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# Improvement of Electricity Power Supply to Harbour Road, Port Harcourt

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## ABSTRACT

*The research work is aimed at improving the electricity power supply with reliable power quality at the Harbour Road distribution network, Port Harcourt, consisting of twenty (20) distribution transformers. Having identified the problem associated in the network with overloading, outages in some of the feeders and gradual system collapse due to lower cross sectional area of conductor, due to these problems; the network was modeled in Electrical Transient Analyzer program (ETAP 16.00). With respect to these, load flow studies was performed using Newton Raphson techniques to know and ascertain the behavioural condition of the network. After the integration of capacitor bank into the network with the values of 8 KVAR and 10KVAR at bus 4 and bus 34 to take care of the Reactive power and the Active power in the system, significant improvement was made in the voltage profile ranging from bus 5 to bus 9 after the compensation.*

**KEY WORDS: E-tap application, Newton Raphson Load Flow, Voltage Equations, Reliability, Adequacy Security, electrical power system, capacitor bank placement, Load Flow, Voltage Profile, E-TAP.**



## I. INTRODUCTION

Electrical power system is a very important infrastructure because it delivers electricity to users either domestic or to commercial consumers. Its continuous and reliable performance is essential to nation building and citizen's way of life. The rate at which power system supply fails in this notion is becoming alarming and unimaginable that the masses are wanting a state of emergency with respect to electricity. Various actions taken to improve the system have not yielded the result expected. Failure of electrical power system have direct and indirect negative effect on the daily activities and the social economic well-being of users.

The problem of inadequate supply of power in this country (Nigeria) is what the society lived with for several years. Solution to problems and inadequate power supply in many areas has shown the abilities of ministers of power in recent years. Some steps that have been laid down in place to check the menace hence fails. The importance of electrical power reliability is demonstrated when electricity is disrupted and it reduces our comforts in various homes and productivity in general, e.g. industries. These have led to economic loss. Provision taken to stop an uninterrupted electricity supply for all customers has been a fundamental issues to designers in power operation, the security of power supplied is also a yardstick against which to measure the performance of electricity.

## II. LITERATURE REVIEW

Electrical power system is very important in a developing nation. Substantial use of electrical power system had open onto serious vulnerability failure of electrical power supply. Reliable power supply thus gain focus, which regards very necessary and essential to power system operations and planning (Billinton, 1992).

Power system distribution serves as a reliable source between distribution system down to the consumers and to serve the society at large. The electrical distribution system normally starts at the medium voltage of three (3) phase 33KV/11KV which is been transmitted by electrical power equipment (transformers). The primary electrical distribution lines which are all live lines convey the medium voltage down to the distribution transformers placed at the customers environment which in turn step down the voltage to the required and approved standard voltage of 415V, 3 phase 4 wire less than 1KV through secondary distribution line utilization voltage, for house hold appliances at the customer premises usually terminated at the metre or customers final circuit. To be able to use electricity system when you need it, is an important factor in a developing nation.

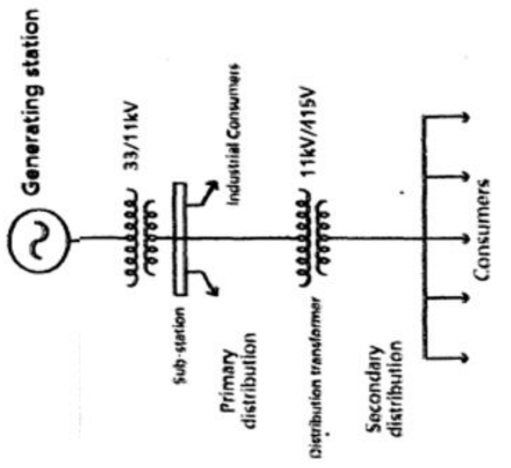



**Fig. 1: Single line diagram showing from generation power station to consumer**

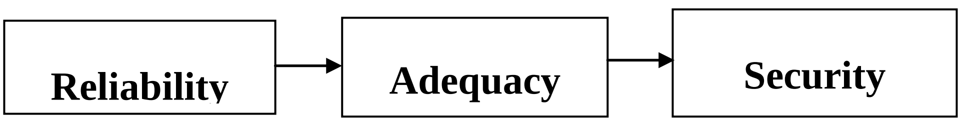



**Fig. 2: Block diagram of reliability system subdivision (*Bengaluru 2011*)**

**Electrical System Reliability**

Reliability denotes the state of being reliable and dependable amount of electrical energy for a given distribution network, if you were a plant engineer encompass the ability of the connected grid to supply the voltage you need, the power you need and also include whatever backup systems you had for, when the grid went down. (Donald Mcleod, 2018).

**Security in Terms of Electrical System**

This is the quality or statue of being able to retain certain level of solidness and allow the flow of electric current from generation, distribution down to consumer without being threatened or disturbed physically.

**Adequacy in Power System**

The quality of being sufficient or able to meet the electricity supply demand of consumers. These denote to sufficient and capacity of the equipment put in place or installed in the power system.

