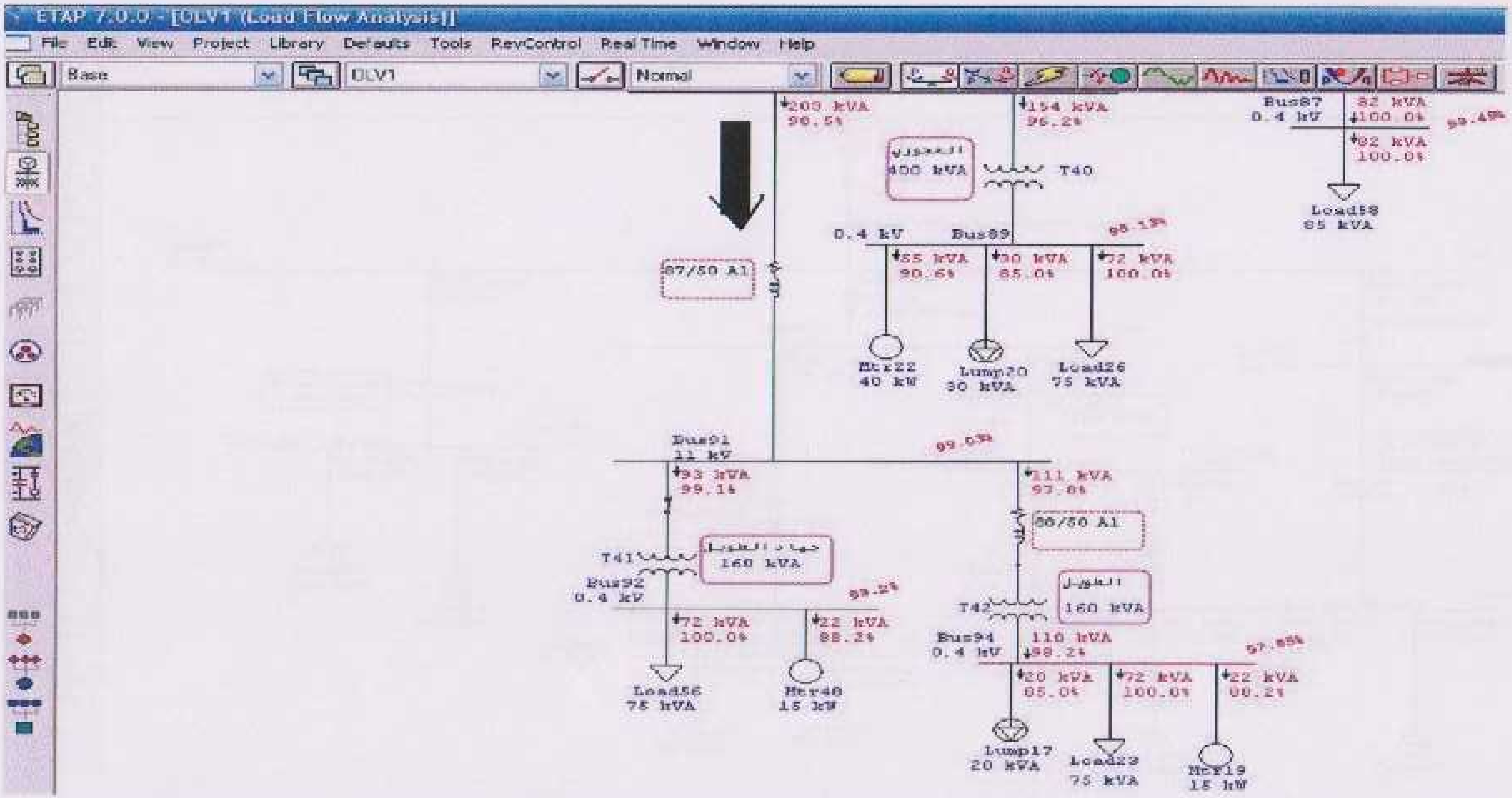
Zoom in for Al-Polytechnic Feeder (C)



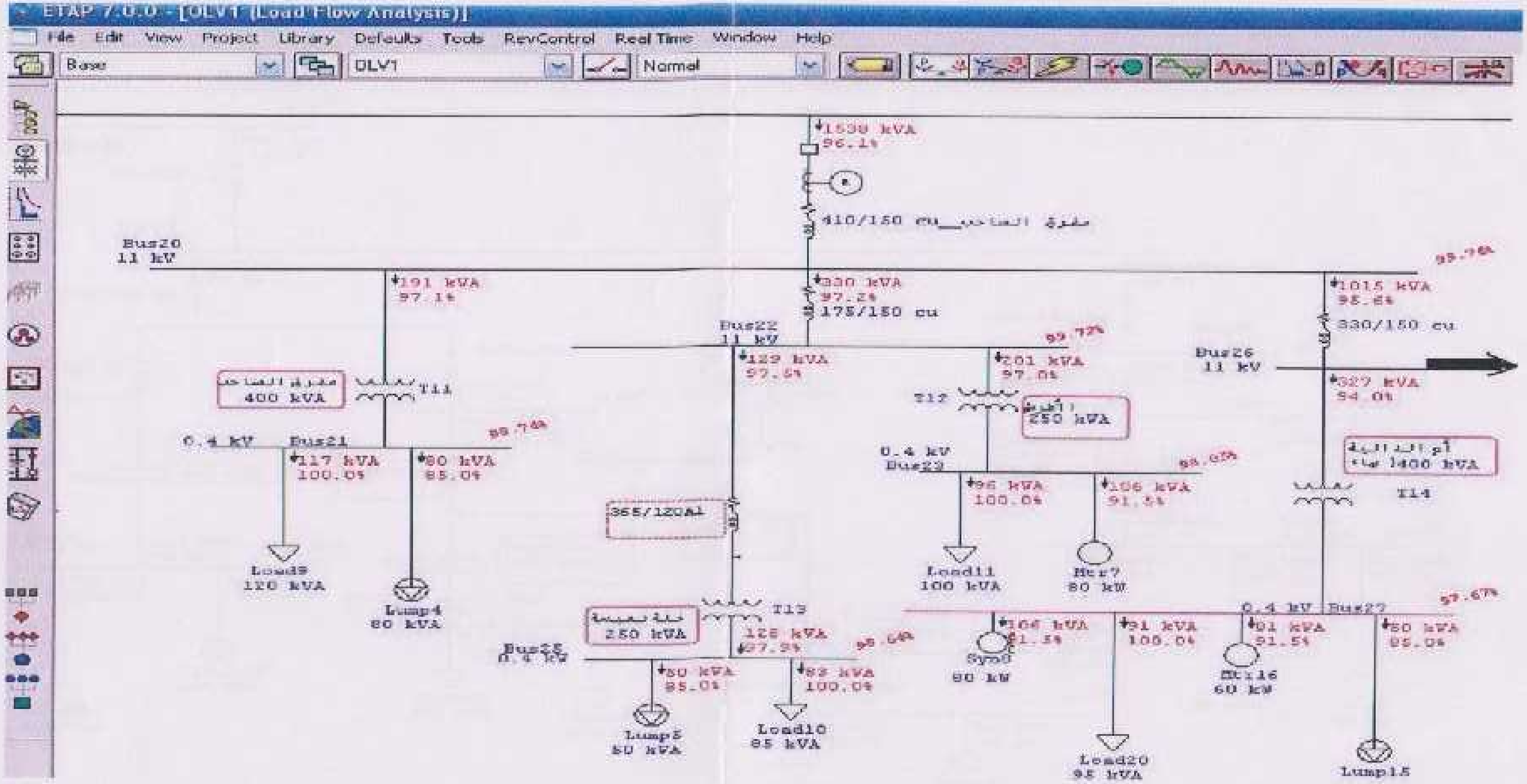
Zoom in for Al-Polytechnic Feeder (**D**)



