

Ibadan Journal *of the* Social Sciences

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The Nature and Consequences of Physical Development under Overhead Electricity Power Lines (EPLs) in Ibadan

Bolanle Wahab and Alaba Adediji

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Infringement by the public through various physical development activities on lands under overhead electricity power lines (EPLs) has become a widespread practice in Nigerian cities in recent years. This study investigated the scenario along four feeders in Akinyele local government area (LGA) of Ibadan, Oyo State. Investigations revealed the causes of indiscriminate physical development and habitation of right-of-way of EPLs as: weak enforcement of development control regulations along transmission lines, lack of strong political will, shortage of manpower, inadequate operational funds, lack of cooperation between planning agency and electricity provider, and ignorance/lackadaisical attitude of the public to the effects of living under EPLs. Further analysis indicated significant difference in the distribution of ailments (such as high blood pressure, arthritis and skin cancer) between permanent and temporary structures under overhead EPLs in the study area ($\chi^2 = 9.19$ ($df = 4$), $P < 0.05$). The paper advocates for a strong political will and strengthening of local planning authorities for effective control of physical developments among other mitigation measures.

Keywords: Land, physical development, electricity power lines, development control

Introduction

Urbanization, which is a process by which a settlement becomes urban, results in increased spatial scale, density and activities of settlements. Literature discussions on the rate of urbanisation and its attendant effects abound (Li and Yeh, 2000; Sui and Zeng, 2000; Heikkala et al., 2003; Xie et al., 2005; Xie and Batty, 2006). The rapid pace of urbanization is a global phenomenon in most of the developing countries (Amin and Fazal, 2012). The population of urban residents

increased from 13% in 1900 to 49% in 2005, which translates to an increase from 220 million people in 1900 to 3.2 billion in 2005 (United Nations, 2014). This population of urban residents is estimated to rise to five billion by 2050 representing 66 percent of the world's population (United Nations, 2014). In the studies that focus on mega-cities and on medium and small sized urban places (UNDP, 2000; van den Berg et al., 2003; Jenkins, 2003), there is a consensus of

opinion in the literature concerning urbanization processes and the associated consequences. For example, it has been noted that although there are relatively few mega cities in Africa (i.e. cities with 10 million inhabitants or more), the urbanization process, unlike in Asia and Europe, is taking place in the absence of significant industrial expansion (Kwasi, 2004). Furthermore, the process is manifested primarily by an outward expansion of built-up areas and the conversion of prime agricultural lands for residential and industrial purposes (Kwasi, 2004) and, as recently noted, conversion of lands under EPLs into diverse usages such as residential, commercial, and educational, among others.

In Nigeria, the urbanization process is similar to what obtains in several other developing countries as the growth and complexity of human settlements and, in particular, the rate of urbanization has been phenomenal (Ujoh et al., 2010). Considering Nigeria's 2006 population figure of over 140 million people – the highest in Sub-Saharan Africa (FRN, 2007); available data, however, shows that the country has been growing at the rate of 5.5 percent annually from 1980 to 1993, and its growth has further increased to the rate of 5.8 percent, which has resulted in a total urban population of 62.66 million people (or, 43 percent of the national population). By projection, this proportion is expected to increase to more than 60 percent by 2025 (UN, 2007). Consequently, Nigeria has one of the highest urban growth rates, having cities, such as Lagos, ranked among the fastest growing in the world. However, some challenges associated with this urbanization include urban growth and development which do not match the rate of urban planning and the provision of urban infrastructure, rate of housing construction below housing demand, inadequate transportation, and rapid growth of informal settlements characterised by inadequate sanitation services and water supply. Agbola (2005) estimated that 65% of the urban population in Nigeria live in these informal settlements. Many of the informal settlers live on lands

under electricity power lines (EPLs) and their right-of-ways (ROWs). The negativities associated with rapid urbanization, particularly the environmental consequences in cities and peri-urban areas, are among the most documented issues in urban environmental research (World Bank, 1997).

In both developed and developing countries, electrical devices and technology have become widely accepted as the most reliable form of energy (Rubins, 1993 cited in Bolton, 1993). Rapid urbanisation is increasing the demand for electricity such that its generation is unable to cope with demand, especially in the developing countries like Nigeria.

There is no doubt about the fact that negativities associated with urbanisation have effects on availability of lands in Nigerian cities, particularly under EPLs. Lands under EPLs and towers (generally referred to as transmission facilities) are either owned by private landowners or public utility company (such as the former National Electric Power Authority and the Power Holding Company of Nigeria), while the government agencies maintain specific rights governing their use. These lands are called rights-of-ways (ROWs). The ROWs agreements restrict owners' rights to activities that do not cause a safety hazard, impact public safety, interfere with the operation of the lines, or interfere with the rights granted. At the same time, the agreements allow the concerned government agencies to construct, expand, maintain and replace existing facilities, while reserving space for future facilities. However, in many urban communities in Nigeria, the set-backs or ROWs to the EPLs are built on with impunity such that buildings (temporary and permanent) of varying heights and uses are found and occupied. These are illegal and informal developments, which abound, owing to many factors. Lands under EPLs appear cheaper in price and easy to acquire because the occupants do not acquire such lands legally. Such lands also require less formalities and negotiations because both the seller and the buyer

know that the land belongs to the government or a public agency.

Data retrieved from Oyo State Urban and Regional Planning Board (OYSURPB) (2010) on inventory of illegal developments under overhead EPLs in nineteen (19) out of the thirty three (33) local government areas (LGAs) of the State indicated a total of 2,084 structures made up of 955 permanent and 1,126 temporary structures both directly under EPLs and on their statutory ROWs. By this, the essence of the statutory ROWs, which is to protect the public against likely detrimental effects emanating from EPLs, is ignored at the risk to the lives of especially the occupants of the structures and users of the spaces and, occasionally, innocent passersby.

Therefore, a major developmental challenge facing the nations, particularly those within the developing world, is how to cope with the increasing urbanization and minimize its adverse consequences

on the cities' environment as well as the overall wellbeing of the people (Jiboye, 2011). Against this backdrop, the paper assesses the nature and consequences of physical development under EPLs in Ibadan.

Conceptual Framework and Literature Review

The conceptual framework is anchored on the concept of governance and development control. The causes and effects of physical developments under overhead EPLs were conceptualized as being dependent on the following factors: land encroachment by temporary and permanent structures; weak enforcement of development control regulations; corruption on the part of Town Planning Officials, presentation of deceitful building plans and financial inducement by the public, and precarious health suffering and residents' safety (Figure 1).

