Palestine Polytechnic University

College of Engineering

Title

Redistribution Analysis of the Load on Low Voltage Distribution Network

At Al -Dahriya City

By

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Submitted to the College of Engineering
in partial fulfillment of the requirements for the
Bachelor degree in Power Engineering

Hebron, December 2017

Palestine Polytechnic University

Collage of Engineering

Electrical Engineering Department

Hebron – Palestine

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Project Team

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Supervisor Signature

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Chair of the Department Signature

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الاهداء

معلمنا الاول ومعلم الناس الخير نبينا محمد "صلى الله عليه وسلم"

الى من زرعوا في نفوسنا الطموح والمثابره .... آبائنا الاعزاء

الى ينابيع المحبه والعطاء .... امهاتنا الاحبه

الى من يحملون في نفوسهم ذكريات الطفولة والشباب .... إخوتنا وأخواتنا

الى من مهّدوا لنا طريق العلم والمعرفة .... أساتذتنا الأفاضل

الى من هم احياء في قلوبنا رغم انهم غادرونا

الى كافه الاصدقاء والاهل والاحبه

الى من قدموا الغالي والنفيس لهذا الوطن .... اسرانا البواسل وشهدائنا الابرار

"ان استطعت فكن عالما .. فـإن لم تستطع فكن متعلما ، فـإن لم تستطع فـأحب العلماء ،فـإن لم تستطع فـلا تبغضـهم"

بعد رحلة بحث و جهد تكللت بإنجاز هذا البحث ، نحمد الله عز وجل على نعمه التي منَ بها علينا فهو العلي القدير ، كما لا يسعنا إلا أن نتقدم بأسمى عبارات الشكر و التقدير

للدكتور مــــــــاهر المغــــــــالسة

وله نقول بشراك قول رسلنا صلى الله عليه وسلم:

" ألا أخبركم عن الأجود الأجود ؟. الله الأجود الأجود ، وأنا أجود ولد آدم ،

وأجودكم من بعدي رجل علم علما فنشر علمه ؛ يبعث يوم القيامة أمة وحده "

ان كان هناك اهل للشكر فانت اهله

كما ونشكر كل من ساعدنا في اتمام هذا البحث:

- الدكتور رائد عمرو

-الدكتور فؤاد الزرو

فريق العمل

Abstract

In AL-dahriya the electrical power system integrated structure in hierarchical aspect. The Israeli electrical corporation (IEC) Supplying energy to the Municipalities of Al dahiriya, works at medium voltage level (33kV), the electrical power system in the city which suffers from many problems as unbalance in the low and medium voltage distribution system, this problem is the worst it's have negative effects on the grid and customer and in this project we trying to find the solution that can be facing this problem.

The idea of the project is to study the unbalance in the low voltage distribution system at AL-dahriya city. Also, study the effect of unbalance on the system losses, power factor, and reliability, we redistribution the load to make the network balanced, and evaluate the result between balanced & unbalanced, The data about the distribution network and load profile will be collected and analyzed. Then, analytical program (E-TAP) will be used to identify the solution.

الملخص

تعتبر شبكة الكهرباء في مدينة الظاهرية شبكة متكاملة مبنية بشكل هرمي , حيث يتم تزويد بلدية الظاهرية بالكهرباء من قبل الشركة الإسرائيلية المزوده(IEC) حيث تعمل شبكة الجهد المتوسط على على جهد(33kv) وتعاني شبكة الظاهرية من عده مشاكل منها عدم الإتزان في توزيع الأحمال على شبكة الجهدالمتوسط والمنخفض , حيث تعتبر هذه المشكلة الأسوأ على مستوى الشبكة لما لها من آثار جانبية سلبية على الشبكة والمشتركين , لذلك سنحاول إيجاد الحلول المناسبة والكفيلة بمواجهة هذه المشكلة .

وتتمثل فكرة المشروع في دراسة عدم التوازن في نظام توزيع الجهد المنخفض في مدينة الظاهرية أيضا دراسة تأثير عدم التوازن على مفاقيد النظام ,معامل القدرة ,والموثوقية . وتم جمع وتحليل البيانات المتعلقة بشبكة التوزيع والاحمال .وفي هذه المرحلة تم استخدام برنامج تحليلي(E-TAP).

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1.1 Overview

1.2 Feature of project

1.3 The objective of project

1.4 Methodology

1.5 Time schedule

1.1 Overview:

The field of power transmission and distribution in Palestine which suffers from many problems and in this project we are trying through the study of the electricity grid and analysis of loads connected to the network of different kinds and classifications to find the problems in the grid and find solutions that can be facing these problems where they can to have these solutions the benefits to protect consumers and workers in this area and reducing the loss of energy.

The idea of the project is to study the unbalance in the low voltage distribution system at AL-dahriya city. Also, study the effect of unbalance on the system losses, power factor, and reliability. The data about the distribution network and load profile will be collected and analyzed. Then, analytical program (E-TAP) will be used to identify the solution.

1.2 Feature of project:

1. Improve the operation by Redistribution and Reinforce network.
2. Reduce the losses, voltage drop, and time outage of electricity.
3. Increasing the economic feasibility of the network.

1.3 The objective of project:

1. Study and analysis the effect of unbalanced load on the Medium Voltage Network.
2. Study the different loads and work statistics required for the development of the network.
3. Redistributed the loaded on the medium Voltage Network to be balanced.
4. Economic Feasibility Study for both case (balanced &unbalanced) and the evaluate the results.
5. Reduce the maintenance and operating cost of the network.

1.4Methodology:

1-Site visits and collecting data about the network and loads using analyzer device.

2-Analyze the data using Excel.

3-Using E –TAP to study the network.

1.5 Time Schedule:

First semester																
week work	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Selection project																
data Collection																
Data analyses																
Preparing the final report																
Prepare the presentation																

Second semester																
Week / Work	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Collecting data																
Data analysis																
Analysis the Etap circuit to get results																
Editing for the introduction of project																
Preparing the final report																

2

Chapter two Adahiriya City Network

2.1 Introduction

2.2 Electrical power system

2.3 Load flow

2.4 Distribution System

2.5 Reliability

2.6 power factor correction

2.7 Element of network

2.1 Introduction:

Al-dahiriya city is located in the Hebron governorate at the southern of West Bank. Located in the south-west of the Hebron city, about 22 km, 655 meters above sea level. The area of al-dahiriya is 120,854 acres, the second-south area of cities.The population of Adahiriya is about 38000[1].

Southern electricity company (SELCO) is power distribution company works at medium voltage level (33kV).The town has been linked to the electricity grid since 1992.whereasPalestine has not yet a unified power system, the existing network is local low voltage distributions networks connected to Israeli electrical corporation (IEC), where around 97% of consumed energy were and still supplied by the IEC.

The IEC Supplying energy to the Municipalities of Adahiriya, Yatta, and Dura. The municipality organized Electricity distribution to citizens. Municipal facing problems in the electricity service, such as the growing demand for Electricity, which requires extending the network to new subscribers.

In al-dahiriya the electrical power system integrated structure in hierarchical aspect that is lead mainly satisfies the main factors that ensure the continuity in the power flow to the consumer and good role in distribution of the energy to the consumer [2].

2.2 Electrical Power System:

Electrical energy is produced through an energy conversion process. The electric power system is a network of interconnected components which generate electricity by converting different form of energy,(Potential energy, kinetic energy, or chemical energy) are the most common forms of energy converted to electrical energy; and transmit the electrical energy to load centers to be used by the consumer. The production and transmission of electricity is relatively efficient and inexpensive, although unlike other forms of energy, electricity is not easily stored and thus must generally be used as it is being produced.

The electric power system consists of three main subsystems: the generation subsystem, the transmission subsystem, and the distribution subsystem. Electricity is generated at the generation station by converting a primary source of energy to electrical energy. The voltage output of the generators is then stepped-up to appropriate transmission levels using a step-up transformer. The transmission subsystem then transmits the power close to the load centers. The voltage is then stepped-down to appropriate levels. The distribution subsystem then transmit the power close to the consumer where the voltage is stepped-down to appropriate levels for use by a residential, industrial, or commercial customer.

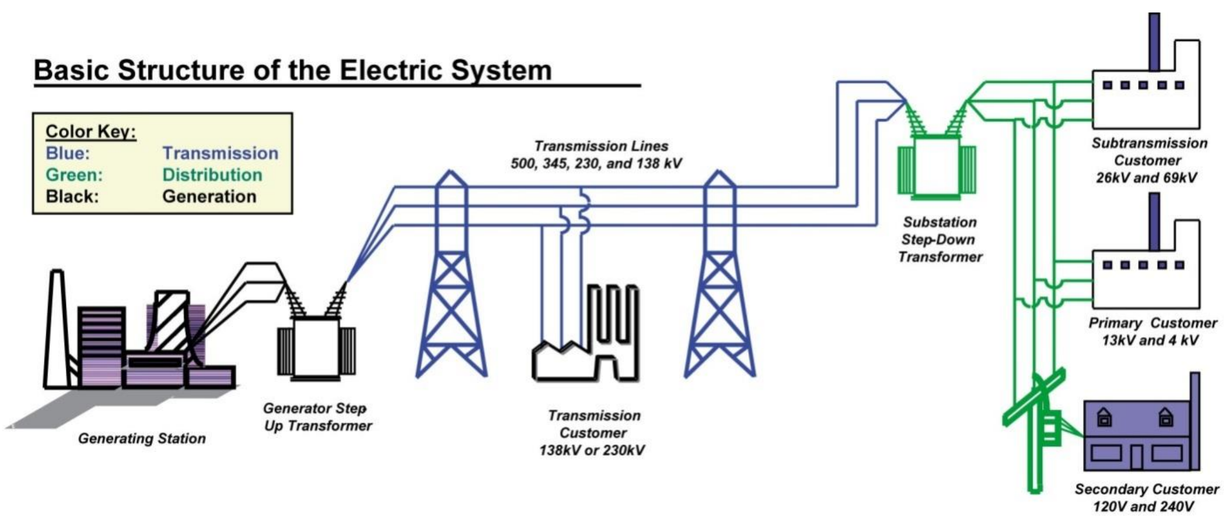


Figure 2.1: Structure of the Electrical Power System.

2.3 Load Flow:

In power engineering, a power flow study usually uses simplified notation, and focuses on various forms of AC power (i.e: reactive, real, and apparent) rather than voltage and current. It analysis the power system in normal steady-state operation. There exit a number of software implementations of power flow studies.

In addition to a power flow study itself, sometimes called the base case, many software implementation perform other type of analysis, such as fault analysis and economic analysis. In practical, some program use linear programming to find the optimal power flow, the conditions which give the lowest cost per kW generated.

The great importance of power flow or load-flow studies is in planning the future expansion of power systems as well as in determining the best operation of existing systems. The principle information obtained from the power flow study is the magnitude and phase angle of the voltage at each bus and the real and reactive power flowing in each line, such as E-TAP power station program.

2.4 Distribution system:

The distribution system is the electrical system between the substations fed by the transmission line system and the customer meter. The distribution system generally consists of feeders, distributer and serves mains.

Classification of distribution systems

The distribution systems may be classified according:

1. Nature of current
   - 1.1 DC distribution system
   - 1.2 AC distribution system

2. Type of construction
    2.1 Overhead system
    2.2 Underground syste
3. Scheme of construction

    3.1 Radial system

        It’s the simplest distribution systems and has low initial cost. Basic problem of this type is the interruption of feeding electrical loads in the event of a breakdown on the distributor or one of its branches.

    3.2 Ring main system

        This system is very reliable. In the event of any fault in any part of the system, the system will continue to work and continue the current flow through the system.

    3.3 Inter-connected system

        This system is increase the reliability. But this system is limited to use only the important electrical loads and which require a high degree of dependability because the economic cost of this system is often more than the previous regimes as well as some difficulties in the operation.

2.5 Reliability:

Reliability is a measure of the ability system's to transmit electrical power from the power generation points to all consumers, and it gives numerical indices to assess this process. The reliability of the system can be described by two basic functional features are security and adequacy.

Reliability refers to the ability of parts and components of the power system to complete the required functionality properly and in a specific time and also under certain conditions. Reliability is the probability of a component or system work reliably used as a characteristic reliable indicator. The reliability of electrical systems is the application of the theory of reliability and measure for the electrical systems, which provides consumers electrical energy with quantity and appropriate quality and according to the standards and also from the lower number of interruption of electricity [3].

Adequacy:

A measure of the ability of the power system to supply the aggregate electric power and energy requirements of the customers within components ratings and voltage limits, taking into account planned and unplanned outages of system components. Adequacy measures the capability of the power system to supply the load in all the steady states in which the power system may exist considering standards conditions.

Security*:*

A measure of power system ability to withstand sudden disturbances such as electric short circuits or unanticipated losses of system components or load conditions together with operating constraints. Another aspect of security is system integrity, which is the ability to maintain interconnected operation. Integrity relates to the preservation of interconnected system operation, or avoidance of uncontrolled separation, in the presence of specified severe disturbances.

2.6 Power Factor Correction:

Most loads on an electrical distribution system fall into one of three categories; resistive, inductive or capacitive. The power factor decreases with the installation of non-resistive loads such as induction motors, transformers, induction motor, lighting ballasts, induction furnace, Induction generators and other loads. A poor power factor can be the result of high harmonic content or distorted current waveform, large losses and greater size conductor required.

Because there are a large number of inductive loads in the distribution system the power factor becomes less than the allowable limit, so the power factor must correction. There are several ways to correct the power factor and the most prominent of these methods using the capacitor bank, but there are many different way for this such as:

1. Static VAR Compensator
2. Static Synchronous Compensator

The methodology for applying power capacitors is relatively straightforward. However, there are a number of influencing factors that must be considered. To ensure that the capacitor installation does not create additional and unexpected problems.

2.7 Elements of Network:

This section shows the elements of the network such as transformers, overhead lines and underground cables, Isolators, Fuses and Surge arrester.

2.7.1 Distribution Transformers:

Adahiriya network consists of 54 (33/0.4 KV) distribution transformers, have wide rating range from (160-630) KVA.

Figure 2.2: Transformer.

Table 2.1: Distribution Transformers in Adahiriya.

Number of Transformers	Transformer Ratings (KVA)
6	630
13	400
28	250
7	160

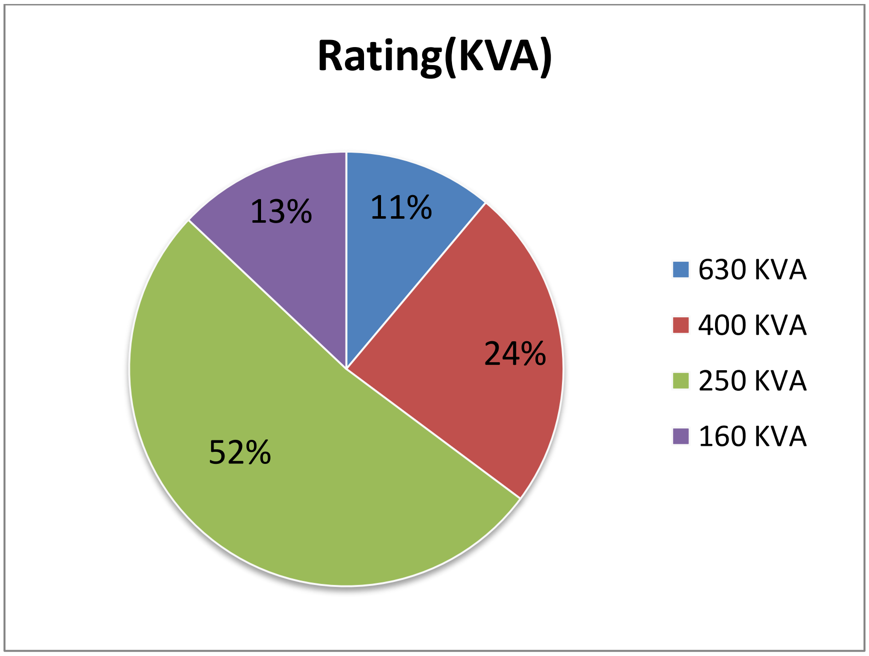


Figure 2.3: Adahiriya Transformers Rating.

2.7.2 Distribution line:

Tow classification of distribution lines in the network, underground and overhead lines, also there are one type of underground cables and three type of overhead lines are used –Coyote ,Dog and Rabbit-as following

Table 2.2: Distribution line Data.

Line type	DISTANCE (Km)
Coyote	7.300
Dog	3.934
Rabbit	10.010
Nexans, THREE CORE 95mm^2	24.322

2.7.3 Isolators:

Isolator (disconnecting switch) operates under no load condition. It does not have any current breaking capacity or current making capacity. Isolator is not even used for breaking load currents.

Isolators are used in addition to circuit breakers, and are provided on each side of every circuit breaker to provide isolation and enable maintenance.

Sequence of operation.

While opening –Open circuit breaker first and then isolators

While closing –Close isolators first and then close circuit breakers

Figure 2.4: Isolator (disconnecting switch).

2.7.4 Fuses:

Fuse is a device used in circuit for protecting electrical equipment's against overloads and /or short circuits.

Fuse element or fuse wire is that part of the fuse device which melts when an excessive current flows in the circuit and thus isolates the faulty device from the supply circuit.

The rated of fuses in Adahiriya medium voltage network based on transformer rating and load of this transformer illustrate in Table (2.3).

Table 2.3: rated fuse used in Adahiriya network.

Transformer rated (KVA)	Fuse rated (A)
160	4
250	6
400	10
630	16

Figure 2.5: 33KV fuses.

2.4.5 Surge arrester:

Surge arresters are devices that help prevent damage to apparatus due to high voltages. The arrester provides a low-impedance path to ground for the current from a lightning strike or transient voltage and then restores to a normal operating conditions. It will release high pressure until a normal operating condition is reached, at Adahiriya network has Surge Arresters with rated voltage 5KV-36KV.

Figure 2.6: Surge arrester.

3

Chapter Three Unbalanced System

3.1 Introduction:

In three phase network, electrical quantities are analyzed for one phase only assuming balanced system. However, where the three phase quantities are unbalanced, and sequence components representation is important, and therefore this is invalid in practical analysis, one of common several methods that quantify the degree of voltage and current unbalance in the network.

3.2 Unbalance Definition:

In general:

A three-phase power system is called balanced if the three-phase voltages and currents have the same amplitude and are phase shifted by 120° with respect to each other. If either or both of these conditions are not met, the system is called unbalanced.

3.2.1 Unbalance voltage:

The two general definitions for voltage unbalance as described are:

1) NEMA Definition:

The voltage unbalance percentage (VUP) at the terminal of a machine as given by the National Electrical Manufacturer Association Motor and Generator Standard (NEMA MGI) used in most studies is[4]. NEMA limits require no more than 5% unbalanced voltage.

$$VUP(\%) = \frac{\text{max voltage deviation from avarege line voltage}}{\text{avarege line voltage}} \qquad (3.1)$$

2) Symmetrical Component Definition:

The voltage unbalance factor (VUF) is defined by International Electro technical Commission (IEC) as the ratio of negative-sequence voltage component to the positive-sequence voltage component [5].

$$VUF(\%) = \frac{|Vn|}{|\mathrm{Vp}|} * 100\% \qquad (3.2)$$

Where Vn and Vp are the magnitude of negative and positive sequence voltage components respectively are obtained by symmetrical component transformation.

3.2.1.1 Types of Voltage Unbalance:

There may be different type of unbalance in a supply system and exists definite possibility of voltage variations above and below the rated value. Thus voltage unbalance can be classified into overvoltage unbalance (OVU) under-voltage unbalance (UVU) unbalance. OVU is a condition when the three phase voltages are not equal to each other, in addition positive sequence component is greater than the rated value while UVU is a condition where the three phase voltages are not equal to each other, and in addition the positive-sequence component is lesser than the rated value. There are many possible voltage unbalance in a power system [6].

