An Analysis of Electric Power Faults in Mubi Undertaking Station, Adamawa State, Nigeria.

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ABSTRACT

This paper is devoted to faults analysis in two transmission lines that supply Mubi Undertaking Station. Types of faults were collected monthly from the power holding company of Nigeria monitored from January to December 2006. Total faults of 128 were recorded in the two transmission line leading to power failure from time to time in the area. The analysis shows that the Gombe transmission line has the highest faults of about (55%) and these faults occurred more frequently in the month of May followed by June 2006.

(Keywords: faults, power interruption, electric power, feeder/transmission line)

INTRODUCTION

Electric power has become very essential in every human life especially in urban areas, but its reliability in Nigeria today is questionable. Electric power interruptions has become a major area of concerned to individuals and to the Nigeria Government. From 1999–2002, the Federal Government of Nigeria attempted to bring an end to the existing problems of power interruption in Nigeria, however, the situation prevailed. Power interruption in Mubi zone has caused a lot of set backs particularly in the area of business, handwork, and industrial activities.

The electric power distribution network starts from a substation after it has come form overhead transmission lines through a the stepped down transformer of 330/132/33KV; further stepped down to 415/240V for domestic use (Ogujor, 2006). Any reliable electric power system should serve consumers without awkward interruptions in power supply voltage, but in the situation in Nigeria today, consumers of the electric power sector are subjected to unplanned outages on a regular basis which influence customer satisfaction (Brown, 2002). The uncertainty of the power supply may be due to outdoor environmental factors and the fact that the transmission lines are geographically dispersed over very wide areas. The electric faults may be as a result of transient lightning strikes, lines tangled by wind, branches of untrimmed tress touching the line, birds/animal, vehicle accidents, rain storms, or permanent conductors faults such as grounded conductors, cut conductors, or shattered insulators (Nasa, 1990). This paper aims to analyze the causes of various faults, the frequency of their occurrence, and also provides useful suggestions to minimize electric power failure in the Mubi undertaking.

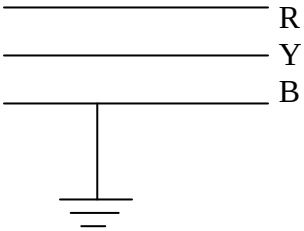
CAUSES OF POWER FAILURE IN NIGERIA

Power failure occurs when there is a disturbance in the electrical power transmission/distribution line. When these faults occur there is an immediate demand for repairs of the electrical power line. Basically there are two types of outages:

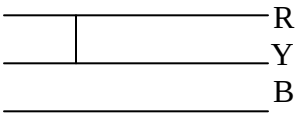
1. Power outages, lasting one minute or longer
2. A momentary interruption which typically lasts less than a second.

A power outage lasting one minute or longer, usually happens when a problem occurs somewhere along the electric distribution system; this can be anyplace between a power plant and end-user. This is usually caused by any number of circumstances such as storms and lightning. When a power outage occurs, Power Holding Company (PHC) will respond to the outage and make any repairs necessary to restore power (Ali, 2005).

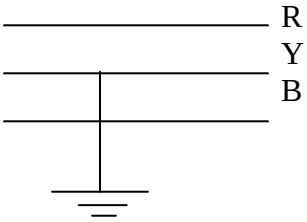
Type of Faults



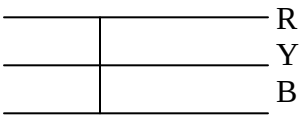
(a) Single Phase to Earth Faults.



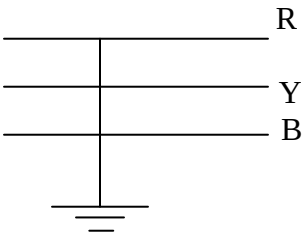
(b) Two Phases Not to Earth Faults.



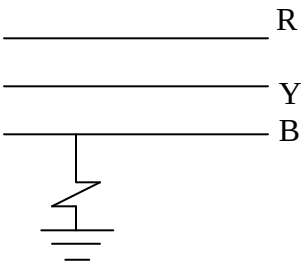
(c) Two Phases to Earth Faults.



(d) Three Phases Not to Faults.



(e) Three Phases to Earth Faults.



(f) Single Phases to Earth Through a Resistor.

(g) Open Circuit Faults.

Let A = Single phase to faults through a resistor
B = open circuit faults
C = two phase faults
D = three phase faults
E = two phase to earth faults
F = three phase to earth faults
G = single phase to earth faults

(PHC Mubi, 2006)

A momentary interruption typically lasts less than a second and is usually caused by a short circuit. Short circuits happen when something comes in contact with power lines, such as an animal or tree, or when power lines come in contact with each other. When this happens a “breaker” automatically de-energizes the circuit and causes an interruption in service. Special electrical equipment is designed to quickly open and close the breaker two or three times automatically – in separate attempts to clear the problem. When this occurs, an end-user might experience a momentary interruption each time. In most cases, short circuits clear themselves and a power outage is avoided. If the problem persists however, PHC will respond to the outage and make any repairs necessary to restore power. (Nasa,1990).