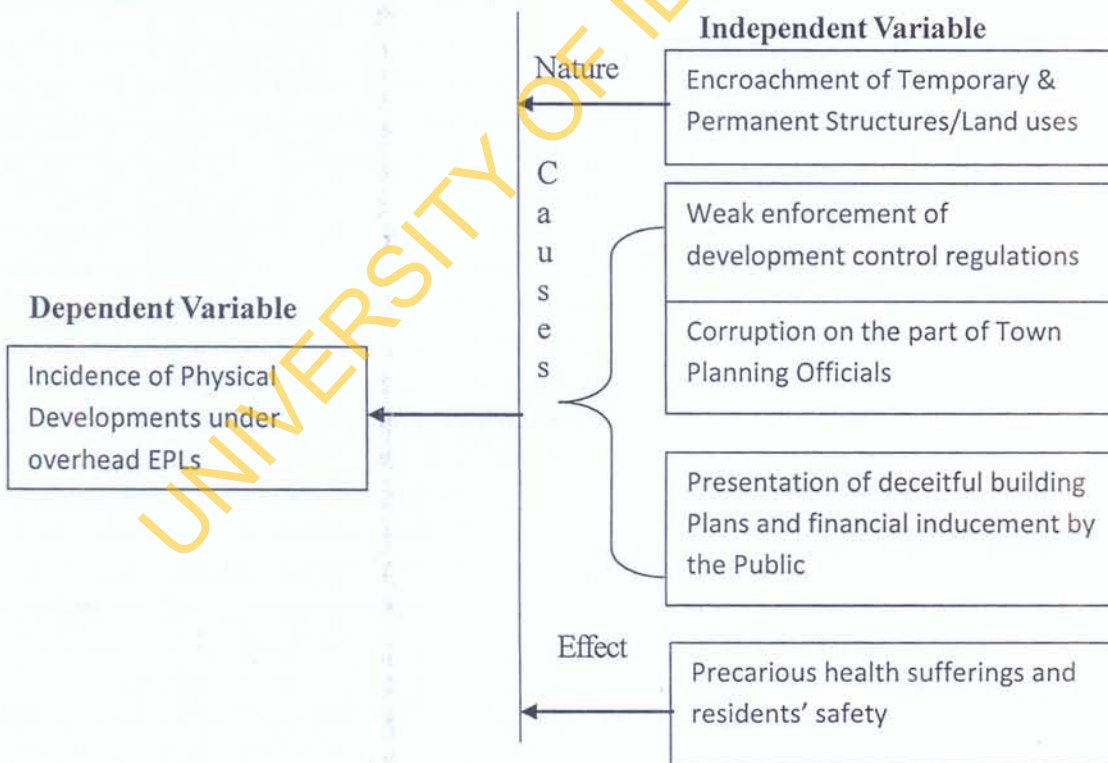


Figure 1: Conceptualization of cause and effect of developments under EPLs
 Source: The Authors (2015)

The concept of 'Governance' has been variously defined. Governance is the manner in which power is exercised in the management of a country's economic and social resources for development (World Bank, 2009). It is also the exercise of political, economic and administrative authority to manage a nation's or community's affairs (UNDP, 1997). In its application to urban planning, FAO (2007) defined governance as the process by which decisions are made regarding the access to and use of land, the method of implementing those decisions and the manner in which conflicting interests in land are protected. Good governance is an asset for city development (Aluko, 2010) and a mechanism that can be used to address the issue of illegal developments on statutory setbacks and ROWs to public infrastructures like electricity powerlines through the provision of appropriate urban planning machinery and logistics that ensure adequate monitoring and prompt removal of illegal and unwholesome developments. Governance can be poor if government is corruptible, tyrannical, undemocratic, incompetent and ineffective (FAO, 2007). Weak governance is often associated with "administrative corruption" (Agbola and Henshaw, 2011). Weak governance in the management of the lands under EPLs means that such lands are neither protected nor properly managed in the overall best interest of the society by both the Ministry of Physical Planning and Urban Development and the Electricity Generation and Transmission Company. Rather, the EPLs right-of-ways are allowed to be abused and misappropriated due to inadequate and ineffective monitoring by development control officials of relevant local planning authority. This results in negative health effects on the occupiers and unbudgeted expenditure by municipal government in form of relief materials and monetary compensations to victims of EPLs disasters.

Development control (DC) is the system by which the use of land and buildings on the land is regulated through density control, building bye-laws, zoning ordinances and subdivision regulations to prevent

any mis-use or abuse of use and non-conforming uses (Wahab, 1999). It is the control of any building, mining, engineering or other operations in, on, over or under any land, or the making of any environmentally significant change in the use of any land (FRN, 1992). The major objective of DC is to regulate the growth of any rural or urban settlement in a planned and sustainable manner.

Chapin (1965) identified health, safety, economy, convenience and amenity as five elements of public interest which prompts the use of control in land development. Land use control is also employed by planning agencies to achieve five purposes in the interest of the public namely (Abrams, 1955:34): i) guide the use of land to promote the advantageous development of the community; ii) curb the mis-use of land; iii) regulate the non-use or dis-use of land; iv) guide the re-use of land for more appropriate purposes, and v) prevent the abuse of land. Several literature exist on the subject of DC (Chapin, 1965; Vagale, 1969; Dorby, 1975; Moore, 1977; Adeniji, 1986; Wahab, 1991a, 1991b, 1999; Kadiri, 1995; Ogunde, 2010).

The Nigerian Urban and Regional Planning (NURP) Decree No. 88 of 1992 (now NURP Law CAP No. 138 of 2004) provides in Section 27 (1) that a Planning Commission at the federal-, a Board at the State, and a Planning Authority at the local level shall respectively establish a Department to be known as a Development Control Department. Sub section (2) provides that the control department created by subsection (1) shall be a multi-disciplinary department charged with the responsibility for matters relating to development control and implementation of physical development plans. The Control Department, according to Sections 28 and 29, is given power and function to give approval for or reject any land development before it is carried out by any developer or government agency (FRN, 1992). The two main instruments used in the DC process are Enforcement Notice and Stop Work Notice. An *Enforcement Notice* is served on any breach of Town Planning Law relating

