

## Electrical and Power Lines Hazards: Implications and Mitigation (A case study)

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### ABSTRACT

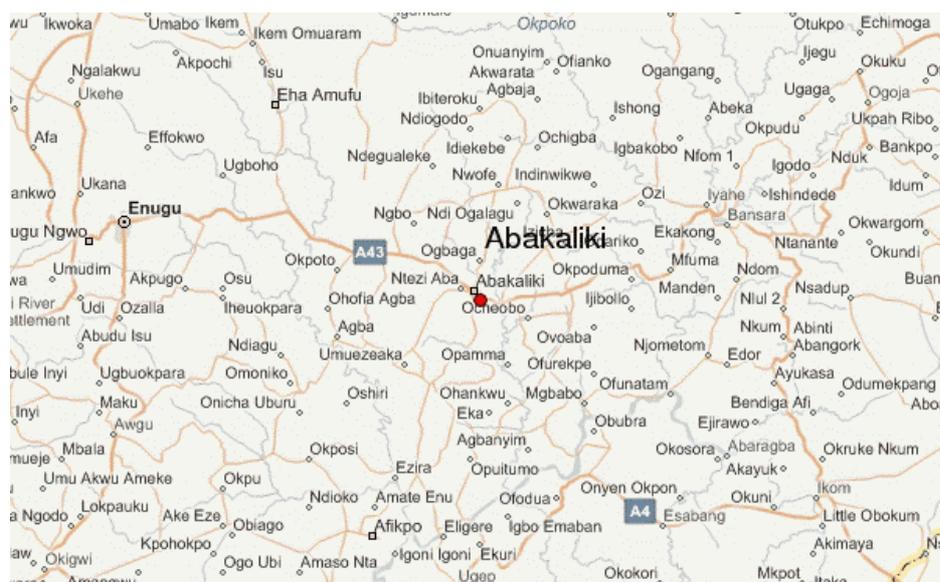
The study investigated the hazards associated to electrical appliances in homes, and power lines in Abakaliki metropolis, Ebonyi State, Nigeria. The hazards (electrocution, shock, house burning, etc), has led to colossal waste of lives and properties within the metropolis. The study x-rayed the possible causes, and implications, and observed that high level of illiteracy, lack of Government attention in enforcing laws that could mitigate future occurrences, bribery and corruption, and crime are the major causes of this ugly scenario. The author then concludes by recommending solutions that will enhance reduced cases, sustainable urban planning, and possible pathways to achieve a hazard-free sustainable green city.

**KEYWORDS:** Keyword 1 hazards Keyword 2 electrocution Keyword 3 Electrical lines Keyword 4 Power lines

### INTRODUCTION

In recent times, most homes are usually equipped with different electrical appliances, ranging from electric iron for ironing clothes, washing machines, air conditioners, radio sets, television, electrical fittings, etc. These appliances contribute in no small measure to the beauty and comfort of the homes. Electricity is one of the most essential ingredients of joy and beauty of modern life, both at home, in our cars, industries, and in our workplace. There are many electrical hazards in our homes, kitchens, industries, schools, laboratories, and even in health institutions because of the variety of electrical appliances in use. This has led to children and even adults to be exposed to electrocution, shock, or death from contact with faulty appliances or wrong use of a working appliance, unsafe work practices in workplace, faulty electrical equipment or wiring, use of damaged receptacles and connectors, or non-adherence to safety precautions in the use of electrical equipments. In the literature, different research groups have reported on the dangers of electricity when used wrongly [1, 2, 3,4].

The hazards associated to power lines are many and varied, and constitutes a significant death route to many persons especially in third world countries. This is mostly due to: ignorance, illiteracy, Government inefficiency, bribery and corruption, and lack of maintenance structure. A typical case is that of Abakaliki metropolis in Ebonyi State, Nigeria. Figure I gives the map of the study area (Abakaliki metropolis). The major aim of the present study is to investigate the hazards associated to electrical and power lines, discuss the implications and mitigations, and suggest the way forward as yardstick for future planning strategy by Government and relevant agencies in the study area and places with similar scenario.