3.2.2 Unbalance current:

The current unbalance it causes Voltage unbalance. If voltages are unbalanced then currents will almost certainly be unbalanced. Even if the voltages are balanced it is possible to have current unbalance.

$$CUP(\%) = \frac{\text{max current deviation from avarege line current}}{\text{avarege line current}} \quad (3.3)$$

3.3 Sequence Components:

Electrical quantities in balanced system are analyzed for one phase but the unbalanced load of a power system the sequence components are important to analyzed of the system , the neutral currents equal 3*I_0 where I_0 is Zero sequence current .

$$\begin{bmatrix} V_a \\ V_b \\ V_c \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{bmatrix} \begin{bmatrix} V_{a0} \\ V_{a1} \\ V_{a2} \end{bmatrix}$$

$$I_0 = \frac{1}{3}(I_a + I_b + I_c) \qquad V_0 = \frac{1}{3}(V_a + V_b + V_c) \quad (3.4)$$

$$I_1 = \frac{1}{3}(I_a + aI_b + a^2 I_c) \qquad V_1 = \frac{1}{3}(V_a + aV_b + a^2 V_c) \quad (3.5)$$

$$I_2 = \frac{1}{3}(I_a + a^2 I_b + aI_c) \qquad V_2 = \frac{1}{3}(V_a + a^2 V_b + aV_c) \quad (3.6)$$

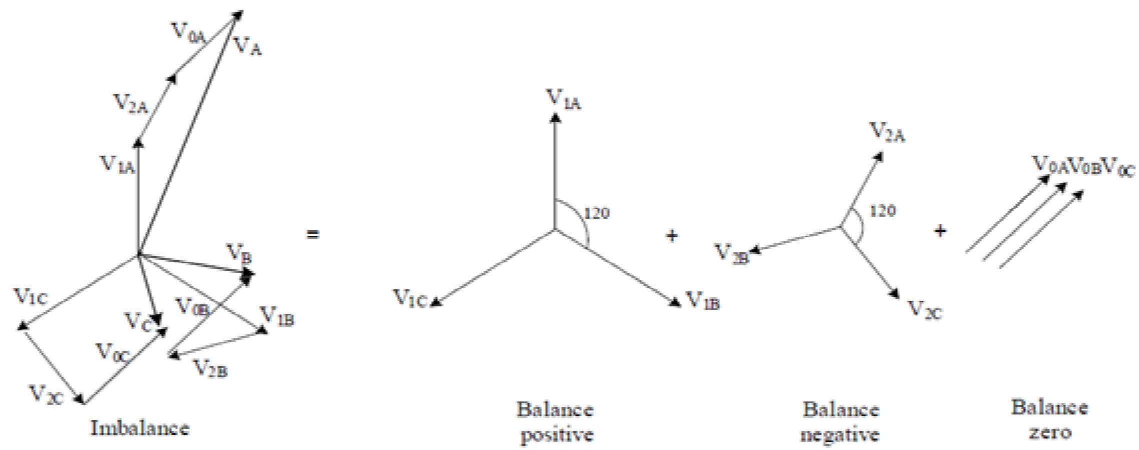


Figure 3.1: Imbalance voltage with its symmetrival components

1. Positive sequence components: It consists of three phasors with equal magnitude and displaced by 120◦ from each other i.e. V1A leads V1B by 120◦ and V1B leads V1C by 120◦ in ABC rotation system. (phasors lags instead of leads in ACB roation system).

2. Negative sequence components: It consists of three phasors with equal magnitude and displaced by 120◦ from each other i.e. V2A lags V2B by 120◦ and V2B lags V2C by 120◦ in ABC rotation system. (phasors leads instead of lags in ACB roation system).

3. Zero sequence components: It consists of three phasors i.e. V0A, V0B and V0C with equal magnitude and zero phase displacement.

3.4 Causes of unbalance load:

A phase unbalance may be caused by unstable supply, unbalanced transformer, unequally distributed single-phase loads on the same power system, or unidentified single-phase to ground faults. Single phasing (phase loss) caused by utility supply faults, broken wires, failed fuses, damaged contacts, or overloads can also result in damaging unbalance conditions.

1) large single phase load, or a number of loads connected to only one phase cause more current to flow from that phase causing voltage drop on line.
2) Unbalance impedances in the power transmission or distribution system cause differentiating current in three phases.
3) Switching of three phase heavy loads results in current and voltage which cause unbalance in the system.
4) A three phase equipment such as induction motor with unbalance in its windings. If the reactance of three phases is not same, it will result in difference current flowing in three phases and give out system unbalance.

3.5 Effects of unbalance load:

Unbalance in power system is related to the power system stability problem. Unbalance may cause excessive drawl of reactive power, mal-operation of equipment, mal-operation of measuring instruments and shortening of life span of different devices.

3.5.1 Effects on the distribution Transformer, cables and overhead lines:

The total losses due to unbalanced load in a transformer cables and overhead lines would be higher as a result of unbalance current flowing through the different phases compared to when the load is balanced.

1. Unbalanced loading in a transformer will reduce the capacity of the transformer in a distribution system.
2. Copper losses vary considerably with the load unbalance.

   Copper losses $= I^2R$

   Where I = current (A) and R = resistance of the transformer winding.
3. Reduced life of distribution transformers and underground cables due to additional thermal stresses on insulation.

3.5.2 Effects on consumer load equipment:

The effects on three-phase consumer load equipment such as rotating machines, AC/DC rectifiers and inverters.

1. The effects on induction machines are heating effects which result in a reduction in efficiency and faster thermal ageing and reduced speed and torque.
2. The effects on rectifiers are additional third harmonic currents, the rectifier circuit increases losses and may damage the rectifier components.
3. The effects on inverters are additional losses, noise issues and additional third harmonic.

3.6 How can unbalance be mitigated:

1. Redistribute the loads in such a way that the system becomes more balanced this is most basic solution.
2. The ‘Scott-transformer’ consists of two single-phase transformers, with special winding ratios, hooked up to a three-phase system. They are connected in such a way that at the output, a two-phase orthogonal voltage system is generated allowing the connection of two single-phase systems. This set-up presents a balanced three-phase power to the grid.

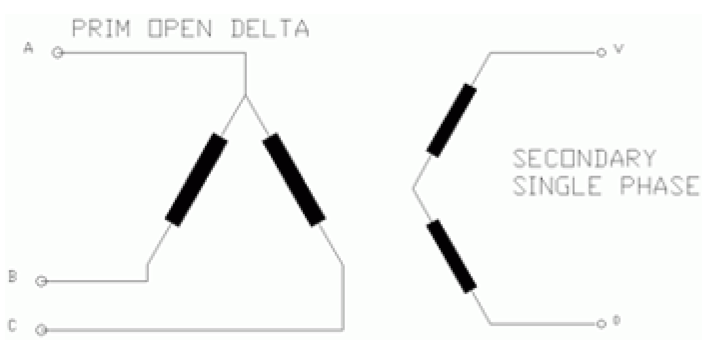


Figure 3.2: Scott -Transformer connection

3. Make balance impedances in the power transmission or distribution system by transposed distribution line.

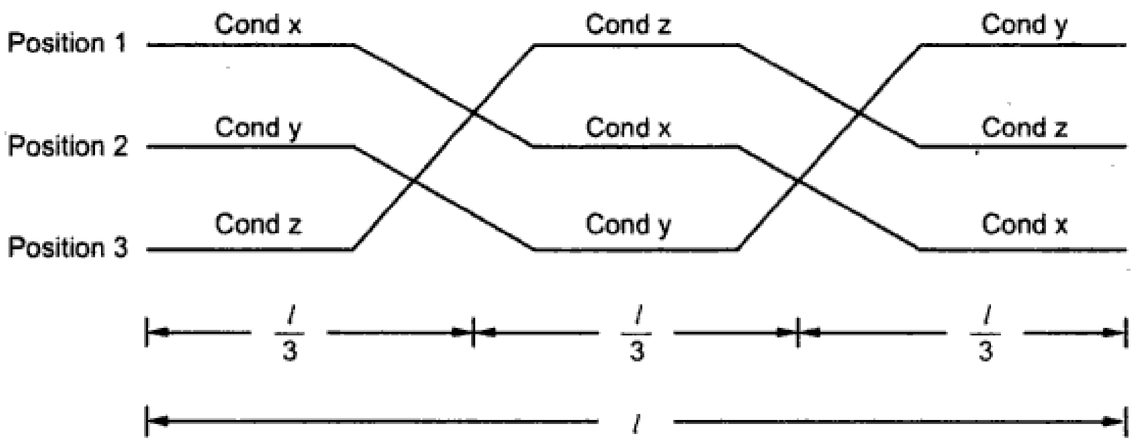


Figure 3.3: Transposition of transmission line

3.7 Protection against the unbalance loading:

Negative Sequence Relay

Definition: A relay which protects the electrical system from negative sequence component is called a negative sequence relay or unbalance phase relay. The negative sequence relay protects the generator and motor from the unbalanced load.

Negative sequence filter provided with the over current relay is used for the protection against unbalance loading. From the theory of the symmetrical components, the unbalanced three phase currents contain the negative sequence component. This negative phase sequence current causes heating of the stator. The negative heating follows the resistance law so it is proportional to the square of the current. The heating time constant usually depend upon the cooling system used and is equal to $I^2t=k$ where I is the negative sequence current and t is the current duration in seconds and k is the constant usually lies between 3 and 20 [7].

When unbalanced load occurs, the negative phase sequence filter circuit produces an output proportional to the negative phase sequence components. This is directed through the relay coil. Hence the relay operates to open the circuit breaker to isolate the generator.

The negative sequence protection is shown in the Figure (3.4).

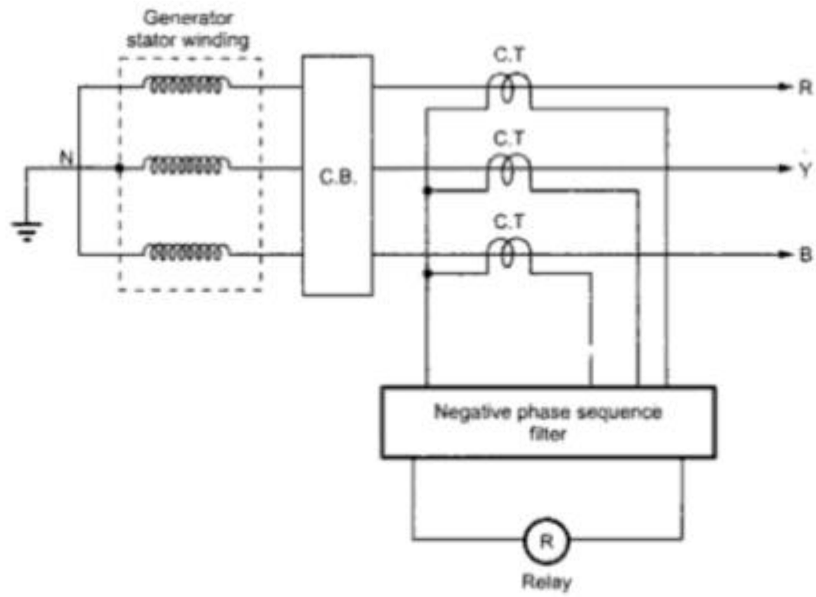


Figure (3.4): Negative sequence protection.

3.8 Benefits of Load balancing:

1. Load balancing improves the performance of each Bus bar and hence the overall system performance.
2. Load balancing reduces the job time in Maintenance
3. Maximum utilization of resources
4. Higher throughput
5. Higher reliability
6. Low cost but high gain
7. Extensibility and incremental growth

4

Chapter Four Collected Data and Analyses

4.1 Power quality analyzers

4.2 Data COLLECTION

4.3 Data Analysis

4.1 Power quality analyzers:

Is a device used to analyze the power on lines and substation , the analyzer offers an extensive and powerful set of measurements to check power distribution system .by using fluke 435 the standard IEC61000-4-30-2003 class A ,it is used to obtain data in the form of values and curves such as :voltage ,current, frequency , power , energy , power factor (PF) and total harmonic distortion (THD).

4.2 Data Collection:

Adahiriya contains around 56 electrical substation , it take 24 hour for each substation as in Appendix A , and the following tables (4.1) show the transformer rating and loading level of substations and table(4.2) the transformer losses.

Table 4.1: Transformer rating and loading level.

No.	Name	Rating KVA	Percentage of maximum loading	No.	Name	Rating KVA	Percentage of maximum loading %
1	Al-masjid Al_kaber	630	42.8	2	Mothalath Al_borg	630	42.8
3	Maskaneh	630	42.8	4	Bear mtawi’	630	31.5
5	Wad algamary 1	400	48	6	Wad algamary 2	250	28.9
7	Al_deir 1	400	55	8	Karam al_ashqar	400	28.1
9	Abu al_humas	400	55	10	Meqtaa’ duma	400	40.5
11	Wad ali	400	40.3	12	Aqabit gharrarah	400	40.9
13	Qata’t al_jamal	400	21	14	Al_markaz	400	23.4
15	Abu hashim	400	51.2	16	Sa’ada	400	24.3
17	Al_baladiya	400	24.3	18	Al_sheehk	400	51.2

19	Al-marj 1	250	29	20	Aqabit al_tarsha	250	48.9
21	Al_mustashfah	250	33.7	22	Da'na	250	36.6
23	Kurza	250	48.9	24	Al-deire 2	250	33.7
25	Rasmi wahab	250	36.6	26	Baten alqar'	250	39.6
27	Al_muntazah	250	21.6	28	Domet al_wridat	250	45.3
29	Juret al_dama	250	53.3	30	Kafar joul	250	30.5
31	Sam'a	250	12.9	32	Khalet al_ayaseh	250	20.2
33	Al_mizrab	250	14.2	34	Al_shadaqa	250	14.2
35	Al_shuqfan	250	32.5	36	Al_estad	250	14.2
37	Eshreeteh	250	36.7	38	Al_muhtasib	250	23.4
39	Jammoq	250	43.5	40	Al_helal	630	1.9
41	Al_muntazah 2	250	21.6	42	Abu njeem 2	250	21.6
43	Al jame'a	250	23.6	44	Alghwla	250	9.5
45	Masafi	250	39.4	46	Al_jebreni	250	48
47	Abu_njeem 1	160	22.2	48	Inab al_kabeer	160	20.1
49	Shweki	160	20.1	50	Al-baha	160	68
51	Inab al_sagher	160	55.8	52	Bank al_eskan	160	22.2
53	Al_tork	630	19.5	54	Wad algamary 3	160	22.2
55	Mana'	250	20.9	56	Al jebreny step up	630	96.8

Table 4.2: Transformer losses.

NO	manufacture company	KVA	impedance	No load losses(W)	Load losses(W)
1	MACE	160	4.5	410	2150
2	MACE	250	4.5	560	2900
3	MACE	400	4.5	780	4100
4	MACE	630	4.5	1150	6050
5	ARDAN	160	4.48	410	2150

6	ARDAN	250	4.8	560	2900
7	ABB	630	4.62	1150	6060

4.3 Data Analysis

After collection the data that it need to analysis to discover the problem in the network that include unbalance in system, voltage drop and PF problem.

The results obtained from the readings that have been measured on transformers.

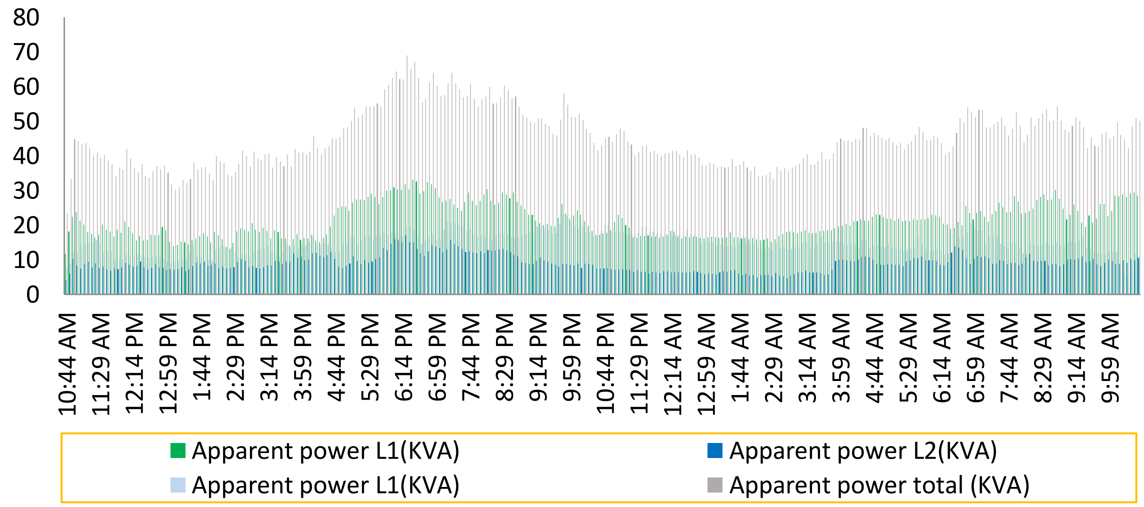


Figure (4.1): Apparent power in Al_muhtasib transformer.

Table 4.3: Apparent power in Al_muhtasib transformer.

Phase Load(KVA)	L1	L2	L3	Total
Minimum load	7.7	4.1	11.7	23.5
Maximum load	19.9	17.1	31.8	68.8
Average load	21.23	9	14.8	45

Table 4.4: Current in Al_muhtasib transformer.

Phase / Current(A)	L1	L2	L3	N
Minimum Current	34	18	51	9
Maximum Current	86	74	136	42

$$CUP(\%) = \frac{\text{max current deviation from avarege line current}}{\text{avarege line current}}$$

Average= (86A + 74A + 136A)/ 3 = 98.66A

Max current deviation from average = 136A - 98.66A = 37.33A

$$CUP(\%) = \frac{37.33}{98.66} = 37.83\%$$

There are High neutral currents Result of presence heavily unbalanced loads. Whenever the current is close to zero, the system is more balanced.

An unbalance in load conditions increases the neutral conductor current, where in this transformer the neutral current arrived to 42A and the percentage unbalance current at the maximum load in this transformer arrived to 37.83%. The maximum unbalanced single-phase loads distribution, in term of percentage current unbalance shall not exceed 10% to protect the system and to minimize the the loss in the system[8].

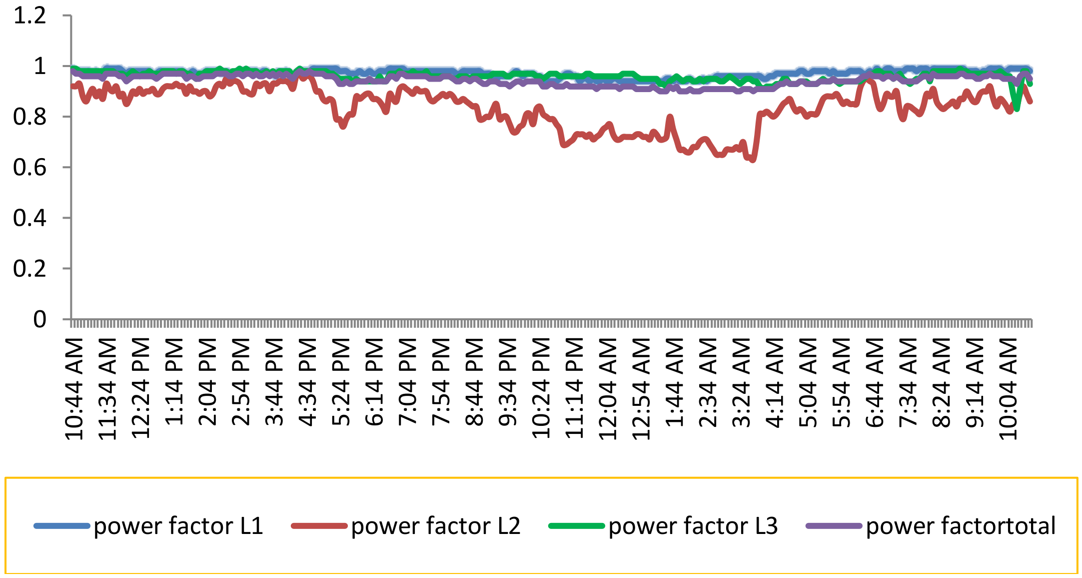


Figure (4.2): power factor in Al_muhtasib transformer.

Table 4.5: Power Factor in Al_muhtasib transformer.

Phase / PF	L1	L2	L3	Total
Minimum PF	0.94	0.63	0.83	0.8
Maximum PF	0.99	0.97	0.99	0.98
Average PF	0.97	0.83	0.96	0.92

5

Chapter Five Software (E-TAP)

5.1 Modeling the network

5.2 E-TAP simulation and result

5.3 Economical study

5.1 Modeling the network:

The design of the Adahiriya network needs a large amount of data represented as 56 transformers, and the length of the cables and overhead lines. The details of the distribution network are shown in **Appendix B1** for balanced loads and unbalanced loads.

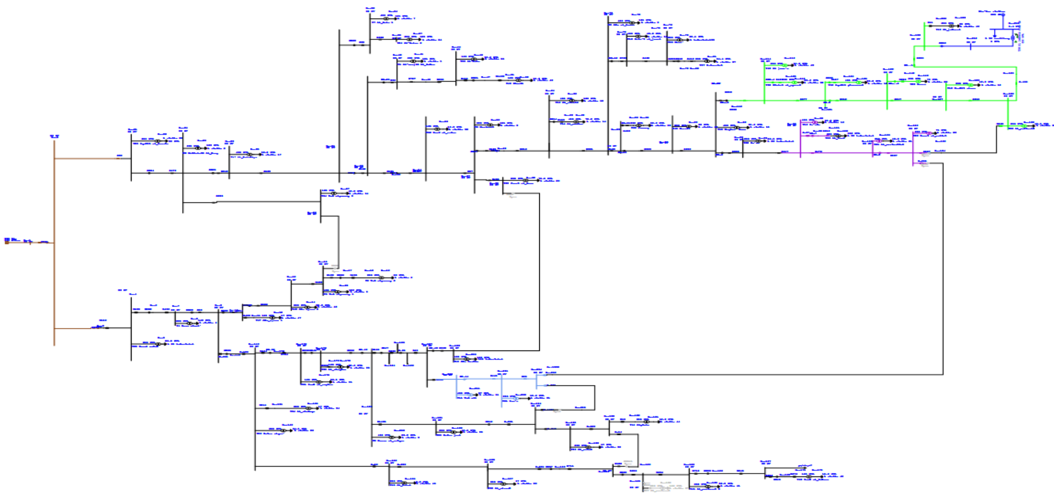


Figure (5.1): The distribution network of Adahiriya city.

