

## **Power Outages in Port Harcourt City: Problems and Solutions**

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**Abstract:** *Frequent power outages arising from poor state of electricity infrastructure is hindering Nigeria's socio-economic growth. Port Harcourt is one of the foremost cities in Nigeria where business and social activities are becoming rapidly more dependent on electricity. Any power outage, even of the shortest duration, in Port Harcourt City has severe socio-economic impacts and there is no likelihood that the phenomenon would abate even in the nearest future. This research investigated the causes of incessant power outages in Port Harcourt City and suggested remedial measures to reverse the trend. The researcher relied on data collected from primary sources through personal observations, interviews and discussions with residents of the City and from secondary sources such as the National Bureau of Statistics (NBS), the Manufacturers Association of Nigeria (MAN) and current scholarly literature relating to this research, over a period of twelve months. The study used a descriptive and the non-parametric simple percentages technique in analysing the data so collected and in drawing conclusions. It was found that inadequate power generating capacity, shortage of gas, weak and dilapidated electrical transmission and distribution network, inadequate power infrastructure facilities, etc. are the chief causes of incessant power outages in the Port Harcourt metropolis. The paper recommends, among others, immediate upgrade of existing power infrastructure facilities, review of government policy on domestic gas supply and stiff statutory legislation on vandalism as measures to stabilise electricity supply in the Port Harcourt city.*

**Keywords:** *Power outages, economy, economic growth, Nigeria, investment*

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### **I. Introduction**

Power outage is a recurrent phenomenon in most sub-Saharan African countries and describes a state of complete absence of electricity at the consumer's end [1]. Despite the billions of dollars invested in the Nigeria's power sector, electricity supply situation in the country keeps worsening, day by day [2] to the extent that about 95% of Nigerians cannot boast of 16 hours of electricity availability daily [3] while many urban cities and towns across the country hardly enjoy three to four hours of uninterrupted power supply each day due to the ever-widening gap between demand and supply, especially in the urban areas. Port Harcourt seems to be the worst hit. This is despite the fact that it is the largest city in the South-South of Nigeria and economically the fastest growing city in the country. Statistics shows that more than 70% of all foreign investments in the Niger Delta region is concentrated within Port Harcourt which is why it is rightly nick-named, 'The Treasures Base' of the nation, being the centre of the Oil and Gas industry - the mainstay of Nigeria's economy.

### **Statement of the Problem**

Port Harcourt, unlike many other parts of Nigeria suffers from acute shortage of electricity supply due to insufficient megawatts the Port Harcourt Electricity Distribution (PHED) Company receives from the national grid daily. Most times, only a small fraction of the actual energy needed for the city is available causing the company to resort to unplanned load-shedding to ensure the limited supply goes round. At other times, power outages occur due to loss of distribution transformers and 132kv transmission lines to vandals [4] who at other times, freely cart away copper cables even when already buried in the ground.

The unreliable state of public electricity supply in Port Harcourt has forced many large business ventures and prominent residents to acquire and depend largely on private electricity generating plants in order to remain in business and live comfortable life. This has greatly increased business running costs, the costs of production of goods and services and the consumers paying more to access basic goods and services. The poor residents and the small-scale businesses who can hardly afford own electricity supply are the most adversely affected. For this category of individuals and business operators, owning and maintaining private electricity generating plants coupled with the associated costs is a herculean task [5]. Most of these have either moved away from the city or closed down their businesses – a trend which if not reversed in good time might cost Port Harcourt City its status as one of the socio-economic nerve-centres in Nigeria.

### **The Study Area**

Port Harcourt is the capital city of Rivers State of Nigeria. It is situated on the coast of the Atlantic Ocean's Gulf of Guinea and approximately 20km inland on the Bonny River (See Fig.1). From a small

population of 235,098 in 1963, its current population stands at 1.5 million [5]. Port Harcourt is one of Nigeria's major Port cities and boasts of two commercial harbours and several private harbours. The city, situated in the south-south political region of Nigeria is the fourth largest city in the country after Lagos, Kano and Ibadan and is home to many industries being the largest oil and gas producing area in Nigeria as well as the country's second largest economy, next only to Lagos state.