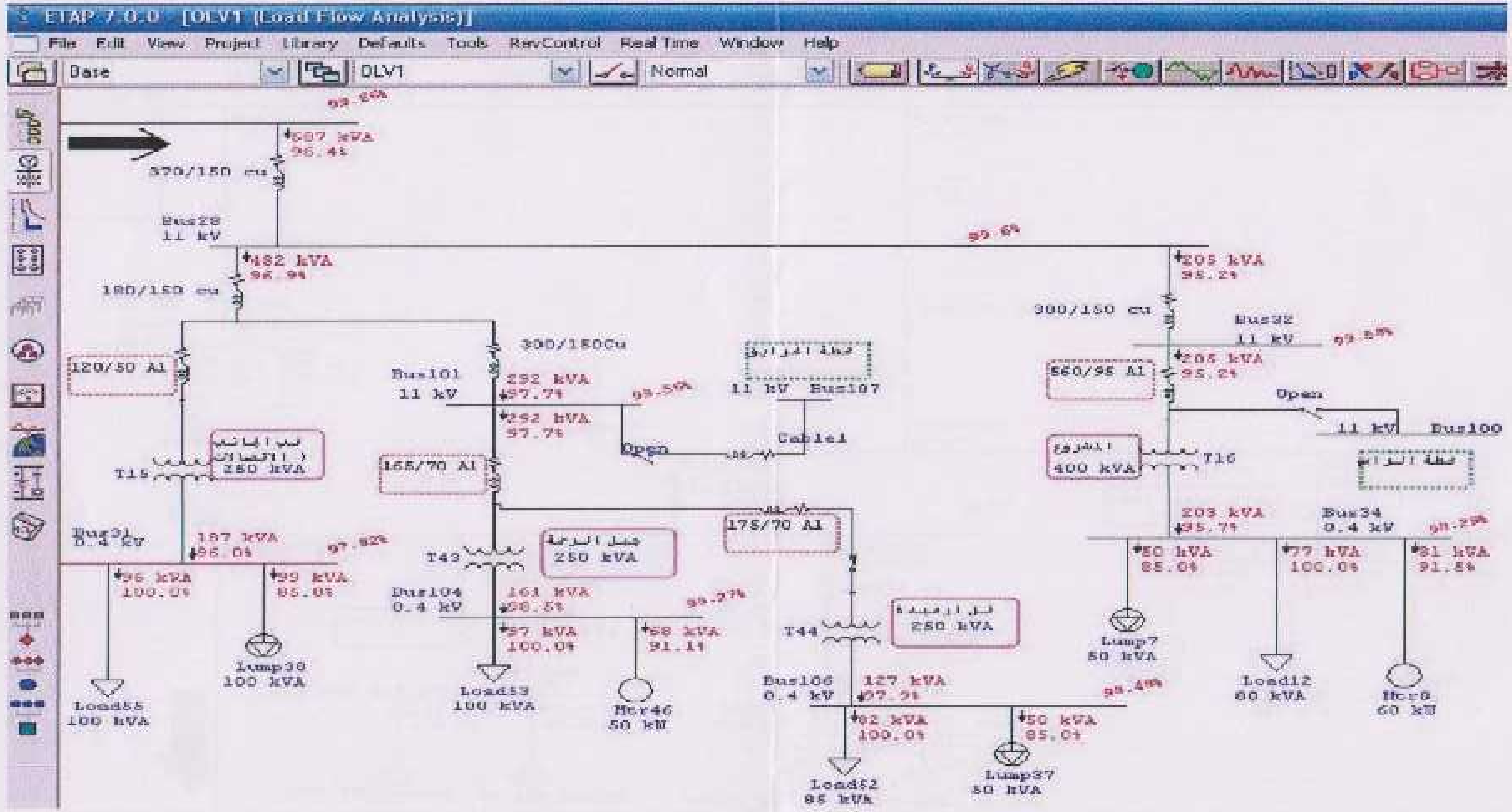
Zoom in for Al-Polytechnic Feeder (**E**)



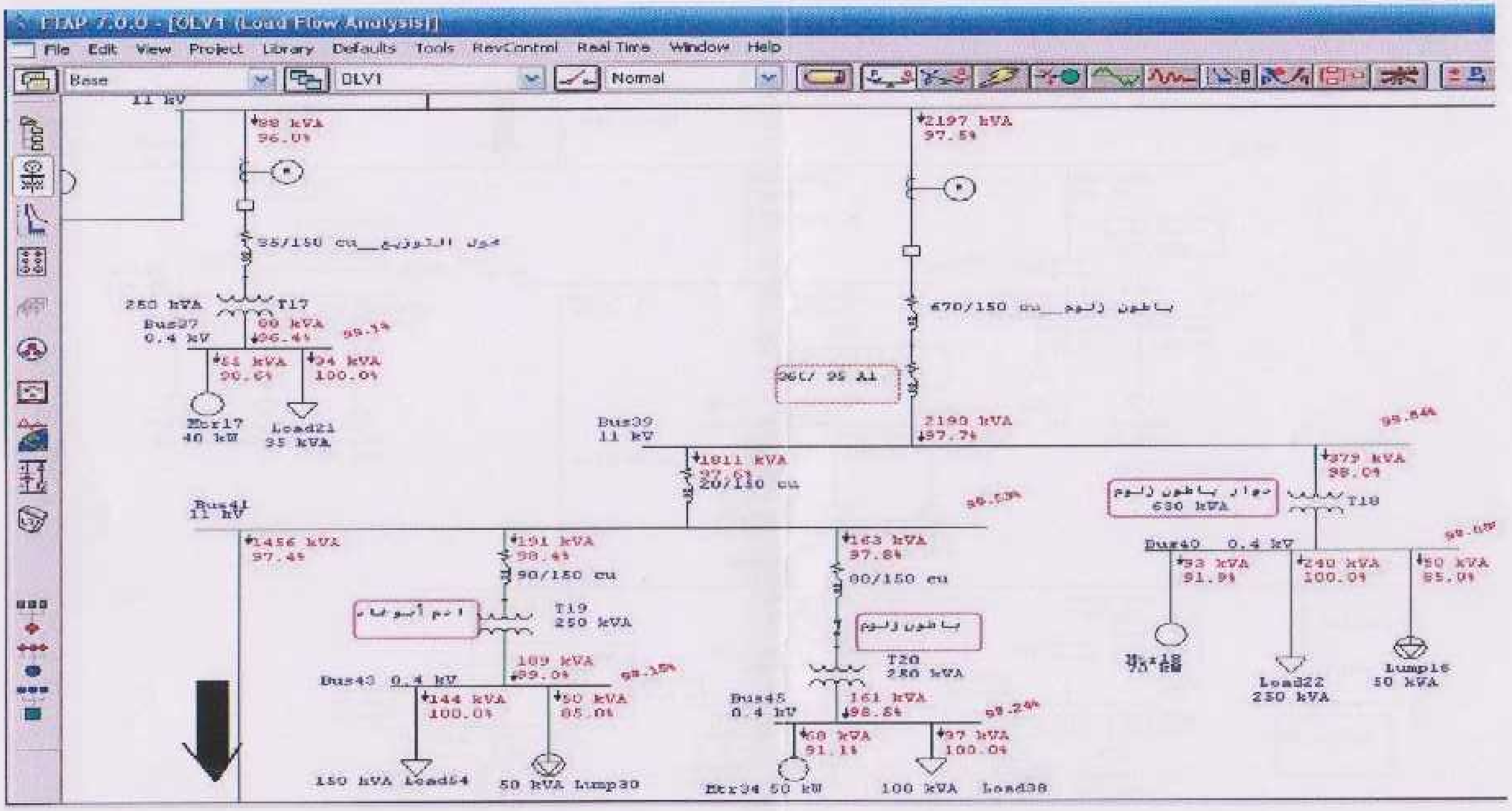
Zoom in for Al-Polytechnic Feeder (F)