5.1.1 Cables and overhead lines:

Adahiriya network has a large number on cables and overhead with a different manufacturer, which has an impedance value effect on the system, the all data of distribution line analysis in Etap in **Appendix B2**.

Table 5.1: Cables and overhead lines data

Line Type	Resistance (Ω/km)	Reactance (Ω/km)	Admittance (Ω^{-1} /km)
Coyote	0.216	0.318	0
Dog	0.269	0.326	0
Rabbit	0.529	0.347	0
Nexans, single core XLPE, 95 mm^2	0.321	0.22	$5.2*10^{-5}$

5.1.2 Transformers:

The most important parameters should be taken into account to represent the transformers in Etap software are the KVA rating, positive and negative impedances, and X/R ratio.

Adahiriya network has a (160, 250, 400, 630) ratings with a different manufacturer, show transformers data in Etap in **Appendix B3**.

Table 5.2: Transformers data

Transformer rating (KVA)	X/R	Z %
160	1.6	4.4
250	2.5	4.4
400	4	4.4
630	6.3	4.4

5.1.3 Loads:

In Etap software there are two type of loads can be used which are (Lumped load, Static load), this project includes Lumped load to analyze unbalanced load.

5.2 E-TAP simulation and result:

Redistribution of loads on the electricity network has impact on the operation and performance of the network, and there are some changes to the characteristics of the network such as the voltage drop, losses and the power factor. The output results from the ETAP in **Appendix C.**

5.2.1 Voltage Validation:

First of all, to ensure the result gained from the ETAP program are approximately closed to the real data were collected from the network by power quality analyzer voltage validation should be checked to verify the result and to build accurate rule to analyze the network. In the Figure (5.3) note the real voltage versus the simulation voltage are approximately the same with a small different.

Table 5.3: Comparison between the simulation and real voltage

Transformer	simulation voltage	real voltage	percentage of error
T 34	229.67	228.86	0.35392816
T 35	228.80	228.1	0.30688294
T 38	229.24	229.46	-0.09587727
T 21	228.78	227.3	0.65112186
T 18	228.71	229.82	-0.48298668
T 16	229.37	228.75	0.27103825
T 43	229.5	230.8	-0.563258232
T 45	229.1	229.3	-0.08722197

Where:

$$\text{percentage of error} = \frac{\text{simulation voltage} - \text{real voltage}}{\text{real voltage}} \qquad (5.1)$$

Refers to the Table (5.3) and Figure (5.2) note the extent to which the real values of the voltage are taken by the power quality analyzer match in approximately 99 % with the simulation values of the voltage in ETAP program.

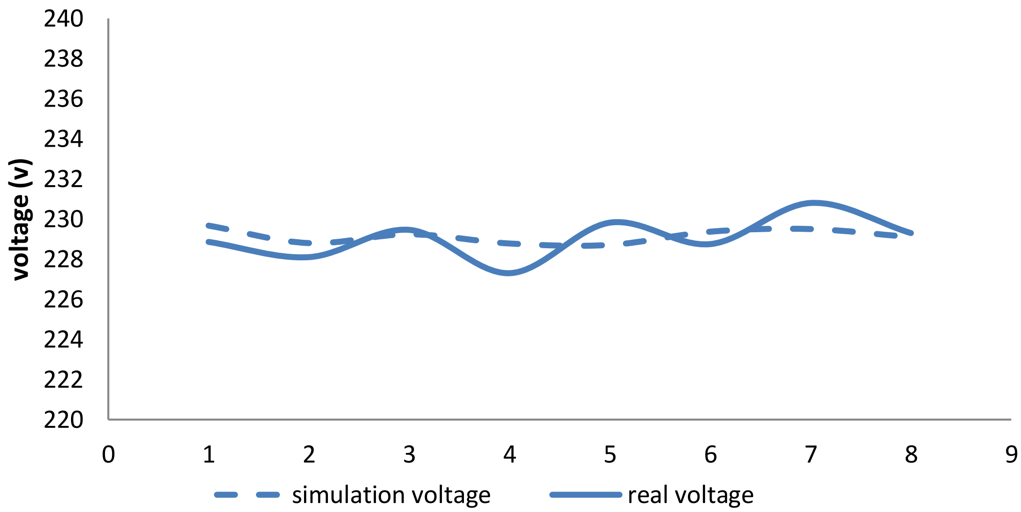


Figure (5.2): The simulation and real voltage.

6.2.2 Voltage drop:

Redistribution of loads change the voltage drop by changing the direction and magnitude of real and reactive power flows, however providing the reactive power to the network leads to increase the voltage on the network and then the one of advantages of redistribution of loads to improve the voltage drop. As shown in the Figure (5.3) after redistribution of loads to the network this lead to reduce the voltage drop on the resistance then the losses are decreasing on the distribution line.

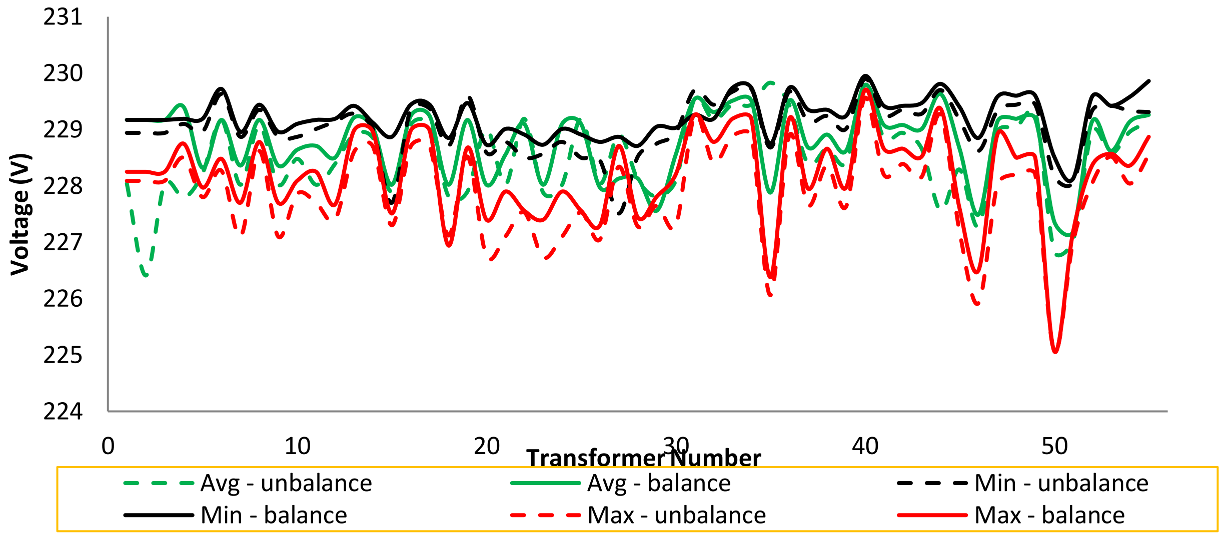


Figure (5.3): Voltage Drop before and after balancing load.

5.2.3 Power Factor:

After redistribution of loads, the power factor increases on phases and decreases at other phases, however the increment equals to decrement value and will they cancel each other. The following figure (5.4) Show the less power factor before balance and the power factor after balance.

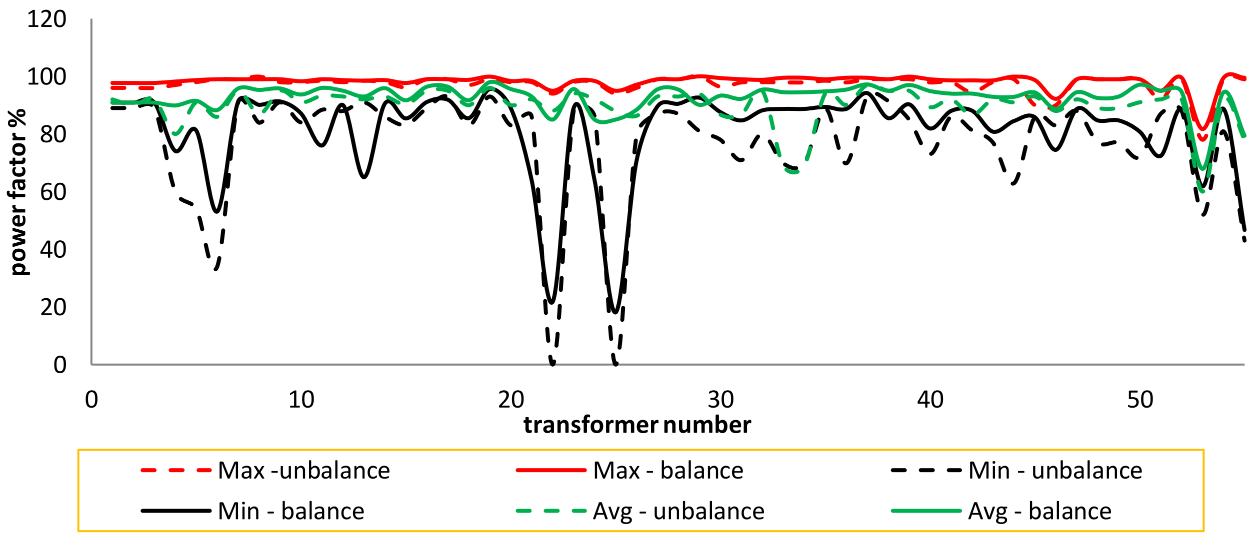


Figure (5.4): Power Factor before and after balancing load.

5.2.4 Losses:

Redistributed loads are reducing the losses on transformer caused by the unbalance system on the network, the losses depend on the current passes through the resistance, the current decreases and the losses also will be decreased. As shown in the Figure (5.5) the losses before and after balancing load.

Table 5.4: The total losses of transformers for three phases.

Total Losses (kw)	Unbalance	Balance
Minimum load	125.6	24
Average load	213	35.7
Maximum load	440.4	54

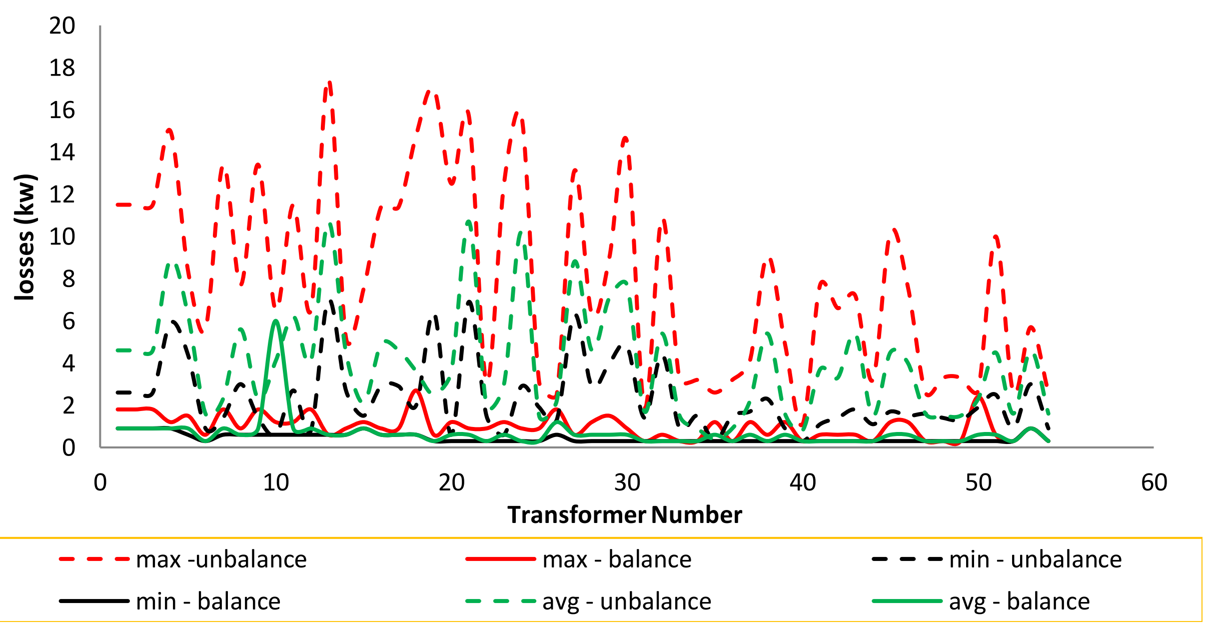


Figure (5.5): losses before and after balancing load.

5.2.5 Power Factor Improvement in the Average Load:

The cosine of angle of phase displacement between voltage and current in an AC circuit is known as Power Factor.

How to improve the P. F?

$$QC = P(\tan\theta\ old - \tan\theta\ new) \qquad (5.2)$$

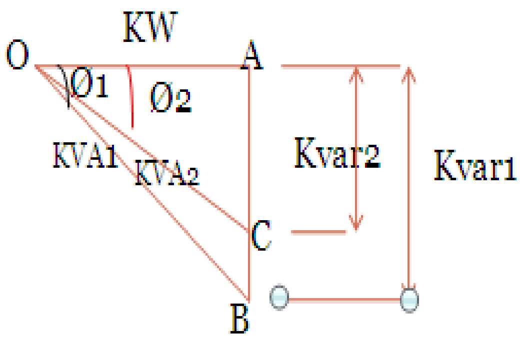
Where:

QC: The reactive power to be compensated by the capacitor.

P: The real power of the load.

θ old: The actual power angle.

θ new: The proposed power angle.



power triangle

Capacitor Banks:

The important of improvement power factor is by adding shunt capacitor banks at the buses at both transmission and distribution levels and loads and there are more effective to add them in the low level Voltages. The following figure shows where the capacitor banks installed in the network.

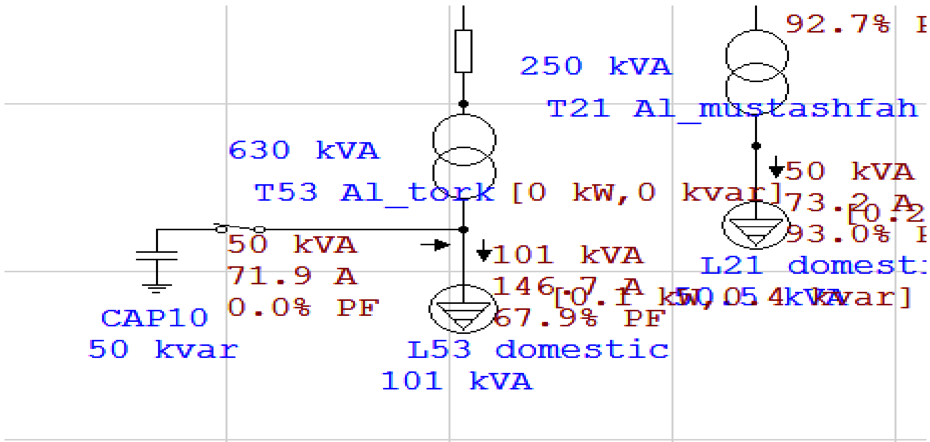


Figure (5.6): Capacitor banks installed in the network.

The following Figure (5.10) shows the results after adding capacitors in order to improve the P.F after balancing average load.

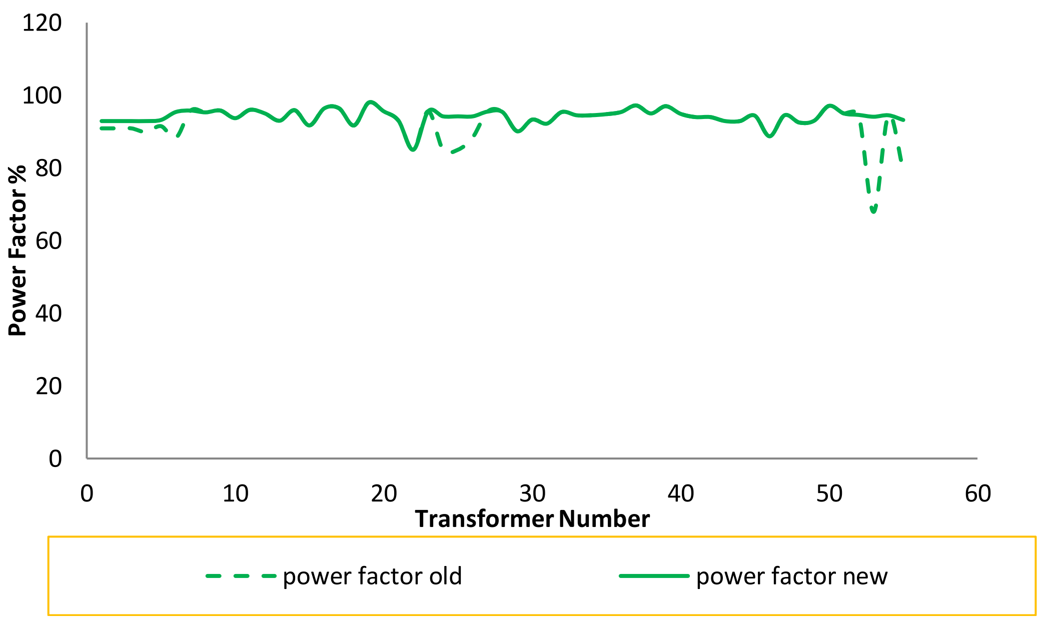


Figure (5.7): The results of improvement P.F in average load.

5.3 Economical study:

In this chapter we will study another face of the project which is a very important in any project, it's the economic study to the system.

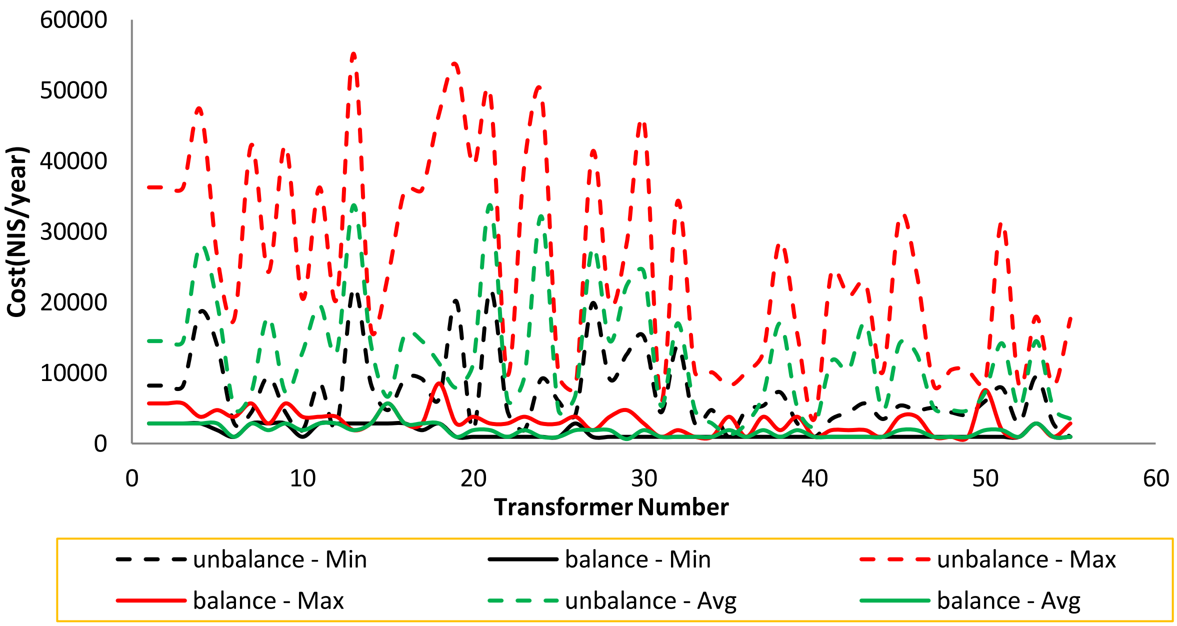


Figure (5.8): Cost of losses before and after balancing load.

Saving in losses at minimum load:

- Minimum losses before balance =125.6 kW.
- Energy of the losses before improvement=125.6*8760=1100256 kWh.
- Cost of losses before improvement= 1100256 *0.36=396092.1 NIS/year.
- Average losses after balance =24 kW.
- Energy of the losses after balance =24*8760=210240 kWh.
- Cost of losses after improvement=210240 *0.36=75686.4 NIS/year.
- Saving in losses= cost of losses before –cost of losses after

  = 396092.1 -75686.4 =320405.7 NIS/year.

Saving in losses at Average load:

- Minimum losses before balance =213kW.
- Energy of the losses before improvement=213*8760=1865880 kWh.
- Cost of losses before improvement= 1865880 *0.36=671716.8 NIS/year.
- Average losses after balance =35.7 kW.
- Energy of the losses after balance =35.7*8760= 312732 kWh.
- Cost of losses after improvement=312732 *0.36= 112583.52 NIS/year.
- Saving in losses= cost of losses before –cost of losses after

= 671716.8 -112583.52 = 559133.28 NIS/year.