to carrying out of development without planning permission (approval) and may result in the demolition of an illegal building or the restoration of an altered building, to its previous condition pursuant to Section 47(1) of Urban and Regional Planning Law, 1992. Section 53 of the URP Law provides that a *Stop Work Notice* could be issued where it appears to the control department that; (a) an unauthorized development is being carried out or (b) where a development deviates from a development permit issued by the Control Department. Sections 28 and 29 of the URP law further mandate all land developers and government agencies to seek approval from the Control Department before any development is carried out. However, private and public developers in Nigeria are found to violate the provisions of the law which explains why people build and live in structures under the EPLs. The literature has established a number of impediments to effective DC practices in Nigeria to include: inadequate manpower, finance, corruption, political interference, socio-cultural attitude of the city's inhabitants (Wahab, 1991a; Kadiri, 1995; Oyesiku, 1998) and the inadequacy of legal sanctions for defaulters of planning law (Aluko, 2000). In 2009 there were 56 personnel in the OYSURPB whereas the approved staff strength in the 2009 budget was 310. The picture was worse in the 11 LPAs in Ibadan region where there were only 65 professional planners and 97 technical staff giving an average of 6 and 9 professional planners and technical staff respectively per LGA to perform the entire planning functions, including DC, under the Urban and Regional Planning law (Wahab, 2011). Compounding DC constraints is the inadequate funding of planning agencies which has remained a long-standing issue (Oyesiku, 1998). Other DC problems are: lack of basic equipment, lack of base maps and development plans, weak and outdated planning laws, public's ignorance of physical planning benefits, and draughtsmen's dishonesty through faulty site plans prepared (Wahab, 1991a). In a survey of DC problems in Lagos in 1995, Wahab identified land acquisition

problem, unhealthy use of money and position by the public to induce or intimidate planning officials, demand for developable sites greater than supply, over-politicization of planning, faulty survey plans, illiteracy, high land and rental values, and threats to lives of DC officials (Wahab, 1999). However, the public also had certain reservations for planning agencies in Lagos in the conduct of their development or land use control assignment which include (in order of rank): cumbersome approval process, corrupt officials, non-involvement of citizens in planning programmes, inadequate publicity, officials' poor human relations, high planning standards, and unreliable draughtsmen (Wahab, 1999). Illegal developments under electricity transmission lines have become a very common and "normal" sight in Nigerian urban and peri-urban settlements as in the city of Ibadan. It is therefore, necessary to study the impediments to effective development control on the lands under EPLs with a view to discouraging the trend.

Literature Review

In Nigeria, as it is in most of the developing nations ravaged by poverty and experiencing poor governance, a large proportion of urban and rural settlements are of informal types that hardly meet the prevailing planning and building standards. Housing units are built in environments that are deemed substandard, hazardous (such as under EPLs), unfit to live by humans and, therefore, declared illegal by housing and governmental authorities. Yet, this is where between 50% and 80% of residents in many developing nations' cities live (Agbola, 2001).

A considerable body of literature has examined illegal and informal housing in the developing nations (Aldrich and Sandhu, 1995; Kumar, 1996; Varley, 1998; Fernandes and Varley, 1998; Tipple, 2000; Smart, 2001, 2006a, 2006b; Davis, 2006; UN-Habitat, 2009; Tanasescu, Wing-tak and Smart, 2010 and Ambaye, 2011). They all contended that illegal dwellers generally live in unsafe, hazardous (such as under ETLs) and

precarious environments, in informal settlements which lack basic facilities, suffer from absence of tenure security and have no legal claim in case of eviction. Illegal and informal housing include those which have been built on land intended or designated for another use, such as the ROWs or set-backs to EPLs, or built on land not owned by the occupier and without permission of the owner (Tipple, 2000). Adelowokan (2011) reported a total of 2,486 illegal developments (contravention cases) in the eleven LGAs in Ibadan between 2008 and 2010. The contravening structures included residential houses, shops, banks, eateries, car-wash, auto-repair, block-making, furniture making, and road-side kiosks constructed or sited either without planning approval or against approved plans. Some of these structures were established on lands which were predisposed to human-induced disasters such as snapping of high-voltage EPLs. The risks arising from building and living under EPLs include: risks to the health, safety and well-being of persons and property, risks to the operation of the transmission network, and risks to amenity (Bolton, 1993). Structures on such lands when demolished do not attract any compensation as they are regarded as contraventions.

Effects of Overhead Electricity Power Lines (EPLs) on Residents' Health

Studies have linked living, working and recreating under high tension power lines to health problems, economic loss and environmental degradation. Electromagnetic Fields (EMFs) generated by EPLs and their potential effects on public health and safety have been reported in the media. Nigeria's local television news programmes and Newspapers such as the Vanguard, Punch, and Tribune, have, at different times between 1987 and 2013 reported ten incidences of electrical transmission line snapping in Lagos, Ibadan and Port-Harcourt with attendant loss of lives as indicated in Table 1.

Experts have confirmed that life is not safe under EPLs (Momoh, 2010a). In a study of 29,081 children with cancer, including 9700 with leukemia, aged 0-14, born in England and Wales, (1962-95) Draper et al., (2005) found that children who lived within 200m from a power line at birth had a relative risk of leukaemia of 1.69 (95% confidence interval of 1.13 to 2.53 range) while those between 200 and 600m had a relative risk of 1.23. They concluded that there is an association between childhood leukemia and proximity of home to high voltage power lines. Scientific evidence in United States also suggests that invisible electromagnetic fields (EMFs) created by high-voltage power lines are linked to series of cancers and other serious health problems in children and adults (Davis et al., 2002; London et al., 2003; Schoenfeld et al., 2003). Air insulation may cause electrical charging of reinforcement in buildings when it passes through a natural course and results in electric shock and/or loss of life. A continuous flow of water from transmission cables to iron roofs or any iron object can also result in electrical shocks and untimely death. Rain water, which many homes in Nigeria depend on as a source of domestic water, is an electric current link between high tension lines and iron objects which shocks, if touched, and may result in death (Momoh, 2010b). Furthermore, EMFs can disturb the production of the hormone melatonin, which is linked with sleep patterns (Swanson and Jeffers, 2000). Litvak and Foster (2002) found that power lines attract particles of radon - a colorless and odorless gas linked with cancer. A Norwegian study found a brain tumor risk for exposure to magnetic fields in the home (Kliukiene et al., 2004), and a study in African-American women found that exposure to magnetic fields from power lines may increase breast cancer risk (Zhu et al., 2003).

Dib and Mordjaoui (2014) reported some health outcomes linked with EMF exposure as: a variety of cancers, leukaemia, tumour growth, skin damage, abnormal cell activity, sleep and daily rhythm disturbances, perception and memory changes, genetic

defects and impairment of hormone regulation and production; also gland deficiencies, mental and behavioural problems, immune system deficiencies, nervous system disorders, fetal development problems, miscarriages, birth defects, and blood and circulatory problems. Also, Shorabi et al. (2010) carried out a case-control study on 300 children aged 1-18 years in Tehran, the Capital of Iran to investigate association of living near high voltage power lines with occurrence of childhood acute lymphoblastic leukaemia (ALL). Their findings revealed that living close to high voltage power lines is a risk for Acute Lymphoblastic Leukaemia (ALL). Also, the study confirmed that at every more 600 meters far from power lines, there is decrease in the risk of ALL by 0.61 folds.