**Fig. 1:** Map of Abakaliki Metropolis, Ebonyi State, Nigeria  
(Source: [5])

#### *Methodology:*

This research work utilised a literature based conceptual approach; hence the author reviewed the literature on electrical and power lines hazards in Abakaliki Metropolis, Ebonyi State, Nigeria. The work then discussed the impact of electrical and power lines hazards in Abakaliki Metropolis on human lives and on the economy, and consequently on the society. The study further discussed on the implications and mitigation with particular reference to Abakaliki Metropolis of Ebonyi State, Nigeria.

#### *Electrical lines:*

Electricity flows through conductors (metals, water, the Earth and the human body) and must have a complete circuit or path to flow. The human body is an efficient conductor of electricity and if it mistakenly becomes part of the electric circuit, an electric shock occurs. This happens if a person's body completes the current path through: (i) both wires of an electric circuit (ii) one wire of an energized circuit and the ground (iii) a metal part that accidentally becomes energized due to a break in its insulation or another conductor" that is carrying a current (iv) direct contact with energized overhead power lines/underground power lines, and (v) direct contact with faulty energized electrical appliances. In general, the use of electricity generates electric and magnetic fields, thus a magnetic field is created when electric current flows through any line or wire including the electrical wiring in a home, industry, schools etc. Other sources of magnetic fields are variety of electrical appliances including radio, power tools, vacuum cleaners, microwaves, computers, fluorescent lights, electric baseboard heat, electric blankets, mobile phones, and other electric device related appliances. This implies that there are so many common sources of electric and magnetic fields (EMF), that everyone is exposed to every day. It is a common knowledge that the strength of a magnetic field decreases dramatically with increasing distance from the source i.e it obeys the inverse-square law [6, 7].

#### *Power lines:*

Power lines can be underground or overhead. In third world countries like Nigeria, power lines are mostly overhead. This is due to the fact that overhead power lines are cheaper to install compared to underground approach as have been established in the literature [8]. The dangers associated to overhead power lines ranges from natural or artificial interference, radiation (electric and magnetic fields), environmental, impact on government due to land tenure system, community impacts related to the construction and operation of transmission lines, and interference on agricultural lands amongst others. It is a common knowledge that accidental contact with live overhead power lines kills people and causes many serious injuries every year at different parts of the world (see Figs 4-7), while some other persons, animals or objects are also harmed if they gets too close to a line and a flashover or power line fall occurs. In general, the impact of a transmission line at any given area depends largely on the topography, land cover, existing land uses, Government regulations, and on the literacy level of the inhabitants. Also the impacts could be grouped under long-term (those that exist as long as the line exists and include health related cases, land use restrictions, loss of woodland, aesthetic impacts,

loss of agricultural and/or private lands) and short term impacts (occurs only during construction or line repair and includes noise or crop damage during construction).

#### *Impacts to Agricultural Lands:*

One of the major impacts of transmission power lines includes that of loss usable agricultural lands. In Nigeria, subsistence farming is more prevalent due to high level of poverty, illiteracy, and land tenure system. However mechanized farming are more common in the Northern and Western parts of Nigeria, and it is commonly observed that transmission lines can affect field operations such as irrigation, aerial spraying, wind breaks, obstructions by the transmission structures (wooden or concrete poles) and reduced farmland access. Further, the transmission structures can cause reduced turning access of field machinery, and increase in soil erosion due to removal of windbreaks/interference with the soil texture. According to the literature [9] further impacts includes; increased access for weed and pest encroachment, obstructs farm planning and subdivision of land for residential and industrial development, and also leads to damage of drainage tiles in some cases.