Saving in losses at Maximum load:

- Minimum losses before balance =440.4kW.
- Energy of the losses before improvement=440.4*8760=3857904 kWh.
- Cost of losses before improvement= 3857904 *0.36=1388845.44 NIS/year.
- Average losses after balance =54 kW.
- Energy of the losses after balance =54*8760=473040kWh.
- Cost of losses after improvement=473040*0.36=170294.4 NIS/year.
- Saving in losses= cost of losses before –cost of losses after

= 1388845.44 -170294.4 =1218551.04 NIS/year.

Table 5.5: The total Cost of losses of transformers for three phases.

Total Cost Losses (NIS/year)	**Unbalance**	**Balance**
Minimum load	396092.1	75686.4
Average load	671716.8	112583.52
Maximum load	1388845.44	170294.4

6

Chapter Six Conclusions and Recommendations

6.1 Conclusions

6.2 Recommendations

Recommendations and Conclusions

7.1 Conclusions

The Conclusions of the project can be summarized as follow:

1. E-TAP software can design the power system precisely as it exists in the real world, and gives the measurement accurately matching the practical system.

2. The present study on Al-Dahiriya MV network show that the percentage loadings on the transformers are less than 50%. However, there is no need for replacing the transformers for the coming years.

3. The analysis at Al-Dahiriya network show that the losses is up to 440kWh due to the unbalance load. This can cost SELCO Company up to 1388845.44 NIS per year. However. The balance loading can be reduced up to 50 kWh, which mean that the losses can be reduced by 88%. Further, the SELCO company can save money up to 1218551.04 NIS per year.

4. Redistribution the loads at Al-Dahiriya network can reduce the voltage drop, increase the power factor, and reduce the losses.

7.2 Recommendations

- Strict procedures to improve the power factor on the industrial loads to reduce the losses in the network.
- Design a SCADA to supervision on the network, and it's simplicity in collecting the data.
- Apply GIS system to find out loads for each customer and on which phase was connected.

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Appendices

Appendix A

Appendix B

Appendix C

Appendix A

Analysis of Substations

Apparent power analysis in all Transformers

Number	Name of substation	Minimum load				Maximum load				Average load			
		L1	L2	L3	Total	L1	L2	L3	Total	L1	L2	L3	Total
1	Al-masjid Al_kaber	34.5	26	29.3	94.1	105.8	78.9	101.8	270.1	73.1	51.9	66	191
2	Mothalath Al_borg	34.5	26	29.3	94.1	105.8	78.9	101.8	270.1	73.1	51.9	66	191
3	Maskaneh	34.5	26	29.3	94.1	105.8	78.9	101.8	270.1	73.1	51.9	66	191
4	Bear mtawi’	19.4	19.1	23.7	62.2	66.8	63.6	87.9	198.9	45	41.7	56.3	143.1
5	Wad algamary 1	17	13.2	9.7	45.3	68	60.8	66.7	192.3	37	34.9	33.9	106
6	Wad algamary 2	2.4	1.3	2.8	8.1	21.2	23.6	27.7	72.3	7.98	7.5	10.5	26
7	Al_deir 1	22.4	22	20.6	72.1	91.8	68.7	68.9	220.1	49	39.5	42.5	131.1
8	Karam al_ashqar	14.3	9.6	8.9	36.8	44.2	44.4	33	112.5	25.7	23.5	10.2	69.3
9	Abu al_humas	22.4	22	20.6	72.1	91.8	68.7	68.9	220.1	49	39.5	42.5	131.1
10	Meqtaa’ duma	14.2	19.6	16.7	60.8	52.7	58	63.6	162.3	29.12	33.56	28.9	91.6
11	Wad ali	15.2	16.9	20.4	58.5	56.4	50.6	69.5	161.5	30.42	28.4	38.1	97
12	Aqabit gharrarah	12.6	14.5	14.6	49.6	61	53.8	57	163.9	29.7	31.2	28.3	89.26
13	Qata’t al_jamal	11.6	9.7	6.1	30.8	40.2	32.4	21.9	84.3	22.1	16.2	12.2	48.2
14	Al_markaz	17.3	20.7	14.8	56.3	34.5	33.6	30.3	93.9	24.4	26.8	21.1	72.3

15	Abu hashim	22.8	20.9	18.4	67.8	80.8	62.1	70.3	205	44.3	38.6	41.6	124.5
16	Sa’ada	12.7	11.3	10.2	35.7	39.5	36.1	27	97.5	22	19.1	17.1	58.2
17	Al_baladiya	12.7	11.3	10.2	35.7	39.5	36.1	27	97.5	22	19.1	17.1	58.2
18	Al_sheehk	22.8	20.9	18.4	67.8	80.8	62.1	70.3	205	44.3	38.6	41.6	124.5
19	Al-marj 1	4	11.1	5.2	24.4	17.9	33.3	26.9	72.7	10.1	19.3	13.7	43.3
20	Aqabit al_tarsha	14.4	13.9	12.3	47.1	45.6	40.2	31.1	122.3	25.2	24.9	25.8	76
21	Al_mustashfah	11.6	9.7	6.1	30.8	40.2	32.4	21.9	84.3	22.1	16.2	12.2	48.2
22	Da’na	0	0	0	100	30.5	31.9	29	91.5	8.7	9.4	8.4	26.5
23	Kurza	14.4	13.9	12.3	47.1	45.6	40.2	31.1	122.3	25.2	24.9	25.8	76
24	Al-deire 2	11.6	9.7	6.1	30.8	40.2	32.4	21.9	84.3	22.1	16.2	12.2	48.2
25	Rasmi wahab	0	0	0	100	30.5	31.9	29	91.5	8.7	9.4	8.4	26.5
26	Baten alqar’	10.8	11.9	9.3	38.8	35.4	37.5	37.7	99	20.7	22.5	21.2	64.5
27	Al_muntazah	6.8	4.9	5.8	19	24.5	14.4	22.4	54.1	13	8	11.7	32.8
28	Domet al_wridat	15.3	11.7	15.3	48	36.5	42	43.8	113.6	23.1	21.7	26.2	71
29	Juret al_dama	7.9	8.9	16.2	36.3	41.9	46.4	49.8	133.4	20.9	19.9	29.6	70.5
30	Kafar joul	5.5	5.9	11.7	22	27.2	21.6	44	76.4	13.9	13.7	24	42.5
31	Sam’a	1.5	3.4	1.5	8.3	13.4	12.3	9.8	32.2	4.3	6.4	4.7	15.6
32	Khalet al_ayaseh	2.6	6.2	2.3	14.4	16.2	27	14.2	50.6	7.4	11.4	6.8	25.6

33	Al_mizrab	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
34	Al_shadaqa	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
35	Al_shuqfan	7.7	6.7	8	25.9	28.3	27.2	30.8	81.3	14.6	13.5	14.4	42.6
36	Al_estad	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
37	Eshreeteh	7.4	5.9	10	27.4	35.5	33.2	37.7	91.8	18.9	14.4	20.7	54.4
38	Al_muhtasib	5.9	5.4	7.9	21	16.2	21	26.6	58.6	10.5	13.4	16.4	40.5
39	Jammoq	9.5	8.4	7.2	31.7	38.5	40.2	38.3	108.8	19.3	18.6	17.6	56.6
40	Al_helal	0.2	0.2	0.2	0.6	4.7	3.8	5.1	12	2.1	1.7	3.1	6.9
41	Al_muntazah 2	6.8	4.9	5.8	19	24.5	14.4	22.4	54.1	13	8	11.7	32.8
42	Abu njeem 2	6.8	4.9	5.8	19	24.5	14.4	22.4	54.1	13	8	11.7	32.8
43	Al jame’a	2.3	5.7	6.5	15.9	17.4	23	27.1	59	7	12.8	14.9	34.8
44	Alghwla	2.4	0.9	2	6.3	12.9	11.2	10.8	23.9	5.2	2.5	4.5	12.3
45	Masafi	8	4.4	5.6	14.8	43	30.9	36.9	98.7	20.1	13.4	15.6	50
46	Al_jebreni	12	13.5	14.5	41.5	44	40.5	35.5	120	28	27	25	80
47	Abu_njeem 1	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
48	Inab al_kabeer	1.5	3.4	1.5	8.3	13.4	12.3	9.8	32.2	4.3	6.4	4.7	15.6
49	Shweki	1.5	3.4	1.5	8.3	13.4	12.3	9.8	32.2	4.3	6.4	4.7	15.6
50	Al-baha	9.5	8.4	7.2	31.7	38.5	40.2	38.3	108.8	19.3	18.6	17.6	56.6

51	Inab al_sagher	12.1	10.9	10.9	39.7	35.1	29.4	33.2	89.3	20.3	16.8	19.5	56.5
52	Bank al_eskan	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
53	Al_tork	12.5	14.7	12.8	39	37.8	44.6	40.8	123.2	31	37.1	33.5	101.8
54	Wad algamary 3	3.7	1.1	2.4	8.6	12.7	12.6	15.8	35.6	6.2	4.9	5.8	17
55	Mana’	1	0.7	1	3.2	21.4	15	17.5	52.4	7.9	5.5	6.73	20.1

Power Factor analysis in all transformer

Number	Name of substation	Minimum PF				Maximum PF				Average PF			
		L1	L2	L3	Total	L1	L2	L3	total	L1	L2	L3	Total
1	Al-masjid Al_kaber	0.89	0.93	0.91	0.91	0.96	0.99	0.98	0.97	0.92	0.96	0.95	0.94
2	Mothalath Al_borg	0.89	0.93	0.91	0.91	0.96	0.99	0.98	0.97	0.92	0.96	0.95	0.94
3	Maskaneh	0.89	0.93	0.91	0.91	0.96	0.99	0.98	0.97	0.92	0.96	0.95	0.94
4	Bear mtawi'	0.60	0.72	0.85	0.75	0.97	0.98	0.99	0.98	0.82	0.80	0.94	0.89
5	Wad algamary 1	0.82	0.83	0.54	0.77	0.99	0.98	0.99	0.98	0.92	0.91	0.90	0.91
6	Wad algamary 2	0.34	0.59	0.65	0.63	0.99	0.99	0.99	0.99	0.86	0.90	0.88	0.88
7	Al_deir 1	0.91	0.92	0.91	0.93	0.99	0.99	0.99	0.98	0.96	0.95	0.95	0.95
8	Karam al_ashqar	0.88	0.92	0.91	0.92	0.99	0.99	0.99	0.99	0.94	0.96	0.95	0.95
9	Abu al_humas	0.91	0.92	0.91	0.93	0.99	0.99	0.99	0.98	0.96	0.95	0.95	0.95
10	Meqtaa' duma	0.92	0.84	0.86	0.9	0.99	0.98	0.98	0.98	0.96	0.92	0.91	0.93
11	Wad ali	0.92	0.92	0.92	0.92	0.99	0.99	0.99	0.98	0.96	0.96	0.95	0.96
12	Aqabit gharrarah	0.92	0.88	0.90	0.90	0.99	0.99	0.98	0.98	0.97	0.93	0.94	0.95
13	Qata't al_jamal	0.84	0.9	0.86	0.89	0.98	0.99	0.98	0.98	0.92	0.94	0.92	0.93
14	Al_markaz	0.86	0.93	0.92	0.92	0.98	0.99	0.99	0.99	0.93	0.97	0.96	0.95
15	Abu hashim	0.86	0.87	0.83	0.87	0.98	0.98	0.97	0.97	0.91	0.93	0.90	0.91
16	Sa'ada	0.93	0.93	0.89	0.94	0.99	0.99	0.99	0.99	0.96	0.97	0.95	0.96
17	Al_baladiya	0.93	0.93	0.89	0.94	0.99	0.99	0.99	0.99	0.96	0.97	0.95	0.96
18	Al_sheehk	0.86	0.87	0.83	0.87	0.98	0.98	0.97	0.97	0.91	0.93	0.90	0.91
19	Al-marj 1	0.93	0.97	0.94	0.96	0.99	1	1	0.99	0.96	0.98	0.98	0.98
20	Aqabit al_tarsha	0.88	0.88	0.91	0.89	0.98	0.99	0.98	0.97	0.94	0.94	0.94	0.94

21	Al_mustashfah	0.84	0.9	0.86	0.89	0.98	0.99	0.98	0.98	0.92	0.94	0.92	0.93
22	Da'na	0.24	0.26	0.03	0.21	0.96	0.95	0.94	0.95	0.92	0.91	0.88	0.89
23	Kurza	0.88	0.88	0.91	0.89	0.98	0.99	0.98	0.97	0.94	0.94	0.94	0.94
24	Al-deire 2	0.84	0.9	0.86	0.89	0.98	0.99	0.98	0.98	0.92	0.94	0.92	0.93
25	Rasmi wahab	0.24	0.26	0.03	0.21	0.96	0.95	0.94	0.95	0.92	0.91	0.88	0.89
26	Baten alqar'	0.83	0.84	0.83	0.85	0.96	0.98	0.97	0.96	0.90	0.83	0.91	0.91
27	Al_muntazah	0.89	0.87	0.94	0.92	0.99	0.99	0.99	0.99	0.95	0.93	0.97	0.95
28	Domet al_wridat	0.89	0.87	0.94	0.92	0.99	0.99	0.99	0.99	0.95	0.93	0.97	0.95
29	Juret al_dama	0.81	0.93	0.96	0.92	1	1	1	0.99	0.94	0.97	0.97	0.95
30	Kafar joul	0.73	0.80	0.95	0.86	0.98	0.98	1	0.99	0.88	0.86	0.98	0.94
31	Sam'a	0.86	0.87	0.77	0.88	0.99	0.99	0.99	0.99	0.95	0.92	0.89	0.92
32	Khalet al_ayaseh	0.90	0.91	0.80	0.88	0.99	0.99	0.98	0.99	0.95	0.96	0.89	0.94
33	Al_mizrab	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
34	Al_shadaqa	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
35	Al_shuqfan	0.92	0.89	0.87	0.90	0.99	0.99	0.99	0.99	0.95	0.94	0.94	0.94
36	Al_estad	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
37	Eshreeteh	0.93	0.97	0.93	0.95	0.99	1	0.99	0.99	0.97	0.98	0.96	0.97
38	Al_muhtasib	0.85	0.82	0.88	0.86	0.99	0.99	0.99	0.99	0.92	0.96	0.95	0.95
39	Jammoq	0.85	0.93	0.93	0.92	1	1	0.99	0.99	0.95	0.97	0.98	0.96
40	Al_helal	0.72	0.74	0.95	0.92	0.99	0.99	0.99	0.98	0.91	0.93	0.97	0.95
41	Al_muntazah 2	0.86	0.87	0.91	0.9	0.98	0.99	0.99	0.98	0.93	0.92	0.95	0.94
42	Abu njeem 2	0.86	0.87	0.91	0.9	0.98	0.99	0.99	0.98	0.93	0.92	0.95	0.94
43	Al jame'a	0.85	0.83	0.77	0.85	0.99	0.98	0.98	0.97	0.92	0.93	0.92	0.93
44	Alghwla	0.88	0.78	0.81	0.87	1	1	0.99	0.99	0.94	0.91	0.91	0.93

45	Masafi	0.86	0.88	0.86	0.88	0.99	0.99	0.98	0.98	0.94	0.95	0.93	0.94
46	Al_jebreni	0.85	0.83	0.88	0.85	0.91	0.95	0.90	0.92	0.88	0.89	0.89	0.90
47	Abu_njeem 1	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
48	Inab al_kabeer	0.86	0.87	0.77	0.88	0.99	0.99	0.99	0.99	0.95	0.92	0.89	0.92
49	Shweki	0.86	0.87	0.77	0.88	0.99	0.99	0.99	0.99	0.95	0.92	0.89	0.92
50	Al-baha	0.72	0.74	0.95	0.92	0.99	0.99	0.99	0.98	0.91	0.93	0.97	0.95
51	Inab al_sagher	0.93	0.87	0.90	0.92	0.99	0.97	0.99	0.98	0.96	0.92	0.95	0.95
52	Bank al_eskan	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
53	Al_tork	0.65	0.67	0.52	0.62	0.86	0.81	0.78	0.82	0.71	0.70	0.60	0.67
54	Wad algamary 3	0.88	0.88	0.90	0.89	0.99	1	0.99	0.99	0.92	0.94	0.95	0.94
55	Mana’	0.49	0.43	0.47	0.52	0.99	0.99	0.99	0.99	0.80	0.78	0.79	0.80

Appendix B1

Appendix B2

Line/Cable Input Data

Line/Cable			Length				Ohms or Siemens/1000 ft per Conductor (Cable) or per Phase (Line)		
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R	X	Y
C.20			65.6	0.0	1	75	0.097536	0.067056	
C56			183.7	0.0	1	75	0.097536	0.067056	
C59			193.6	0.0	1	75	0.097841	0.067361	
C60			1207.3	0.0	1	75	0.097536	0.067056	
C61			200.1	0.0	1	75	0.097841	0.067361	
C80			262.5	0.0	1	75	0.097536	0.067056	
C96			315.0	0.0	1	75	0.097536	0.067056	
C97			318.2	0.0	1	75	0.097536	0.067056	
C100			328.1	0.0	1	75	0.097536	0.067056	
C107			347.8	0.0	1	75	0.097536	0.067056	
C117			383.9	0.0	1	75	0.097536	0.067056	
C120			393.7	0.0	1	75	0.097536	0.067056	
C128			419.9	0.0	1	75	0.097536	0.067056	
C160			524.9	0.0	1	75	0.097536	0.067056	
C162			531.5	0.0	1	75	0.097536	0.067056	
C163			534.8	0.0	1	75	0.097536	0.067056	
C191			623.4	0.0	1	75	0.097536	0.067056	
C193			633.2	0.0	1	75	0.097536	0.067056	
C203			666.0	0.0	1	75	0.097536	0.067056	
C216			708.7	0.0	1	75	0.097536	0.067056	
C246			807.1	0.0	1	75	0.097536	0.067056	
C280			918.6	0.0	1	75	0.097536	0.067056	
C319			1046.6	0.0	1	75	0.097536	0.067056	
C322			1056.4	0.0	1	75	0.097536	0.067056	
C330			1082.7	0.0	1	75	0.097536	0.067056	
C352			1154.9	0.0	1	75	0.097536	0.067056	
C361			1181.1	0.0	1	75	0.097536	0.067056	
C365			1181.1	0.0	1	75	0.097536	0.067056	
C368			1207.3	0.0	1	75	0.097536	0.067056	
C399			1309.1	0.0	1	75	0.097536	0.067056	
C409			1509.2	0.0	1	75	0.097536	0.067056	
C419			1374.7	0.0	1	75	0.097536	0.067056	
C422			1384.5	0.0	1	75	0.097536	0.067056	
C440			1443.6	0.0	1	75	0.097536	0.067056	

Ohms or Siemens/1000 ft per Conductor (Cable) or per Phase (Line)

Line/Cable			Length						
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R	X	Y
C450			1476.4	0.0	1	75	0.097536	0.067056	
C.450			1476.4	0.0	1	75	0.097536	0.067056	
C461			1515.7	0.0	1	75	0.097536	0.067056	
C462			1509.2	0.0	1	75	0.097536	0.067056	
C463			1519.0	0.0	1	75	0.097841	0.067056	
C473			1551.8	0.0	1	75	0.097536	0.067056	
C476			1561.7	0.0	1	75	0.097536	0.067056	
C514			1686.4	0.0	1	75	0.097536	0.067056	
C517			1696.2	0.0	1	75	0.097536	0.067056	
C518			1699.5	0.0	1	75	0.097536	0.067056	
C526			1725.7	0.0	1	75	0.097536	0.067056	
C558			1830.7	0.0	1	75	0.097536	0.067056	
C577			1889.8	0.0	1	75	0.097536	0.067056	
C587			1925.9	0.0	1	75	0.097536	0.067056	
C603			1978.3	0.0	1	75	0.097536	0.067056	
C622			2040.7	0.0	1	75	0.097536	0.067056	
C727			2385.2	0.0	1	75	0.097536	0.067056	
C728			2388.5	0.0	1	75	0.097536	0.067056	
C806			2644.4	0.0	1	75	0.097536	0.067056	
C811			2660.8	0.0	1	75	0.097536	0.067056	
C815			2673.9	0.0	1	75	0.097536	0.067056	
C880			2887.1	0.0	1	75	0.097536	0.067056	

Line / Cable resistances are listed at the specified temperatures.

