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Electrical Power Failure in Nigeria-A Case Study of the 33KV Feeder in Benin District

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Abstract: Electrical power interruption/failure has been a persistent problem in Benin District. This study looks at the Benin District of power holding company of Nigeria 33KV feeder. The availability and non-availability of the various 33KV feeders that make up the Benin District including failure report analysis are also presented. The study revealed the causes of failure and the problem associated with the 33KV feeder under the District. A number of suggestions were proffered to improve the availability of Electric power supply in the district. The study will be of relevance to power system engineers involved in transmission and distribution of electric power.

Key words: Feeder, 33KV, Benin District, power failure, Nigeria

INTRODUCTION

Transmission and distribution of voltages vary from country to country, the difference originating mainly from geographical and historical reason. The power holding company of Nigeria has the monopoly of electric power supply in Nigeria. The generation, transmission, distribution and marketing of this commodity in Nigeria is solely done by the power holding company of Nigeria.

As the load and population grow, generation, transmission and distribution must be increased to cope with this growth, expansion of supply system must often be planned years in advance. The validity such planning depends to a great extent on the quality of the forecast, future substation load upon which plan is based.

The electrical energy demand in Benin district has continued to increase yearly in recent times due to development and population growth of the people. As a result of this accelerated growth of power consumption in the district, the supply authority try as much as possible to satisfy the public demand. In doing this some of the supply facilities are over stretched. When the supply facilities are over stretched coupled with poor maintenance culture, power supply problems are inevitable. Regular maintenance of equipment is essential for good performance and long trouble free service. A new name in maintenance is tero-technology defined as a combination of management, financial engineer and other practices applied to physical assets in pursuit of economic life cost, its practice is concerned with the specification and design for reliability and maintainability of plant, machinery equipment, buildings and structures and their installation, commissioning, maintenance, modification and replacement. Maintenance strategy is thus a planed device for the maintenance of given equipment (Gupta, 1993; Hughes, 1978).

33KV FEEDERS IN BENIN DISTRICT

The Benin District electric power transmission station gets its power supply from Sapele generation station at a voltage level of 330KV. This voltage is stepped down by 90MVA transformer to a voltage of 132KV and the 132KV is fed into the 132KV busbar and further stepped down to a voltage level of 33KV by, T_2 1X 30MVA transformer and being step down to 33KV, which supply the whole of Benin down to Oghara, Koko and so on. From the same busbar, the 132KV is transmitted to Irrua 45MVA transformer where it is stepped down to 33KV and supply the area down to Ekpoma, Uzebba, Ebelle e.t.c. From Irrua, the 132KV is transmitted to Okpella 15MVA 132/33KV substation from there to Okene 30MVA 132/33KV is substation which supply area around the places.

The Benin Electric power transmission station also gets electric power supply from other power stations. This is in the case of electric power failure of Sapele generation station. For example, electric power supply from Delta line 1 and 2 generation station at Ughelli at a voltage level of 132KV, this voltage is fed into a busbar and stepped down to 33KV by a step down transformer.

To achieve this economically, safely and reliably several sophisticated equipments are involved. Some of

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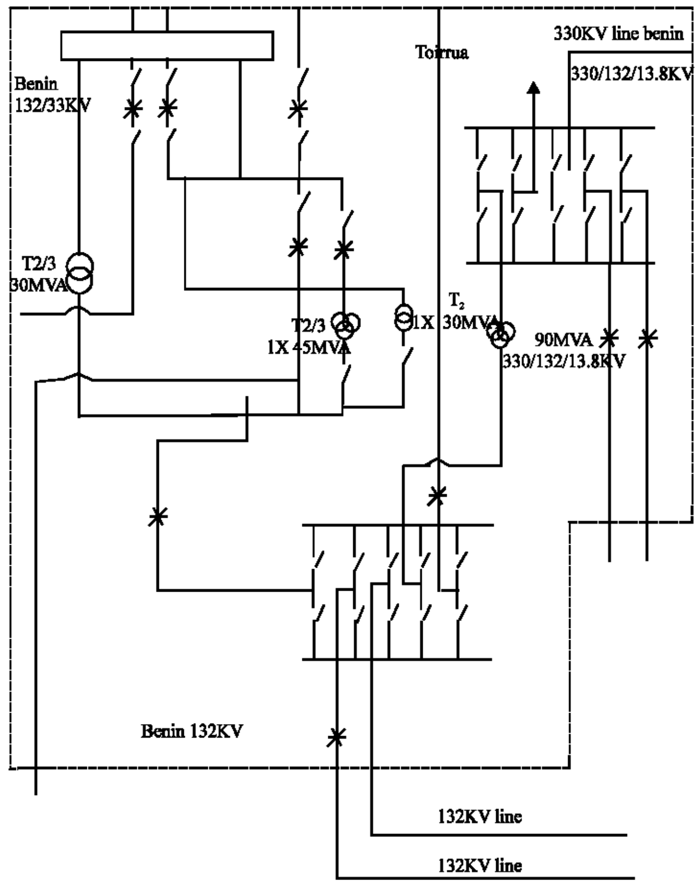

Fig. 1: Atypical Schmatic diagram of 33KV power in benin district under study

the principal units associated with power transmission are: Transformers, reactors and switch gears, circuit breakers and feeder pillars, ring main units, fuses, isolators etc. A typical schematic diagram of 33KV power in Benin district under study is shown in Fig. 1.