Furthermore, Lowenthal et al. (2007) used a case-control study of 854 patients aged 0-94 years to determine if there was an increased risk of Lympho Proliferative Disorders (LPD) or Myelo Proliferative Disorders (MPD) associated with residence $\leq 300\text{m}$ from high-voltage power lines in Tasmania, Hobart, in Australia between 1972 and 1980. The results raised the possibility that prolonged residence close to high-voltage power lines, especially early in life, may increase the risk of the development of MPD and LPD later.

The United Kingdom Stakeholder Advisory Group on Extremely Low Frequency EMFs (2007, cited in Dib and Mordjaoui, 2014) established links between EMFs and the following adverse effects; childhood and adult leukaemia, adult brain cancer, Alzheimer's disease, Lou Gehrig's disease, breast cancer, childhood cancers, depression, electrical sensitivity symptoms, certain types of heart disease, miscarriage and suicide. In a study published in June 2005 by Oxford University Researchers, it was found that the risk of leukaemia increased by 69% for children whose home is located within 200 meters of high voltage lines at birth and by 23% for those living at a distance between 200 and 599 meters, compared to those born at more than 600 meters. Macdonald (2001)

in her work on the health effects of extremely low frequency electromagnetic fields in communities of East and West St. Paul reported that there was a statistical association between exposures to relatively strong magnetic fields (greater than $0.4 \mu\text{T}$), and an increased likelihood of having childhood leukaemia in epidemiological studies.

A comprehensive review of recorded EMF effects on human health and behaviour conducted by Rubtsova et al (1999) included those effects recorded elsewhere in the literature as well as the following: fatigue, decrease in visual and motor reaction time, attention and memory deterioration, persistent mental disorders, headache, nausea, male sexual dysfunction, changes in cardio-respiratory functions, nervous system changes, and embryonic death. Epidemiological studies show an increased risk of cancer and leukaemia in children exposed to low frequency electromagnetic-field and beyond the $5 \text{ kV} / \text{m}$ and 0.4 T .

From the perspective of physics, Ogunbunmi (2010) observes that metallic cloth lines placed under high tension wire stand the risk of being electrified and can cause death if touched. Ogunleye (2009) offers a biological view by stating that experiments carried out in Europe shows that there are differences in cardiac rhythm between subjects exposed to the electric field and those not exposed to it; and also that there is a relationship between EPLs and childhood cancer.

Ayeni (2009) cited in Akinrinade (2010) observes that operating business or living in residential structures exposes occupants to a lot of radiation and vibration coming from the cables day and night and it could cause irregular beating of the heart for the people living or trading around them. Additional health hazards from the transmission devices are disorderliness of body joints and inhibition of the blood vessels in the body (Ayeni, 2009).

According to a report by NG (1997), encroachment of development into the power lines corridor creates unhealthy and aesthetically

dissatisfying residential environment. The report advocated prevention of residential development from being established too close to power lines on grounds of quality of amenity, health and safety concerns. Proximity of property to high tension power lines also affects the economic value of the property. In a study of values of residential property close to power lines in Portland (USA), Steven and Wolverton (2013) found that the selling prices of property close to power lines were about 20% lower than what the property market in the city offered. Similar studies have also established an association between property values and proximity to high tension power lines (Graham, 2011; Sandy et al., 2013).

Cases of Electricity Power Lines' Disaster in Nigeria

Not a few Nigerians have lost their lives to electrocution in the recent past (Akinrinade, 2010). As indicated in Table 1, between 1987 and 2013 in some communities in Nigeria, eighty-five (85) people reportedly lost their

lives while twenty (20) people had their legs amputated owing to the snapping of transmission lines. As one of the measures to mitigate the incidents, the Federal Ministry of Power on the 13th May, 2010, through a letter with Ref. No FMP/W/247/V3 drew the attention of Oyo State Urban and Regional Planning Board via Oyo State Ministry of Environment and Water Resources to the issue of erection of building/structures under high tension electric lines. The agency frowned on the developments as their location was considered dangerous to lives and properties, calling for a decisive action to be taken by the Oyo State government. Similarly, the Power Holding Company of Nigeria (PHCN) on 17th July, 2012 warned against construction of structures under power lines. The agency observed that despite the existing Oyo State Urban and Regional Planning laws which stipulate mandatory distances (set-backs) to various power lines, members of the public had continued to violate the laws by constructing and occupying structures on the statutory set-backs, thereby exposing the occupiers to deleterious effects of overhead transmission line.

Table 1: Overhead Electricity Power Lines (EPLs) Disaster in parts of Nigeria 1987-2013

| Place | Victims' Record | Consequence | Date | Source |
|--|---|----------------------|-------------------------------|---|
| Surulere area, Lagos State | Eighteen (18) | Legs amputated | 9 th October, 1987 | Akinrinade (27th March, 2010) |
| Orile – Agege, Lagos State | One (1) | Burnt and later died | 6 th June, 1989 | Akinrinade (27th March, 2010) |
| Ipaja, Lagos | Two (2) traders and one (1) school girl | Instant death | 21 st April, 2002 | Momoh (30th June, 2010) |
| Ojo/Akobo motor park, Ibadan | Un-quantified | Instant death | 19 th March, 2009 | Federal Ministry of Power, (13th May, 2010) |
| Oginigba area Trans-Amadi industrial layout, | | | | |

| | | | | |
|--|------------------------|--|--------------------------------|--|
| Port Harcourt, River State. | Forty (40) | Instant death | February, 2010 | <i>Guardian</i> and <i>This Day</i> newspapers (2010) |
| | Two (2) | Legs amputated | February, 2010 | <i>Guardian</i> and <i>This Day</i> , 2010 |
| Woji area, Port Harcourt, River State. | Two (2) | One died instantly while the second one sustained fatal injury | November 13, 2012 | www.ynaija.com/freakaccident-man-el |
| Oginigba community, Akpor LGA, River State. | Thirty-two (32) people | Instant death | 13 th Feb, 2011 | Akinrinade (27 th March, 2010) |
| Apata Market, Ibadan, Oyo State | Seven (7) | Instant death | 25 th June, 2012 | Authors' field work, 2012 |
| Ikosi area, Lagos State. | Two (2) | Instant death | 31 st January, 2013 | <i>Vanguard</i> (1 st February, 2013) www.vanguardngr.com |

Source: Authors' Compilation (2013)

In spite of EPLs carnage and its attendant death toll as indicated in Table 1, physical developments continue to spring up under and within their statutory right of way. A land use inventory carried out in 2010 by OYSURPB on illegal developments under/near EPLs revealed that the infringement was noticeable virtually in all the 33 local government areas of the state.