## III. METHODOLOGY

Having identified the problem in the study case, this work will consider the application of Newton Raphson (NR load flow) and voltage equations for the analysis and investigation of the system overload and network violations. This can be achieved using capacitor bank.

**Table 1: The location of transformers, rating and current reading in Harbour Road 11KV Feeder.**

| S/No | Name Of Street/Location Of Transformer | Transformer Rating | R (A) | Y (A) | B (A) |
|---|---|---|---|---|---|
| 1 | IBETO | 500KVA | 415 | 360 | 450 |
| 2 | CANTREESIDE VILLA AP | 500KVA | 198 | 118 | 208 |
| 3 | AP | 500KVA | 265 | 352 | 414 |
| 4 | STELLA MARIS I | 500KVA | 250 | 208 | 200 |
| 5 | STELLA MARIS II | 500KVA | 410 | 384 | 512 |
| 6 | STELLA MARIS II | 500KVA | 472 | 420 | 464 |

**Source: Port Harcourt Electricity Distribution Company (PHEDC)**



In calculating the transformer load and percentage load in Harbour Road 11KV feeder. The data in table 1 above are used in calculating the Transformer load, Percentage loading, Apparent, Active power, Reactive power and Complex power, as show below.

Current on transformer loading

Current, $I = \frac{I_R + I_Y + I_B}{3}$ 1

Apparent power $S_{VA} = \sqrt{3}\, x\, v$ x I 2

Percentage loading, (%);

% loading = $\frac{S_{VA}}{S_{MAx}} x$ 100 % 3

$S_{VA}$ = Operating KVA of the loads

$S_{MAX}$ = Rating of the transformer in (KVA)

Active power, P =$\sqrt{3}\, VI\ \cos\theta$ 4

Reactive power, Q =$\sqrt{3}\, VI\ \sin\theta$ 5

Complex power, S = P + Jq 6

**Case 1:** Ibeto junction transformer (500KVA)

Current, $I = \frac{I_R + I_Y + I_B}{3}$

$I = \frac{415+360+450}{3}$

$= \frac{1225}{3}$ = 408.33A

Applying equation 2

Apparent power, $S_{VA}$

$S_{VA} = \sqrt{3}\ x\ v\ x\ I$

$S_{VA} = \sqrt{3}\ x\ 0.415\ x\ 408.33A$

= 1.7320 x 0.415 x 408.33A

$S_{VA} = 293.49\ KVA$

Using equation 3, the percentage loading condition

% loading = $\frac{S_{VA}}{S_{MNx}} x\ 100\ \%$

% Loading = $\frac{293.49}{500} KVA\ x\ 100\%$

= 58.698%

Applying equation 4

The Active power, (P) = $\sqrt{3}\ VIcos\theta$

Where $cos\theta = 0.8$

But the $\sqrt{3}\ VI$ = 293.49x0.8

P = 234.792KW

Applying equation 5

The reactive power, (Q) = $\sqrt{3v1}\ sin\theta$

$\sqrt{3v\text{I}}$ = 293.49

$sin\theta = 0.6$

Thus, Reactive power = 293.49x0.6

Reactive power, (Q) = 176.094KVA

Applying equation 6

Complex power, (S) = P + JQ

S = 234.792KW + j176.094$K_{VAR}$

**Case 2: Stella Maris 1 transformer (500KVA)**

The current (I) = $\frac{198+118+208}{3}$

I = 175A

Using question 2 becomes,

$S_{VA} = \sqrt{3}\ x\ 0.415\ Kv\ x\ 175A$

$S_{VA}$ = 17320 x 0.415 x 175A

$S_{VA} = 125.79\ KvA$

Applying equation 3

% loading = $\frac{125.79\ x\ 100\%}{500}$

= 25.2%

Applying equation 4

Active power, (P) = 125.79 x 10.8

P = 100.63Kw

The Reactive power 3.5

Q = 125.79 x 0.6

Q = 75.47 $K_{VAR}$

Applying equation 6

Complex power, S

S = 100.63KW +j 75.47$K_{VAR}$

**Case 3: Stella Maris II transformer (500KVA)**

Using equation 1 Current

I = $\frac{265+372+414}{3}$

I = 350A

Using equation 2 Apparent Power, $S_{VA}$

$S_{VA} = \sqrt{3}\ x\ 0.415Kv\ x\ 350A$

= 1.7320 x 0.415Kv x 350A

$S_{VA} = 251.6KVA$

Using equation 3, the percentage loading condition

% loading = $\frac{251.6K_{VA}}{500K_{VA}}\ x\ 100\%$

= 50.3%

Using equation 4, Active power, (P)

Active power, (P) = 251.6 x 0.8

P = 201.28Kw

Using equation 5, Reactive Power, (Q)

Reactive power, (Q) = 251.6x0.6

Q = 150.96$K_{VAR}$

Using equation 6, Complex Power, (S)

Complex power, (S)