Port Harcourt is an international hub for business activities and holds great potentials not only for growth and expansion but possesses a resource base not common in the entire West African region. It is in this light that efforts must be geared up to salvage it from insufficient and decaying infrastructure especially the present state of epileptic electricity supply. The Port Harcourt Electricity Distribution Company, one of the 11 distribution companies (DISCOs) that recently took over the assets of the defunct Power Holding Company of Nigeria (PHCN) is located in Port Harcourt.

Many households and most of the large industries in Port Harcourt generate their own electricity confirming the World Bank's estimates that only 41% of Nigeria is electrified [6]. Although the area has a transmission network at 132kV, actual distribution of electricity is through 33kV networks and 33/11kV injection substations, 11kV distribution networks and low voltage networks that supply electricity to the end users.

There are acute power generation, transmission and distribution shortfalls in Port Harcourt. The city currently receives a paltry 200MW out of an estimated actual electricity demand of 803MW [6] and due to this gross shortfall in energy supply, the city experiences frequent power outages forcing many industries and businesses to acquire and operate their own generators to meet their daily demands for uninterrupted electricity supply.

The Port Harcourt International Airport, for instance, relies 100 per cent on generators for the running of the airport and uses about 132,000 litres of diesel monthly to power its private generating plants [7].



**Fig. 1:** Map of Port Harcourt

At another firm, the Port Harcourt Refinery Company (PHRC), frequent power outages has damaged many processing plants and reduced production at the firm to near zero level. According to [8], the company operated for only 82 days in the entire 2013 due to pipeline vandalism, another social menace commonplace in the modern-day Nigeria.

A recent statistics on the use of generating sets in the country showed that about 60 million Nigerians spend N1.6 trillion on generators annually [9]. This is besides more than 93% of Nigerian firms that depend on their own private generators for electricity supply [10]. In fact, the Manufacturers Association of Nigeria (MAN) and the National Association of Small Scale Industries (NASSI) say their members spend an average of about N2billion (about \$12 million) weekly to generate their own electricity [9,11].

Experts have projected that the electricity demand by Port Harcourt city alone by 2020 may be as high as 1.93GW, an indication of a possible, very severe and escalating energy shortfall in the nearest future [6]. Presently, some businesses, especially the small-scale ones have closed shop and many others are on the

verge of doing so while social activities no longer boom as usual. There is the need, therefore, to take urgent proactive actions now to forestall an impending severe energy deficit among business operators and the collapse of social life in this Nigeria's rapidly growing city.

## II. Literature Review

Adequate and reliable power supply is fundamental to the rapid and sustainable socio-economic development of a people or nation [12]. Good infrastructural services, especially electricity, is a prerequisite to the rapid and sustainable socio-economic growth of any country. But inadequate and unreliable access to electricity services have been a regular feature in the Nigerian power sector [13,14,15]. Any power outage, even of the shortest duration, in Port Harcourt City has severe economic impact. Business and social activities in the area are becoming rapidly more dependent on electricity and there is no likelihood that the potential impacts of power outages on industries would abate in the nearest future.

The high cost of power outages has inspired a lot of studies into the power sector of the economy over the years. Various researchers [10,16,17,18,19,20,21] have investigated the different aspects of the cost of power outage to the economy. In particular, [18] established a variation in the outage costs of electricity among consumers and noted that though the residential outage costs are lower than those of commercial and industrial consumers, the difference between industrial outage costs and the commercial costs is not very significant.

As noted in [22], besides causing prolonged blackouts, power outages result in factory closure, health problems, loss of life and properties and eruption of violence with the subsequent hampering of economic development. According to [23], the erratic electricity supply in Nigeria can hinder industrial growth unless the sector is reactivated by means of some radical public-private sector participation strategies.