STUDY AREA AND JUSTIFICATION

Mubi is the second largest town in Adamawa State in Nigeria, it is located between latitude $10^0 1^1$N and $10^0 21^1$N, longitude $13^0 1^1$E and $13^0 30^1$E. It occupies a land area of about 725.85Km^2 with a projected population of over 345,137 (Adebayo, 2004).

Mubi town has four different tertiary institutions which include Adamawa State University, Federal Polytechnic, Adamawa State College of Agriculture, and College of Health and Technology. It also has general hospital and water board. All of these organizations mentioned above depend on electric power to carry out most of their activities.

Mubi is also known as one of the highest commercial area in the Northeast of Nigeria. Most of these commercial activities depend on stable electric power to carry out their business, handwork, and small industrial activities. The inconsistency of the electric power supply as a result of power interruptions due to electric faults, have caused people and industry many set backs in the areas of educational and business activities in Mubi. This situation has prompted the research presented here into the causes and nature of faults and the frequency of their occurrence so that useful suggestions and recommendations can be can be drawn from the analysis made to minimize the rate of the power failure in Mubi town.

METHOD OF DATA COLLECTION

The monthly breakdown of faults in the Domboa and Gombe feeders were collected from the Power Holding Company, Mubi undertaking. The faults investigation was conducted in the Mubi zone by the PHC. These monthly breakdowns of faults in the two feeders are presented in Tables 1, 2, and 3, below.

Table 1: Monthly Breakdown of Faults in 2006 Damboa Feeder.

Feeder	Types of Faults	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Damboa	A	0	3	0	2	2	2	0	1	0	1	1	0	12
	B	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	3	0	2	1	4	3	1	1	0	2	0	1	18
	D	0	0	0	0	0	0	0	0	0	0	0	0	0
	E	0	0	1	1	3	2	1	0	1	1	2	1	13
	F	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	2	2	0	2	2	1	1	0	2	1	1	0	14
Total		5	5	3	6	11	8	3	2	3	5	4	2	57

Table 2: Monthly Breakdown of Faults in 2006 Gombe Feeder.

Feeder	Type of Faults	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Gombe	A	1	1	3	2	4	3	1	1	0	1	0	0	17
	B	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	1	1	4	3	2	2	1	1	1	0	1	17
	D	0	0	0	0	0	0	0	0	0	0	0	0	0
	E	1	1	0	1	2	3	2	1	1	2	1	1	16
	F	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	3	1	2	6	4	2	0	1	1	1	0	21
Total		2	6	5	9	15	12	7	3	3	5	2	2	71

Table 3: Total Monthly Types of Faults.

Month/ Faults	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A	1	4	3	4	6	5	1	2	0	2	1	0	29
B	0	0	0	0	0	0	0	0	0	0	0	0	0
C	3	1	3	5	7	5	3	2	1	3	0	2	35
D	0	0	0	0	0	0	0	0	0	0	0	0	0
E	1	1	1	2	5	5	3	1	2	3	3	2	29
F	0	0	0	0	0	0	0	0	0	0	0	0	0
G	2	5	1	4	8	5	3	0	3	2	2	0	35
Total	7	11	8	15	26	20	10	5	6	10	6	4	128

FAULTS ANALYSIS

The graphs in Figures 1, 2, and 3, show the analysis of the breakdown of monthly faults and total faults in the feeders, respectively.

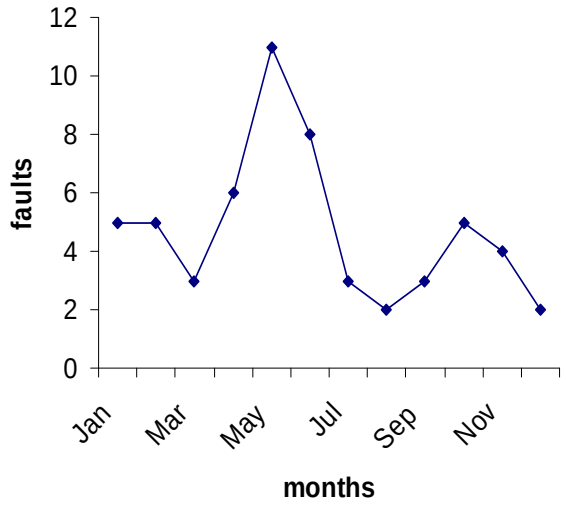


Figure 1: Monthly Breakdown of Faults in Domboa Feeder.