Impedance Input Data

Impedance	Positive Sequence Impedanc			
ID	R	X	Y	Unit
Co14	0.138	0.203	0	Ohm
Co57	0.0123	0.0181	0	Ohm
Co58	0.0123	0.0181	0	Ohm
Co130	0.028	0.0413	0	Ohm
Co260	0.0561	0.0826	0	Ohm
Co261	0.056	0.082	0	Ohm
Co294	0.057	0.084	0	Ohm
Co528	0.114	0.167	0	Ohm
Co600	0.129	0.1908	0	Ohm
Co645	0.139	0.205	0	Ohm
Co999	0.215	0.317	0	Ohm
Co.1032	0.223	0.328	0	Ohm
D240	0.0647	0.0782	0	Ohm
D256	0.0647	0.0782	0	Ohm
D276	0.18	0.2184	0	Ohm
D634	0.171	0.2067	0	Ohm
D655	0.1766	0.2135	0	Ohm
D711	0.191	0.231	0	Ohm
D718	0.193	0.234	0	Ohm
R10	0.216	0.142	0	Ohm
R36	0.019	0.012	0	Ohm
R45	0.0238	0.0156	0	Ohm
R106	0.056	0.036	0	Ohm
R150	0.079	0.051	0	Ohm
R164	0.0772	0.0506	0	Ohm
R190	0.10051	0.065	0	Ohm
R380	0.20102	0.1318	0	Ohm
R410	0.216	0.142	0	Ohm
R436	0.23	0.151	0	Ohm
R455	0.24	0.157	0	Ohm
R560	0.296	0.194	0	Ohm
R734	0.388	0.254	0	Ohm
R803	0.424	0.278	0	Ohm
R844	0.4464	0.292	0	Ohm
R950	0.502	0.329	0	Ohm

Impedance Input Data

Impedance	Positive Sequence Impedanc			
ID	R	X	Y	Unit
R1435	0.388	0.254	0	Ohm
R1499	0.792	0.52	0	Ohm

Appendix B3

2-Winding Transformer Input Data

Transformer		Rating								Z Variation		% Tap Setting		Adjusted		Phase Shift	
ID	Phase	MVA	Prim. kV	Sec. kV	% Z1	% Z0	X1/R1	X0/R0	% Tol.	+ 5%	- 5%	Prim.	Sec.	% Z 1	% Z 0	Type	Angle
T1 Al-masjid Al_kaber	3-Phase	0.630	33.000	0.400	4.40	4.40	6.30	6.30	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T10 Meqtaa' duma	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T11 Wad ali	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T12 Aqabit gharrarah	3-Phase	0.400	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T13 Qata't al_jamal	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T14 Al_markaz	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T15 Abu hashim	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T16 Sa'ada	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T17 Al_baladiya	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T18 Al_sheehk	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T19 Kerbit alama	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T2 Mothalath Al_borg	3-Phase	0.630	33.000	0.400	4.40	4.40	6.30	6.30	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T20 Aqabit al_tarsha	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T21 Al_mustashfah	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T22 Da'na	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T23 Kurza	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T24 Al-deire 2	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T25 Rasmi wahab	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T26 Baten alqar'	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T27 Al_muntazah	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T28 Domet al_wridat	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T29 Juret al_dama	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T3 Maskaneh	3-Phase	0.630	33.000	0.400	4.40	4.40	6.30	6.30	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T30 Kafar joul	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T31 Sam'a	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T32 Khalet al_ayaseh	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T33 Al_mizrab	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T34 Al_shadaqa	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T35 Al_shuqfan	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T36 Al_estad	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T37 Eshreeteh	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T38 Al_muhtasib	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T39 Jammoq	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T4 Bear mtawi'	3-Phase	0.630	33.000	0.400	4.40	4.40	6.30	6.30	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T40 Al_helal	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T41 Al_muntazah 2	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T42 Abu njeem 2	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T43 Al jame'a	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T44 Alghwla	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T45 Masafi	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T46 Al_jebreni	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T47 Abu_njeem 1	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000

Transformer		Rating								Z Variation		% Tap Setting		Adjusted		Phase Shift	
ID	Phase	MVA	Prim. kV	Sec. kV	% Z1	% Z0	X1/R1	X0/R0	% Tol.	+ 5%	- 5%	Prim.	Sec.	% Z 1	% Z 0	Type	Angle
T48 Inab al_kabeer	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T49 Shweki	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T5 Wad algamary 1	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T50 Al-baha	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T51 Inab al_sagher	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T52 Bank al_eskan	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T53 Al_tork	3-Phase	0.630	33.000	0.400	4.40	4.40	6.30	6.30	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T54 Wad algamary 3	3-Phase	0.160	33.000	0.400	4.40	4.40	1.60	1.60	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T55 Mana’	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T56 Al jebreny step up	3-Phase	0.630	0.400	33.000	4.00	4.00	1.50	1.50	0	0	0	0	2.500	4.0000	4.0000	Dyn	-30.000
T6 Wad algamary 2	3-Phase	0.250	33.000	0.400	4.40	4.40	2.50	2.50	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T7 Al_deir 1	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T8 Karam al_ashqar	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000
T9 Abu al_humas	3-Phase	0.400	33.000	0.400	4.40	4.40	4.00	4.00	0	0	0	0	0	4.4000	4.4000	Dyn	-30.000

Appendix C

Output result from the E-Tap

Unbalanced Load Flow Report

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
* Bus1	33.000	A	100.009	0.0	1.943	0.345	0	0	Bus2	A	1.943	0.345	103.6	98.5	
		B	99.949	-120.0	1.858	0.433	0	0		B	1.858	0.433	100.2	97.4	
		C	100.043	120.0	1.826	0.318	0	0		C	1.826	0.318	97.2	98.5	
										N			0.0		
Bus2	33.000	A	99.997	0.0	0	0	0	0	Bus3	A	0.660	0.124	35.2	98.3	
		B	99.938	-120.0	0	0	0	0		B	0.614	0.157	33.3	96.9	
		C	100.032	120.0	0	0	0	0		C	0.609	0.102	32.4	98.6	
										N			0.0		
									Bus21	A	1.283	0.221	68.3	98.5	
										B	1.244	0.276	66.9	97.6	
										C	1.217	0.216	64.8	98.5	
										N			0.0		
									Bus1	A	-1.943	-0.345	103.6	98.5	
										B	-1.858	-0.433	100.2	97.4	
										C	-1.826	-0.318	97.2	98.5	
										N			0.0		
Bus3	33.000	A	99.993	0.0	0	0	0	0	Bus2	A	-0.660	-0.124	35.2	98.3	
		B	99.934	-120.0	0	0	0	0		B	-0.614	-0.157	33.3	96.9	
		C	100.029	120.0	0	0	0	0		C	-0.609	-0.102	32.4	98.6	
										N			0.0		
									Bus4	A	0.660	0.124	35.2	98.3	
										B	0.614	0.157	33.3	96.9	
										C	0.609	0.102	32.4	98.6	
										N			0.0		
Bus4	33.000	A	99.982	0.0	0	0	0	0	Bus3	A	-0.660	-0.124	35.2	98.3	
		B	99.923	-120.0	0	0	0	0		B	-0.614	-0.157	33.3	96.9	
		C	100.018	120.0	0	0	0	0		C	-0.609	-0.102	32.4	98.6	
										N			0.0		
									Bus6	A	0.632	0.114	33.7	98.4	
										B	0.584	0.147	31.6	97.0	
										C	0.580	0.090	30.8	98.8	
										N			0.0		
									Bus5	A	0.028	0.009	1.6	94.8	
										B	0.030	0.010	1.7	95.2	
										C	0.029	0.012	1.6	92.8	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus5	0.400	A	98.913	29.2	0	0	0.029	0.009	Bus4	A	-0.029	-0.009	132.9	96.0	
		B	98.856	-90.7	0	0	0.030	0.010		B	-0.030	-0.010	139.1	95.0	
		C	98.983	149.3	0	0	0.027	0.010		C	-0.027	-0.010	126.4	94.0	
										N			5.9		
Bus6	33.000	A	99.962	0.0	0	0	0	0	Bus4	A	-0.632	-0.114	33.7	98.4	
		B	99.904	-120.0	0	0	0	0		B	-0.584	-0.147	31.6	97.0	
		C	100.000	120.0	0	0	0	0		C	-0.580	-0.090	30.8	98.8	
										N			0.0		
									Bus7	A	0.632	0.114	33.7	98.4	
										B	0.584	0.147	31.6	97.0	
										C	0.580	0.090	30.8	98.8	
										N			0.0		
Bus7	33.000	A	99.917	-0.1	0	0	0	0	Bus9	A	0.554	0.091	29.5	98.7	
		B	99.861	-120.0	0	0	0	0		B	0.521	0.130	28.2	97.0	
		C	99.960	120.0	0	0	0	0		C	0.505	0.082	26.8	98.7	
										N			0.0		
									Bus6	A	-0.631	-0.114	33.7	98.4	
										B	-0.583	-0.147	31.6	97.0	
										C	-0.580	-0.090	30.8	98.8	
										N			0.0		
									Bus8	A	0.077	0.023	4.2	95.8	
										B	0.063	0.017	3.4	96.5	
										C	0.075	0.008	4.0	99.5	
										N			0.0		
Bus8	0.400	A	99.296	29.2	0	0	0.065	0.016	Bus7	A	-0.065	-0.016	290.5	97.0	
		B	99.422	-90.7	0	0	0.062	0.013		B	-0.062	-0.013	275.1	98.0	
		C	99.394	149.0	0	0	0.087	0.012		C	-0.087	-0.012	382.0	99.0	
										N			88.2		
Bus9	33.000	A	99.914	-0.1	0	0	0	0	Bus7	A	-0.554	-0.091	29.5	98.7	
		B	99.858	-120.0	0	0	0	0		B	-0.521	-0.130	28.2	97.0	
		C	99.957	120.0	0	0	0	0		C	-0.505	-0.082	26.8	98.7	
										N			0.0		
									Bus10	A	0.127	0.022	6.8	98.6	
										B	0.121	0.026	6.5	97.7	
										C	0.120	0.018	6.4	98.8	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus145	A	0.427	0.070	22.7	98.7	
										B	0.400	0.103	21.7	96.8	
										C	0.385	0.064	20.5	98.7	
										N			0.0		
Bus10	33.000	A	99.908	-0.1	0	0	0	0	Bus11	A	0.014	0.003	0.8	97.4	
		B	99.851	-120.0	0	0	0	0		B	0.012	0.001	0.6	99.5	
		C	99.951	120.0	0	0	0	0		C	0.015	0.001	0.8	99.9	
										N			0.0		
									Bus9	A	-0.127	-0.022	6.8	98.6	
										B	-0.121	-0.026	6.5	97.7	
										C	-0.120	-0.018	6.4	98.8	
										N			0.0		
									Bus13	A	0.113	0.018	6.0	98.7	
										B	0.109	0.025	5.9	97.4	
										C	0.105	0.018	5.6	98.6	
										N			0.0		
Bus11	33.000	A	99.907	-0.1	0	0	0	0	Bus10	A	-0.014	-0.003	0.8	97.4	
		B	99.851	-120.0	0	0	0	0		B	-0.012	-0.001	0.6	99.5	
		C	99.950	120.0	0	0	0	0		C	-0.015	-0.001	0.8	99.9	
										N			0.0		
									Bus12	A	0.014	0.003	0.8	97.4	
										B	0.012	0.001	0.6	99.5	
										C	0.015	0.001	0.8	99.9	
										N			0.0		
Bus12	0.400	A	99.164	29.5	0	0	0.013	0.002	Bus11	A	-0.013	-0.002	55.3	99.0	
		B	99.329	-90.5	0	0	0.013	0		B	-0.013	0.000	54.8	100.0	
		C	99.096	149.4	0	0	0.016	0.002		C	-0.016	-0.002	68.8	99.0	
										N			8.8		
Bus13	33.000	A	99.902	-0.1	0	0	0	0	Bus15	A	0.091	0.017	4.9	98.3	
		B	99.845	-120.0	0	0	0	0		B	0.087	0.018	4.7	97.9	
		C	99.946	120.0	0	0	0	0		C	0.088	0.014	4.7	98.8	
										N			0.0		
									Bus10	A	-0.113	-0.018	6.0	98.7	
										B	-0.109	-0.025	5.9	97.4	
										C	-0.105	-0.018	5.6	98.6	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus14	A	0.022	0.001	1.2	99.9	
										B	0.022	0.007	1.2	95.2	
										C	0.017	0.004	0.9	97.5	
										N			0.0		
Bus14	0.400	A	99.199	29.3	0	0	0.023	0.003	Bus13	A	-0.023	-0.003	103.7	98.9	
		B	99.207	-90.4	0	0	0.018	0.006		B	-0.018	-0.006	84.2	94.5	
		C	99.555	149.4	0	0	0.019	0		C	-0.019	0.000	80.7	100.0	
										N			0.0		
Bus15	33.000	A	99.898	-0.1	0	0	0	0	Bus17	A	0.024	0.006	1.3	97.0	
		B	99.842	-120.0	0	0	0	0		B	0.022	0.003	1.2	99.0	
		C	99.942	120.0	0	0	0	0		C	0.026	0.003	1.4	99.3	
										N			0.0		
									Bus13	A	-0.091	-0.017	4.9	98.3	
										B	-0.087	-0.018	4.7	97.9	
										C	-0.088	-0.014	4.7	98.8	
										N			0.0		
									Bus20	A	0.067	0.011	3.6	98.6	
										B	0.064	0.015	3.5	97.4	
										C	0.062	0.011	3.3	98.5	
										N			0.0		
Bus17	33.000	A	99.898	-0.1	0	0	0	0	Bus15	A	-0.024	-0.006	1.3	97.0	
		B	99.841	-120.0	0	0	0	0		B	-0.022	-0.003	1.2	99.0	
		C	99.942	120.0	0	0	0	0		C	-0.026	-0.003	1.4	99.3	
										N			0.0		
									Bus18	A	0.024	0.006	1.3	97.0	
										B	0.022	0.003	1.2	99.0	
										C	0.026	0.003	1.4	99.3	
										N			0.0		
Bus18	33.000	A	99.896	-0.1	0	0	0	0	Bus17	A	-0.024	-0.006	1.3	97.0	
		B	99.840	-120.0	0	0	0	0		B	-0.022	-0.003	1.2	99.0	
		C	99.940	120.0	0	0	0	0		C	-0.026	-0.003	1.4	99.3	
										N			0.0		
									Bus19	A	0.024	0.006	1.3	97.0	
										B	0.022	0.003	1.2	99.0	
										C	0.026	0.003	1.4	99.3	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus19	0.400	A	99.268	29.4	0	0	0.021	0.003	Bus18	A	-0.021	-0.003	92.2	99.0	
		B	99.245	-90.6	0	0	0.023	0.003		B	-0.023	-0.003	102.7	99.0	
		C	99.193	149.2	0	0	0.027	0.004		C	-0.027	-0.004	120.5	99.0	
										N			24.7		
Bus20	0.400	A	98.963	28.8	0	0	0.067	0.010	Bus15	A	-0.067	-0.010	296.3	99.0	
		B	98.991	-91.0	0	0	0.059	0.012		B	-0.059	-0.012	264.9	98.0	
		C	99.081	148.8	0	0	0.066	0.009		C	-0.066	-0.009	290.4	99.0	
										N			30.3		
Bus21	33.000	A	99.985	0.0	0	0	0	0	Bus2	A	-1.283	-0.221	68.3	98.6	
		B	99.925	-120.0	0	0	0	0		B	-1.243	-0.276	66.9	97.6	
		C	100.021	120.0	0	0	0	0		C	-1.217	-0.216	64.8	98.5	
										N			0.0		
									Bus24	A	1.244	0.216	66.3	98.5	
										B	1.202	0.266	64.7	97.6	
										C	1.181	0.206	62.9	98.5	
										N			0.0		
									Bus22	A	0.039	0.005	2.1	99.3	
										B	0.041	0.010	2.2	97.2	
										C	0.035	0.010	1.9	96.5	
										N			0.0		
Bus22	0.400	A	98.570	28.8	0	0	0.044	0.009	Bus21	A	-0.044	-0.009	199.2	98.0	
		B	98.874	-91.0	0	0	0.040	0.006		B	-0.040	-0.006	175.3	99.0	
		C	99.103	149.2	0	0	0.030	0.006		C	-0.030	-0.006	135.4	98.0	
										N			66.1		
Bus24	33.000	A	99.927	-0.1	0	0	0	0	Bus28	A	1.125	0.185	59.9	98.7	
		B	99.868	-120.0	0	0	0	0		B	1.105	0.234	59.4	97.8	
		C	99.966	120.0	0	0	0	0		C	1.073	0.193	57.3	98.4	
										N			0.0		
									Bus26	A	0.014	0.003	0.8	97.4	
										B	0.012	0.001	0.6	99.5	
										C	0.015	0.001	0.8	99.9	
										N			0.0		
									Bus21	A	-1.243	-0.216	66.3	98.5	
										B	-1.201	-0.266	64.7	97.6	
										C	-1.180	-0.206	62.9	98.5	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus25	A	0.104	0.028	5.6	96.6	
										B	0.084	0.030	4.7	94.2	
										C	0.092	0.012	4.9	99.1	
										N			0.0		
Bus25	0.400	A	98.889	28.8	0	0	0.101	0.030	Bus24	A	-0.101	-0.030	462.1	96.0	
		B	99.399	-90.9	0	0	0.078	0.011		B	-0.078	-0.011	342.9	99.0	
		C	99.190	148.8	0	0	0.100	0.020		C	-0.100	-0.020	443.8	98.0	
										N			94.6		
Bus26	33.000	A	99.926	-0.1	0	0	0	0	Bus24	A	-0.014	-0.003	0.8	97.4	
		B	99.867	-120.0	0	0	0	0		B	-0.012	-0.001	0.6	99.5	
		C	99.965	120.0	0	0	0	0		C	-0.015	-0.001	0.8	99.9	
										N			0.0		
									Bus27	A	0.014	0.003	0.8	97.4	
										B	0.012	0.001	0.6	99.5	
										C	0.015	0.001	0.8	99.9	
										N			0.0		
Bus27	0.400	A	99.183	29.5	0	0	0.013	0.002	Bus26	A	-0.013	-0.002	55.3	99.0	
		B	99.344	-90.5	0	0	0.013	0		B	-0.013	0.000	54.8	100.0	
		C	99.113	149.4	0	0	0.016	0.002		C	-0.016	-0.002	68.8	99.0	
										N			8.8		
Bus28	33.000	A	99.900	-0.1	0	0	0	0	Bus31	A	1.091	0.183	58.1	98.6	
		B	99.840	-120.0	0	0	0	0		B	1.067	0.227	57.3	97.8	
		C	99.939	120.0	0	0	0	0		C	1.042	0.185	55.6	98.5	
										N			0.0		
									Bus24	A	-1.125	-0.185	59.9	98.7	
										B	-1.104	-0.234	59.4	97.8	
										C	-1.073	-0.193	57.3	98.4	
										N			0.0		
									Bus30	A	0.034	0.002	1.8	99.8	
										B	0.037	0.007	2.0	98.1	
										C	0.031	0.008	1.7	96.8	
										N			0.0		
Bus30	0.400	A	99.336	29.3	0	0	0.039	0.006	Bus28	A	-0.039	-0.006	171.7	99.0	
		B	99.417	-90.6	0	0	0.036	0.005		B	-0.036	-0.005	156.9	99.0	
		C	99.596	149.5	0	0	0.027	0.004		C	-0.027	-0.004	117.2	99.0	
										N			49.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus31	33.000	A	99.886	-0.1	0	0	0	0	Bus32	A	0.113	0.009	6.0	99.7	
		B	99.826	-120.0	0	0	0	0		B	0.113	0.030	6.2	96.6	
		C	99.926	120.0	0	0	0	0		C	0.095	0.020	5.1	97.8	
										N			0.0		
									Bus28	A	-1.091	-0.182	58.1	98.6	
										B	-1.067	-0.227	57.3	97.8	
										C	-1.042	-0.185	55.6	98.5	
										N			0.0		
									Bus38	A	0.978	0.173	52.2	98.5	
										B	0.954	0.197	51.2	97.9	
										C	0.947	0.165	50.5	98.5	
										N			0.0		
Bus32	33.000	A	99.885	-0.1	0	0	0	0	Bus31	A	-0.113	-0.009	6.0	99.7	
		B	99.825	-120.0	0	0	0	0		B	-0.113	-0.030	6.2	96.6	
		C	99.925	120.0	0	0	0	0		C	-0.095	-0.020	5.1	97.8	
										N			0.0		
									Bus35	A	0.032	0.002	1.7	99.8	
										B	0.035	0.009	1.9	96.5	
										C	0.027	0.008	1.5	95.5	
										N			0.0		
									Bus34	A	0.081	0.007	4.3	99.6	
										B	0.078	0.021	4.3	96.7	
										C	0.068	0.012	3.6	98.5	
										N			0.0		
Bus34	0.400	A	98.630	28.3	0	0	0.090	0.013	Bus32	A	-0.090	-0.013	400.8	99.0	
		B	98.977	-91.2	0	0	0.068	0.010		B	-0.068	-0.010	299.3	99.0	
		C	99.037	148.7	0	0	0.068	0.010		C	-0.068	-0.010	300.1	99.0	
										N			101.4		
Bus35	33.000	A	99.883	-0.1	0	0	0	0	Bus32	A	-0.032	-0.002	1.7	99.8	
		B	99.823	-120.0	0	0	0	0		B	-0.035	-0.009	1.9	96.5	
		C	99.924	120.0	0	0	0	0		C	-0.027	-0.008	1.5	95.5	
										N			0.0		
									Bus37	A	0.032	0.002	1.7	99.8	
										B	0.035	0.009	1.9	96.5	
										C	0.027	0.008	1.5	95.5	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
Bus37	0.400	A	98.629	28.9	0	0	0.039	0.008	Bus35	A	-0.039	-0.008	175.5	98.0	
		B	98.988	-90.9	0	0	0.032	0.005		B	-0.032	-0.005	141.2	99.0	
		C	99.278	149.4	0	0	0.021	0.004		C	-0.021	-0.004	95.2	98.0	
										N			78.2		
Bus38	33.000	A	99.870	-0.1	0	0	0	0	Bus42	A	0.154	0.035	8.3	97.5	
		B	99.811	-120.0	0	0	0	0		B	0.137	0.039	7.5	96.2	
		C	99.911	120.0	0	0	0	0		C	0.142	0.022	7.6	98.8	
										N			0.0		
									Bus31	A	-0.978	-0.173	52.2	98.5	
										B	-0.953	-0.197	51.2	97.9	
										C	-0.947	-0.165	50.5	98.5	
										N			0.0		
									Bus53	A	0.824	0.138	43.9	98.6	
										B	0.817	0.158	43.7	98.2	
										C	0.804	0.142	42.9	98.5	
										N			0.0		
Bus41	0.400	A	98.831	28.8	0	0	0.101	0.030	Bus42	A	-0.101	-0.030	462.3	96.0	
		B	99.343	-90.9	0	0	0.078	0.011		B	-0.078	-0.011	343.0	99.0	
		C	99.134	148.8	0	0	0.100	0.020		C	-0.100	-0.020	444.0	98.0	
										N			94.6		
Bus42	33.000	A	99.869	-0.1	0	0	0	0	Bus38	A	-0.154	-0.035	8.3	97.5	
		B	99.810	-120.0	0	0	0	0		B	-0.137	-0.039	7.5	96.2	
		C	99.910	120.0	0	0	0	0		C	-0.142	-0.022	7.6	98.8	
										N			0.0		
									Bus43	A	0.050	0.008	2.7	98.9	
										B	0.052	0.009	2.8	98.6	
										C	0.050	0.010	2.7	98.1	
										N			0.0		
									Bus41	A	0.104	0.028	5.6	96.6	
										B	0.084	0.030	4.7	94.2	
										C	0.092	0.012	4.9	99.1	
										N			0.0		
Bus43	33.000	A	99.866	-0.1	0	0	0	0	Bus42	A	-0.050	-0.008	2.7	98.9	
		B	99.806	-120.0	0	0	0	0		B	-0.052	-0.009	2.8	98.6	
		C	99.907	120.0	0	0	0	0		C	-0.050	-0.010	2.7	98.1	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow							XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF		% Tap
									Bus44	A	0.050	0.008	2.7	98.9		
										B	0.052	0.009	2.8	98.6		
										C	0.050	0.010	2.7	98.1		
										N			0.0			
Bus44	33.000	A	99.858	-0.1	0	0	0	0	Bus47	A	0.012	0.001	0.6	99.7		
		B	99.798	-120.0	0	0	0	0		B	0.013	0.002	0.7	98.1		
		C	99.899	120.0	0	0	0	0		C	0.011	0.003	0.6	97.2		
										N			0.0			
									Bus43	A	-0.050	-0.008	2.7	98.9		
										B	-0.052	-0.009	2.8	98.6		
										C	-0.050	-0.010	2.7	98.1		
										N			0.0			
									Bus46	A	0.038	0.007	2.0	98.6		
										B	0.039	0.006	2.1	98.7		
										C	0.039	0.007	2.1	98.3		
										N			0.0			
Bus46	0.400	A	97.689	28.5	0	0	0.038	0.005	Bus44	A	-0.038	-0.005	169.1	99.0		
		B	97.632	-91.5	0	0	0.039	0.006		B	-0.039	-0.006	176.6	99.0		
		C	97.802	148.5	0	0	0.038	0.005		C	-0.038	-0.005	168.1	99.0		
										N			8.1			
Bus47	33.000	A	99.858	-0.1	0	0	0	0	Bus44	A	-0.012	-0.001	0.6	99.7		
		B	99.797	-120.0	0	0	0	0		B	-0.013	-0.002	0.7	98.1		
		C	99.898	120.0	0	0	0	0		C	-0.011	-0.003	0.6	97.2		
										N			0.0			
									Bus51	A	0.012	0.001	0.6	99.7		
										B	0.013	0.002	0.7	98.1		
										C	0.011	0.003	0.6	97.2		
										N			0.0			
Bus51	33.000	A	99.855	-0.1	0	0	0	0	Bus47	A	-0.012	-0.001	0.6	99.7		
		B	99.794	-120.0	0	0	0	0		B	-0.013	-0.002	0.7	98.1		
		C	99.895	120.0	0	0	0	0		C	-0.011	-0.003	0.6	97.2		
										N			0.0			
									Bus52	A	0.012	0.001	0.6	99.7		
										B	0.013	0.002	0.7	98.1		
										C	0.011	0.003	0.6	97.2		
										N			0.0			