#### *Aesthetics Impacts:*

The aesthetic impacts of transmission power lines is likely to be negative to most people, especially where the power lines transversed natural landscapes, private properties, wild life reserves, industrial layout and recreational cites amongst others.

#### *Other Impacts:*

Other impact of transmission power lines vary from place to place depending on the degree of civilisation and on religious and cultural beliefs. A typical example is that of the Amish community that are non-confrontational community, and usually tend not to become involved in government processes, and do not use most services of modern technology including electric services [10]. In airports, transmission power lines could pose serious risk during takeoff and landing if not properly located at suitable distances. Transmission line can damage archeological and historical sites during construction and maintenance either by digging, crushing artifacts with heavy equipment, uprooting trees, exposing sites to erosion or the elements, or by making the sites more accessible to vandals, and thus distorts the aesthetic view of such resource centres.

#### *Illiteracy:*

The number of illiterates in Nigeria is very high. According to the current literature reports [11], about 65 million Nigerians are still illiterate. Ebonyi State has a population of 2,176,947 based on the 2006 census [12, 13], with Abakaliki metropolis making up a population 79280. The population of illiterate persons in Abakaliki is very high, estimated at over 65% of the total population as contained in the literature [14]. This makes a greater percentage of the population of Abakaliki metropolis not to be aware of the dangers associated to power lines especially when residential building are cited under them as shown on Figure 2. Lack of awareness by Government and the relevant agencies have led to significant loss of lives around the metropolis. Recently, a pupil of Echara community primary school in Ezza South LGA, Ebonyi State, lost his life because he climbed a cashew tree without knowing that one of the branches of the tree was resting on a high tension wire that supplied electricity to the community [15]. Another contributing factor to that of lack of awareness due to illiteracy is the inability of the inhabitants to distinguish between short term and long term effect of the power line associated hazards. Due to the high level of illiteracy, poor maintenance culture also add a significant quota towards damaging the power lines structures (wooden poles) mostly from incessant bush burning.

#### *Bribery and Corruption:*

Bribery and corruption is one of the most endemic diseases in Nigeria. It has sunk deep into the veins of almost every Nigerian in that it permeates all sectors and has eaten deep, and continues to eat deep into the fabrics of the society. Most recently, the President and Commander-in-Chief of the Armed forces of Nigeria, Major General Muhammadu Buhari (rtd), noted that if "Nigeria do not kill Corruption, Corruption will Kill Nigeria" [16, 17], with > 90% of the population being corrupt [18]. Corruption was believed to be widely liberalised and publicized in Nigeria during the IBB regime [19]. The major cause of bribery and corruption is mostly due to; tribalism, fake election campaign promises, ostentatious life style, God-fatherism [20, 21], poverty, and poor value system. However, tribalism and fake election campaign promises has been crawling from the administration of the past leaders till date in Nigeria. For instance, according to the literature [20], it was reported that in December 2014, Major General Muhammadu Buhari (rtd) went on to say that he would abolish the office of the First Lady in-toto, if elected as President, since such office was unconstitutional- a promise he is yet to redeem till date. Due to the inability of successive government to keep her election promises amongst others, breakdown of checks and balances are observed in the three Thiers of Government, poor coordination of activities; lack of sustainability of programme and projects; absence of achievable target setting; absence of monitoring, evaluation and impact assessment; absence of effective coordination

and collaboration between the agencies of government and among the three tiers of government and duplication of functions resulting in unnecessary rivalry among institutions has become the order of the day, and all these culminate to a dwindling resources flow thereby incapacitating the nation's economy.

*Poverty:*

Poverty is a general scourge in most developing countries. One of deadliest and most rampant disease in Ebonyi State is Poverty. According to the most recent report from the National Bureau of Statistics [13], about 73.6% of Ebonyians are poor. Recent research work by Onwe and Nwakama [22], noted that the debilitating effects of poverty which often manifests in loss of hope, aspirations, malnutrition and sometimes sudden death, is very common in Nigeria in that the country has a startling 69% national poverty level. It is mostly because of poverty that some people build houses and live under transmission power lines independent of the hazards usually associated to it. Most of them do not have the money to relocate and Government do not pay the necessary compensation that could have enabled them to relocate. A typical example is shown on Figure 2. Occupants of such residential buildings are more likely to be victims of fallen power lines, increased exposed radiation or other associated hazards.