Maintenance is an essential work, which must be carried out on the feeder for continuous availability and reliability. For effective management, maintenance is divided into four sections. The sections are:

- Line section, which is charged with the responsibility of maintaining already existing line and also constructing new ones or an extension to the already existing one.
- Cable jointing section, which is responsible for connection and termination of cables like paper insulated led sheathed copper high voltage cable, cross-linked polyethylene copper high cable e.t.c.
- Filter section, which is in charge of the installation and maintenance of transformer, ring main units, oil circuit breakers and feeder pillars. This section also carry out earthling of these electrical equipment and the distribution substation.
- Protection section, which is in charge of testing of the entire distribution appliance like the transformer, ring main unit, the feeder pillar, cables e.t.c and the same time control the entire distribution process (Theraja and Theraja, 1998).

Problems with the benin district: The problems of 33KV electrical power supply of the Benin district are basically the problems faced by the supply authority both in the hands of electrical consumers and government. The problems go as far to delay rectification of faults and even abandonment of faulty equipment for so long. Most of the problems facing 33KV power supply as follows:

- Shortage of manpower.
- Lack of adequate planning.
- Vandalization of electrical equipment.
- Illegal installations.
- Poor financing.
- Negligence of power holding company staff and institutional staff.

- Low levels of water in Kainji Dam.
- Earth fault problems.
- Over current problems.
- Problem due to system disturbance.
- Problem of load shedding e.t.c. (PHCN, 2001a, b).

RESULTS AND DISCUSSION

A study was carried out on daily bases for a period of 1 year to know the performance of some feeder pillars in Benin district is shown in the Table 1.

Table 1 describes the feeders available and those that are not available for time specified. In the tables, A stand for feeders available for the whole day, P stands for the feeders available for a part of day and U stands for unavailable for the whole day. The dates, months and years under consideration are also specified. Some of the feeders under the district considered are: Guinness 33KV feeder, Ikpoba Dam 33KV feeder, G.R.A 33KV feeder, Nekpenekpen 33KV feeder, Etete 33KV feeder and Sapele/Koko 33KV feeder.

The analysis of results for availability, partial availability and nonavailability or unavailability of fault report from January to December 2005 in Benin district is shown Table 2.

For the Guinness 33KV feeder, total feeder available for the whole day (A) in the 12-month was 320. Total feeder available for Part of the day (P) in the 12-month was 43. While total feeder Unavailable for the whole day (U) in the 12 month was 3.

Table 1: Failure report from january to december 2005

	January 2005				February 2005				March 2005				April 2005			
Feeders	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Guinness	28	2	1	31	26	2	0	28	25	5	1	31	22	8	0	30
Ikpoba Dam 33KV feeder	28	3	0	31	25	3	0	28	27	4	0	31	29	1	0	30
G.R.A 33KV feeder	30	1	0	31	26	2	0	28	28	3	0	31	28	2	0	30
Nekpenekpen 33KV feeder	31	0	0	31	26	2	0	28	29	2	0	31	29	1	0	30
Etete 33KV feeder	31	0	0	31	27	1	0	28	26	5	0	31	26	4	0	30
Sapele/Koko 33KV feeder	30	1	0	31	27	1	0	28	27	3	1	31	29	1	0	30
Total	178	7	1		157	11	0		162	22	2		163	17	0	

	May 2005				June 2005				July 2005				August 2005			
Feeders	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Guinness	29	2	0	31	26	4	0	30	28	3	0	31	27	4	0	31
Ikpoba Dam 33KV feeder	28	3	0	31	28	2	0	30	29	2	0	31	28	3	0	31
G.R.A 33KV feeder	29	2	0	31	28	2	0	30	29	2	0	31	30	1	0	31
Nekpenekpen 33KV feeder	31	0	0	31	27	3	0	30	30	1	0	31	30	1	0	31
Etete 33KV feeder	30	1	0	31	27	3	0	30	29	2	0	31	31	0	0	31
Sapele/Koko 33KV feeder	29	2	0	31	26	4	0	30	27	4	0	31	28	3	0	31
Total	176	10	0		162	18	0		172	14	0		174	12	0	