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus52	0.400	A	99.071	29.5	0	0	0.013	0.002	Bus51	A	-0.013	-0.002	58.4	99.0	
		B	99.169	-90.5	0	0	0.012	0.002		B	-0.012	-0.002	53.5	99.0	
		C	99.367	149.6	0	0	0.010	0.001		C	-0.010	-0.001	42.6	99.0	
										N			14.0		
Bus53	33.000	A	99.855	-0.1	0	0	0	0	Bus54	A	0.824	0.138	43.9	98.6	
		B	99.795	-120.0	0	0	0	0		B	0.817	0.158	43.7	98.2	
		C	99.896	120.0	0	0	0	0		C	0.804	0.142	42.9	98.5	
										N			0.0		
									Bus38	A	-0.824	-0.138	43.9	98.6	
										B	-0.817	-0.158	43.7	98.2	
										C	-0.804	-0.142	42.9	98.5	
										N			0.0		
Bus54	33.000	A	99.842	-0.1	0	0	0	0	Bus57	A	0.810	0.134	43.2	98.7	
		B	99.782	-120.0	0	0	0	0		B	0.804	0.156	43.1	98.2	
		C	99.883	120.0	0	0	0	0		C	0.789	0.142	42.1	98.4	
										N			0.0		
									Bus53	A	-0.824	-0.138	43.9	98.6	
										B	-0.817	-0.158	43.7	98.2	
										C	-0.804	-0.142	42.9	98.5	
										N			0.0		
									Bus56	A	0.014	0.003	0.8	97.4	
										B	0.012	0.001	0.6	99.5	
										C	0.015	0.001	0.8	99.9	
										N			0.0		
Bus56	0.400	A	99.097	29.5	0	0	0.013	0.002	Bus54	A	-0.013	-0.002	55.3	99.0	
		B	99.260	-90.5	0	0	0.013	0		B	-0.013	0.000	54.8	100.0	
		C	99.030	149.4	0	0	0.016	0.002		C	-0.016	-0.002	68.8	99.0	
										N			8.8		
Bus57	33.000	A	99.834	-0.1	0	0	0	0	Bus54	A	-0.810	-0.134	43.2	98.7	
		B	99.774	-120.0	0	0	0	0		B	-0.804	-0.156	43.1	98.2	
		C	99.876	120.0	0	0	0	0		C	-0.789	-0.142	42.1	98.4	
										N			0.0		
									Bus63	A	0.660	0.103	35.1	98.8	
										B	0.675	0.126	36.1	98.3	
										C	0.648	0.129	34.7	98.1	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus60	A	0.046	0.004	2.4	99.7	
										B	0.044	0.000	2.3	100.0	
										C	0.049	0.001	2.5	100.0	
										N			0.0		
									Bus59	A	0.104	0.028	5.6	96.6	
										B	0.084	0.030	4.7	94.2	
										C	0.092	0.012	4.9	99.1	
										N			0.0		
Bus59	0.400	A	98.795	28.8	0	0	0.101	0.030	Bus57	A	-0.101	-0.030	462.4	96.0	
		B	99.308	-90.9	0	0	0.078	0.011		B	-0.078	-0.011	343.1	99.0	
		C	99.099	148.8	0	0	0.100	0.020		C	-0.100	-0.020	444.1	98.0	
										N			94.6		
Bus60	33.000	A	99.832	-0.1	0	0	0	0	Bus57	A	-0.046	-0.004	2.4	99.7	
		B	99.773	-120.0	0	0	0	0		B	-0.044	0.000	2.3	100.0	
		C	99.874	120.0	0	0	0	0		C	-0.049	-0.001	2.5	100.0	
										N			0.0		
									Bus62	A	0.046	0.004	2.4	99.7	
										B	0.044	0.000	2.3	100.0	
										C	0.049	0.001	2.5	100.0	
										N			0.0		
Bus62	0.400	A	98.920	28.7	0	0	0.042	0	Bus60	A	-0.042	0.000	182.6	100.0	
		B	98.865	-91.3	0	0	0.046	0		B	-0.046	0.000	202.3	100.0	
		C	98.856	148.5	0	0	0.050	0		C	-0.050	0.000	217.1	100.0	
										N			29.8		
Bus63	33.000	A	99.826	-0.1	0	0	0	0	Bus57	A	-0.660	-0.103	35.1	98.8	
		B	99.766	-120.0	0	0	0	0		B	-0.675	-0.126	36.1	98.3	
		C	99.868	120.0	0	0	0	0		C	-0.648	-0.129	34.7	98.1	
										N			0.0		
									Bus64	A	0.660	0.103	35.1	98.8	
										B	0.675	0.126	36.1	98.3	
										C	0.648	0.129	34.7	98.1	
										N			0.0		
Bus64	33.000	A	99.813	-0.1	0	0	0	0	Bus69	A	0.033	0.005	1.8	98.7	
		B	99.752	-120.0	0	0	0	0		B	0.033	0.007	1.8	97.9	
		C	99.854	120.0	0	0	0	0		C	0.032	0.006	1.7	98.0	
										N			0.0		