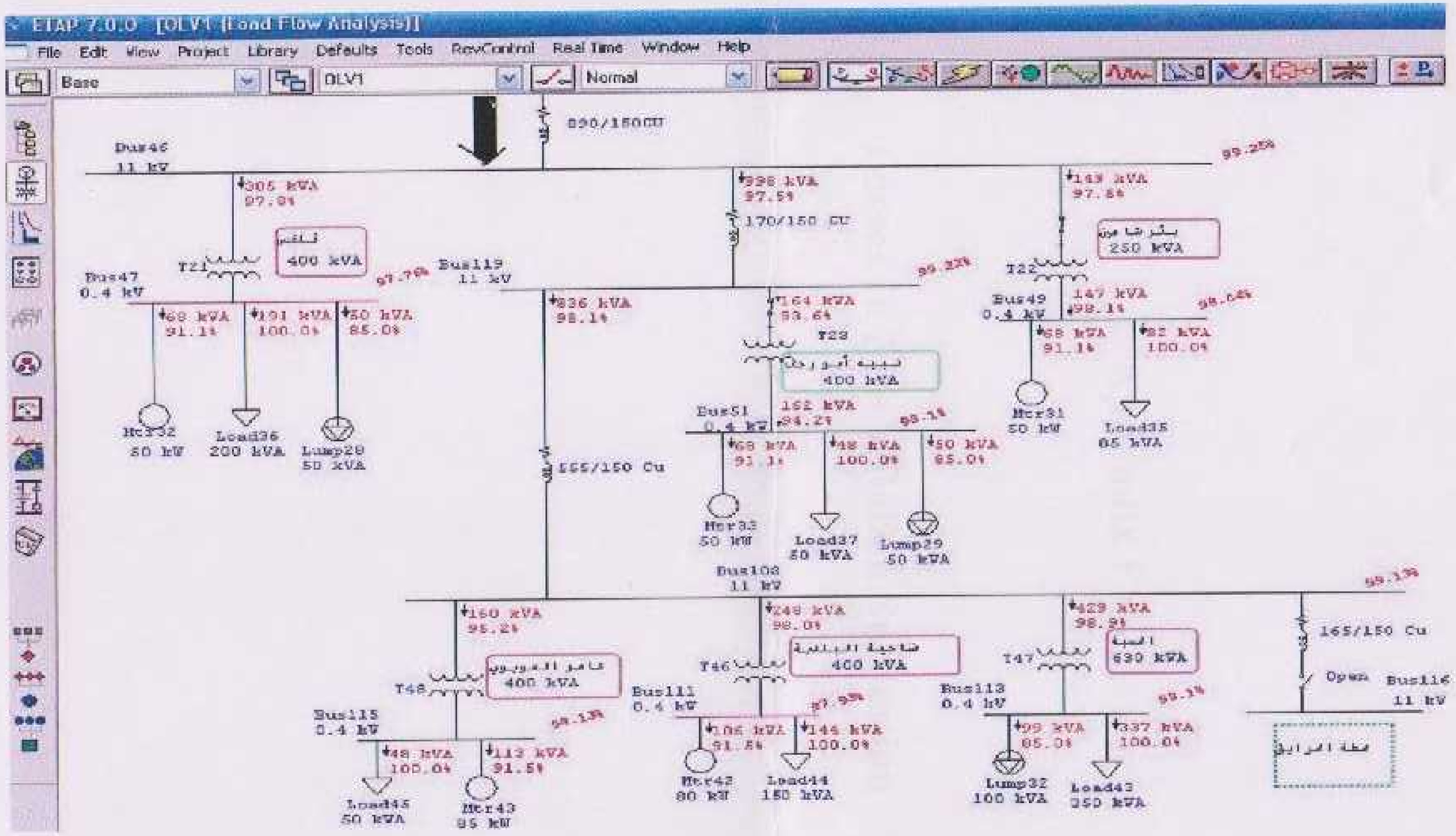
Zoom in for Al-Saheb Feeder (A)



Zoom in for Al-Saheb Feeder (B)



Zoom in for Baton-Zallom Feeder (A)



Zoom in for Baton-Zallom Feeder (**B**)

Appendix F

Losses In Em-AlDaliah Substation

Losses in Em-AlDaliah Substation

ETAP

7.0.0

[illegible]		Page:	1
[illegible]		Date:	05-31-2015
[illegible]		SN:	12345678
[illegible]	Study Case: LF	Revision:	Base
[illegible]	Em Al-Daliah MAX	Config.:	Normal