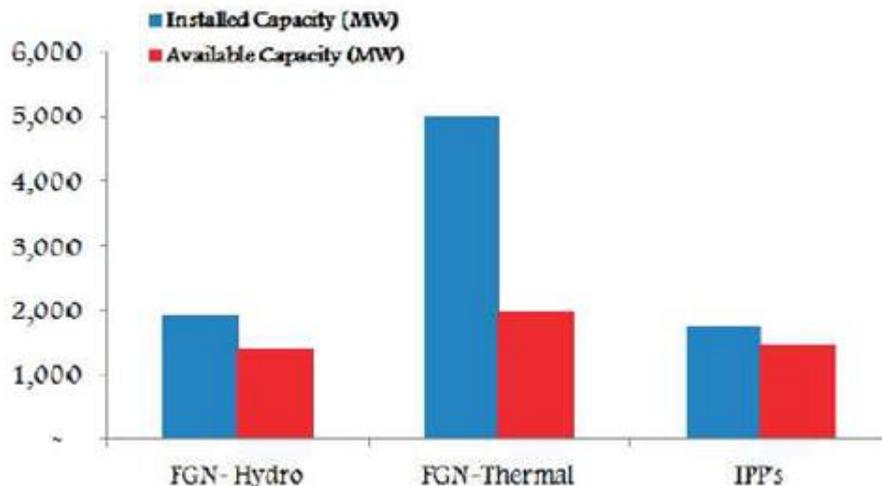


Fig. 2: Installed and Available electricity capacity in Nigeria (Source: Nigerian Bureau of Public Enterprises, 2011)

Nigeria is currently faced with acute shortage of electricity despite the availability of vast natural resources in the country [24]. The country has 14 generating plants, which supply electric energy to the national grid. Three of these plants are hydro located at Kainji, Jebba and Shiro and 11 are thermal (gas/steam) situated at Afam, Sapele, Ogorode (Delta), Egbin, etc. (Ezechukwu, 2013). The total installed capacity of the generating plants is above 5,000 MW, but the available capacity is less than 4,000 MW. Presently, seven of the fourteen power stations are over 20 years old causing the average daily power generation output come far below the demand and forcing the nation to experience massive load shedding always [25]. Though some of these plants are either being renovated or upgraded, there are still other technical issues e.g. overloaded transformers, weak cables etc. along the transmission and distribution networks which continue to make the enjoyment of regular electricity supply difficult for the consumers [26].

Nigeria's transmission network is very weak and has maximum electricity wheeling capacity of only 4,000 MW [25]. The distribution network too is riddled with technical problems coupled with high technical and commercial losses which make it difficult for the distribution companies (DisCos) to recoup returns on their investments. Fig. 2 shows the installed and available electrical power as contributed by both the Federal Government and the Independent Power Projects (IPPs) in Nigeria.

## III. Methodology

Data for this study was collected through both primary and secondary sources. Primary data were collected through personal observations, face-to-face interviews and discussions held with residents of the city over a twelve month period. Current and recent scholarly literature related to this research were also consulted.

The study population comprised the entire Port Harcourt City. To facilitate the distribution and retrieval of the questionnaire, the entire city was segmented into four zones; north, south, east and west according to geographic locations and to each zone was assigned a survey helper who assisted in the distribution and retrieval of copies of the questionnaire. For purposes of this research, a sample population of 300 was purposively selected from the total population of 1.5 million people in the ratio 1:1:1 in order to have representative samples of the residents, industrialists and commercial business people who have either lived or operated their businesses within the area for at least 30 years. A total of 300 copies of the questionnaire were distributed therefore to the respondents. Only 280 copies were however successfully retrieved and used for this research. The remaining 20 copies were either misplaced or destroyed by the supposed respondents and could therefore not be accounted for. Through the questionnaire, the respondents were made to provide answers to probing questions such as: "What factors do you think are responsible for frequent power outages in Port Harcourt?" and "Kindly rank the factors that you have stated as being responsible for power outages in Port Harcourt in the order of their severity." The study employed descriptive and non-parametric percentages technique of data analysis and presentation. This article made its recommendations based on information extracted from returned copies of the questionnaire and the secondary sources herein referenced.