S = 201.28Kw + j150.96$K_{VAR}$

**Case 4: Sea shell Primary School Transformer (500KVA)**

Using equation 1, Current

I = $\frac{250 + 204 + 200}{3}$

I = 218A

Using equation 2, Apparent Power, $S_{VA}$

$S_{VA} = \sqrt{3}\ x\ 0.415Kv\ x\ 218A$

$S_{VA}$ = 1.7320 x 0.415Kv x 218A

$S_{VA} = 156.69\ KVA$

Using equation 3, the percentage loading condition

$\therefore \%\ loanding = \frac{156.69KVA}{500KVA}\ x\ 100\%$

= 31.3%

Using equation 4, Active Power, (P)

Active power, (P) = 156.69 x 0.8

P = 125.35 KW

Using equation 5, Reactive Power, (Q)

Reactive power, (Q) = 156.69 x 0.6

Q = 94.01$K_{VAR}$

Using equation 6, Complex power, (S)

Complex power, (S) =

S = 125.35KW + j 94.01$K_{VAR}$

**Case 5: Harbour Road Transformer (500KVA)**

Applying equation 1

I = $\frac{410 + 384 + 512}{3}$

I = 435.33A

Using equation 2, Apparent Power $S_{VA}$

$S_{VA} = \sqrt{3}\ x\ 0.415Kv\ x\ 35.33A$

= 1.732 x 0.415Kv x 435.33A

$S_{VA} = 312.91KVA$

Using equation 3, the percentage loading condition

$\therefore \%\ loading = \frac{312.91}{500}\ x\ 100$

= 62.58 %

Using equation 4, Active power, (P)

Active power, (P) = 312.91 x 0.8

P = 250.33Kw
Using equation 5, Reactive power, (Q)
Reactive power, (Q) = 312.91 x 0.6
Q = 187.76 KVAR
Using equation 6, Complex power, (S)
Complex power, (S) =
S = 250.33Kw x j 188.76KVAR

**Case 6: Milet Quarters transformer (500KVA)**
Using equation 1, Current
I = $\frac{472+420+464}{3}$
I = 452A
Applying equation 2 above
$S_{VA} = \sqrt{3}\, x\, 0.415Kv\, x\, 452A$
$S_{VA} = 1.732\, x\, 0.415Kv\, x\, 452A$
$S_{VA} = 324.89KVA$
Apply equation 3 above
$\therefore \%\, loading = \frac{324.89KVA}{500KVA}\, x\, 100\%$
% loading = 64.98%
Applying equation 3.4 above
Active power, (P) = 324.89 x 0.8
P = 259.91 Kw
Applying equation 5 above
Reactive power, (Q) = 324.89 x 0.6
Q = 194. 93 KVAR
Applying equation 3.6 above
Complex power, (S) =
S = 259.91 Kw x j 194.93KVAR

**Presentation of Data Collected**

i. System capacity, $1 \times 15MVA$ at 33KV Bus bar
ii. System capacity reactance of $15MVA$
iii. Present (maximum) load; $11MVA$
iv. Proposed power factor (Pf); 70%
v. Proposed power factor (Pf); 96%
vi. Received line voltage ($V_L$); $33KV$
vii. Sending end line voltage ($V_S$); $11KV$
viii. System frequency ($f$); $50H_Z$

**Analytical Formulation and Data Processing**

Processing of data collected and analytical formulation are presented as follows:
Hence;

i. Determination of present $MVA$ demand $MVA_1$

$$\text{Present } MVA\ demand = \frac{Present\ \ Load}{Present\ \ Power\ \ Factor} = MVA \qquad 7$$

$$\text{Present, } MVA\ (demand) = \frac{11MW}{0.70} = 15.7143$$

$$\therefore \quad MVA_1 = 15.7143$$

ii. Determination of proposed $MVA\ demand\ (MVA)_2$ or proposed power factor ($pf$)

$$\text{Proposed } MVA\ demand = \frac{present\ \ load\ \ (MW)}{Proposed\ \ power\ \ factor} = (MVA)_2 \qquad 8$$

$$(MVA)_2 = \frac{11}{0.96}$$

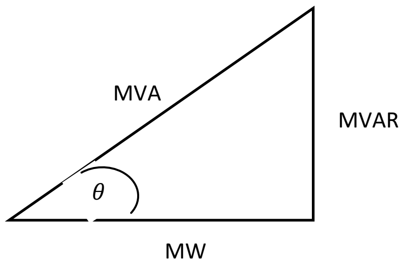
$\therefore \quad (MVA)_2 = 11.4583$

iii. Determination of reactive power $(MVAR)$, size required to compensate for voltage drop, closes etc given as;

$MVAR = \ Size\ of\ reactive\ power\ required$

Hence;

Using the first principle of power triangle, Pythagoras principle:




Power Triangle

i.e $(MVA)^2 = (MW)^2 + (MVAR)^2$ 9

$(MVAR)_1 = \sqrt{(MVA)_1^2 - (MW)_1^2}\ for\ 70\%\ power\ factor$ 10

$where$

$(MVA)_1; = 15.714,$ $(Mw)_{1;}11$

Applying equation 10 gives

$(MVAR)_1 = \sqrt{(15.714)_1^2 - (11)^2}$

$(MVAR)_1 = \sqrt{246.92796 - 121}$

$(MVAR)_1 = 11.22$

Similarly applying equation (10) for this proposed power factor of 96%

$(MVAR)_2 = \sqrt{(MVA)_2^2 - (MW)}$

Where

$(MVA)_2 = 11.4583$ from equation (8)