Bus			**Voltage**		**Generation**		**Load**		**Load Flow**						**XFMR**
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus63	A	-0.660	-0.103	35.1	98.8	
										B	-0.675	-0.126	36.1	98.3	
										C	-0.648	-0.129	34.7	98.1	
										N			0.0		
									Bus70	A	0.553	0.082	29.4	98.9	
										B	0.573	0.097	30.6	98.6	
										C	0.550	0.108	29.5	98.1	
										N			0.0		
									Bus66	A	0.074	0.016	4.0	97.8	
										B	0.069	0.022	3.8	95.3	
										C	0.066	0.015	3.6	97.6	
										N			0.0		
Bus66	0.400	A	98.560	28.5	0	0	0.079	0.016	Bus64	A	-0.079	-0.016	353.0	98.0	
		B	98.881	-91.1	0	0	0.061	0.012		B	-0.061	-0.012	270.7	98.0	
		C	98.727	148.8	0	0	0.068	0.017		C	-0.068	-0.017	306.8	97.0	
										N			85.1		
Bus68	0.400	A	99.250	29.3	0	0	0.034	0.007	Bus69	A	-0.034	-0.007	150.1	98.0	
		B	99.362	-90.6	0	0	0.033	0.005		B	-0.033	-0.005	146.1	99.0	
		C	99.467	149.4	0	0	0.030	0.004		C	-0.030	-0.004	131.6	99.0	
										N			24.1		
Bus69	33.000	A	99.812	-0.1	0	0	0	0	Bus64	A	-0.033	-0.005	1.8	98.7	
		B	99.751	-120.0	0	0	0	0		B	-0.033	-0.007	1.8	97.9	
		C	99.853	120.0	0	0	0	0		C	-0.032	-0.006	1.7	98.0	
										N			0.0		
									Bus68	A	0.033	0.005	1.8	98.7	
										B	0.033	0.007	1.8	97.9	
										C	0.032	0.006	1.7	98.0	
										N			0.0		
Bus70	33.000	A	99.793	-0.1	0	0	0	0	Bus83	A	0.385	0.064	20.5	98.6	
		B	99.731	-120.0	0	0	0	0		B	0.408	0.058	21.7	99.0	
		C	99.834	120.0	0	0	0	0		C	0.402	0.082	21.6	98.0	
										N			0.0		
									Bus64	A	-0.553	-0.082	29.4	98.9	
										B	-0.573	-0.097	30.6	98.6	
										C	-0.550	-0.108	29.5	98.1	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus73	A	0.087	0.010	4.6	99.4	
										B	0.087	0.018	4.7	97.8	
										C	0.080	0.014	4.2	98.5	
										N			0.0		
									Bus72	A	0.081	0.007	4.3	99.6	
										B	0.078	0.021	4.3	96.7	
										C	0.068	0.012	3.6	98.5	
										N			0.0		
Bus72	0.400	A	98.536	28.3	0	0	0.090	0.013	Bus70	A	-0.090	-0.013	401.1	99.0	
		B	98.884	-91.2	0	0	0.068	0.010		B	-0.068	-0.010	299.5	99.0	
		C	98.946	148.7	0	0	0.068	0.010		C	-0.068	-0.010	300.3	99.0	
										N			101.4		
Bus73	33.000	A	99.787	-0.1	0	0	0	0	Bus76	A	0.056	0.009	3.0	98.7	
		B	99.725	-120.0	0	0	0	0		B	0.051	0.009	2.7	98.5	
		C	99.828	120.0	0	0	0	0		C	0.053	0.005	2.8	99.6	
										N			0.0		
									Bus70	A	-0.087	-0.010	4.6	99.4	
										B	-0.087	-0.018	4.7	97.8	
										C	-0.080	-0.014	4.2	98.5	
										N			0.0		
									Bus75	A	0.031	0.001	1.6	100.0	
										B	0.036	0.009	2.0	96.7	
										C	0.026	0.009	1.5	94.3	
										N			0.0		
Bus75	0.400	A	99.212	29.2	0	0	0.040	0.006	Bus73	A	-0.040	-0.006	174.9	99.0	
		B	99.293	-90.6	0	0	0.032	0.006		B	-0.032	-0.006	140.9	98.0	
		C	99.511	149.6	0	0	0.021	0.004		C	-0.021	-0.004	95.1	98.0	
										N			64.0		
Bus76	33.000	A	99.785	-0.1	0	0	0	0	Bus79	A	0.036	0.007	1.9	98.3	
		B	99.723	-120.0	0	0	0	0		B	0.033	0.004	1.7	99.3	
		C	99.826	120.0	0	0	0	0		C	0.037	0.002	2.0	99.8	
										N			0.0		
									Bus73	A	-0.056	-0.009	3.0	98.7	
										B	-0.051	-0.009	2.7	98.5	
										C	-0.053	-0.005	2.8	99.6	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus78	A	0.020	0.002	1.0	99.4	
										B	0.018	0.005	1.0	96.3	
										C	0.016	0.002	0.9	99.2	
										N			0.0		
Bus78	0.400	A	99.148	29.4	0	0	0.021	0.003	Bus76	A	-0.021	-0.003	93.1	99.0	
		B	99.359	-90.4	0	0	0.015	0.002		B	-0.015	-0.002	65.2	99.0	
		C	99.357	149.5	0	0	0.017	0.002		C	-0.017	-0.002	76.1	99.0	
										N			24.4		
Bus79	33.000	A	99.784	-0.1	0	0	0	0	Bus76	A	-0.036	-0.007	1.9	98.3	
		B	99.722	-120.0	0	0	0	0		B	-0.033	-0.004	1.7	99.3	
		C	99.825	120.0	0	0	0	0		C	-0.037	-0.002	2.0	99.8	
										N			0.0		
									Bus82	A	0.036	0.007	1.9	98.3	
										B	0.033	0.004	1.7	99.3	
										C	0.037	0.002	2.0	99.8	
										N			0.0		
Bus81	0.400	A	98.762	29.0	0	0	0.035	0.005	Bus82	A	-0.035	-0.005	154.9	99.0	
		B	99.088	-91.0	0	0	0.033	0		B	-0.033	0.000	144.6	100.0	
		C	98.805	148.9	0	0	0.037	0.005		C	-0.037	-0.005	164.4	99.0	
										N			20.7		
Bus82	33.000	A	99.782	-0.1	0	0	0	0	Bus79	A	-0.036	-0.007	1.9	98.3	
		B	99.720	-120.0	0	0	0	0		B	-0.033	-0.004	1.7	99.3	
		C	99.823	120.0	0	0	0	0		C	-0.037	-0.002	2.0	99.8	
										N			0.0		
									Bus81	A	0.036	0.007	1.9	98.3	
										B	0.033	0.004	1.7	99.3	
										C	0.037	0.002	2.0	99.8	
										N			0.0		
Bus83	33.000	A	99.787	-0.1	0	0	0	0	Bus70	A	-0.385	-0.064	20.5	98.6	
		B	99.725	-120.0	0	0	0	0		B	-0.408	-0.058	21.7	99.0	
		C	99.827	120.0	0	0	0	0		C	-0.402	-0.082	21.6	98.0	
										N			0.0		
									Bus87	A	0.348	0.061	18.6	98.5	
										B	0.368	0.057	19.6	98.8	
										C	0.361	0.077	19.4	97.8	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus86	A	0.037	0.004	1.9	99.5	
										B	0.040	0.001	2.1	100.0	
										C	0.041	0.005	2.2	99.4	
										N			0.0		
Bus85	0.400	A	98.943	28.8	0	0	0.038	0	Bus86	A	-0.038	0.000	167.8	100.0	
		B	98.945	-91.2	0	0	0.040	0		B	-0.040	0.000	175.2	100.0	
		C	98.791	148.9	0	0	0.038	0.005		C	-0.038	-0.005	167.1	99.0	
										N			18.0		
Bus86	33.000	A	99.785	-0.1	0	0	0	0	Bus83	A	-0.037	-0.004	1.9	99.5	
		B	99.723	-120.0	0	0	0	0		B	-0.040	-0.001	2.1	100.0	
		C	99.825	120.0	0	0	0	0		C	-0.041	-0.005	2.2	99.4	
										N			0.0		
									Bus85	A	0.037	0.004	1.9	99.5	
										B	0.040	0.001	2.1	100.0	
										C	0.041	0.005	2.2	99.4	
										N			0.0		
Bus87	33.000	A	99.775	-0.1	0	0	0	0	Bus83	A	-0.348	-0.061	18.6	98.5	
		B	99.712	-120.0	0	0	0	0		B	-0.368	-0.057	19.6	98.8	
		C	99.814	120.0	0	0	0	0		C	-0.361	-0.077	19.4	97.8	
										N			0.0		
									Bus90	A	0.308	0.055	16.5	98.5	
										B	0.332	0.048	17.7	99.0	
										C	0.327	0.072	17.6	97.6	
										N			0.0		
									Bus89	A	0.039	0.006	2.1	98.9	
										B	0.036	0.010	2.0	96.5	
										C	0.034	0.005	1.8	98.9	
										N			0.0		
Bus89	0.400	A	98.548	28.8	0	0	0.042	0.006	Bus87	A	-0.042	-0.006	187.8	99.0	
		B	98.918	-90.8	0	0	0.030	0.004		B	-0.030	-0.004	134.7	99.0	
		C	98.721	149.0	0	0	0.036	0.007		C	-0.036	-0.007	161.0	98.0	
										N			55.4		
Bus90	33.000	A	99.756	-0.1	0	0	0	0	Bus113	A	0.089	-0.006	4.7	99.8	
		B	99.692	-120.1	0	0	0	0		B	0.098	-0.017	5.2	98.6	
		C	99.794	120.0	0	0	0	0		C	0.103	-0.003	5.4	99.9	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus93	A	0.164	0.046	8.9	96.3	
										B	0.178	0.055	9.8	95.6	
										C	0.163	0.063	9.2	93.3	
										N			0.0		
									Bus87	A	-0.308	-0.055	16.5	98.5	
										B	-0.332	-0.048	17.7	99.0	
										C	-0.327	-0.072	17.6	97.6	
										N			0.0		
									Bus92	A	0.056	0.015	3.0	96.7	
										B	0.056	0.010	3.0	98.5	
										C	0.060	0.012	3.2	98.0	
										N			0.0		
Bus92	0.400	A	99.018	29.0	0	0	0.052	0.007	Bus90	A	-0.052	-0.007	229.6	99.0	
		B	98.881	-91.0	0	0	0.057	0.011		B	-0.057	-0.011	252.9	98.0	
		C	98.864	148.8	0	0	0.062	0.013		C	-0.062	-0.013	277.3	98.0	
										N			49.8		
Bus93	33.000	A	99.749	-0.1	0	0	0	0	Bus96	A	0.136	0.036	7.4	96.6	
		B	99.685	-120.1	0	0	0	0		B	0.148	0.045	8.1	95.7	
		C	99.787	120.0	0	0	0	0		C	0.135	0.052	7.6	93.4	
										N			0.0		
									Bus90	A	-0.164	-0.046	8.9	96.3	
										B	-0.178	-0.055	9.8	95.6	
										C	-0.163	-0.063	9.2	93.3	
										N			0.0		
									Bus95	A	0.028	0.009	1.6	94.8	
										B	0.030	0.010	1.7	95.2	
										C	0.029	0.012	1.6	92.8	
										N			0.0		
Bus95	0.400	A	98.675	29.2	0	0	0.029	0.008	Bus93	A	-0.029	-0.008	133.1	96.0	
		B	98.619	-90.8	0	0	0.030	0.010		B	-0.030	-0.010	139.3	95.0	
		C	98.752	149.3	0	0	0.027	0.010		C	-0.027	-0.010	126.5	94.0	
										N			5.9		
Bus96	33.000	A	99.748	-0.1	0	0	0	0	Bus93	A	-0.136	-0.036	7.4	96.6	
		B	99.683	-120.1	0	0	0	0		B	-0.148	-0.045	8.1	95.7	
		C	99.785	120.0	0	0	0	0		C	-0.135	-0.052	7.6	93.4	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus103	A	0.071	0.011	3.8	98.9	
										B	0.074	0.015	4.0	98.1	
										C	0.070	0.015	3.7	97.7	
										N			0.0		
									Bus99	A	0.031	0.023	2.0	79.3	
										B	0.036	0.023	2.3	84.6	
										C	0.034	0.028	2.3	76.7	
										N			0.0		
									Bus98	A	0.034	0.002	1.8	99.8	
										B	0.037	0.007	2.0	98.1	
										C	0.031	0.008	1.7	96.8	
										N			0.0		
Bus98	0.400	A	99.181	29.2	0	0	0.039	0.006	Bus96	A	-0.039	-0.006	171.9	99.0	
		B	99.260	-90.7	0	0	0.036	0.005		B	-0.036	-0.005	157.0	99.0	
		C	99.443	149.4	0	0	0.027	0.004		C	-0.027	-0.004	117.3	99.0	
										N			49.1		
Bus99	33.000	A	99.747	-0.1	0	0	0	0	Bus102	A	0.031	0.023	2.0	79.3	
		B	99.683	-120.1	0	0	0	0		B	0.036	0.023	2.3	84.6	
		C	99.785	120.0	0	0	0	0		C	0.034	0.028	2.3	76.7	
										N			0.0		
									Bus96	A	-0.031	-0.023	2.0	79.3	
										B	-0.036	-0.023	2.3	84.6	
										C	-0.034	-0.028	2.3	76.7	
										N			0.0		
Bus101	0.400	A	99.170	29.6	0	0	0.032	0.019	Bus102	A	-0.032	-0.019	164.5	86.0	
		B	99.049	-90.4	0	0	0.036	0.026		B	-0.036	-0.026	194.2	81.0	
		C	99.144	149.6	0	0	0.032	0.025		C	-0.032	-0.025	177.6	78.0	
										N			15.1		
Bus102	33.000	A	99.746	-0.1	0	0	0	0	Bus99	A	-0.031	-0.023	2.0	79.3	
		B	99.681	-120.1	0	0	0	0		B	-0.036	-0.023	2.3	84.6	
		C	99.783	120.0	0	0	0	0		C	-0.034	-0.028	2.3	76.7	
										N			0.0		
									Bus101	A	0.031	0.023	2.0	79.3	
										B	0.036	0.023	2.3	84.6	
										C	0.034	0.028	2.3	76.7	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
Bus103	33.000	A	99.744	-0.1	0	0	0	0	Bus96	A	-0.071	-0.011	3.8	98.9	
		B	99.679	-120.1	0	0	0	0		B	-0.074	-0.015	4.0	98.1	
		C	99.782	120.0	0	0	0	0		C	-0.070	-0.015	3.7	97.7	
										N			0.0		
									Bus106	A	0.040	0.009	2.1	97.6	
										B	0.039	0.005	2.1	99.2	
										C	0.043	0.007	2.3	98.7	
										N			0.0		
									Bus105	A	0.032	0.002	1.7	99.8	
										B	0.035	0.009	1.9	96.5	
										C	0.027	0.008	1.5	95.5	
										N			0.0		
Bus105	0.400	A	98.487	28.9	0	0	0.039	0.008	Bus103	A	-0.039	-0.008	175.7	98.0	
		B	98.843	-90.9	0	0	0.032	0.005		B	-0.032	-0.005	141.3	99.0	
		C	99.138	149.4	0	0	0.021	0.004		C	-0.021	-0.004	95.3	98.0	
										N			78.3		
Bus106	33.000	A	99.742	-0.1	0	0	0	0	Bus103	A	-0.040	-0.009	2.1	97.6	
		B	99.677	-120.1	0	0	0	0		B	-0.039	-0.005	2.1	99.2	
		C	99.779	120.0	0	0	0	0		C	-0.043	-0.007	2.3	98.7	
										N			0.0		
									Bus108	A	0.040	0.009	2.1	97.6	
										B	0.039	0.005	2.1	99.2	
										C	0.043	0.007	2.3	98.7	
										N			0.0		
Bus108	0.400	A	98.694	28.9	0	0	0.036	0.005	Bus106	A	-0.036	-0.005	159.3	99.0	
		B	98.577	-91.1	0	0	0.041	0.006		B	-0.041	-0.006	183.4	99.0	
		C	98.595	148.8	0	0	0.043	0.006		C	-0.043	-0.006	191.3	99.0	
										N			28.7		
Bus113	33.000	A	99.755	-0.1	0	0	0	0	Bus90	A	-0.089	0.006	4.7	99.8	
		B	99.691	-120.1	0	0	0	0		B	-0.098	0.017	5.2	98.6	
		C	99.792	120.0	0	0	0	0		C	-0.103	0.003	5.4	99.9	
										N			0.0		
									Bus114	A	0.089	-0.006	4.7	99.8	
										B	0.098	-0.017	5.2	98.6	
										C	0.103	-0.003	5.4	99.9	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus114	33.000	A	99.752	-0.1	0	0	0	0	Bus113	A	-0.089	0.006	4.7	99.8	
		B	99.688	-120.1	0	0	0	0		B	-0.098	0.017	5.2	98.6	
		C	99.789	120.0	0	0	0	0		C	-0.103	0.003	5.4	99.9	
										N			0.0		
									Bus120	A	0.015	0.002	0.8	98.7	
										B	0.022	0.001	1.2	100.0	
										C	0.020	0.008	1.1	93.5	
										N			0.0		
									Bus121	A	0.053	-0.015	2.9	96.0	
										B	0.055	-0.019	3.1	94.5	
										C	0.058	-0.015	3.1	96.8	
										N			0.0		
									Bus116	A	0.021	0.007	1.2	94.6	
										B	0.020	0.002	1.1	99.6	
										C	0.025	0.004	1.4	98.8	
										N			0.0		
Bus116	0.400	A	99.224	29.5	0	0	0.017	0.002	Bus114	A	-0.017	-0.002	75.7	99.0	
		B	99.108	-90.6	0	0	0.023	0.003		B	-0.023	-0.003	100.1	99.0	
		C	98.991	149.2	0	0	0.026	0.005		C	-0.026	-0.005	118.1	98.0	
										N			33.1		
Bus119	0.400	A	99.255	29.5	0	0	0.016	0.002	Bus120	A	-0.016	-0.002	70.5	99.0	
		B	98.998	-90.7	0	0	0.027	0.004		B	-0.027	-0.004	117.6	99.0	
		C	99.372	149.6	0	0	0.014	0.003		C	-0.014	-0.003	61.7	98.0	
										N			49.3		
Bus120	33.000	A	99.752	-0.1	0	0	0	0	Bus114	A	-0.015	-0.002	0.8	98.7	
		B	99.688	-120.1	0	0	0	0		B	-0.022	-0.001	1.2	100.0	
		C	99.788	120.0	0	0	0	0		C	-0.020	-0.008	1.1	93.5	
										N			0.0		
									Bus119	A	0.015	0.002	0.8	98.7	
										B	0.022	0.001	1.2	100.0	
										C	0.020	0.008	1.1	93.5	
										N			0.0		
Bus121	33.000	A	99.750	-0.1	0	0	0	0	Bus124	A	0.058	0.010	3.1	98.4	
		B	99.686	-120.1	0	0	0	0		B	0.057	0.012	3.1	97.9	
		C	99.787	120.0	0	0	0	0		C	0.056	0.010	3.0	98.4	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus126	A	-0.005	-0.026	1.4	18.7	
										B	-0.001	-0.031	1.6	3.9	
										C	0.002	-0.025	1.3	6.7	
										N			0.0		
									Bus114	A	-0.053	0.015	2.9	96.0	
										B	-0.055	0.019	3.1	94.5	
										C	-0.058	0.015	3.1	96.8	
										N			0.0		
Bus124	33.000	A	99.749	-0.1	0	0	0	0	Bus121	A	-0.058	-0.010	3.1	98.4	
		B	99.686	-120.1	0	0	0	0		B	-0.057	-0.012	3.1	97.9	
		C	99.786	120.0	0	0	0	0		C	-0.056	-0.010	3.0	98.4	
										N			0.0		
									Bus125	A	0.058	0.010	3.1	98.4	
										B	0.057	0.012	3.1	97.9	
										C	0.056	0.010	3.0	98.4	
										N			0.0		
Bus125	0.400	A	98.657	28.9	0	0	0.060	0.009	Bus124	A	-0.060	-0.009	266.3	99.0	
		B	98.815	-90.9	0	0	0.053	0.008		B	-0.053	-0.008	234.6	99.0	
		C	98.732	149.0	0	0	0.056	0.011		C	-0.056	-0.011	248.7	98.0	
										N			42.0		
Bus126	33.000	A	99.751	-0.1	0	0	0	0	Bus127	A	-0.044	-0.030	2.8	82.2	
		B	99.687	-120.1	0	0	0	0		B	-0.043	-0.041	3.1	71.9	
		C	99.788	120.0	0	0	0	0		C	-0.034	-0.035	2.6	69.5	
										N			0.0		
									Bus121	A	0.005	0.026	1.4	18.7	
										B	0.001	0.031	1.6	3.9	
										C	-0.002	0.025	1.3	6.7	
										N			0.0		
									Bus142	A	0.039	0.005	2.1	99.3	
										B	0.041	0.010	2.2	97.2	
										C	0.035	0.010	1.9	96.5	
										N			0.0		
Bus127	33.000	A	99.754	-0.1	0	0	0	0	Bus126	A	0.044	0.030	2.8	82.2	
		B	99.691	-120.1	0	0	0	0		B	0.043	0.041	3.1	71.9	
		C	99.790	120.0	0	0	0	0		C	0.034	0.035	2.6	69.5	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus132	A	-0.067	-0.035	4.0	88.7	
										B	-0.068	-0.039	4.1	86.8	
										C	-0.064	-0.038	3.9	86.2	
										N			0.0		
									Bus129	A	0.023	0.005	1.2	98.1	
										B	0.025	-0.003	1.3	99.5	
										C	0.030	0.003	1.6	99.6	
										N			0.0		
Bus129	0.400	A	99.213	29.4	0	0	0.018	0.003	Bus127	A	-0.018	-0.003	77.9	99.0	
		B	99.053	-91.0	0	0	0.033	0		B	-0.033	0.000	145.0	100.0	
		C	99.251	149.2	0	0	0.027	0		C	-0.027	0.000	117.0	100.0	
										N			64.3		
Bus132	33.000	A	99.761	-0.1	0	0	0	0	Bus135	A	-0.088	-0.041	5.1	90.4	
		B	99.697	-120.1	0	0	0	0		B	-0.086	-0.040	5.0	90.6	
		C	99.797	120.0	0	0	0	0		C	-0.088	-0.040	5.1	91.0	
										N			0.0		
									Bus127	A	0.067	0.035	4.0	88.7	
										B	0.068	0.039	4.1	86.8	
										C	0.064	0.038	3.9	86.2	
										N			0.0		
									Bus134	A	0.000	0.000	0.0	0.0	
										B	0.000	0.000	0.0	0.0	
										C	0.000	0.000	0.0	0.0	
										N			0.0		
									Bus133	A	0.021	0.007	1.2	95.3	
										B	0.019	0.002	1.0	99.5	
										C	0.024	0.002	1.3	99.5	
										N			0.0		
Bus133	0.400	A	99.265	29.5	0	0	0.016	0.002	Bus132	A	-0.016	-0.002	70.5	99.0	
		B	99.170	-90.6	0	0	0.021	0.003		B	-0.021	-0.003	91.4	99.0	
		C	99.084	149.2	0	0	0.026	0.004		C	-0.026	-0.004	115.8	99.0	
										N			39.2		
Bus134	33.000	A	99.761	-0.1	0	0	0	0	Bus132	A	0.000	0.000	0.0	0.0	
		B	99.697	-120.1	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.797	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
Bus135	33.000	A	99.765	-0.1	0	0	0	0	Bus132	A	0.088	0.041	5.1	90.4	
		B	99.702	-120.1	0	0	0	0		B	0.086	0.040	5.0	90.6	
		C	99.801	120.0	0	0	0	0		C	0.088	0.040	5.1	91.0	
										N			0.0		
									Bus138	A	-0.088	-0.041	5.1	90.4	
										B	-0.086	-0.040	5.0	90.6	
										C	-0.088	-0.040	5.1	91.0	
										N			0.0		
Bus138	33.000	A	99.774	-0.1	0	0	0	0	Bus135	A	0.088	0.041	5.1	90.4	
		B	99.711	-120.1	0	0	0	0		B	0.086	0.040	5.0	90.6	
		C	99.810	120.0	0	0	0	0		C	0.088	0.040	5.1	91.0	
										N			0.0		
									Bus139	A	0.037	0.016	2.1	92.2	
										B	0.038	0.017	2.2	91.1	
										C	0.036	0.017	2.1	90.5	
										N			0.0		
									Bus213	A	-0.125	-0.057	7.2	90.9	
										B	-0.124	-0.058	7.2	90.7	
										C	-0.124	-0.057	7.2	90.9	
										N			0.0		
Bus139	0.400	A	97.997	29.0	0	0	0.040	0.018	Bus138	A	-0.040	-0.018	192.9	91.0	
		B	98.341	-91.0	0	0	0.038	0.013		B	-0.038	-0.013	177.2	95.0	
		C	98.402	149.2	0	0	0.032	0.015		C	-0.032	-0.015	155.2	90.0	
										N			53.7		
Bus142	33.000	A	99.746	-0.1	0	0	0	0	Bus126	A	-0.039	-0.005	2.1	99.3	
		B	99.682	-120.1	0	0	0	0		B	-0.041	-0.010	2.2	97.2	
		C	99.783	120.0	0	0	0	0		C	-0.035	-0.010	1.9	96.5	
										N			0.0		
									Bus143	A	0.039	0.005	2.1	99.3	
										B	0.041	0.010	2.2	97.2	
										C	0.035	0.010	1.9	96.5	
										N			0.0		
Bus143	0.400	A	98.326	28.7	0	0	0.044	0.009	Bus142	A	-0.044	-0.009	199.5	98.0	
		B	98.631	-91.1	0	0	0.040	0.006		B	-0.040	-0.006	175.5	99.0	
		C	98.865	149.1	0	0	0.030	0.006		C	-0.030	-0.006	135.6	98.0	
										N			66.2		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus145	33.000	A	99.895	-0.1	0	0	0	0	Bus146	A	0.427	0.069	22.7	98.7	
		B	99.838	-120.0	0	0	0	0		B	0.400	0.103	21.7	96.8	
		C	99.940	120.0	0	0	0	0		C	0.385	0.064	20.5	98.7	
										N			0.0		
									Bus9	A	-0.427	-0.069	22.7	98.7	
										B	-0.400	-0.103	21.7	96.8	
										C	-0.385	-0.064	20.5	98.7	
										N			0.0		
Bus146	33.000	A	99.891	-0.1	0	0	0	0	Bus152	A	0.079	0.012	4.2	98.9	
		B	99.834	-120.0	0	0	0	0		B	0.067	0.020	3.7	95.9	
		C	99.936	120.0	0	0	0	0		C	0.066	0.006	3.5	99.6	
										N			0.0		
									Bus145	A	-0.427	-0.069	22.7	98.7	
										B	-0.400	-0.103	21.7	96.8	
										C	-0.385	-0.064	20.5	98.7	
										N			0.0		
									Bus172	A	0.295	0.045	15.7	98.9	
										B	0.286	0.070	15.5	97.1	
										C	0.269	0.049	14.4	98.4	
										N			0.0		
									Bus151	A	0.015	0.002	0.8	98.9	
										B	0.013	0.003	0.7	97.4	
										C	0.013	0.000	0.7	100.0	
										N			0.0		
									Bus148	A	0.037	0.011	2.0	96.0	
										B	0.035	0.010	1.9	95.8	
										C	0.036	0.008	2.0	97.4	
										N			0.0		
Bus148	0.400	A	98.606	29.1	0	0	0.035	0.010	Bus146	A	-0.035	-0.010	161.2	96.0	
		B	98.782	-90.9	0	0	0.035	0.008		B	-0.035	-0.008	155.1	97.5	
		C	98.770	149.0	0	0	0.037	0.008		C	-0.037	-0.008	166.2	97.6	
										N			0.0		
Bus150	0.400	A	99.407	29.6	0	0	0.014	0.003	Bus151	A	-0.014	-0.003	62.0	97.9	
		B	99.585	-90.3	0	0	0.012	0.001		B	-0.012	-0.001	52.6	99.7	
		C	99.624	149.5	0	0	0.015	0		C	-0.015	0.000	64.1	100.0	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus151	33.000	A	99.889	-0.1	0	0	0	0	Bus146	A	-0.015	-0.002	0.8	98.9	
		B	99.832	-120.0	0	0	0	0		B	-0.013	-0.003	0.7	97.4	
		C	99.935	120.0	0	0	0	0		C	-0.013	0.000	0.7	100.0	
										N			0.0		
									Bus150	A	0.015	0.002	0.8	98.9	
										B	0.013	0.003	0.7	97.4	
										C	0.013	0.000	0.7	100.0	
										N			0.0		
Bus152	33.000	A	99.891	-0.1	0	0	0	0	Bus146	A	-0.079	-0.012	4.2	98.9	
		B	99.833	-120.0	0	0	0	0		B	-0.067	-0.020	3.7	95.9	
		C	99.936	120.0	0	0	0	0		C	-0.066	-0.006	3.5	99.6	
										N			0.0		
									Bus155	A	0.074	0.011	3.9	99.0	
										B	0.063	0.019	3.4	95.9	
										C	0.062	0.005	3.3	99.7	
										N			0.0		
									Bus154	A	0.005	0.001	0.3	98.6	
										B	0.005	0.001	0.3	95.5	
										C	0.004	0.001	0.2	97.9	
										N			0.0		
Bus154	0.400	A	99.693	29.8	0	0	0.005	0.001	Bus152	A	-0.005	-0.001	21.3	98.6	
		B	99.746	-90.1	0	0	0.004	0.001		B	-0.004	-0.001	18.5	97.9	
		C	99.830	149.8	0	0	0.004	0		C	-0.004	0.000	19.4	99.8	
										N			0.0		
Bus155	33.000	A	99.886	-0.1	0	0	0	0	Bus158	A	0.059	0.008	3.1	99.0	
		B	99.828	-120.0	0	0	0	0		B	0.050	0.016	2.8	95.5	
		C	99.932	120.0	0	0	0	0		C	0.048	0.004	2.6	99.6	
										N			0.0		
									Bus152	A	-0.074	-0.011	3.9	99.0	
										B	-0.063	-0.019	3.4	95.9	
										C	-0.062	-0.005	3.3	99.7	
										N			0.0		
									Bus157	A	0.015	0.002	0.8	98.9	
										B	0.013	0.003	0.7	97.4	
										C	0.013	0.000	0.7	100.0	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus157	0.400	A	99.403	29.6	0	0	0.014	0.003	Bus155	A	-0.014	-0.003	62.0	97.9	
		B	99.582	-90.3	0	0	0.012	0.001		B	-0.012	-0.001	52.6	99.7	
		C	99.621	149.5	0	0	0.015	0		C	-0.015	0.000	64.1	100.0	
										N			0.0		
Bus158	33.000	A	99.884	-0.1	0	0	0	0	Bus155	A	-0.059	-0.008	3.1	99.0	
		B	99.827	-120.0	0	0	0	0		B	-0.050	-0.016	2.8	95.5	
		C	99.931	120.0	0	0	0	0		C	-0.048	-0.004	2.6	99.6	
										N			0.0		
									Bus159	A	0.059	0.008	3.1	99.0	
										B	0.050	0.016	2.8	95.5	
										C	0.048	0.004	2.6	99.6	
										N			0.0		
Bus159	33.000	A	99.881	-0.1	0	0	0	0	Bus160	A	0.059	0.008	3.1	99.0	
		B	99.823	-120.0	0	0	0	0		B	0.050	0.016	2.8	95.5	
		C	99.928	120.0	0	0	0	0		C	0.048	0.004	2.6	99.6	
										N			0.0		
									Bus158	A	-0.059	-0.008	3.1	99.0	
										B	-0.050	-0.016	2.8	95.5	
										C	-0.048	-0.004	2.6	99.6	
										N			0.0		
Bus160	33.000	A	99.877	-0.1	0	0	0	0	Bus163	A	0.035	0.005	1.9	99.0	
		B	99.820	-120.0	0	0	0	0		B	0.031	0.009	1.7	95.8	
		C	99.926	120.0	0	0	0	0		C	0.030	0.004	1.6	99.3	
										N			0.0		
									Bus159	A	-0.059	-0.008	3.1	99.0	
										B	-0.050	-0.016	2.8	95.5	
										C	-0.048	-0.004	2.6	99.6	
										N			0.0		
									Bus162	A	0.023	0.003	1.2	99.0	
										B	0.019	0.006	1.0	95.0	
										C	0.019	0.001	1.0	99.9	
										N			0.0		
Bus162	0.400	A	99.158	29.3	0	0	0.024	0.003	Bus160	A	-0.024	-0.003	106.6	99.0	
		B	99.476	-90.4	0	0	0.014	0.002		B	-0.014	-0.002	62.6	99.0	
		C	99.321	149.4	0	0	0.022	0.003		C	-0.022	-0.003	97.4	99.0	
										N			40.2		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Phase	MW	Mvar	Amp	% PF	XFMR % Tap
Bus163	33.000	A	99.876	-0.1	0	0	0	0	Bus160	A	-0.035	-0.005	1.9	99.0	
		B	99.818	-120.0	0	0	0	0		B	-0.031	-0.009	1.7	95.8	
		C	99.924	120.0	0	0	0	0		C	-0.030	-0.004	1.6	99.3	
										N			0.0		
									Bus166	A	0.012	0.001	0.6	99.7	
										B	0.013	0.002	0.7	98.1	
										C	0.011	0.003	0.6	97.2	
										N			0.0		
									Bus165	A	0.024	0.004	1.3	98.5	
										B	0.018	0.007	1.0	93.7	
										C	0.019	0.001	1.0	99.9	
										N			0.0		
Bus165	0.400	A	99.091	29.3	0	0	0.024	0.005	Bus163	A	-0.024	-0.005	106.7	98.0	
		B	99.474	-90.4	0	0	0.014	0.002		B	-0.014	-0.002	62.6	99.0	
		C	99.320	149.4	0	0	0.022	0.003		C	-0.022	-0.003	97.4	99.0	
										N			35.7		
Bus166	33.000	A	99.875	-0.1	0	0	0	0	Bus167	A	0.012	0.001	0.6	99.7	
		B	99.817	-120.0	0	0	0	0		B	0.013	0.002	0.7	98.1	
		C	99.923	120.0	0	0	0	0		C	0.011	0.003	0.6	97.2	
										N			0.0		
									Bus163	A	-0.012	-0.001	0.6	99.7	
										B	-0.013	-0.002	0.7	98.1	
										C	-0.011	-0.003	0.6	97.2	
										N			0.0		
Bus167	33.000	A	99.875	-0.1	0	0	0	0	Bus166	A	-0.012	-0.001	0.6	99.7	
		B	99.817	-120.0	0	0	0	0		B	-0.013	-0.002	0.7	98.1	
		C	99.923	120.0	0	0	0	0		C	-0.011	-0.003	0.6	97.2	
										N			0.0		
									Bus168	A	0.012	0.001	0.6	99.7	
										B	0.013	0.002	0.7	98.1	
										C	0.011	0.003	0.6	97.2	
										N			0.0		
Bus168	33.000	A	99.874	-0.1	0	0	0	0	Bus167	A	-0.012	-0.001	0.6	99.7	
		B	99.816	-120.0	0	0	0	0		B	-0.013	-0.002	0.7	98.1	
		C	99.923	120.0	0	0	0	0		C	-0.011	-0.003	0.6	97.2	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus171	A	0.012	0.001	0.6	99.7	
										B	0.013	0.002	0.7	98.1	
										C	0.011	0.003	0.6	97.2	
										N			0.0		
Bus170	0.400	A	99.089	29.5	0	0	0.013	0.002	Bus171	A	-0.013	-0.002	58.3	99.0	
		B	99.195	-90.5	0	0	0.012	0.002		B	-0.012	-0.002	53.5	99.0	
		C	99.391	149.6	0	0	0.010	0.001		C	-0.010	-0.001	42.6	99.0	
										N			14.0		
Bus171	33.000	A	99.874	-0.1	0	0	0	0	Bus168	A	-0.012	-0.001	0.6	99.7	
		B	99.816	-120.0	0	0	0	0		B	-0.013	-0.002	0.7	98.1	
		C	99.922	120.0	0	0	0	0		C	-0.011	-0.003	0.6	97.2	
										N			0.0		
									Bus170	A	0.012	0.001	0.6	99.7	
										B	0.013	0.002	0.7	98.1	
										C	0.011	0.003	0.6	97.2	
										N			0.0		
Bus172	33.000	A	99.884	-0.1	0	0	0	0	Bus146	A	-0.295	-0.045	15.7	98.9	
		B	99.826	-120.0	0	0	0	0		B	-0.286	-0.070	15.5	97.1	
		C	99.930	120.0	0	0	0	0		C	-0.269	-0.049	14.4	98.4	
										N			0.0		
									Bus173	A	0.295	0.045	15.7	98.9	
										B	0.286	0.070	15.5	97.1	
										C	0.269	0.049	14.4	98.4	
										N			0.0		
Bus173	33.000	A	99.850	-0.1	0	0	0	0	Bus176	A	0.276	0.039	14.7	99.0	
		B	99.791	-120.0	0	0	0	0		B	0.268	0.062	14.5	97.4	
		C	99.898	120.0	0	0	0	0		C	0.252	0.044	13.4	98.5	
										N			0.0		
									Bus172	A	-0.295	-0.045	15.7	98.9	
										B	-0.286	-0.070	15.5	97.1	
										C	-0.269	-0.049	14.4	98.4	
										N			0.0		
									Bus175	A	0.019	0.006	1.0	95.8	
										B	0.018	0.008	1.0	92.2	
										C	0.017	0.006	0.9	94.8	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus175	0.400	A	98.543	29.3	0	0	0.019	0.005	Bus173	A	-0.019	-0.005	88.7	96.6	
		B	98.684	-90.5	0	0	0.015	0.007		B	-0.015	-0.007	73.3	92.1	
		C	98.657	149.3	0	0	0.019	0.006		C	-0.019	-0.006	85.1	95.5	
										N			17.8		
Bus176	33.000	A	99.840	-0.1	0	0	0	0	Bus173	A	-0.276	-0.039	14.7	99.0	
		B	99.781	-120.0	0	0	0	0		B	-0.268	-0.062	14.5	97.4	
		C	99.889	120.0	0	0	0	0		C	-0.252	-0.044	13.4	98.5	
										N			0.0		
									Bus179	A	0.030	0.005	1.6	98.8	
										B	0.028	0.006	1.5	97.9	
										C	0.028	0.004	1.5	99.0	
										N			0.0		
									Bus180	A	0.246	0.034	13.1	99.0	
										B	0.239	0.056	12.9	97.3	
										C	0.224	0.040	11.9	98.5	
										N			0.0		
Bus178	0.400	A	98.124	28.9	0	0	0.029	0.005	Bus179	A	-0.029	-0.005	129.3	98.6	
		B	98.291	-91.0	0	0	0.027	0.004		B	-0.027	-0.004	121.5	98.8	
		C	98.372	148.8	0	0	0.029	0.003		C	-0.029	-0.003	127.0	99.4	
										N			0.0		
Bus179	33.000	A	99.839	-0.1	0	0	0	0	Bus176	A	-0.030	-0.005	1.6	98.8	
		B	99.780	-120.0	0	0	0	0		B	-0.028	-0.006	1.5	97.9	
		C	99.887	120.0	0	0	0	0		C	-0.028	-0.004	1.5	99.0	
										N			0.0		
									Bus178	A	0.030	0.005	1.6	98.8	
										B	0.028	0.006	1.5	97.9	
										C	0.028	0.004	1.5	99.0	
										N			0.0		
Bus180	33.000	A	99.821	-0.1	0	0	0	0	Bus176	A	-0.246	-0.034	13.1	99.1	
		B	99.762	-120.0	0	0	0	0		B	-0.239	-0.056	12.9	97.3	
		C	99.871	120.0	0	0	0	0		C	-0.224	-0.040	11.9	98.5	
										N			0.0		
									Bus194	A	0.145	0.024	7.7	98.7	
										B	0.142	0.037	7.7	96.8	
										C	0.133	0.028	7.1	97.8	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus181	A	0.065	0.004	3.4	99.8	
										B	0.055	0.016	3.0	96.1	
										C	0.049	0.001	2.6	100.0	
										N			0.0		
									Bus208	A	0.037	0.006	2.0	98.5	
										B	0.043	0.004	2.3	99.6	
										C	0.042	0.010	2.3	97.0	
										N			0.0		
Bus181	33.000	A	99.814	-0.1	0	0	0	0	Bus184	A	0.027	0.003	1.4	99.4	
		B	99.755	-120.0	0	0	0	0		B	0.025	0.004	1.3	98.8	
		C	99.866	120.0	0	0	0	0		C	0.025	0.002	1.3	99.8	
										N			0.0		
									Bus180	A	-0.065	-0.004	3.4	99.8	
										B	-0.055	-0.016	3.0	96.1	
										C	-0.049	-0.001	2.6	100.0	
										N			0.0		
									Bus183	A	0.038	0.001	2.0	100.0	
										B	0.030	0.012	1.7	93.0	
										C	0.025	0.000	1.3	100.0	
										N			0.0		
Bus183	0.400	A	98.627	29.0	0	0	0.037	0.008	Bus181	A	-0.037	-0.008	164.1	97.9	
		B	99.004	-90.6	0	0	0.023	0.007		B	-0.023	-0.007	106.6	96.4	
		C	99.445	149.0	0	0	0.031	-0.004		C	-0.031	0.004	138.1	99.0	
										N			0.0		
Bus184	33.000	A	99.813	-0.1	0	0	0	0	Bus181	A	-0.027	-0.003	1.4	99.4	
		B	99.754	-120.0	0	0	0	0		B	-0.025	-0.004	1.3	98.8	
		C	99.865	120.0	0	0	0	0		C	-0.025	-0.002	1.3	99.8	
										N			0.0		
									Bus185	A	0.027	0.003	1.4	99.4	
										B	0.025	0.004	1.3	98.8	
										C	0.025	0.002	1.3	99.8	
										N			0.0		
Bus185	33.000	A	99.812	-0.1	0	0	0	0	Bus189	A	0.011	0.001	0.6	99.9	
		B	99.753	-120.0	0	0	0	0		B	0.012	0.001	0.6	99.7	
		C	99.864	120.0	0	0	0	0		C	0.011	0.001	0.6	99.3	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus184	A	-0.027	-0.003	1.4	99.4	
										B	-0.025	-0.004	1.3	98.8	
										C	-0.025	-0.002	1.3	99.8	
										N			0.0		
									Bus188	A	0.015	0.002	0.8	98.9	
										B	0.013	0.003	0.7	97.4	
										C	0.013	0.000	0.7	100.0	
										N			0.0		
Bus188	0.400	A	99.326	29.6	0	0	0.014	0.003	Bus185	A	-0.014	-0.003	62.0	97.9	
		B	99.511	-90.3	0	0	0.012	0.001		B	-0.012	-0.001	52.6	99.7	
		C	99.552	149.5	0	0	0.015	0		C	-0.015	0.000	64.2	100.0	
										N			0.0		
Bus189	33.000	A	99.812	-0.1	0	0	0	0	Bus193	A	0.000	0.000	0.0	0.0	
		B	99.753	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.864	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		
									Bus185	A	-0.011	-0.001	0.6	99.9	
										B	-0.012	-0.001	0.6	99.7	
										C	-0.011	-0.001	0.6	99.3	
										N			0.0		
									Bus192	A	0.011	0.001	0.6	99.9	
										B	0.012	0.001	0.6	99.7	
										C	0.011	0.001	0.6	99.3	
										N			0.0		
Bus191	0.400	A	99.488	29.6	0	0	0.013	0	Bus192	A	-0.013	0.000	56.0	100.0	
		B	99.572	-90.3	0	0	0.011	0		B	-0.011	0.000	48.6	100.0	
		C	99.569	149.6	0	0	0.011	0.002		C	-0.011	-0.002	46.9	99.0	
										N			14.3		
Bus192	33.000	A	99.811	-0.1	0	0	0	0	Bus189	A	-0.011	-0.001	0.6	99.9	
		B	99.752	-120.0	0	0	0	0		B	-0.012	-0.001	0.6	99.7	
		C	99.863	120.0	0	0	0	0		C	-0.011	-0.001	0.6	99.3	
										N			0.0		
									Bus191	A	0.011	0.001	0.6	99.9	
										B	0.012	0.001	0.6	99.7	
										C	0.011	0.001	0.6	99.3	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus193	33.000	A	99.812	-0.1	0	0	0	0	Bus189	A	0.000	0.000	0.0	0.0	
		B	99.753	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.864	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		
Bus194	33.000	A	99.818	-0.1	0	0	0	0	Bus180	A	-0.145	-0.024	7.7	98.7	
		B	99.758	-120.0	0	0	0	0		B	-0.142	-0.037	7.7	96.8	
		C	99.868	120.0	0	0	0	0		C	-0.133	-0.028	7.1	97.8	
										N			0.0		
									Bus195	A	0.145	0.024	7.7	98.7	
										B	0.142	0.037	7.7	96.8	
										C	0.133	0.028	7.1	97.8	
										N			0.0		
Bus195	33.000	A	99.809	-0.1	0	0	0	0	Bus196	A	0.145	0.024	7.7	98.7	
		B	99.749	-120.0	0	0	0	0		B	0.142	0.037	7.7	96.8	
		C	99.859	120.0	0	0	0	0		C	0.133	0.028	7.1	97.8	
										N			0.0		
									Bus194	A	-0.145	-0.024	7.7	98.7	
										B	-0.142	-0.037	7.7	96.8	
										C	-0.133	-0.028	7.1	97.8	
										N			0.0		
Bus196	33.000	A	99.808	-0.1	0	0	0	0	Bus195	A	-0.145	-0.024	7.7	98.7	
		B	99.748	-120.0	0	0	0	0		B	-0.142	-0.037	7.7	96.8	
		C	99.859	120.0	0	0	0	0		C	-0.133	-0.028	7.1	97.8	
										N			0.0		
									Bus197	A	0.145	0.024	7.7	98.7	
										B	0.142	0.037	7.7	96.8	
										C	0.133	0.028	7.1	97.8	
										N			0.0		
Bus197	33.000	A	99.807	-0.1	0	0	0	0	Bus198	A	0.070	0.013	3.8	98.3	
		B	99.747	-120.0	0	0	0	0		B	0.073	0.020	4.0	96.4	
		C	99.858	120.0	0	0	0	0		C	0.066	0.019	3.6	96.0	
										N			0.0		
									Bus209	A	0.075	0.011	4.0	99.0	
										B	0.069	0.017	3.7	97.2	
										C	0.067	0.009	3.6	99.1	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
									Bus196	A	-0.145	-0.024	7.7	98.7	
										B	-0.142	-0.037	7.7	96.8	
										C	-0.133	-0.028	7.1	97.8	
										N			0.0		
Bus198	33.000	A	99.805	-0.1	0	0	0	0	Bus197	A	-0.070	-0.013	3.8	98.3	
		B	99.744	-120.0	0	0	0	0		B	-0.073	-0.020	4.0	96.4	
		C	99.856	120.0	0	0	0	0		C	-0.066	-0.019	3.6	96.0	
										N			0.0		
									Bus200	A	0.070	0.013	3.8	98.3	
										B	0.073	0.020	4.0	96.4	
										C	0.066	0.019	3.6	96.0	
										N			0.0		
Bus200	0.400	A	98.691	28.6	0	0	0.073	0.013	Bus198	A	-0.073	-0.013	325.6	98.4	
		B	98.577	-91.2	0	0	0.068	0.019		B	-0.068	-0.019	312.6	96.2	
		C	98.888	148.8	0	0	0.066	0.013		C	-0.066	-0.013	292.8	98.2	
										N			0.0		
Bus201	33.000	A	99.801	-0.1	0	0	0	0	Bus204	A	0.000	0.000	0.0	0.0	
		B	99.741	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.852	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		
									Bus209	A	-0.011	-0.002	0.6	98.8	
										B	-0.013	-0.002	0.7	99.3	
										C	-0.012	-0.003	0.6	96.6	
										N			0.0		
									Bus203	A	0.011	0.002	0.6	98.8	
										B	0.013	0.002	0.7	99.3	
										C	0.012	0.003	0.6	96.6	
										N			0.0		
Bus203	0.400	A	99.474	29.6	0	0	0.012	0.001	Bus201	A	-0.012	-0.001	50.6	99.9	
		B	99.427	-90.4	0	0	0.013	0.002		B	-0.013	-0.002	55.8	98.6	
		C	99.519	149.6	0	0	0.011	0.002		C	-0.011	-0.002	48.1	97.9	
										N			0.0		
Bus204	33.000	A	99.801	-0.1	0	0	0	0	Bus201	A	0.000	0.000	0.0	0.0	
		B	99.741	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.852	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		