Right-of-Ways (ROWs) to Overhead Electricity Power Lines & Physical Planning Standards

Generally, planning standards are of two types: prescriptive and legislative. While zoning prescribes guidelines or specifications for the dimensioning of land uses in the preparation of development schemes; planning standards are usually mandatory and inflexible

(Agbola, 2001). For the 11kv and 33kv cables, Oyo state government gazette stipulates six (6) and eight (8) meters ROWs respectively. The statutory right of ways for 132kv and 330kv are 15 meters and 30 meters respectively. A surveillance road of 6.0m should be provided as buffer between plot boundaries and Power Holding Company of Nigeria (PHCN) electricity line's right of way (OYSURPB, 2010). However, PHCN standard ROWs specifications are a bit different from those stipulated by the OYSURPB (Table 2). For the 11Kv and 33Kv lines, a clearance of 5.5 meters must be observed on both sides of the line, while for 132 Kv a clearance of 12.5 meters is required on both sides. For the 330 Kv cable, a clearance of 50.0 meters is required on both sides. This difference, to a certain extent, indirectly encourages and enhances the development of illegal structures under overhead EPLs and their ROWs.

Table 2: Statutory Right-of-ways to Different Electric Power Lines

| Power Line Cables | Statutory Right-of-way by OYSURPB | Statutory Right of way by PHCN |
|-------------------|-----------------------------------|--------------------------------|
| 11kv | 6.0 metres | 5.5 meters |
| 33kv | 10.0 meters | 5.5 meters |
| 132kv | 15.0 meters | 12.5 meters |
| 330kv | 30.0 meters | 50.0 meters |

Source: Federal Republic of Nigeria (1990) and Oyo State Urban and Regional Planning Board (2010)

The Study Setting and Methodology

The study was conducted in four (4) major communities in Akinyele local government area of Ibadan. These communities are Arulogun, J. and P., L.A. Adisa and Orogun-Sagbe. Akinyele is a local government area in Oyo State, Nigeria. It is one of the eleven local governments that make up Ibadan metropolis. It is located between latitude 7° 29' to 7° 40' and longitude ranging from 3° 45' to 4° 04'. It occupies a land area of 464.892km² with a population density of 516 persons per square kilometre and situates along the northern region of Ibadan city. It is bounded in the north by Afijio local government area, in the south by Ibadan north local government area, in the west by Ido local government area, and in the east by Lagelu local government area. The local government is divided into 12 administrative (political) wards.

The study area experiences a tropical type of climate and a mean annual temperature of about 32° C. The relative humidity can be as high as 95% and a total of about 1250 mm as mean annual rainfall. The area is located in the tropical rain forest belt of the country. Generally, the vegetation in the area is broadly dominated by palm trees. The soil of the area were formed from rocks of pre-Cambrian basement complex formation particularly granites, gneisses, quartz-schist, biotite gneisses and schist.

According to the 2006 census figures as released by the National Population Commission (2006), the population of Akinyele local government was 211,359. Using 3.2% growth rate from 2006 census figures, the 2010 estimated population for the local government is 239,745. One salient feature of the population is the predominance of Yoruba ethnic group, which is over 95% of the total population of the area. Other notable ethnic groups are Hausa (reside mostly in Sasa), Igbo, Edo, Fulani, Nupe, Tivs, Efiks among others. The major occupation of the people is agriculture owing to a favourable climate and soil condition. However, trading and civil service work are now competing with agriculture in the area. There are periodic markets in the area where farmers sell their surplus agricultural products.

Research Design

This research adopted a descriptive survey design and utilized a case study approach to achieve its objectives. The study made use of data from both primary and secondary sources. The primary source relied on the use of field survey and observation, structured questionnaire and key informant interviews. The primary data gathered were supplemented by secondary data from journals, newspapers, websites and OYSURPB office.

Records of illegal physical developments under and within the ROWs to electricity transmission cables obtained from the Oyo State Urban and Regional Planning Board (OYSURPB) in 2010 revealed a total of 2,084 of such structures in 19 (58%) out of the 33 local government areas of Oyo State, seven of them in Ibadan land (Table 3). As indicated in Table 3, Ibadan, the capital of Oyo State, has seven of its eleven LGAs namely: Akinyele, Egbeda, Ibadan South West (IbSW),

Ibadan North (IbN), Ibadan North West (IbNW), and Ido having the highest records of 935 (44.9%), of physical developments under and within the ROWs to overhead EPLs. It also indicates that out of the seven LGAs in Ibadan, Akinyele had the highest number, 297 (129 permanent and 168 temporary) - 31.8%, of illegal structures under and near overhead EPLs in Ibadan, hence its choice as the case study area.

Table 3: Inventory of illegal structures under and within the ROWs of overhead transmission lines in 19 LGAs in Oyo State in 2010

| S/No | Local Government/ Local Planning Authority | Permanent | Temporary | Total |
|------|---|------------|--------------|--------------|
| 1 | Ibadan South West* | 34 | 07 | 41 |
| 2 | Ibadan North* | 30 | 20 | 50 |
| 3 | Egbeda* | 59 | 02 | 61 |
| 4 | Ibadan North West* | 80 | 22 | 102 |
| 5 | OnaAra* | 86 | 95 | 181 |
| 6 | Ido* | 97 | 103 | 203 |
| 7 | Akinyele* | 129 | 168 | 297 |
| 8 | Atiba | 53 | 46 | 99 |
| 9 | Kajola | 13 | 59 | 72 |
| 10 | Atisbo | 8 | - | 08 |
| 11 | Oyo West | 88 | 16 | 104 |
| 12 | Itesiwaju | 20 | 26 | 46 |
| 13 | Saki West | 05 | 227 | 232 |
| 14 | Surulere | - | 38 | 38 |
| 15 | Oyo East | 145 | 75 | 220 |
| 16 | Ogbomoso South | - | 21 | 21 |
| 17 | Ibarapa Central | - | 14 | 14 |
| 18 | Iseyin | 100 | 72 | 172 |
| 19 | Afijio | 08 | 115 | 123 |
| | Total | 955 | 1,126 | 2,084 |

*LGAs in Ibadan Region

Source: Oyo State Urban and Regional Planning Board (2010)