$(MW)_1 = (MW)_2 = 11$

$(MVAR)_2 = \sqrt{(11.4583)_2^2 - (11)^2}$

$MVAR_2 = \sqrt{131.2934028 - 121}$

$MVAR_2 = \sqrt{10.29340278}$

$MVAR_2 = 3.20$

$\therefore \quad MVAR_2 = 3.20$

Hence Reactive power (Sizing) becomes

$MVAR = MVAR_2 - MVAR_1$

$= 3.20 - 11.22 = -8.02$

$= -8MVAR$

Hence, it is imperative to point out that the negative sign represent the lagging power factor

Collected values from the substation

Line Voltage $(V_L) = 33KV$

Capacitor bank calculated = 8 KVAR

Capacitor bank Line current $(I_{LC})$

$$I_{LC} = \frac{MVAR}{\sqrt{3}\,(V_L)} = \frac{8 \times 10^6}{\sqrt{3} \times 33 \times 10^3}$$

$= 139.968A$

Phase current of capacitor bank ($I_{ph}$)

$$I_{ph} = \frac{I_{LC}}{\sqrt{3}} = \frac{139.968}{\sqrt{3}} = 80.8A$$

Thus the capacitive reactance is $XC$,

$$XC = \frac{V_L}{I_{ph}}$$

Where $XC$ is capacitive reactance

$V_L = Line\ Voltage$

$I_{ph} = Phase\ current\ to\ capacitor\ bank$

Thus $XC = \frac{V_L}{I_{ph}} = \frac{33\times10^6}{80.8}$

$= 408.4\Omega/ph$

v. Determination of capacitance for phase of the capacitor bank from

$$XC = \frac{1}{2\pi fxc}$$

$Where\ f = frequency = 50\ H_Z$

$\pi = 3.142\ constant\ for\ frequency\ related\ values$

Thus capacitance, $C = \frac{1}{2x \times 50 \times 408.4}$

$= 7.79407 \times 10^{-7}F$

$= 77.9407 \times 10^{-6}$

$= 78\mu F$

## IV. RESULTS AND DISCUSSION

Figure 4.1 shows the voltage magnitude and phase angle of the existing and improved study case, for bus1-10, there is slight improvement in the voltage profile.

Figure 4.2 shows voltage profile improvement in bus 5, 7 and 9 by the addition of capacitor bank placement (8KVAR) respectively at bus 4 and bus 34.

Figure 4.3 shows a graphical representation of voltage profile improvement to the study case under investigation. By the addition of capacitor bank (10KVAR) to the existing system under investigation. The voltage level improved significantly, this will enhance good power quality in the study zone Harbour Road.

**Table 2:** % Voltage Magnitude Versus Bus Number

| Buses | % Voltage Magnitude(existing) | voltage angle1 | %Voltage Magnitude(improved) | voltage angle2 |
|---|---|---|---|---|
| bus-1 | 99.3 | -0.1 | 100 | 0 |
| bus-2 | 99.3 | -0.1 | 99.96 | 0 |
| bus-3 | 99.2 | -0.1 | 99.393 | -0.1 |
| bus-4 | 99.11 | -0.1 | 99.402 | -0.1 |
| bus-5 | 99.886 | -0.1 | 100.339 | -0.1 |
| bus-6 | 98.902 | -0.1 | 99.407 | -0.1 |
| bus-7 | 98.711 | -0.1 | 99.45 | -0.1 |
| bus-8 | 98.703 | -0.1 | 97.666 | 0 |
| bus-9 | 99.392 | -0.1 | 99.276 | -0.1 |
| bus-10 | 95.914 | 0.1 | 99.166 | -0.1 |