Bus ID	Bus kV	Phase	Voltage % Mag.	Voltage Ang.	Generation MW	Generation Mvar	Load MW	Load Mvar	Load Flow ID	Load Flow Phase	Load Flow MW	Load Flow Mvar	Load Flow Amp	Load Flow % PF	XFMR % Tap
									Bus205	A	0.000	0.000	0.0	0.0	
										B	0.000	0.000	0.0	0.0	
										C	0.000	0.000	0.0	0.0	
										N			0.0		
									Bus206	A	0.000	0.000	0.0	0.0	
										B	0.000	0.000	0.0	0.0	
										C	0.000	0.000	0.0	0.0	
										N			0.0		
Bus205	33.000	A	99.801	-0.1	0	0	0	0	Bus204	A	0.000	0.000	0.0	0.0	
		B	99.741	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.852	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		
Bus206	33.000	A	99.801	-0.1	0	0	0	0	Bus204	A	0.000	0.000	0.0	0.0	
		B	99.741	-120.0	0	0	0	0		B	0.000	0.000	0.0	0.0	
		C	99.852	120.0	0	0	0	0		C	0.000	0.000	0.0	0.0	
										N			0.0		
Bus208	0.400	A	99.364	29.2	0	0	0.039	0.002	Bus180	A	-0.039	-0.002	168.5	99.8	
		B	99.242	-90.8	0	0	0.044	0.006		B	-0.044	-0.006	192.6	99.0	
		C	99.272	149.3	0	0	0.038	0.009		C	-0.038	-0.009	168.9	97.4	
										N			0.0		
Bus209	33.000	A	99.801	-0.1	0	0	0	0	Bus201	A	0.011	0.002	0.6	98.8	
		B	99.742	-120.0	0	0	0	0		B	0.013	0.002	0.7	99.3	
		C	99.853	120.0	0	0	0	0		C	0.012	0.003	0.6	96.6	
										N			0.0		
									Bus197	A	-0.075	-0.011	4.0	99.0	
										B	-0.069	-0.017	3.7	97.2	
										C	-0.067	-0.009	3.6	99.1	
										N			0.0		
									Bus211	A	0.064	0.009	3.4	99.0	
										B	0.056	0.015	3.1	96.5	
										C	0.055	0.006	2.9	99.5	
										N			0.0		
Bus211	0.400	A	98.814	28.8	0	0	0.061	0.013	Bus209	A	-0.061	-0.013	274.5	98.0	
		B	99.046	-91.0	0	0	0.053	0.009		B	-0.053	-0.009	233.2	98.5	
		C	99.244	148.8	0	0	0.060	0.003		C	-0.060	-0.003	262.8	99.9	
										N			0.0		

Bus			Voltage		Generation		Load		Load Flow						XFMR
ID	kV	Phase	% Mag.	Ang.	MW	Mvar	MW	Mvar	ID	Phase	MW	Mvar	Amp	% PF	% Tap
Bus212	0.400	A	99.595	30.7	0.127	0.061	0	0	Bus213	A	0.127	0.061	613.1	90.0	
		B	99.620	-89.2	0.126	0.062	0	0		B	0.126	0.062	610.6	89.9	
		C	99.680	150.7	0.127	0.061	0	0		C	0.127	0.061	611.3	90.1	
										N			0.0		
Bus213	33.000	A	99.774	-0.1	0	0	0	0	Bus212	A	-0.125	-0.057	7.2	90.9	2.500
		B	99.711	-120.1	0	0	0	0		B	-0.124	-0.058	7.2	90.7	
		C	99.810	120.0	0	0	0	0		C	-0.124	-0.057	7.2	90.9	
										N			0.0		
									Bus138	A	0.125	0.057	7.2	90.9	
										B	0.124	0.058	7.2	90.7	
										C	0.124	0.057	7.2	90.9	
										N			0.0		

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

\# Indicates a bus with a load mismatch of more than 0.1 MVA

\+ The power flows across center-tap transformers correspond to the phases of the From side.