Branch Losses Summary Report

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
410/150 cu_[illegible]	1.477	0.427	-1.476	-0.422	1.0	4.7	99.9	99.7	0.15
1000/150 cu_[illegible]	0.692	0.176	-0.692	-0.174	0.5	2.3	99.9	99.7	0.16
T49	-8.556	-1.575	8.562	1.581	6.4	6.4	99.9	100.0	0.12
40/150 cu	-0.290	-0.052	0.290	0.052	0.0	0.2	99.7	99.7	0.00
30/0/95 Al	0.167	0.049	-0.167	-0.050	0.0	1.3	99.7	99.7	0.03
T6	0.124	0.003	-0.123	0.000	0.6	3.1	95.7	95.2	0.55
T1	-0.282	-0.073	0.285	0.082	2.7	8.4	98.1	99.7	1.55
T10	-0.115	-0.036	0.116	0.040	0.9	3.4	98.1	99.7	1.58
T7	0.165	-0.045	0.167	0.050	1.5	4.7	98.1	99.7	1.55
400/150 cu	0.407	0.092	-0.407	-0.092	0.1	0.5	99.7	99.7	0.01
220/150 cu	0.116	0.040	-0.116	-0.040	0.0	0.0	99.7	99.7	0.01
175/150 cu	0.321	0.078	-0.321	-0.078	0.0	0.1	99.7	99.7	0.01
330/150 cu	0.970	0.257	-0.970	-0.255	0.4	1.7	99.7	99.7	0.08
T11	0.185	0.047	-0.183	-0.042	1.8	5.6	99.7	98.1	1.60
Line15	0.126	0.028	-0.126	-0.030	0.0	-1.5	99.7	99.7	0.00
T12	0.195	0.049	-0.193	-0.043	2.0	6.2	99.7	98.0	1.68
T13	-0.125	-0.026	0.126	0.030	2.7	3.4	98.6	99.7	1.08
370/150 cu	0.662	0.183	-0.662	-0.182	0.2	0.9	99.7	99.6	0.05
T14	0.308	0.112	-0.304	-0.102	3.3	10.3	99.7	97.7	1.96
180/150 cu	0.467	0.120	-0.467	-0.119	0.0	0.2	99.6	99.6	0.02
300/150 cu	0.195	0.065	-0.195	-0.062	0.0	0.1	99.6	99.6	0.02
T15	-0.180	-0.052	0.182	0.058	1.8	5.6	97.8	99.6	1.75
Line16	0.195	0.062	-0.195	-0.065	0.0	-1.9	99.6	99.6	0.01
T16	-0.194	-0.059	0.195	0.064	1.1	5.4	98.3	99.6	1.29
35/150 cu_[illegible]	0.085	0.025	-0.085	-0.025	0.0	0.0	99.9	99.9	0.00
670/150 cu_[illegible]	2.142	0.485	-2.138	-0.474	3.4	15.6	99.9	99.5	0.31
1480/120cu_[illegible]	2.159	0.457	-2.152	-0.426	7.0	32.9	99.9	99.3	0.61
T17	0.085	0.025	-0.084	-0.023	0.6	1.9	99.9	98.6	1.24
Line1	2.138	0.474	-2.138	-0.471	0.0	2.2	99.6	99.5	0.04
20/150 cu	1.767	0.396	-1.767	-0.396	0.1	0.3	99.5	99.5	0.01
T18	0.372	0.076	-0.368	-0.063	3.2	12.9	99.5	98.1	1.46
80/150 cu	0.169	0.034	-0.150	-0.034	0.0	0.0	99.5	99.5	0.00
90/150 cu	0.188	0.034	-0.188	-0.034	0.0	0.0	99.5	99.5	0.00
890/150CU	1.419	0.328	-1.417	-0.319	2.0	9.3	99.5	99.3	0.22
T19	0.188	0.034	-0.187	-0.030	1.5	3.5	99.5	98.1	1.38

Losses in Em-AlDaliah Substation

ETAP
7.0.0

Page: 2
Date: 05-31-2015
SN: 12345678
Revision: Base
Config.: Normal

Study Case: LF

Em Al-Daliah_MAX

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
T20	0.160	0.034	-0.159	-0.028	1.1	5.5	99.5	98.2	1.29
170/150 CU	0.973	0.222	-0.973	-0.222	0.2	0.8	99.3	99.2	0.04
T21	0.299	0.063	-0.296	-0.054	2.9	9.0	99.3	97.8	1.50
T22	0.145	0.033	-0.144	-0.028	0.9	4.6	99.3	98.0	1.22
T23	0.153	0.058	-0.153	-0.054	0.7	3.5	99.2	98.1	1.11
235/150 cu	1.795	0.339	-1.794	-0.335	0.8	3.9	99.3	99.2	0.08
Line5	0.358	0.085	-0.358	-0.086	0.0	-0.5	99.3	99.3	0.00
T24	0.183	0.038	-0.181	-0.033	1.7	5.4	99.3	97.8	1.45
Line6	-0.175	-0.048	0.175	0.048	0.0	-0.4	99.3	99.3	0.00
T28	0.175	0.048	-0.173	-0.043	1.6	5.1	99.3	97.7	1.58
200/150 cu	1.701	0.317	-1.700	-0.314	0.6	3.0	99.2	99.1	0.07
T29	0.093	0.018	-0.093	-0.016	0.7	2.2	99.2	98.1	1.13
00/150 cu	0.170	0.037	-0.170	-0.037	0.0	0.0	99.1	99.1	0.00
184/150 cu	1.144	0.214	-1.144	-0.213	0.3	1.2	99.1	99.1	0.04
T30	0.386	0.063	-0.383	-0.049	3.5	13.8	99.1	97.7	1.38
Line7	0.103	0.018	-0.103	-0.018	0.0	-0.2	99.1	99.1	0.00
T31	0.067	0.019	-0.066	-0.018	0.3	1.1	99.1	98.3	0.84
T32	0.103	0.018	-0.102	-0.015	0.8	2.5	99.1	97.9	1.21
100/150 cu	0.085	0.012	-0.085	-0.012	0.0	0.0	99.1	99.1	0.00
184/150 CU	0.948	0.169	-0.948	-0.168	0.2	0.8	99.1	99.0	0.03
T34	0.111	0.031	-0.110	-0.028	1.0	3.2	99.1	97.5	1.59
T33	0.085	0.012	-0.084	-0.010	0.6	1.8	99.1	98.1	0.93
90/150 Cu	0.105	0.021	-0.105	-0.021	0.0	0.0	99.0	99.0	0.00
90/150 CU	0.843	0.147	-0.843	-0.147	0.1	0.3	99.0	99.0	0.01
Line8	0.843	0.147	-0.843	-0.148	0.0	-0.6	99.0	99.0	0.00
Line9	0.628	0.109	-0.628	-0.109	0.0	-0.2	99.0	99.0	0.00
T35	0.092	0.012	-0.091	-0.010	0.5	2.0	99.0	98.2	0.83
T36	0.123	0.027	-0.122	-0.023	0.8	3.2	99.0	98.0	1.02
Line10	0.529	0.093	-0.529	-0.093	0.0	-1.1	99.0	99.0	0.00
T37	0.098	0.015	-0.098	-0.013	0.6	2.3	99.0	98.1	0.94
235/150 Cu	0.083	0.002	-0.083	-0.002	0.0	0.0	99.0	99.0	0.00
Line11	0.348	0.078	-0.348	-0.079	0.0	-1.2	99.0	99.0	0.00
T38	0.098	0.015	-0.098	-0.013	0.6	2.3	99.0	98.1	0.94
T39	0.083	0.002	-0.082	0.000	0.4	1.6	99.0	98.5	0.54
Line12	0.200	0.035	-0.200	-0.035	0.0	-0.5	99.0	99.0	0.00
T40	0.148	0.044	-0.147	-0.039	1.0	4.9	99.0	97.5	1.45
Line13	0.109	0.025	-0.109	-0.025	0.0	-0.5	99.0	99.0	0.00

Losses in Em-AlDaliah Substation

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Study Case: LF

Em Al-Daliah_MAX

Page:	3
Date:	05-31-2015
SN:	12345678
Revision:	Base
Config.:	Normal

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
T41	0.092	0.017	-0.091	-0.010	0.5	2.6	99.6	98.2	0.83
T42	0.109	0.024	-0.108	-0.021	0.8	2.8	99.6	97.8	1.18
300/150Cu	0.283	0.062	0.285	-0.062	0.0	0.1	99.6	99.6	0.02
Line17	0.182	0.037	0.182	0.038	0.0	-0.7	99.6	99.6	0.00
Line14	0.285	0.062	-0.285	-0.062	0.0	-0.5	99.6	99.6	0.00
Line18	0.125	0.029	-0.125	-0.030	0.0	-0.6	99.6	99.6	0.00
T43	0.160	0.034	-0.159	-0.028	1.1	5.5	99.6	98.3	1.29
T44	0.125	0.030	-0.125	-0.026	0.7	3.4	99.6	98.5	1.08
555/150 Cu	-0.819	0.162	0.820	0.164	0.4	1.9	99.1	99.2	0.09
T46	0.243	0.049	-0.241	-0.043	1.9	5.9	99.1	97.9	1.20
T47	0.424	0.064	-0.421	-0.052	2.9	11.5	99.1	98.1	1.03
T48	0.152	0.049	-0.152	-0.046	0.7	3.3	99.1	98.1	1.00
T45	-0.105	0.018	0.105	0.021	0.7	2.6	97.9	99.0	1.10
					74.6	203.6			