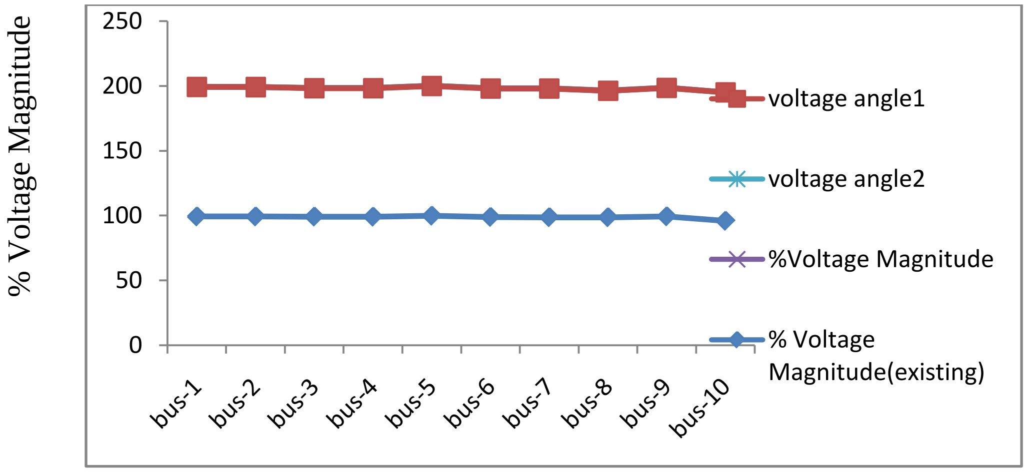



**Fig. 3: % Voltage Magnitude Versus Bus Number**

**Table: 3 % Voltage magnitude versus voltage angle.**

| Buses | % Voltage Magnitude(existing) | voltage angle1 | %Voltage Magnitude (improved) | voltage angle2 |
|---|---|---|---|---|
| bus-1 | 99.3 | -0.1 | 100 | 0 |
| bus-2 | 99.3 | -0.1 | 99.96 | 0 |
| bus-3 | 99.2 | -0.1 | 99.393 | -0.1 |
| bus-4 | 99.11 | -0.1 | 99.402 | -0.1 |
| bus-5 | 99.886 | -0.1 | 100.339 | -0.1 |
| bus-6 | 98.902 | -0.1 | 99.407 | -0.1 |
| bus-7 | 98.711 | -0.1 | 99.45 | -0.1 |
| bus-8 | 98.703 | -0.1 | 97.666 | 0 |
| bus-9 | 99.392 | -0.1 | 99.276 | -0.1 |
| bus-10 | 95.914 | 0.1 | 99.166 | -0.1 |



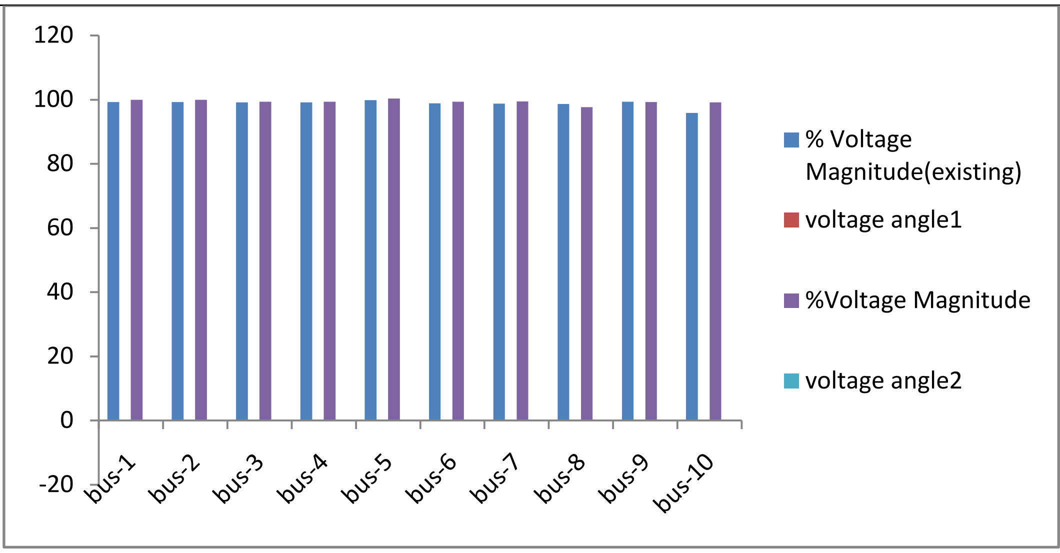



**Fig. 4: Voltage Magnitude (Existing) Versus Bus-Number.**

**Table 4: % Voltage Magnitude and Voltage Magnitude Improvement**

| Buses | % Voltage Magnitude (existing) | voltage angle1 | %Voltage Magnitude (improved) | voltage angle2 |
|---|---|---|---|---|
| bus-1 | 99.3 | -0.1 | 100 | 0 |
| bus-2 | 99.3 | -0.1 | 99.96 | 0 |
| bus-3 | 99.2 | -0.1 | 99.393 | -0.1 |
| bus-4 | 99.11 | -0.1 | 99.402 | -0.1 |
| bus-5 | 99.886 | -0.1 | 100.339 | -0.1 |
| bus-6 | 98.902 | -0.1 | 99.407 | -0.1 |
| bus-7 | 98.711 | -0.1 | 99.45 | -0.1 |
| bus-8 | 98.703 | -0.1 | 97.666 | 0 |
| bus-9 | 99.392 | -0.1 | 99.276 | -0.1 |
| bus-10 | 95.914 | 0.1 | 99.166 | -0.1 |