The frequency of the faults is determine by using pie chart, the faults angle is calculated using Equation (1) as (Ezeowu, 1990):

$$X_A^0 = \frac{y}{z} \times 360^0 \qquad \textbf{(1)}$$

where $y =$ the number of faults per feeder
$z =$ total number of faults
$X_A^0 =$ the faults angle in degree

$$X_A^0 = \frac{29}{128} \cdot 360^0 = 81.6^0$$

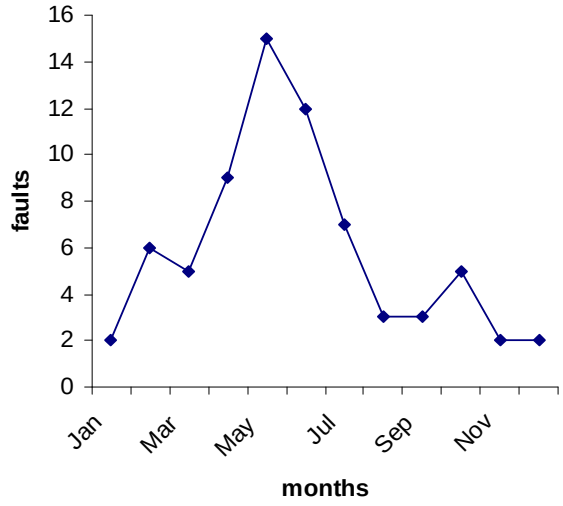


Figure 2: Monthly Breakdown of Faults in Gombe Feeder.

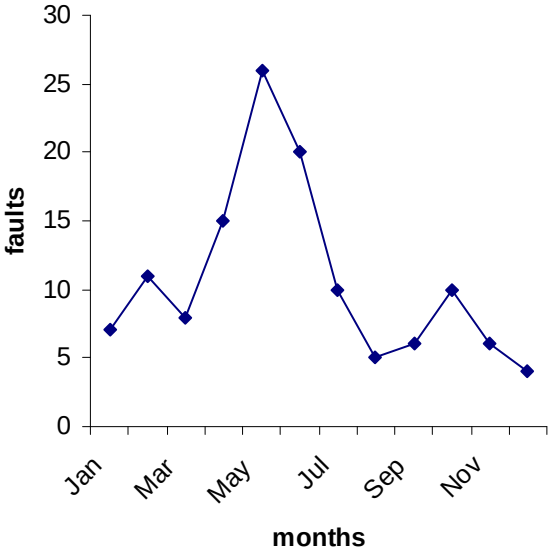


Figure 3: Total Types of Faults in Gombe and Domboa Feeder.

in similar manner the other values of x0 are obtained as shown in Table 4.

Table 4: Faults Angle Calculation.

Faults	Faults Angle (x^0)
A	81.6
B	0
C	98.4
D	0
E	81.6
F	0
G	98.4
Total	360

The information in table 4 can be represented below in pie chart as:

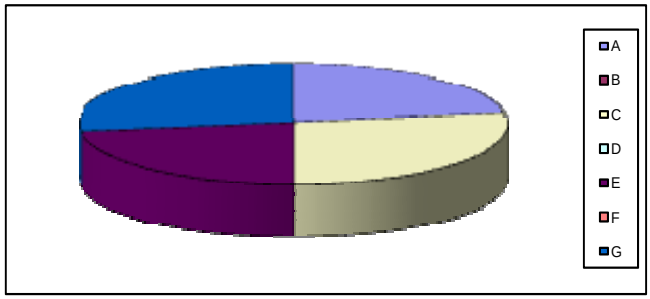


Figure 4: Fault Distribution Pie Chart.

DISCUSSION

The monthly breakdown of faults monitored from January – December 2006 is analyzed in Figure 1 and Figure 2. These two graphs show that the month of May had the highest number of faults followed by June 2006. In Figure 1, the lowest level of faults were recorded in the month of December followed by November. Figure 2, the lowest number of faults were recorded in the month of August. These monthly faults in the two feeders were combined in Figure 3 and shows that the month May had highest number of faults in the year followed by June. This may be attributed to thunder storm, rain storms, and strong wing activities during the early rainy season of the year in the Northeastern region of Nigeria.

The lowest level of faults were recorded in the month of December followed by November when the no more thunder storms, rain storms, and strong winds are prevalent.
Figure 4 describes the frequency of the faults (faults angle) occurred in the two feeders, single phase to Earth faults and two phase faults occurred more frequently than the single phase to Earth faults through a resistor and two phase to earth faults. Open circuit faults, three phase faults and three phases to earth faults did not completely occurred throughout the year.

Table 2 indicates that faults appeared to occurs more frequently in Gombe feeder than Damboa which is about 55.5%. The reason for this may be related to the length that the Gombe feeder covers which is a wider area and may be subjected to many outdoors variables.

CONCLUSION

Fault occurrences have been investigated and recorded in the power distribution network in Mubi zone between the months of January to December 2006. A total of 128 faults occurred in the two feeders that led the power failure/ interruption in Mubi zone. This study reveals that if the following recommendations are put in place it would tremendously reduce the causes of power failure in Mubi undertaking station and Nigeria at large.

RECOMMENDATIONS

1. There should be proper vegetation management to reduce incidents of Earth faults,
2. All defective components should be replaced before the rainy season,
3. Animal guards should be provided on poles and towers,
4. Power Holding Company should adapt to underground transmission line connections, and
5. Power Holding Company should find a means of preventing birds and other animals from coming into contact with the power lines.

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