#### **IV. Findings and Discussion**

##### **Problems facing adequate and reliable Electricity Supply in Port Harcourt City**

- Weak and broken transmission and distribution networks: Weak and dilapidated electrical networks such as shown in Fig.3 is among the major causes of frequent power outages in Nigeria and in Port Harcourt particularly. Power system networks nowadays operate very close to their stability limits due to increasing load demand, industrialization, environmental and economic factor which makes the construction of new transmission lines and generating stations somewhat difficult. Consequently, many of the networks have become weak, heavily loaded and prone to voltage instability [27]. Currently, Nigeria's transmission system network has a maximum wheeling capacity of about 4,000 MW due to its technical weakness and high responsiveness to major system disturbances. Some sections of it are also outdated and are yet to be upgraded to meet the present load demand [25].
- Inadequate power generating capacity: The total installed capacity of the generating plants is above 5,000 MW, but the available capacity is about 4,000 MW and coupled with the fact that significant number of these power plants are over 20 years old, the average daily power generation is below 2,700 MW. The result is that present power demand in Nigeria is far above the available generating capacity thus power outages occur frequently [10,12,28].
- Lack of good maintenance culture: Nigeria has poor record of maintenance programme of existing electrical facilities. Most of the transmission lines, distribution transformers and equipment are very weak having outlived their usefulness. Still, these are neither discarded, upgraded nor maintained in spite of being in much deplorable condition due to poor maintenance culture. Lack of maintenance makes equipment to perform below optimal levels and contribute to incessant power outages [9,28].



**Fig. 3:** Broken infrastructure potential cause of power outage. Source: (Omoju, 2014)

- Climatic condition, storms and lightning strikes: Power supply situation in Port Harcourt worsens during the period of April to July due to rainfall, resulting in outages arising from system failures. System failures, sometimes, last for over two weeks caused by very huge tree falling and sometimes destroying to the very foundation transmission towers. Oftentimes, several areas are simultaneously thrown into darkness due to a big storm that knock out three transmission towers[12].
- Inadequate infrastructural facilities: The last transmission line in Nigeria was constructed over twenty years ago. Many of the distribution facilities too have become undersized and can no longer carry the available loads since these are above their originally designed capacities[29]. The number of available generating plants are also not enough to provide adequate electricity to meet the ever growing demand for its supply[30]
- Vandalism: There have been several reported cases of vandalism of electricity infrastructures across Nigeria. Though these occur mostly in rural areas like Port Harcourt, the phenomenon poses great danger to the efforts of government and the power industry to achieve efficient electricity supply to the populace [12, 28]. There also have been reported cases of some of these vandals electrocuted while engaged in their nefarious acts. See Fig.4.
- Wasteful use of electricity. Most Nigerian are ignorant of the need for energy conservation. In spite of the shortage in electrical energy, most consumers leave their electrical appliances e.g. Television sets, room and security lights, etc. switched on for long hours even while away from homes during the daytime. Some leave air conditioners, refrigerators and other energy-consuming fittings on in the offices and shops over the weekends. This leads to wastage of scarce electrical energy and hinders those in dire need of the energy from accessing it [12,28].
- Corruption: Sometimes, utility staff deliberately discourage electricity consumers from settling bills officially, preferring rather to adjust energy meter readings in favour of such customers in exchange for some fees usually far less than what the consumer would have otherwise paid officially as bill to the utility. Such dubious acts impact negatively on the finances of the electricity distribution company (DisCo) and makes it more difficult for the company to meet its statutory obligation of efficient service delivery due to shortage of funds [12].