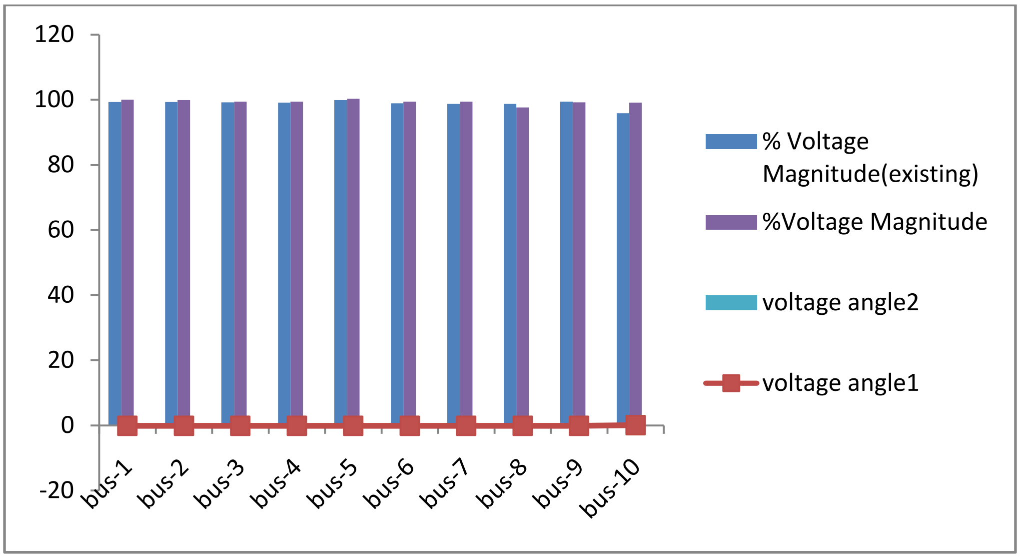



**Fig. 5: Existing Voltage Magnitude And Improved Voltage Magnitude**

**Table 5: % Voltage Magnitude Versus Power (MW)**

| Buses | % Voltage Magnitude(existing)1 | MW existing | MVAR existing | % Voltage Magnitude(existing)2 | MW - improved | MVAR existing2 |
|---|---|---|---|---|---|---|
| bus-1 | 99.3 | 0.009 | 0.006 | 99.3 | 0.009 | 0.006 |
| bus-2 | 99.3 | -0.009 | -0.006 | 99.3 | -0.009 | -0.006 |
| bus-3 | 99.2 | 0.009 | 0.006 | 99.2 | 0.009 | 0.006 |
| bus-4 | 99.11 | -0.001 | -0.001 | 99.11 | -0.001 | -0.006 |
| bus-5 | 99.886 | 0 | 0 | 99.886 | 0 | -0.001 |
| bus-6 | 98.902 | 0 | 0 | 98.902 | 0 | 0 |
| bus-7 | 98.711 | 0 | 0 | 98.711 | 0 | 0 |
| bus-8 | 98.703 | 0 | 0 | 98.703 | 0 | 0 |
| bus-9 | 99.392 | 0 | 0 | 99.392 | 0 | 0 |
| bus-10 | 95.914 | 0 | 0 | 95.914 | 0 | 0 |

To resize chart data range, drag lower right corner of range.

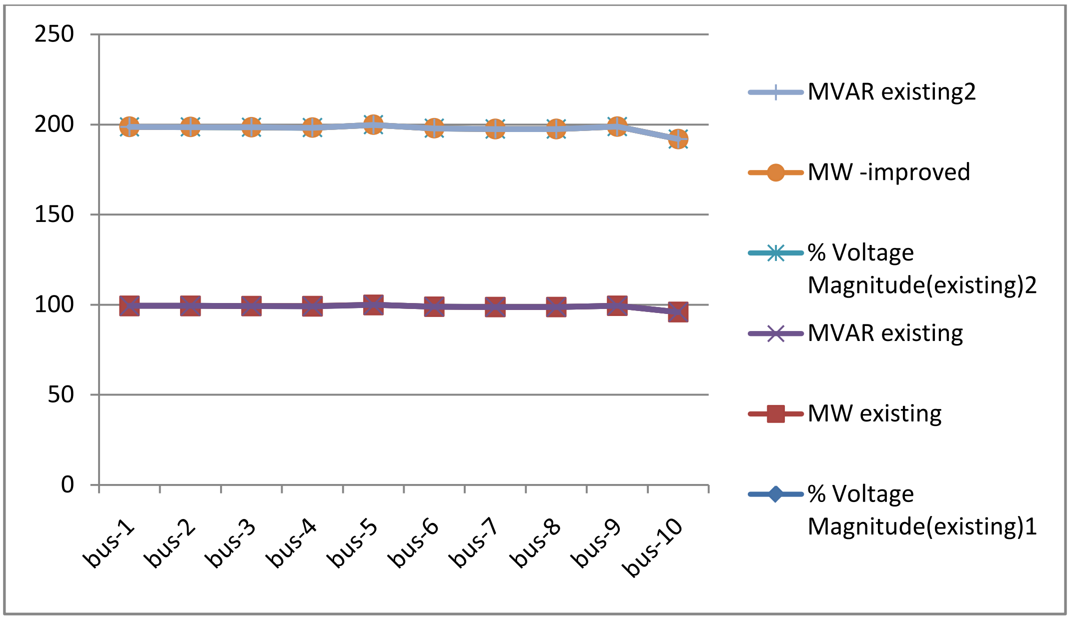



**Fig. 6: Power, (MVAR) Versus MW**

## V. CONCLUSION AND RECOMMENDATION

**Conclusion**

After careful examination of the study case (Harbour Road 11Kv distribution network), the research work showed that the existing state of the electrical power network of Harbour Road 11Kv distribution network taking its supply of power from 33/11Kv Reclamation Injection Substation feeder has some system failures which includes: overloading of existing power distribution transformers, outages to distribution feeders, gradual system collapse and poor power quality.