Questionnaire survey was preceded by the physical enumeration of structures and identification of occupiers of lands under EPLs and their ROWs in Arulogun, J. & P., L. A. Adisa and Orogun-Sagbe which were the four communities through which high-voltage pylons/electric transmission lines passed across. To test the validity and reliability of the research questionnaire (Saunders et. al., 1997 cited in Yusuf, 2014), it was pre-tested and administered to a pilot group of 32 people residing in permanent (16) and temporary (16) structures built under the overhead EPLs in the four communities. The pilot group was, however, excluded from the final survey and their data were also not included in the final data for the study. The pre-tested questionnaire was successfully administered by trained field assistants to 160 respondents representing 53.9% of the population of occupiers of both permanent and temporary structures under overhead power lines and their ROWs, in the four (4) communities where high EPLs pass across in Akinyele LGA. Random sampling method was adopted in selecting the respondents. Out of the 160 questionnaire administered, only 149 were properly filled while the remaining 11 were discarded giving a response rate of 93.1% which was considered significant enough to provide valid and reliable conclusions from the data collected.

An In-depth Interview (IDI) was conducted with the Director of Town Planning in Akinyele Local Planning Authority while Key Informant Interviews (KIIs) were held with site inspectors and the Development Control Officials of the Planning Authority. Questions asked included what they considered to be the causes of developments under EPLs, the effects and the efforts of the Planning Authority to stop the practice. Similarly, at the Ministry of Physical Planning and Urban Development, a KII session was held with the Director in the Development Control Department. Questions bothering on causes, consequences and efforts of the Ministry to stop development under EPLs were asked. The perceptions

of the Planning Officials on the level of awareness of the developers of extant planning laws and building regulations and the consequences of the physical development under EPLs were sought.

Quantitative data collected were analyzed by the use of descriptive and inferential statistics using the Statistical Package for Social Sciences (SPSS). Ethical issue was given consideration as regards active acceptance of subjects' right to privacy, confidentiality, and informed consent (Obono et. al., 2006). The researchers endeavored to respect the views of the respondents and ensured that respondents accepted to answer questions voluntarily. The primary data collected were not personalized and were handled with the confidentiality required.

Presentation of Results and Discussions

Socio-Economic Characteristics of Respondents

This section discusses the demographic and socio-economic characteristics of people living under electricity transmission lines in Akinyele LGA of Ibadan.

Age-sex Distribution of Respondents

The age distribution of residents under EPLs varies as shown in table 4, but a modal value of ages between 41-50 years in both temporary and permanent structures indicate that they were for the most part mature and thus germane as an understudy of phenomenon on physical developments under EPLs. The table also indicates dominance of male respondents (64 percent) over female respondents (36 percent) in permanent structures. The fact that household heads were male is typical of most Nigerian communities. However, under temporary structures, female respondents (51 percent) were slightly above male respondents (49 percent). The insignificant difference here infers that sex is not a factor for encroaching on lands under overhead EPLs.

Table 4 : Age-Sex Distribution of Respondents

| Age Parameters | Permanent Residents | | Temporary Residents | | Total | |
|-----------------------|---------------------|--------------|---------------------|--------------|------------|--------------|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| 18-30years | 9 | 10.7 | 10 | 15.4 | 19 | 12.8 |
| 31-40years | 11 | 13.1 | 11 | 16.9 | 22 | 14.7 |
| 41-50years | 30 | 35.7 | 21 | 32.3 | 51 | 34.2 |
| 51-60years | 26 | 31.0 | 17 | 26.2 | 43 | 28.9 |
| 61years and above | 8 | 9.5 | 6 | 9.2 | 14 | 9.4 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |
| Sex Parameters | | | | | | |
| Male | 54 | 64.3 | 32 | 49.2 | 86 | 57.7 |
| Female | 30 | 35.7 | 33 | 50.8 | 63 | 42.3 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |

Source: Authors' Survey, 2012.

Educational Status and Monthly Income of Respondents

The educational status and monthly income of the residents under EPLs is shown in table 5. The table reveals that, in case of permanent residents; only 6.0 percent were without formal education. About 29.8 percent attained primary, standard 6 or Arabic education. This implies that 35.8 percent of the respondents were or near illiterates. However, with only 38.1 percent permanent respondents having tertiary education, it could be inferred that lack of adequate education and awareness of the attendant danger was one reason why people built and lived

permanently under overhead EPLs. As for temporary residents, 54.5 percent were illiterates while 40 percent attained secondary and 7.7 percent had tertiary education. This is a clear indication that lack of education is one of the determining factors for residing under EPLs, coupled with poor enforcement of planning laws and building regulations. Also, income of residents varied as contained in the table. In the case of permanent respondents, modal respondents earned below N10,000 and this may determine their choice location. In the case of temporary residents, the modal value of respondents earned between N10,000 – 30,000; an income value that is grossly small to sustain a vibrant age bracket in Nigeria.

Table 5: Educational Status and Monthly Income

| Education Parameters | Permanent Residents | | Temporary Residents | | Total | |
|--------------------------|---------------------|--------------|---------------------|--------------|------------|--------------|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Primary, St VI or Arabic | 25 | 29.8 | 30 | 46.2 | 55 | 36.9 |
| Secondary | 22 | 26.2 | 26 | 40.0 | 48 | 32.2 |
| Tertiary | 32 | 38.1 | 5 | 7.7 | 37 | 24.8 |
| No formal education | 5 | 6.0 | 4 | 6.2 | 09 | 6.0 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |
| Income Parameters | | | | | | |
| <10,000 | 39 | 46.4 | 16 | 24.6 | 55 | 36.9 |
| 10,000-30,000 | 17 | 20.2 | 23 | 35.4 | 40 | 26.8 |

| | | | | | | |
|----------------|-----------|--------------|-----------|--------------|------------|--------------|
| 31,000 -50,000 | 15 | 17.9 | 11 | 16.9 | 26 | 17.4 |
| 51,000 -70,000 | 08 | 9.5 | 09 | 13.8 | 17 | 11.4 |
| 71,000 & above | 05 | 6.0 | 06 | 9.3 | 11 | 7.4 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |

Source: Authors' Survey, 2012.