**Fig. 2:** Residential building located under overhead power lines at Barr Igwe Ama Avenue, Ntezi Aba in Abakaliki metropolis.

*Government Inefficiency:*

Lack of proper monitoring and implementation of existing laws is a contributing factor in exaggerating the hazards associated to power lines in Abakaliki Metropolis. The Abakaliki Capital Territory Development Board, and Ministry of Works, Housing and Transport are both government parastatals that are responsible for housing and road projects within the metropolis. However, due to their inefficiency, people use under power lines as major streets and roads, and these agencies simply do nothing. Figure 3 gives a typical example of such case. Residential buildings are also cited without consideration for minimum distance that should be observed for power lines when citing a building (see Figure 2). Also inadequate monitoring of power line materials by the Enugu Energy Distribution Company (EEDC) officials (the company that is responsible for the provision of electricity in the study area), and lack of awareness programmes to sensitize the masses on the dangers of handling power lines without adequate training has also led to the loss of lives within the metropolis. A typical scenario is indicated in Figure 5.



**Fig. 3:** Typical street under overhead power lines (Amazon Drive, Ntezi-Aba, Abakaliki Capital City).

*Crime:*

Crime has been identified as one of the commonest social problems in Ebonyi State as is usually evidenced occasional in the Nigeria national dailies [23]. A state that is poverty-stricken city is most likely to be highly prone to different forms of crime. Cases of electrocution of armed robbers and thieves has been widely reported within the metropolis [24, 25]. Figures 4-7 gives a typical picture of the associated crime scenario of power lines in Ebonyi State and the possible consequences. Carelessness of the PHCN and use of inferior materials in power lines has also led to the loss of lives of innocent citizens within and outside Abakaliki metropolis, as highlighted in the literature [26, 27]. As shown on Figs 6-7, a man trying to tap current illegally from the power lines in Onicha Local Government Area of Ebonyi State, Nigeria, and an unidentified middle-aged man that was electrocuted in an attempt to steal an electric cable at a power installation point in Accra Crescent by Local Education Authority Primary School, Uguwar Rimi, Kaduna state, Nigeria. The crime rate in Nigeria is relatively synonymous to the poverty rate and literacy level. Every city in Nigeria has her own share of the scourge. This is further aggravated by the inefficiencies of the law enforcement agencies, and “political heavy weights” who act as sponsor/godfathers to most of the criminals for selfish interests as those people serve as political thugs for them during electioneering periods. This has been widely reported by different research groups in the literature [21, 28, 29, 30].



**Fig. 4:** Middle-aged man electrocuted at Agba Abor Isu in Onicha local government area of Ebonyi State.  
Source: (<http://www.newscabal.com/2015/07/07/man-electrocuted-at-eedc-abakaliki-power-line/>)



**Fig. 5:** Untrained staff working on power lines in Ebonyi State.

Source: (<http://www.nigerianbulletin.com/threads/ebonyi-man-electrocuted-to-death-while-helping-power-company-repair-faulty-power-line.114116/>)

*Mitigating Potential Impacts:*

In general, different approach to mitigate the potential impacts of electric and power lines hazards exists. It may be possible to reduce potential environmental, landowner, and community impacts by adjusting the proposed route of power lines, choosing a different type of pole structure, using different construction methods, implementing any number of post-construction practices, replacing or upgrading existing lines, and improvement on the maintenance culture to safeguard the existing structures. Use of stronger conductors can minimize line sag and provide a sleeker profile thereby reducing the associated risks.