Losses in Em-AlDaliah Substation after replace transformers which its loading below 60%

ETAP

7.0.0

Page: 1

Date: 05-31-2015

SN: 12345678

Revision: Base

Config.: Normal

Study Case: LF

Em Al-Daliah_MAX

Branch Losses Summary Report

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
410/150 cu_طارق الصحب	1.478	0.425	-1.477	-0.420	1.2	4.7	99.9	99.7	0.15
1000/150 cu_الكلية	0.693	0.175	-0.692	-0.172	0.5	2.5	99.9	99.7	0.16
T49	-6.560	-1.563	6.566	1.570	6.4	6.4	99.9	100.0	0.12
40/150 cu	-0.291	-0.050	0.291	0.050	0.0	0.0	99.7	99.7	0.00
390/95 AL	0.167	0.047	-0.167	-0.048	0.0	-1.2	99.7	99.7	0.00
T6	0.124	0.003	-0.123	0.000	0.5	3.1	99.7	99.2	0.53
T1	-0.582	-0.073	0.285	0.082	2.7	8.4	98.1	99.7	1.63
T10	-0.115	-0.056	0.116	0.040	0.9	3.4	98.1	99.7	1.58
T7	0.166	0.045	0.167	0.048	0.3	2.9	98.7	99.7	0.97
400/150 cu	0.407	0.090	-0.407	-0.090	0.1	0.5	99.7	99.7	0.03
220/150 cu	0.116	0.040	-0.116	-0.040	0.0	0.0	99.7	99.7	0.01
175/150 cu	0.321	0.078	-0.321	-0.078	0.0	0.1	99.7	99.7	0.01
330/150 cu	0.970	0.297	-0.970	-0.295	0.4	1.7	99.7	99.7	0.08
T11	0.186	0.045	-0.185	-0.042	1.1	3.5	99.7	98.7	0.99
Line15	0.126	0.028	-0.126	-0.030	0.0	-1.2	99.7	99.7	0.00
T12	0.195	0.049	-0.193	-0.043	2.0	6.2	99.7	98.0	1.68
T13	-0.125	-0.026	0.126	0.030	0.7	3.4	98.6	99.7	1.08
370/150 cu	0.662	0.183	-0.662	-0.182	0.2	0.9	99.7	99.6	0.06
T14	0.308	0.112	-0.304	-0.102	3.3	10.5	99.7	97.7	1.99
180/150 cu	0.467	0.120	-0.467	-0.119	0.0	0.2	99.6	99.6	0.02
300/150 cu	0.195	0.063	-0.195	-0.062	0.0	0.1	99.6	99.6	0.02
T15	-0.180	-0.052	0.182	0.058	1.8	5.6	97.8	99.6	1.75
Line16	0.195	0.062	-0.195	-0.064	0.0	-1.9	99.6	99.6	0.01
T16	-0.194	-0.059	0.195	0.064	1.1	5.4	98.3	99.6	1.29
35/150 cu_محول توزيع	0.085	0.025	-0.085	-0.025	0.0	0.0	99.9	99.9	0.00
670/150 cu_باطون زلوم	2.142	0.489	-2.138	-0.474	3.4	15.8	99.9	99.6	0.31
1380/150cu_البوليتكنك	2.162	0.450	-2.155	-0.417	7.2	32.9	99.9	99.3	0.61
T17	0.085	0.025	-0.084	-0.023	0.4	1.2	99.9	99.1	0.79
Line1	2.138	0.474	-2.138	-0.471	0.0	2.2	99.6	99.5	0.04
20/150 cu	1.767	0.396	-1.767	-0.395	0.1	0.3	99.5	99.5	0.01
T18	0.372	0.076	-0.368	-0.063	3.2	12.9	99.5	98.1	1.46
80/150 cu	0.160	0.034	-0.160	-0.034	0.0	0.0	99.5	99.5	0.00
90/150 cu	0.188	0.034	-0.188	-0.034	0.0	0.0	99.5	99.5	0.00
890/150CU	1.419	0.328	-1.417	-0.319	2.0	9.3	99.5	99.3	0.27
T19	0.188	0.034	-0.187	-0.026	1.5	7.5	99.5	98.2	1.38

Losses in Em-AlDaliah Substation after replace transformers which its loading below 60%

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	% Drop in Vmag
T20	0.160	0.034	-0.159	-0.028	1.1	5.5	99.5	98.5	1.29
170/150 CU	0.973	0.222	-0.973	-0.222	0.2	0.8	99.3	99.3	0.04
T21	0.259	0.093	-0.256	-0.084	2.9	9.0	99.3	97.8	1.50
T22	0.145	0.037	-0.144	-0.028	0.9	4.6	99.3	98.0	1.72
T23	0.153	0.058	-0.153	-0.031	0.7	3.5	99.2	98.1	1.11
235/150 cu	1.796	0.355	-1.792	-0.332	0.8	3.9	99.3	99.2	0.08
Line5	0.359	0.084	-0.359	-0.083	0.0	0.5	99.3	99.3	0.00
T24	0.184	0.036	-0.182	-0.033	1.1	3.4	99.3	98.4	0.93
Line6	-0.175	-0.046	0.175	0.046	0.0	-0.4	99.3	99.3	0.00
T28	0.175	0.046	-0.174	-0.043	1.0	3.2	99.3	98.3	0.97
700/150 cu	1.702	0.314	-1.701	-0.311	0.6	3.0	99.3	99.1	0.07
T29	0.094	0.018	-0.094	-0.016	0.4	1.9	99.2	98.5	0.72
60/150 cu	0.170	0.037	-0.170	-0.035	0.0	0.3	99.1	99.1	0.00
184/150 cu	1.145	0.218	-1.145	-0.216	0.3	1.2	99.1	99.1	0.04
T30	0.386	0.063	-0.383	-0.049	3.5	13.8	99.1	97.8	1.38
Line7	0.103	0.018	-0.103	-0.018	0.0	-0.2	99.1	99.1	0.00
T31	0.067	0.019	-0.066	-0.018	0.3	1.1	99.1	98.2	0.84
T32	0.103	0.018	-0.102	-0.016	0.9	2.6	99.1	97.9	1.21
100/150 cu	0.085	0.012	-0.085	-0.012	0.0	0.0	99.1	99.1	0.00
184/150 CU	0.949	0.167	-0.949	-0.160	0.2	0.8	99.1	99.1	0.07
T34	0.111	0.030	-0.110	-0.028	0.7	2.1	99.1	98.1	1.01
T33	0.085	0.012	-0.084	-0.010	0.5	1.8	99.1	98.2	0.93
90/150 Cu	0.105	0.021	-0.105	-0.021	0.0	0.0	99.1	99.1	0.00
90/150 CU	0.842	0.146	-0.843	-0.145	0.1	0.4	99.1	99.0	0.01
Line8	0.843	0.145	-0.840	-0.146	0.0	-0.6	99.0	99.0	0.00
Line9	0.628	0.107	-0.628	-0.107	0.0	-0.2	99.0	99.0	0.00
T35	0.092	0.012	-0.091	-0.010	0.5	3.0	99.0	98.2	0.83
T36	0.123	0.027	-0.122	-0.023	0.6	3.3	99.0	98.0	1.02
Line10	0.530	0.092	-0.530	-0.093	0.0	-1.1	99.0	99.0	0.00
T37	0.098	0.015	-0.098	-0.013	0.6	2.1	99.0	98.1	0.94
235/150 Cu	0.083	0.002	-0.083	-0.002	0.0	0.0	99.0	99.0	0.00
Line11	0.349	0.076	-0.349	-0.077	0.0	-1.7	99.0	99.0	0.00
T38	0.098	0.015	-0.098	-0.013	0.6	3.3	99.0	98.1	0.94
T39	0.083	0.002	-0.082	0.001	0.4	1.5	99.0	98.5	0.54
Line12	0.200	0.033	-0.200	-0.035	0.0	-0.2	99.0	99.0	0.00
T40	0.148	0.042	-0.146	-0.039	0.6	3.1	99.0	98.1	0.90
Line13	0.104	0.024	-0.104	-0.023	0.0	0.5	99.0	99.0	0.00