**Recommendation**

Based on the analysis and findings, the following recommendations are pointed out to ensure optimal performance and reliability of the 11kv distribution. Replacement of undersized cables in the network.

- Fixing capacitor bank compensator where necessary in order to reduce voltage instability problems, electricity cost due to excessive losses.
- Periodic load flow analysis should be carried out by the Port Harcourt Electricity Distribution Company (PHEDC) to know the status of the network without over stressing the system (ETAP 16.00 version).

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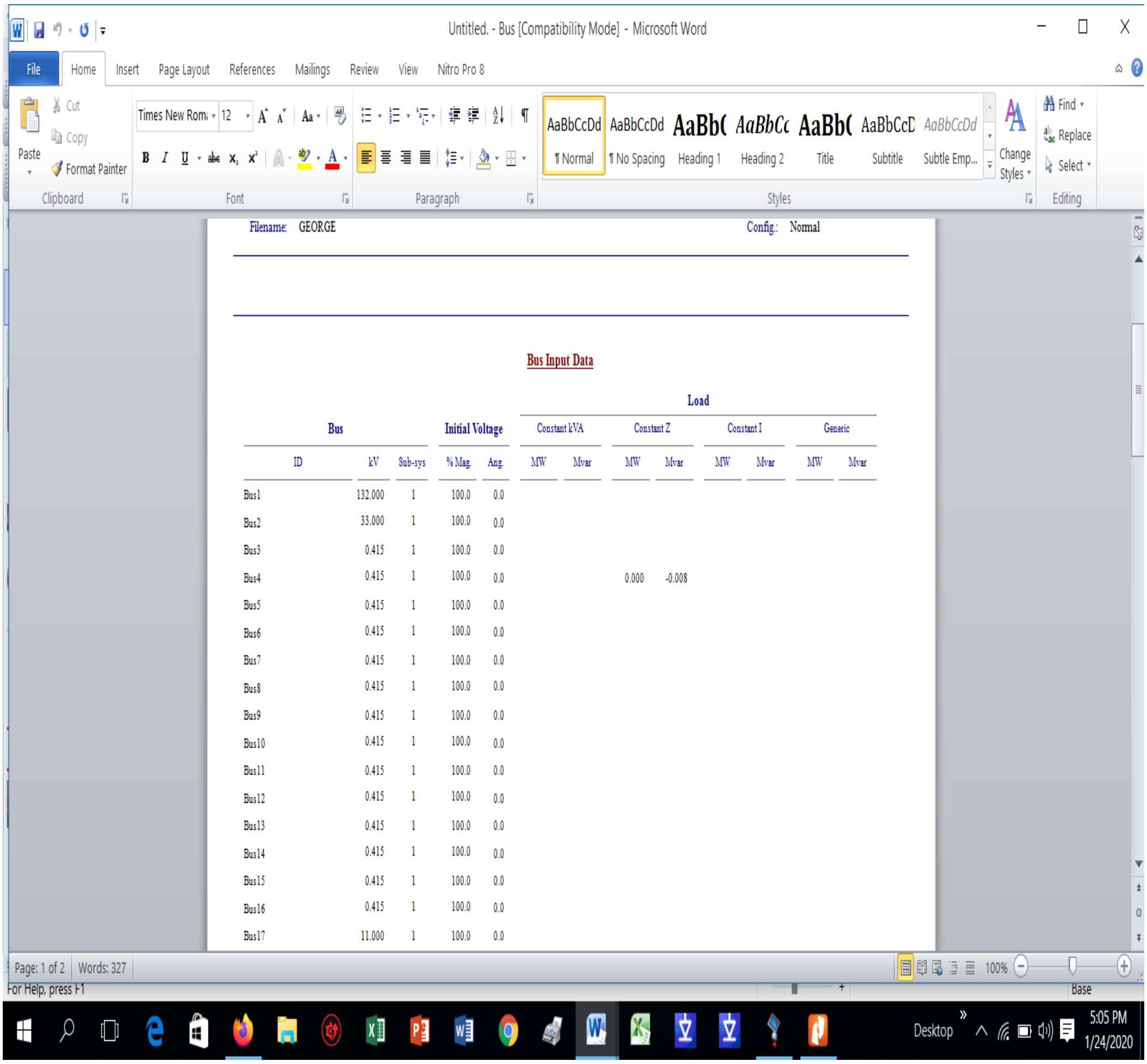
# Appendix 1