**Fig. 4:** A Vandal electrocuted in a distribution transformer (Source: Usman, 2014)

- High transmission and distribution losses: The Nigeria 330 KV transmission grid is characterized by high power losses due to its very long transmission lines. Power losses result in lower power availability to the consumers, leading to brownout or inadequate power to operate appliances; a situation synonymous with power shortage [30]. The aggregate transmission and distribution loss in Nigeria averages 40% of electric energy generated and is also among the world's highest [31,32]. Energy losses make it difficult for electricity distribution companies (DisCos) to breakeven and reinvest into their business.
- Unpruned trees under transmission lines: Sometimes trees are allowed to grow under transmission lines which if left unpruned grow to the height of the transmission lines and short circuit two or more current carrying conductors which leads eventually to sudden power outages [12].
- Shortage of skilled manpower: Lack of technically skilled staff is among the challenges facing the power industry in Nigeria. Presently, there is great scarcity of technical specialists who are able to apply modern sophisticated technologies in a production activity in the power sector. Specialists are a great asset to the power sector because they help enhance efficiency and productivity in the power industry. The absence of this grade of personnel is often among the major causes of delay in restoring normalcy to power system

grids in most developing countries including Nigeria. Investment in electricity infrastructure alone will not promote efficiency, unless there is a corresponding investment in human resources and research development [33].

- Overloading of transformers and electrical equipment: Most distribution networks are overloaded due to limitation in transformer capacities. This results in failure of the distribution transformers or the melting of protective devices. At other times, the consequence is a low voltage that cannot serve any useful purpose to the consumer. Such is usually the case in most urban areas with high population densities like Port Harcourt [12].
- Shortage of Gas: Nigeria is rich with natural gas reserves ranging into several trillions of standard cubic feet, still the country is in dire need of gas to fire its power stations [29]. This is partly due to persistent destruction of the gas pipelines by vandals, inadequate infrastructure needed for gas gathering, processing and transportation of the gas to required destinations [9] and the preference of the gas producing companies to sell to other customers rather than supply government at low prices [12,29]. For instance, some of the newly commissioned power plants like Geregu and Omotosho plants in South Western Nigeria do not have the needed gas supply infrastructure [34]. Added to this is the problem of flagrant gas flaring. Nigeria currently flares about 2 billion standard cubic feet of gas thus making itself responsible for over 75 per cent of the gas flared in the entire Africa [35].
- Bush Burning: During dry seasons, farmers and cattle ranchers ignorantly burn bushes under and near transmission lines causing flashovers between towers and phase conductors of the 330KV transmission lines which happening disrupts normal electricity supply [12].
- Illegal connections: Many electricity consumers use the energy illegally by hooking their residential houses and business premises on to the grid through illegal connections thus forcing the Utility to lose funds which should have been reinvested to offer more efficient statutory services to the customers. Besides, illegal consumption of electricity makes load forecasting and planning rather cumbersome. Worse still, most of these illegal connections which are usually hurriedly and loosely made with undersized cables and at night when nobody can see them later result into occasional sparking and sometimes very serious damages to both the distribution lines and transformers [12].

**Table 1:** Ranking of the Problems affecting Adequate and Regular Electricity Supply in Port Harcourt City in their order of severity (The higher the percentage, the more severe)

| Problem  | Severity expressed in terms of number of respondents | Percentage of severity expressed as percentage of total number of respondents) |
|--|--|--|
| Weak Transmission and Distribution Network           | 30   | 10.71%   |
| Inadequate Power Generating Capacity                 | 50   | 17.86%   |
| Lack of Good Maintenance Culture                     | 15   | 5.36%  |
| Climatic Conditions                                  | 10   | 3.57%  |
| Inadequate Infrastructural facilities                | 30   | 10.71%   |
| Vandalism  | 25   | 8.93%  |
| Wasteful Use of Electricity                          | 10   | 3.57%  |
| High Transmission and Distribution Losses            | 10   | 3.57%  |
| Shortage of Skilled Manpower                         | 15   | 5.36%  |
| Shortage of Gas                                      | 35   | 12.50%   |
| Corruption   | 10   | 3.57%  |
| Illegal Electrical Connections                       | 10   | 3.57%  |
| Bush Burning   | 10   | 3.57%  |
| Unpruned Trees Under High-Tension Transmission Lines | 5  | 1.79%  |
| Overloading of transformers and electrical equipment | 15   | 5.36%  |
| <b>Total</b>   | <b>280</b>   | <b>100%</b>  |