Losses in Em-AlDaliah Substation after replace transformers which its loading below 60%

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
T41	0.092	0.012	-0.091	-0.010	0.5	2.0	99.0	98.2	0.83
T42	0.109	0.023	-0.108	-0.021	0.8	2.8	99.0	97.8	1.18
500/150Cu	0.285	0.062	-0.285	-0.062	0.0	0.1	99.6	99.5	0.02
Line17	0.152	0.057	-0.152	-0.058	0.0	-0.7	99.6	99.5	0.00
Line14	0.285	0.062	-0.285	-0.063	0.0	-1.5	99.6	99.5	0.00
Line15	0.125	0.029	-0.125	-0.030	0.0	-1.6	99.6	99.6	0.00
T42	0.160	0.034	-0.159	-0.078	1.1	3.2	99.6	98.3	1.29
T44	0.125	0.030	-0.125	-0.026	0.7	3.4	99.6	98.5	1.08
555/150 Cu	-0.819	-0.162	0.820	0.164	0.8	1.9	99.1	99.2	0.09
T46	0.243	0.049	-0.241	-0.043	1.9	5.9	99.1	97.9	1.20
T47	0.421	0.064	-0.421	-0.057	2.5	11.5	99.1	98.1	1.03
T48	0.152	0.049	-0.152	-0.046	0.7	3.3	99.1	98.1	1.00
T45	-0.105	-0.018	0.135	0.021	0.3	2.4	98.2	99.1	0.83
					70.6	255.7			

Losses in Em-AlDaliah Substation after 20 years

ETAP
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Page:	1
Date:	05-31-2015
SN:	12345678
Revision:	Base
Config.:	Normal

Em Al-Daliah MAX

Study Case: LF

Branch Losses Summary Report

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
410/150 cu دوري الصبحي	1.782	0.497	-1.781	-0.491	1.5	6.9	99.9	99.7	0.18
1000/150 cu__العكلة	0.834	0.226	-0.833	-0.222	0.8	3.6	99.9	99.7	0.23
T40	-8.130	-2.027	8.145	2.037	19.2	10.0	99.9	100.0	0.14
40/150 cu	-0.382	-0.080	0.382	0.080	0.0	0.0	99.6	99.6	0.02
390/95 Al	0.231	0.076	-0.231	-0.077	0.0	-1.2	99.6	99.6	0.01
T6	0.151	0.005	-0.150	0.000	2.8	4.7	99.5	99.0	0.69
T1	-0.302	-0.085	0.305	0.094	3.2	9.8	97.9	99.7	1.81
T10	-0.145	-0.042	0.146	0.047	1.5	5.3	97.7	99.6	1.91
T7	-0.229	-0.071	0.231	0.077	1.8	5.7	98.2	99.6	1.45
400/150 cu	0.328	0.128	-0.328	-0.127	0.1	0.6	99.7	99.5	0.05
220/150 cu	0.146	0.047	-0.146	-0.047	0.0	0.0	99.6	99.6	0.01
175/150 cu	0.399	0.107	-0.399	-0.107	0.0	0.1	99.7	99.7	0.02
350/150 cu	1.150	0.326	-1.149	-0.321	0.5	2.3	99.7	99.6	0.09
T11	0.232	0.058	-0.230	-0.052	1.8	5.5	99.7	98.4	1.25
Line15	0.161	0.044	-0.161	-0.045	0.0	-1.2	99.7	99.7	0.00
T12	0.239	0.063	-0.236	-0.054	3.0	9.3	99.7	97.6	2.09
T13	0.160	-0.039	0.151	0.045	1.1	5.7	98.1	99.7	1.57
370/150 cu	0.801	0.198	-0.801	0.197	0.3	1.2	99.6	99.5	0.07
T14	0.348	0.125	-0.344	-0.112	4.3	13.2	99.6	97.4	2.23
150/150 cu	0.556	0.118	-0.556	-0.117	0.1	0.3	99.5	99.5	0.02
100/150 cu	0.245	0.079	-0.245	0.079	0.0	0.1	99.5	99.5	0.02
T15	-0.227	0.052	0.230	0.061	2.8	8.7	97.5	99.5	2.01
Line16	0.245	0.079	-0.245	-0.081	0.0	-1.8	99.5	99.5	0.00
T16	-0.243	-0.073	0.245	0.081	1.7	8.6	97.9	99.5	1.61
95/150 cu__سهون التوزيع	0.101	0.028	-0.101	-0.028	0.0	0.0	99.9	99.5	0.38
670/150 cu__باطون زلوم	2.569	0.519	-2.564	0.596	4.9	22.9	99.9	99.5	0.38
1380/150cu__البوليفتلك	2.847	0.556	-2.834	-0.590	12.5	57.6	99.5	99.0	0.83
T17	0.100	0.223	-0.100	-0.076	0.5	1.7	99.5	98.9	3.97
Line1	2.368	0.599	-2.366	-0.592	0.0	5.1	99.5	99.4	0.05
20/150 cu	2.125	0.498	-2.125	-0.498	0.1	0.5	99.4	99.4	0.01
T18	0.440	0.094	-0.435	-0.076	4.6	18.1	99.4	97.7	1.76
80/150 cu	0.209	0.061	-0.209	-0.061	0.0	0.0	99.4	99.4	0.00
90/150 cu	0.232	0.056	-0.232	-0.056	0.0	0.0	99.4	99.4	0.00
890/150CU	1.683	0.381	-1.680	-0.368	2.8	13.1	99.4	99.1	0.32
T19	0.232	0.066	-0.230	-0.044	2.3	11.8	99.4	97.4	1.97