## Bus Voltage

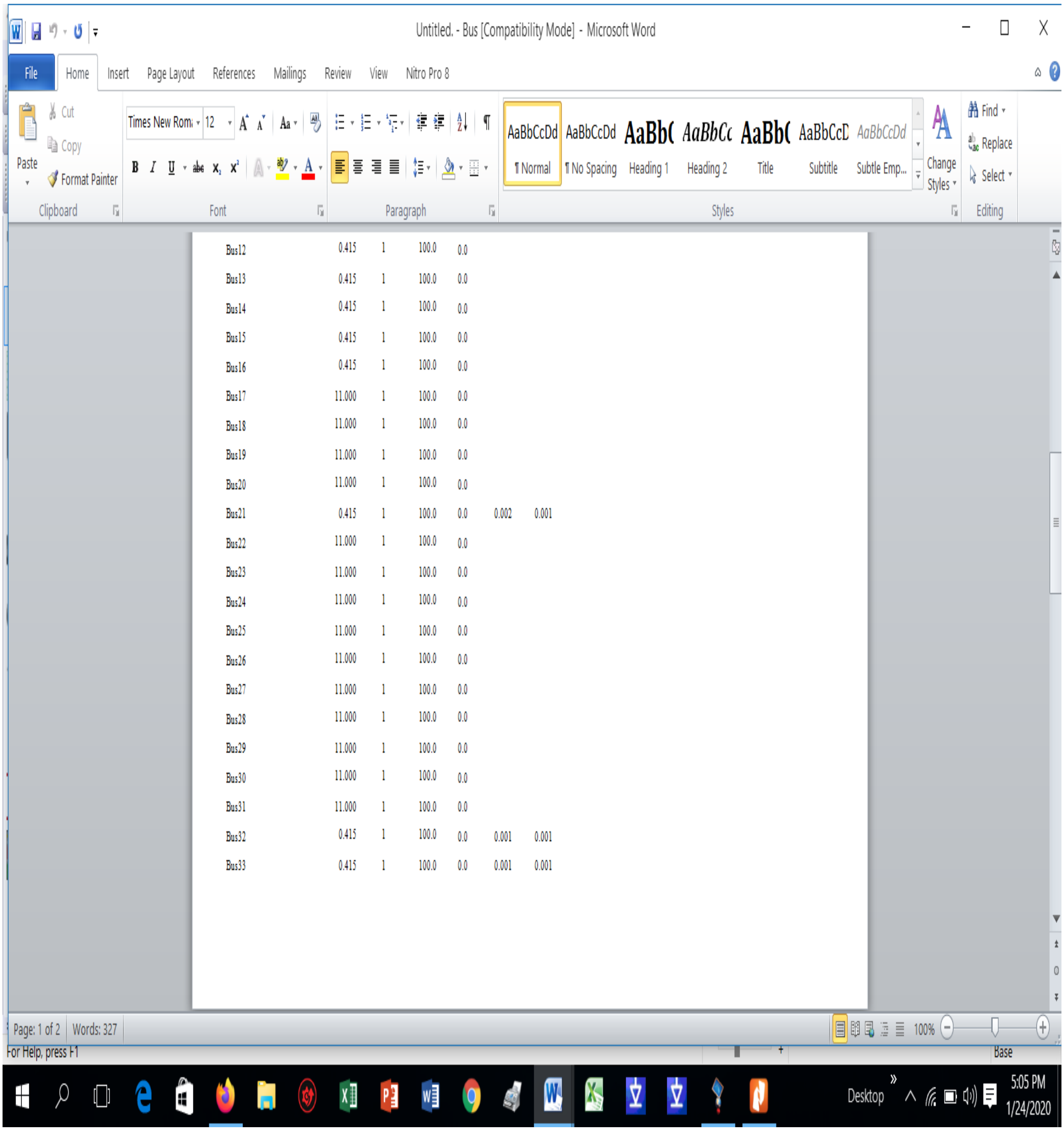


Filename: GEORGE Config.: Normal

**Bus Input Data**

| Bus | | | Initial Voltage | | Load | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Constant kVA | | Constant Z | | Constant I | | Generic | |
| ID | kV | Sub-sys | % Mag. | Ang. | MW | Mvar | MW | Mvar | MW | Mvar | MW | Mvar |
| Bus1 | 132.000 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus2 | 33.000 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus3 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus4 | 0.415 | 1 | 100.0 | 0.0 | | | 0.000 | -0.008 | | | | |
| Bus5 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus6 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus7 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus8 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus9 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus10 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus11 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus12 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus13 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus14 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus15 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus16 | 0.415 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus17 | 11.000 | 1 | 100.0 | 0.0 | | | | | | | | |

# Appendix 2



| | | | | | | |
|---|---|---|---|---|---|---|
| Bus12 | 0.415 | 1 | 100.0 | 0.0 | | |
| Bus13 | 0.415 | 1 | 100.0 | 0.0 | | |
| Bus14 | 0.415 | 1 | 100.0 | 0.0 | | |
| Bus15 | 0.415 | 1 | 100.0 | 0.0 | | |
| Bus16 | 0.415 | 1 | 100.0 | 0.0 | | |
| Bus17 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus18 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus19 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus20 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus21 | 0.415 | 1 | 100.0 | 0.0 | 0.002 | 0.001 |
| Bus22 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus23 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus24 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus25 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus26 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus27 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus28 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus29 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus30 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus31 | 11.000 | 1 | 100.0 | 0.0 | | |
| Bus32 | 0.415 | 1 | 100.0 | 0.0 | 0.001 | 0.001 |
| Bus33 | 0.415 | 1 | 100.0 | 0.0 | 0.001 | 0.001 |