*Mitigation of Aesthetic Impacts:*

It could be possible to divert electric transmission lines in such a way that scenic areas could be left unperturbed. Possible transmission line routes can be selected to pass through non-commercial/industrial areas or along land use boundaries, while line colour modification can also minimize aesthetic impacts significantly. Use of wooden/rust brown oxidized steel may blend better with wooded landscapes and improve the aesthetics.



**Fig. 6:** The man was trying to tap current illegally from the power lines in Onicha LGA of Ebonyi State, Nigeria.

Source: (<http://www.newscabal.com/2015/07/07/man-electrocuted-at-eedc-abakaliki-power-line/>).

*Mitigation of Agricultural Impacts:*

Land tenure system in Nigeria has led to fragmentation of land in such a way that mechanised agriculture is seriously hampered in some regions especially in the south-eastern part of the country (study area is located in the south-east). Construction of power lines also add its quota in reducing agricultural lands as well as the aesthetics. Landowners have little influence in the control of where the poles will be mounted as Government owns the land based on Nigeria land ownership system. According to the literature [31], general mitigative measures on agricultural impacts includes: (i) using single-pole structures instead of H-frame or other multiple-pole structures for reduced interference with farm machinery, (ii) installation of power lines along fence lines, field lines, or adjacent to roads in order to reduce field impacts (iii) reduced use of guy wires but where necessary, the guy wires should be shielded and also kept out of crop and hay (iv) where aerial spraying and seeding are required, pole heights should be reduced and markers installed on the shield wires above the conductors (v) new transmission lines should be located along existing transmission line corridors, and (vi) existing irrigation systems should protected through use of special transmission designs.



**Fig. 7:** The man was trying to steal electric cable cable at a power installation point in Accra Crescent by LEA Primary School, Unguwar Rimi, Kaduna state.

Source: (<http://www.nigerianewsheadlines.com/2015/12/oops-man-got-himself-electrocuted-while-trying-to-steal-an-electric-cable-at-a-power-installation-point-photo/>)

#### *Recommendations:*

In view of the foregoing discussion, the author strongly recommends that;

i. Government should step up her campaign of “Poverty Eradication in Nigeria”. This could be done through diversification of the economy by opening up other sources of revenues through accelerated mechanised agriculture, waste to energy programmes, and activation of other sustainable energy sources. Such ventures will help to bring down the high rate of youth unemployment in Nigeria, and increased government revenue. Reduced poverty rate in Nigeria will also lead to reduction in crime level, including illiteracy.

ii. Government should do more in her fight against corruption. In Nigeria, sexagenarians, septuagenarians and octogenarians who have been involved in series of corruption scandals are still major stakeholders at the corridor of power. Different research groups [32,33,34,35,36,37,38] have reported on this ugly scenario. These die-hards remain in public offices indefinitely, and this keeps the corruption chain rolling. Corruption has crippled, and still continues to hamper a lot of government programmes that are meant to yield positive dividends to the masses.

iii. Politicians should try and fulfil their election campaign promises.

iv. Tribalism and God-fatherism should be minimised. This will help to ensure that the suitable persons are put in office such that inefficiency in government offices and parastatals will be reduced, bribery and corruption, and other negative vices will be significantly minimised.

v. The collective application of the aforementioned points will help to put in place all the measures needed to mitigate the hazards associated to electrical and power lines in the study area, and in other developing economies with similar challenges.

#### *Conclusion:*

In summary, the hazards associated with electric and power lines have been investigated in Abakaliki metropolis, Ebonyi State, Nigeria. The findings observed that high level of illiteracy, poor maintenance culture, crime, bribery and corruption, and lack of awareness amongst others are among the major factors that are

responsible for this scourge. The study also discussed the steps needed to mitigate the hazards, and further recommended further solutions that will enhance reduced hazards associated to electric and power lines in the study area. The steps discussed in the present investigation are fundamental in assisting government in policy formulation, to achieve a hazard free environment in the study area.

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