Losses in Em-AlDaliah Substation after 20 years

ETAP

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Page: 2

Date: 05-31-2015

SN: 12345678

Revision: Base

Config.: Normal

Study Case: LF

Em-Al-Daliah_MAX

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
T20	0.209	0.061	-0.207	-0.051	1.9	9.8	99.4	97.4	2.00
170/150 CU	1.144	0.260	-1.144	-0.259	0.2	1.2	99.1	99.1	0.04
T21	0.346	0.066	-0.342	-0.054	3.9	12.3	99.1	97.4	1.66
T22	0.191	0.042	-0.189	-0.034	1.6	7.9	99.1	97.5	1.56
T23	0.205	0.041	-0.204	-0.035	1.2	6.0	99.1	97.8	1.27
235/150 cu	2.379	0.486	-2.375	-0.479	1.5	6.9	99.0	98.9	0.11
Line5	0.458	0.113	-0.458	-0.113	0.0	-0.5	99.0	99.0	0.00
T34	0.201	0.053	-0.200	-0.049	1.4	4.2	99.0	97.8	1.12
Line6	-0.257	-0.060	0.257	0.060	0.0	-0.3	99.0	99.0	0.00
T28	0.257	0.060	-0.255	-0.054	2.2	6.8	99.0	97.7	1.35
200/150 cu	2.244	0.455	-2.243	-0.440	1.1	5.2	98.9	98.8	0.06
T29	0.130	0.025	-0.130	-0.021	0.7	3.7	98.4	97.9	1.00
60/150 cu	0.250	0.059	-0.250	-0.059	0.0	0.0	98.8	98.8	0.00
184/150 cu	1.476	0.297	-1.476	-0.295	0.4	2.1	98.8	98.8	0.06
T30	0.517	0.093	-0.511	-0.068	6.3	25.1	98.8	96.9	1.91
Line7	0.148	0.026	-0.148	-0.026	0.0	-0.2	98.8	98.8	0.00
T31	0.101	0.033	-0.100	-0.030	0.7	2.8	98.8	97.5	1.26
T32	0.148	0.025	-0.147	-0.021	1.8	5.5	98.8	97.1	1.73
100/150 cu	0.125	0.022	-0.125	-0.022	0.0	0.0	98.8	98.8	0.00
184/150 CU	1.180	0.225	-1.179	-0.224	0.2	1.0	98.8	98.7	0.04
T34	0.171	0.047	-0.169	-0.045	1.6	4.9	98.8	97.2	1.55
T33	0.125	0.022	-0.124	-0.018	1.3	4.0	98.8	97.3	1.47
90/150 Cu	0.158	0.036	-0.158	-0.036	0.0	0.0	98.7	98.7	0.00
90/150 CU	1.021	0.188	-1.021	-0.187	0.1	0.5	98.7	98.7	0.02
Line8	1.021	0.187	-1.021	-0.188	0.0	-0.5	98.7	98.7	0.01
Line9	0.722	0.125	-0.722	-0.125	0.0	-0.2	98.7	98.7	0.00
T35	0.128	0.021	-0.127	-0.017	1.1	3.8	98.7	97.3	1.23
T36	0.171	0.042	-0.170	-0.035	1.2	6.5	98.7	97.2	1.50
Line10	0.575	0.094	-0.575	-0.095	0.0	-1.0	98.7	98.7	0.00
T37	0.147	0.032	-0.146	-0.026	1.4	5.2	98.7	97.1	1.58
255/150 Cu	0.082	0.002	-0.082	-0.002	0.0	0.0	98.7	98.7	0.00
Line11	0.371	0.077	-0.371	-0.078	0.0	-1.2	98.7	98.7	0.00
T38	0.122	0.017	-0.121	-0.013	1.2	3.5	98.7	97.5	1.18
T39	0.082	0.002	-0.082	0.000	0.4	1.6	98.7	98.1	0.53
Line12	0.199	0.035	-0.199	-0.035	0.0	-0.5	98.7	98.7	0.00
T40	0.172	0.043	-0.171	-0.039	0.8	4.1	98.7	97.7	0.97
Line13	0.108	0.023	-0.108	-0.023	0.0	-0.5	98.7	98.7	0.00

Losses in Em-AlDaliah Substation after 20 years

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
T41	0.091	0.012	-0.091	-0.010	0.5	1.9	98.7	97.5	0.83
T42	0.108	0.023	-0.107	-0.021	0.6	2.6	98.7	97.5	1.18
[illegible]	0.326	0.257	-0.326	-0.057	0.0	0.2	99.3	99.5	0.02
Line17	0.230	0.060	-0.230	-0.061	0.0	-0.7	99.5	99.5	0.00
Line14	0.326	0.057	-0.326	-0.057	0.0	-0.5	99.5	99.5	0.00
Line18	0.147	0.022	-0.147	-0.023	0.0	-0.6	99.5	99.5	0.00
T43	0.179	0.035	-0.178	-0.028	1.3	6.9	99.5	98.1	1.38
T44	0.147	0.023	-0.146	-0.018	0.5	4.6	99.5	98.5	1.02
555/120 Cu	-0.938	-0.196	0.939	0.198	0.8	2.5	98.9	99.1	0.11
T46	0.296	0.054	-0.293	-0.046	2.9	8.8	98.9	97.5	1.41
T47	0.447	0.081	-0.444	-0.068	3.3	13.0	98.9	97.8	1.17
T48	0.194	0.060	-0.192	-0.054	2.1	6.4	98.9	97.1	1.85
T45	-0.157	-0.030	0.158	0.036	1.1	5.5	97.4	98.7	1.34
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Losses in Em-AlDaliah Substation after 20 years after replace overloded transformers

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...name: Em-Al-Daliah_MAX

Study Case: LF

Page: 1
Date: 05-31-2015
SN: 12345678
Revision: Base
Config: Normal

Branch Losses Summary Report

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
420/150 cu_[illegible]	1.785	0.486	-1.784	-0.479	1.5	6.9	99.5	99.7	0.17
1000/150 cu_[illegible]	0.834	0.224	-0.833	-0.220	0.8	3.6	99.5	99.7	0.20
T49	-8.138	-2.005	8.148	2.018	10.0	10.0	99.9	100.0	0.14
400/150 cu	-0.382	-0.080	0.382	0.080	0.0	0.0	99.6	99.6	0.00
300/95 Al	0.231	0.076	-0.231	-0.077	0.0	-1.3	99.6	99.6	0.01
T6	0.151	0.065	-0.150	-0.060	0.9	1.7	99.6	99.0	0.65
T?	-0.302	-0.085	0.303	0.094	3.2	9.8	97.9	99.7	1.80
T10	-0.145	-0.042	0.147	0.045	1.2	3.6	98.2	99.5	1.39
T7	-0.229	-0.071	0.231	0.077	1.8	5.7	98.2	99.5	1.43
400/150 cu	0.528	0.126	-0.528	-0.125	0.1	0.8	99.7	99.6	0.05
220/150 cu	0.147	0.045	-0.147	-0.045	0.0	0.0	99.6	99.6	0.01
175/150 cu	0.400	0.103	-0.400	-0.103	0.0	0.1	99.7	99.7	0.02
380/150 cu	1.152	0.318	-1.151	-0.316	0.5	2.3	99.7	99.6	0.06
T11	0.232	0.058	-0.230	-0.052	1.8	5.5	99.7	98.4	1.25
Line15	0.161	0.044	-0.161	-0.045	0.0	-1.2	99.7	99.7	0.00
T12	0.239	0.060	-0.238	-0.054	1.4	5.8	99.7	98.4	1.29
T13	-0.160	-0.039	0.161	0.045	1.1	5.7	98.1	99.7	1.32
370/150 cu	0.803	0.195	-0.802	-0.194	0.3	1.2	99.6	99.5	0.07
T14	0.349	0.121	-0.347	-0.112	2.1	8.5	99.6	98.3	1.27
180/150 cu	0.557	0.114	-0.557	-0.114	0.1	0.3	99.5	99.5	0.02
300/150 cu	0.245	0.078	-0.245	-0.079	0.0	0.1	99.5	99.5	0.02
T15	-0.229	-0.052	0.231	0.058	1.8	5.4	98.3	99.5	1.20
Line16	0.245	0.079	-0.245	-0.081	0.0	-1.8	99.5	99.5	0.01
T16	-0.243	-0.073	0.245	0.081	1.7	8.5	97.9	99.5	1.61
35/150 cu_محول التوزيع	0.101	0.029	-0.101	-0.029	0.0	0.0	99.9	99.9	0.00
600/150 cu_[illegible]	2.572	0.517	-2.567	-0.589	4.9	22.9	99.9	99.5	0.38
1380/150 cu_[illegible]	2.847	0.653	-2.834	-0.599	12.3	57.6	99.9	99.0	0.84
T17	0.101	0.029	-0.100	-0.026	0.8	2.6	99.9	98.4	1.44
Line1	2.567	0.589	-2.567	-0.585	0.0	4.2	99.5	99.4	0.05
20/150 cu	2.127	0.491	-2.127	-0.491	0.1	0.5	99.4	99.4	0.01
T18	0.440	0.094	-0.435	-0.076	4.9	18.1	99.4	97.7	1.75
80/150 cu	0.209	0.061	-0.209	-0.061	0.0	0.0	99.4	99.4	0.00
90/150 cu	0.234	0.049	-0.234	-0.049	0.0	0.0	99.4	99.4	0.00
390/150 cu	1.684	0.381	-1.681	-0.368	2.8	13.1	99.4	99.1	0.32
T19	0.234	0.049	-0.232	-0.044	1.8	5.5	99.4	98.2	1.18