Types, Usage and Planning Approval Status of Developments under overhead EPLs

Types and Usage of Developments under overhead EPLs

Basically, there are two types of developments under overhead EPLs; permanent and temporary, as shown in table 6. Also, the table indicated different uses that lands under EPLs are used for. In the case of permanent land uses, the modal usage of lands was for residential purpose (29.8 percent). This is followed by commercial (27.4 percent), religious (14.3 percent)

and educational (13.1 percent) land use respectively. Smog of other uses of lands under overhead EPLs were noticeable as shown in the table. With respect to temporary land uses, there was the predominance of commercial land use (67.7 percent) over other land uses. This indicates that the quest for economic survival is the motive for temporary encroachment under EPLs

Table 6: Types and Usage of Developments under Overhead EPLs

| Land Use Parameter | Permanent | | Temporary | | Total | |
|----------------------------|-----------|--------------|-----------|--------------|------------|------------|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Residential | 25 | 29.8 | 4 | 6.2 | 29 | 19.5 |
| Commercial | 23 | 27.4 | 44 | 67.7 | 67 | 45.0 |
| Industrial | 2 | 2.4 | 7 | 10.8 | 09 | 6.0 |
| Educational | 11 | 13.1 | 5 | 7.7 | 16 | 10.7 |
| Residential and Commercial | 3 | 3.6 | 3 | 4.6 | 06 | 4.0 |
| Agricultural | 2 | 2.4 | 2 | 3.1 | 04 | 2.7 |
| Agric. and Residential | 1 | 1.2 | - | - | 01 | 0.7 |
| Office | 2 | 2.4 | - | - | 02 | 1.3 |
| Education and Residential | 2 | 2.4 | - | - | 02 | 1.3 |
| Recreational | 1 | 1.2 | - | - | 01 | 0.7 |
| Religious | 12 | 14.3 | - | - | 12 | 8.1 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100 |

Source: Authors' Survey, 2012.

Availability of Approved Development Plan and Planning Approval Status

Table 7 indicates that more than half (58.3 percent) of residents of permanent structures got approval for their physical developments. Out of this, 29.8 percent got temporary approval and 28.6 percent had full approval. However, 41.7 percent had no approval for their permanent physical developments. This clearly indicates very serious laxity on the part of the Town Planning Officials and the cause for this is explained in the subsequent paragraph. In the case of temporary structures, 55.4 percent had temporary approval for their structures while 44.6 percent did not respond and deemed to, most probably, have no approval for their structures

God” and was “beyond their control.” However, 10.8 percent each attributed theirs to scarcity of land and relative cheap price of lands under EPLs. In the case of temporary residents, the chief reason for staying under overhead EPLs was given to be lucrative business purpose (55.4 percent), and this explains the reason why the major landuse activity in the temporary structures was commercial.

Residents’ Reasons for Locating under Electricity Power Lines

The reasons for the choice location of residents under overhead EPLs are contained in table 8. A significant number of permanent residents (53.1 percent) attributed it to closeness to place of work, while 25.3 percent ascribed their choice location to destiny. Ascribing it to destiny means that it was “ordained by

Table 7: Availability of Approved Development Plan and Planning Approval Status

| Approved Plans | Permanent | | Temporary | | Total | |
|------------------------|-----------|--------------|-----------|--------------|------------|--------------|
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| Available | 49 | 58.3 | 36 | 55.4 | 85 | 57.0 |
| Not available | 35 | 41.7 | 29 | 44.6 | 64 | 43.0 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |
| Approval status | | | | | | |
| Temporary | 25 | 29.8 | 36 | 55.4 | 61 | 40.9 |
| Full approval | 24 | 28.6 | - | - | 24 | 16.0 |
| No response | 35 | 41.7 | 29 | 44.6 | 64 | 43.0 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |

Source: Authors’ Survey, 2012

Table 8: Residents' Reasons for Locating under Electricity Power Lines

| Reasons | Permanent | | Reasons | Temporary | | Total | |
|-------------------------------|-----------|------|---------------------------------|-----------|------|-----------|------|
| | Frequency | % | | Frequency | % | Frequency | % |
| Scarcity of land | 9 | 10.7 | Land here is relatively cheaper | 8 | 12.3 | 17 | 11.4 |
| Land here is relatively cheap | 9 | 10.7 | Lucrative business purpose | 36 | 55.4 | 45 | 30.2 |
| Closeness to place of work | 45 | 53.6 | Space availability | 4 | 6.2 | 49 | 32.9 |
| Destiny | 21 | 25.0 | It is my father's property | 2 | 3.1 | 23 | 14.0 |
| - | - | - | Destiny | 4 | 6.2 | 4 | 3.1 |

Source: Authors' Survey, 2012

Causes of Physical Developments under Overhead EPLs

The results of the IDI conducted with the Director in the Development Control Department in the Ministry of Physical Planning and Urban Development, and the Director of Town Planning in Akinyele Local Planning Authority and also the Key Informant Interview (KII) held with the Development Control Staff of the Planning Authority are presented in the next subsection of the paper.

Questions that the planning authority staff were asked included what they considered to be the causes of developments under EPLs, the effects and the efforts of the Planning Authority to stop the practice. Similarly, at the Ministry of Physical Planning and Urban Development, questions bothering on causes, consequences and efforts of the Ministry to stop development under EPLs were asked. The perceptions of the Planning Officials on the level of awareness of the developers of extant planning laws and building regulations and the consequences of developments on land under EPLs were also sought.

AKTPA Town Planning Officials' Perspective on Structures under EPLs

Findings from Town Planning Officials of AKTPA revealed that owners of structures under overhead EPLs obtained planning approvals through presentation of deceitful, faulty and misleading building plans. In addition, financial inducement (bribery) to planning officials by developers contributed to the emergence of physical developments under EPLs. It can, therefore, be inferred that fraud on the part of owners of illegal structures and corruption on the part of town planning officials constitute very significant factors in explaining the development of illegal structures under overhead EPLs.

Perceived Effectiveness of Development Control on Lands under EPLs by Staff of AKTPA and OYSURPB

The IDI and KII sessions held with Town Planning Officials at AKTPA and OYURPB indicated that enforcement drives in EPLs areas were ineffective. The observed high rate of perceived ineffectiveness

of enforcement drive in the study area was attributed mostly to political interference, with lack of political will, shortage of manpower, inadequate finance, and lack of police back-up.

Perceived Health Effect of Electricity Power Lines

As stated in previous paragraphs, existing literature (Momoh, 2010a 2010b; Davis et al., 2002; Litvak and Foster, 2002; Zhu et al., 2003 and Ayeni, 2009), associate residing under EPLs with some health challenges, prominent among which are: high blood pressure, irregular heart beat, skin cancer, body joints dislocation and arthritis. Investigations were conducted on prevalence of these health challenges in the study area, with the view of checking for possible effects of the nature of the structure (i.e. whether permanent or temporary) on perceived severity of the health effects.