	September 2005				October 2005				November 2005				December 2005			
Feeders	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Guinness	27	3	0	30	27	4	0	31	27	3	0	30	27	3	1	31
Ikpoba Dam 33KV feeder	26	4	0	30	29	2	0	31	29	1	0	30	30	1	0	31
G.R.A 33KV feeder	29	1	0	30	29	2	0	31	29	1	0	30	31	0	0	31
Nekpenekpen 33KV feeder	29	1	0	30	29	2	0	31	29	1	0	30	31	0	0	31
Etete 33KV feeder	29	1	0	30	30	1	0	31	27	3	0	30	30	1	0	31
Sapele/Koko 33KV feeder	27	3	0	30	27	4	0	31	23	2	5	30	30	1	0	31
Total	167	13	0		171	15	0		164	11	5		179	6	1	

1 = Availability (A), 2 = Partial Availability (P), 3 = Unavailability (U), 4 = Total

Table 2: Summary of result from January 2005 to December 2005

Items	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
A	178	163	162	163	163	176	172	174	167	171	164	179	2031
PA	7	11	22	17	17	10	14	12	13	15	11	6	154
UA	1	0	2	0	0	0	0	0	0	0	5	1	9
T	186	174	186	180	186	178	186	186	180	186	180	186	2194

Table 3: Faults/failures and remedies for improvement

Faults	Remedies by (PHCN)	Additional remedies
(1) Overloading of feeder	Load shedding, loads should be connected to the three phase in turn isolating the area for some time.	Provide a more suitable transformer that will be able to serve the area. The rated fuses for the feeder should not be exceeded
concrete (2) Broken poles	Replacement of the wooden poles without much delay.	(1)Wooden poles should be treated with Geosote. (2) Steel or reinforced poles should be used in place of wooden poles
(3) Broken cross arms	Replacement of cross arms with wooden ones.	(1) wooden cross arms should be of hardwood (2)Earthed steel cross arm could be used.
(4) Over current	Separating the lines that are short circuited or reducing the number of loads on a phase that is being over loaded	(1)The spacing between conductors should be such that they can never come to within sparking distance or each other. (2)Loads should be connected to the three phase lines in turn
(5)Rainstorm and thunder effects	Burnt or shattered or tripped device or equipment is replaced.	(1)Lighting arresters should be will grounded (2)All metals along the lines and at s/s should be earthed
(6) Earth fault	Clearing the obstacle that is linking the line to earth	(1) Overhead lines should be kept free form trees and weed contact (2) j and p fuses should mounted in such a way that when they blow, the element do not come in contact with the channel irons that are earthed.
(7) Transformer fault	Replacement of the affected parts	(1) Transformers should be checked and maintained regularly as they are equipped with protective devices, (2) The oil should be checked often (3) Insulation and earth resistance tests regularly.
(8) Burnt cables or wires	Replacement of wires or cable	(1) Excess currents in the wires should be guided against.
(9) Sagging overhead lines	Re-erecting the poles that could have fallen partially to sag the wires or reducing the number of loads on the if the sagging is due to expansion or over loading	The size of the wires or cable should be according to regulation Conductors should be well spaced and then held in position using spaces Excess current should be prevented so that over loading of the line will not occur.
(10) Faults Developed in substation (s/s)	Identifying and clearing the faults accordingly with little delay as possible	(1)Bush burning around the s/s should be prevented (2) Vehicle accidents should be guided against (3) S/s should comply with regulation and properly earthed

For the Ikpoba Dam 33KV feeder, total feeder available for the whole day (A) in the 12-month was 337. Total feeder available for part of the day (P) in the 12-month was 29. Total feeder unavailable for the whole day (U) in the 12-months was 0.

For the G.R.A 33KV feeder, total feeder available for the whole day (A) in the 12-month was 347. Total feeder available for part of the day (P) 12-month was 19. Unavailable was zero (0).

For Nekpenekpen 33KV feeder, the total feeder available for the whole day (A) in the 12-month is 352. Total feeder available for part of the day (P) in the 12-month was 14. Unavailable was zero (0).

For Etete 33KV feeder, total feeder Available for the whole day (A) in the 12 month was 344. Total feeder available for Part of the day (P) in the 12-Ionth was 22. Unavailability was zero (0).

For Sapele/Koko 33KV feeder, feeder available for the whole day (A) in the 12-month was 331. Total feeder available for Part of the day (P) in the 12-month was 29. Total feeder Unavailable for the whole day (U) in the 12-month was 6.

A = Availability, UA = Unavailability, PA = Partial Availability, T = Total

Some faults that causes power interruption and suggestions on how to ensure less power failures in the district is shown in Table 3.

CONCLUSION

From the study of the fault analysis, the Guinness 33KV feeder has the highest availability, which is mainly due to heavy equipment used in that area.

More efforts could be made on improving the availability by increasing the power supply, that is, by running another separate 33KV feeders to the industry.

Sapele/Koko 33KV feeder also has low availability due to long distance of the feeder and which result to high voltage drop.

A substation should be constructed to that end to enhance the power supply in that area. Nevertheless, less maintenance would be carried out on the feeders if more feeders are provided in congested and industrial areas.

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