Losses in Em-AlDaliah Substation after 20 years after replace overloded transformers

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	% Drop in Vmag
T20	0.209	0.061	-0.207	-0.051	1.9	9.8	99.4	97.4	2.00
170/150 CU	1.145	0.259	-1.144	-0.258	0.2	1.7	99.1	99.1	0.04
T21	0.346	0.066	-0.342	-0.054	3.9	12.0	99.1	97.4	1.06
T22	0.191	0.042	-0.189	-0.034	1.6	7.8	99.1	97.5	1.56
T23	0.205	0.061	-0.204	-0.055	1.2	6.6	99.1	97.8	1.27
255/150 cu	2.376	0.486	-2.375	-0.480	1.5	6.9	99.0	98.9	0.11
Line5	0.458	0.113	-0.458	-0.113	0.0	-0.5	99.0	99.0	0.00
T24	0.201	0.053	-0.200	-0.049	1.4	4.2	99.0	97.9	1.12
Line6	-0.257	-0.060	0.257	0.060	0.0	0.4	99.0	99.0	0.00
T28	0.257	0.060	-0.255	-0.054	2.2	6.8	99.0	97.7	1.35
200/150 cu	2.744	0.455	-2.343	-0.450	1.1	5.2	98.9	98.8	0.09
T29	0.130	0.025	-0.130	-0.021	0.7	3.7	98.9	97.9	1.00
60/150 cu	0.251	0.057	-0.251	-0.057	0.0	0.0	98.8	98.8	0.00
184/150 cu	1.475	0.299	-1.475	-0.297	0.4	2.1	98.8	98.8	0.05
T30	0.517	0.093	-0.511	-0.068	6.3	25.1	98.8	96.9	1.91
Line7	0.149	0.024	-0.149	-0.024	0.0	0.2	98.8	98.8	0.00
T31	0.101	0.035	-0.100	-0.032	0.7	2.6	98.8	97.5	1.36
T32	0.149	0.024	-0.148	-0.021	1.2	3.6	98.8	97.7	1.10
100/150 cu	0.125	0.022	-0.125	-0.022	0.0	0.0	98.8	98.8	0.00
194/150 CU	1.179	0.227	-1.178	-0.226	0.3	1.3	98.8	98.7	0.04
T34	0.171	0.047	-0.169	-0.042	1.6	4.9	98.8	97.2	1.55
T33	0.125	0.022	-0.124	-0.018	1.3	4.0	98.8	97.3	1.47
90/150 Cu	0.158	0.036	-0.158	-0.036	0.0	0.0	98.7	98.7	0.00
90/150 CU	1.020	0.190	-1.020	-0.190	0.1	0.5	98.7	98.7	0.02
Line8	1.020	0.190	-1.020	-0.190	0.0	-0.5	98.7	98.7	0.01
Line9	0.721	0.128	-0.721	-0.128	0.0	-0.2	98.7	98.7	0.00
T35	0.128	0.021	-0.127	-0.017	1.1	3.8	98.7	97.5	1.25
T36	0.171	0.042	-0.170	-0.035	1.3	6.5	98.7	97.2	1.50
Line10	0.574	0.096	-0.574	-0.097	0.0	-1.0	98.7	98.7	0.00
T37	0.147	0.032	-0.146	-0.026	1.4	5.2	98.7	97.1	1.58
235/150 Cu	0.082	0.002	-0.082	-0.002	0.0	0.0	98.7	98.7	0.00
Line11	0.370	0.075	-0.370	-0.080	0.0	-1.7	98.7	98.7	0.00
T38	0.172	0.017	-0.121	-0.013	1.0	3.5	98.7	97.6	1.10
T39	0.082	0.002	-0.082	0.000	0.4	1.6	98.7	98.1	0.53
Line12	0.199	0.035	-0.199	-0.035	0.0	0.5	98.7	98.7	0.00
T40	0.171	0.046	-0.170	-0.106	1.3	6.6	98.7	97.1	1.58
Line13	0.108	0.023	-0.108	-0.023	0.0	-0.5	98.7	98.3	0.30

Losses in Em-AlDaliah Substation after 20 years after replace overloded transformers

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...ation:		Date: 05-31-2015
...ract:		SN: 12345678
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...name: Em-Al-Daliah_MAX		Config.: Normal

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	
T41	0.091	0.012	-0.091	-0.010	0.5	1.9	98.7	97.9	0.83
T42	0.108	0.023	-0.107	-0.021	0.8	2.8	98.7	97.5	1.18
300/150Cu	0.326	0.057	-0.326	-0.057	0.0	0.2	99.5	99.5	0.02
Line17	0.231	0.037	-0.231	-0.038	0.0	-0.7	99.5	99.5	0.00
Line14	0.326	0.057	-0.326	-0.057	0.0	-0.5	99.5	99.5	0.00
Line18	0.147	0.022	-0.147	-0.025	0.0	-0.6	99.5	99.5	0.00
T43	0.179	0.033	-0.178	-0.026	1.3	6.9	99.2	98.1	1.38
T44	0.147	0.023	-0.146	-0.018	0.9	4.6	99.5	98.5	1.02
555/150 Cu	-0.938	-0.195	0.939	0.197	0.5	2.5	98.9	99.1	0.11
T46	0.297	0.054	-0.295	-0.046	2.1	8.2	98.9	97.8	1.12
T47	0.447	0.081	-0.444	-0.068	3.3	13.0	98.9	97.8	1.17
T48	0.194	0.060	-0.192	-0.054	2.1	6.4	98.9	97.1	1.85
T45	-0.157	-0.033	0.158	0.038	1.1	5.5	97.4	98.7	1.34
					104.7	998.5			

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