The study revealed variations in the perceived health effects of living under EPLs in the study area (Table 9). The most prominent health effect on those residents under EPLs in the area was high blood pressure (68.0 percent). This was perceived to be higher in permanent structures (96.5 percent) than temporary structures (30.8 percent). The next highly rated health effect of EPLs in the study area was irregular heart beat (48.0 percent) perceived to be

higher in permanent structures (54.8 percent) than in temporary structures (40.0 percent). Body joints dislocation came third in overall rating (16.7 percent) and was still perceived to be more severe in permanent structures (26.2 percent) than in temporary structures (4.6 percent). Skin cancer was rated fourth in the order of perceived severity (14.7 percent) and was also perceived to be more severe in temporary structures (24.6 percent) than in permanent structures (7.1 percent). The health effect rated least in the study area was arthritis (7.3 percent) perceived to be more severe in temporary structures (9.2 percent) than in permanent structures (6 percent). Although the observed variations in the perceived severity of health effects of EPLs between temporary and permanent structures could be due to occupants' duration of stay under overhead EPLs. Further investigations were conducted to establish whether the observed variations were statistically significant or not.

Table 9: Responses of Occupiers Regarding Effects of Living under EPLs on their Health

| Ailments | Permanent Structures | | Temporary Structures | | Total | |
|-------------------------|----------------------|--------------|----------------------|--------------|------------|--------------|
| | No. | Percent | No. | Percent | No. | Percent |
| High blood pressure | 81 | 96.0 | 20 | 31.0 | 101 | 68.0 |
| No high blood pressure | 03 | 4.0 | 45 | 69.0 | 48 | 32.0 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |
| Irregular heart beat | 46 | 54.8 | 26 | 40.0 | 72 | 48.3 |
| Skin cancer | 6 | 7.1 | 16 | 24.6 | 22 | 15.0 |
| Body joints dislocation | 22 | 26.2 | 3 | 4.6 | 25 | 17.0 |
| Arthritis | 5 | 6.0 | 6 | 9.2 | 11 | 7.0 |
| No response | 5 | 6.0 | 14 | 21.5 | 19 | 13.0 |
| Total | 84 | 100.0 | 65 | 100.0 | 149 | 100.0 |

Source: Authors' Survey, 2012

Using the contents of Table 9, Chi-square (X^2) test was conducted to test the validity or otherwise of the researchers' hypothesis that 'there is no significant difference in the health challenges faced by residents in temporary and permanent structures underneath overhead EPLs'. The decision rule was that we reject H_0 if the calculated value of X^2 is greater than the table value. The results of the investigation revealed and computed $X^2 = 39.43$, tabulated $X^2 = 9.19$, $df = 4$, $P < 0.05$.

Since the calculated X^2 (39.43) is greater than the table X^2 (9.19) at $P < 0.05$, the difference is significant. Therefore, there is a significant difference in the distribution of ailments between permanent and temporary structures. The observed higher incidence of ailments in permanent structures than in temporary structures might be due to longer period that occupiers spend in permanent structures than in temporary structures under overhead EPLs.

Conclusion and Recommendations

Conclusion

The study has provided empirical evidence of the adverse health effects of residing in structures under overhead EPLs. It can thus be concluded that the nature of the structures – whether permanent or temporary- affects the overall health of the residents under overhead EPLs in the study area.

Recommendations

Urban planners should pay adequate attention to and apply the provisions of space standards, extant planning laws, building regulations and development plans when designing lands that are in close proximity to electricity power lines (EPLs) and their right-of-ways (ROWs). Similarly, planning agencies should protect such lands from misuse and abuse of use by developments that are detrimental to the health, safety and security of the public. Where lands under/near overhead EPLs and their ROWs have been developed, as in Akinyele LGA discussed in this paper, adequate and concerted

measures should be taken to mitigate the effects of EMFs to the barest minimum. In addition, fraud in the planning agencies should be precisely and decisively tackled. Proactive measures are required by planning agencies in collaboration with power transmission companies geared towards pre-occurrence and re-occurrence of infringement on ROWs. This is more cost effective in both the short and the long run.

The findings from this research revealed the need for the government to take holistic approach towards addressing proliferation of physical developments under EPLs and their right-of-ways. Such an approach would hinge on the adoption and strict enforcement of the extant physical planning standards and the Nigerian Urban and Regional Planning (NURP) law. Whatever the case may be, development control which aims at preventing the erection or/and removal of all forms of physical developments under overhead EPLs, is an indispensable strategy for remediating the anomalies. The provisions of Sections 28 to 31 of the NURP law should be evoked and strictly enforced in order to protect the health and safety of people and also improve the aesthetics of the environment.

Buildings located at or near the edge of the ROWs may face certain impacts from electric field induction. These impacts can be mitigated if they are better understood at the time of the land development planning stage. Nothing should ever be attached to a transmission tower or pole, whether temporary or permanent. Storage or use of hazardous materials that are inflammable, explosive, or corrosive should not be permitted in or near ROWs.

Through proper public enlightenment, 'political heavyweights', the elites and the general public should be made fully aware of the deleterious effects that overhead transmission lines induce on the occupiers of lands under them. Such a concerted and routine effort by planning agencies in collaboration with power transmission companies, emergency management agencies and civil society organisations will enable

government secure a 'development free zone' under overhead EPLs. Once this is achieved, government, through the power transmission company, must take immediate physical possession of the land by using barricaded wires for demarcation of all lands under overhead EPLs. This is necessary so as to deter likely intrusion or encroachment on these lands. Also, local government councils should be made to include the management and control of lands under overhead EPLs in their areas of jurisdiction into their urban management responsibilities by working in synergy and collaborating with physical planning agencies, the electricity transmission company and traditional institutions and civil society groups. In addition, the Federal Ministry of Power (Electrical Inspectorate Division) should be made responsible for routine and comprehensive monitoring of overhead transmission lines, basically for time-to-time determination of pylons that need to be upgraded and reporting cases of infringement on ROWs to the appropriate government agency(ies) for necessary actions.

Landscaping is one of the most effective methods to diffuse the effects of transmission facilities, while transforming the space within and adjacent to the ROWs into an aesthetically pleasing amenity to homeowners. Screening can enhance the quality and intimacy of the immediate setting by creating the perception that towers have receded into the distance. Consideration should, therefore, be given to the use of green screening in layers with varying heights to match site circumstances. This will also enhance vegetal cover and promote climate change mitigation in the area. Appropriate low growing vegetation can be located within the ROW, while larger species can be planted near the edge of the ROW. At the edge of the ROW, the species must be planted far enough from the transmission facilities as not to pose a threat to the facilities (swaying into the wires, etc.). Street planting can be 'retro-fitted' to existing environments to soften the visual impact of towers and overhead EPLs.

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