Source: Field Survey, 2015

### V. Conclusion and recommendations

This study affirms that power outage is a great hindrance to the sustainable socio-economic growth of Port Harcourt and that certain factors are majorly responsible for the persistence of the phenomenon. The most severe of these as reflected in Table 1 are: Inadequate power generating capacity, shortage of Gas, weak transmission and distribution network, inadequate infrastructural facilities, vandalism, wasteful use of electricity etc. This researcher, therefore, makes the following recommendations towards the improvement of electricity supply to the area:

1. There should be frequent inspection and planned maintenance programme for all electrical installations and facilities. The high voltage transmission lines should be closely monitored and regularly inspected to avoid trees growing under and bridging the high tension (H.T.) lines.
2. There should be an immediate upgrade of the power transmission and distribution infrastructures beginning with those at the distribution sub-sector to ensure that they can efficiently distribute the amount of electrical power being generated currently and in the foreseeable future. The number of power generating stations should be increased also to meet the ever increasing demand for electricity. It is both important and necessary to avoid overloading of transmission lines and distribution transformers. In the same vein, the daily energy allocation to Port Harcourt should be increased in view of the City's current high level demand for electricity.
3. There should be an immediate and comprehensive power generation planning programme that would determine the country's maximum load demand when the suppressed loads are added to the national grid.
4. The on-going deregulation of the power sector should be fully implemented and the new distribution companies (DisCos) should be adequately funded to enable them overcome some of the inherent teething problems and also guarantee their smooth take-off.
5. Government should legislate against people who vandalise electrical installations and those pride in making illegal connections to electrical infrastructures. Persons who connive with distribution companies (DisCos) staff to avert/circumvent payment of electricity bills should equally be made to suffer stiff penalties for such offence (s).
6. Nigeria should emulate Ghana and Niger republic and legislate an energy conservation and efficiency policy that would encourage consumers to use electric gadgets and devices that do not consume much current. For instance incandescent bulbs should be outlawed to give way for LED bulbs in order to save some energy.
7. Nigeria should consider entering into an agreement with neighbouring African countries for a power pool programme that would enable them share electrical energy sources commonly among themselves.
8. Distributed generation should be encouraged so that more and more power plants can be installed especially at locations where fuel such as gas and coal are available. This would help determine the maximum energy demand not only for Port Harcourt but for Nigeria as a whole.
9. Alternative sources of energy must be fully explored and used in order to reduce the nation's over-dependence on gas. Government must review its current policy on domestic gas supply and ensure increased investment in gas infrastructures so that gas can be readily available for local use.
10. Efforts should be expedited to make pre-paid meters available to every electricity consumers. This would help checkmate power wastages and exploitation of unsuspecting customers by dubious staff of electricity distribution companies (DisCos).
11. There should be programmes to enlighten the public and especially electricity users on how to use the energy economically and efficiently and on the need to safeguard electrical installations and equipment in their domains from being vandalised. The populace should also be taught the danger of burning bushes near electrical infrastructures and under high tension transmission lines. In the same vein, they must be told of the legal implications of illegal use of electricity.
12. There should be regular and proper policing of electrical installations, equipment and gas pipelines by the relevant security agencies. Government should as matter of urgent national interest make vandalism an illegal business by ensuring that suspected vandals are promptly prosecuted. Proper street lighting of areas where these installations are located too will reduce the activities of the vandals. The relevant agencies of government should liaise with community leaders to sensitise their people and help in policing electrical installations in their areas.
13. Utility companies workforce should be overhauled from time to time to ensure that only qualified and technically competent persons drive the new efficient and sustainable electric power system. There should be in place also, regular on-the-job training and retraining of staff of the electricity supply companies to keep them abreast of latest developments in the power system world.

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