



## **ACOUSTIC AND PARTICULATE EMISSIONS EMANATING FROM POWER GENERATING SETS IN OUR URBAN CENTERS CONSTITUTE ENVIRONMENTAL POLLUTION: A CASE STUDY FOR UMUAHIA METROPOLIS**

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### **ABSTRACT**

Apart from not generating and distributing power to Nigerians for various purposes including domestic use, Power Holding Company of Nigeria (PHCN) (a federal government outfit responsible for this task) has directly or indirectly encouraged pollution of our immediate environment. In a bid to search for an alternative power source for inevitable domestic chores, assorted generating sets have been imported into the country and electricity consumers in the urban centers are using them to further pollute our already degraded surroundings (unconsciously, anyway). This is an aspect of environmental degradation in our midst which many people take no notice of, but it is a big problem. This paper intends to highlight some of the increasing nuisance caused daily by indiscriminate use of these machines and also solutions are proffered accordingly.

**Keywords:** generating set, pollution, environment, electric power, noxious fumes, PHCN

### **INTRODUCTION**

Following the colossal failure of our Power Holding Company of Nigeria (PHCN) to produce and distribute electric power for agricultural, industrial, commercial, and domestic purposes many urban dwellers have resorted to procuring electric power generators. It is a common site to see generating sets of assorted types and sizes, disturbing the peaceful and wholesome quietness of our surroundings in a bid to supply energy. Actually, these machines are solving some obvious problems but in the course of solving one problem they create more problems, at times more serious problems than the prevailing ones we want to solve.

It is important to state that these power plants are useful as we employ them for home and domestic usage even in the rural and sub-urban centers. In these centers we do not notice any problems emanating from them because they are very few and there is more vegetative cover which absorb the noise/sound and fumes they hitherto produce. In sharp contrast, within our metropolis and cities a large number of generators are located here and there in high density populated areas. As a typical example, the author's place of abode in Umuahia where this treatise was prepared, there are thirteen clustered two/three-storey buildings within the vicinity comprising of one hundred and four (104) flat appointments of three or four bedrooms each. It is important to mention here that all these flats have generators for electricity supply. If one comes here between 17.00 and 23.30 hours UT daily when apparently all the gen sets are functioning, one would experience the level of degradation we do to our immediate environment without knowing. Hence, the primary objective of this paper is to assess, from scientific point of view, the way we degrade or pollute our surroundings in quest for electric power especially within the urban settlements of Nigeria.

### **Brief Historical Reminiscence**

But for Michael Faraday (1791-1867) no one knows what this world would have looked like without his invention of electricity (Cane and Nisenson, 1969). Nigeria inherited Electricity Corporation of Nigeria (ECN) at independence in 1960 to generate and distribute electric power all over the country. After some years the name was changed to National Electric Power Authority (NEPA) with a wider scope of service to produce and distribute electric power in Nigeria and export beyond Nigerian borders. By this, some neighboring countries like Cameroon, Niger Republic, Chad, Benin Republic, etc could import power from Nigeria's hydroelectric power project. As years went by, NEPA was not living up to expectations and this resulted into serious power crisis as industries were forced to close down. This earned them a "befitting" name "Never Expect Power Always" to rhyme with the official acronym. In the same vein, commercial and domestic usage gradually crumbled down to "No Electric Power At-all". Meanwhile, to cushion the effect of this horrible situation, many generators were being imported into the country from other countries notably Japan, China, and Taiwan. NEPA's poor or non-performance necessitated and desired another change of name again; this time to Power Holding Company of Nigeria (PHCN), we prayed that this new body/name would live up to the desired expectations.

The change in name however, did not change matters. Rather, higher monthly electric tariffs were collected but little or no power delivered. Nobody can say whether they are "hiding" the power or "holding" it so as to reach nobody. This is briefly the condition Nigerians found themselves that led to searching for alternative power supply system and this they discovered in encouraging individuals to own power generating plants. Thus, generating sets have come to stay with their attendant nuisance to our environment in different ways. Electricity is an essential utility and its absence is felt in various aspects of human endeavor.

### **Uses and Undesirable Effects on Our Environment**

The electric power generator, called by many different names – gen set, plant, power generator, 'I pass my neighbor', etc – is a machine or device which produces electricity by burning petrol or gasoline, depending on the capacity or volume of work needed to be done, the generator is of different brands, types and sizes. We have Tiger, Sumec, EleMax, EleMaQ, EloPaC, Yamaha, Honda and others which are the principal items of discussion here and not the gigantic plants used in universities, institutes, ministries, big factories and banks. The gen sets under study are household machines capable of delivering power for home-based chores or small-scale enterprises. Their use gives rise to the following problems:

- i. **Air Pollution:** while the generators are functioning, they produce toxic fumes like carbon monoxide (CO), sulphur dioxide (SO<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), hydrogen sulphide (H<sub>2</sub>S), nitrous oxide (N<sub>2</sub>O), etc as by-products of hydrocarbon combustion. These gases pollute the air we breathe within the immediate environment causing irritating red eyes and severe hardness in breathing. At this stage, any further increase of these noxious gases into the surrounding could cause instant death. Also, man and the machines are competing for the available oxygen around (as animals use it for breathing, machines use it to support combustion of hydrocarbon to release energy). With many hours of numerous machines working simultaneously, oxygen might be in short supply and there are no vegetative plants to absorb the constantly produced carbon dioxide and other toxic gases; thus, the animal species around which use oxygen for respiration may be in danger of breathing their last (Chukwu, 2008). Carbon-particulates in air which contribute in causing global warming and climatic change take their origin from carbon fumes/smokes (Freer-Smith et al., 2004).
- ii. **Vibrations:** The vibrations generated by the generators send out strong waves which quake the buildings to have cracks and fractures thereby weakening the walls, roofs, ceilings and even the foundations of our houses. This could result into collapsing of buildings in any moment (Main, 1993). Also, the vibrations produce high amplitude of painfully loud sound that affects the tympanic membrane of our ears (Crawford, 1969; Main, 1993).
- iii. **Sound/Noise:** Another adverse effect that is borne out of a functioning power generating set is the production of irritating and undesirable sound or noise. The excruciating pains or

uneasiness caused by a cluster of many working generators (tens to hundreds in small vicinity) would certainly be dangerous to health (Onuu and Menkiti, 1996). The sound coming from this aggregate of machines in relatively small area must, for sure, be greater than the tolerable level for human habitation. By this, our environment is being summarily debased.

### **Threats to Human Life**

“Our leaders”, according to the Daily Independent Editorial (2009), “should have been bothered by the calamities that the dependence on power generating sets and petroleum products has caused so many families and corporate bodies through explosions, fires, and toxic fumes over the years. Everywhere in our over-crowded homes and neighborhoods, children and adults alike are seen with jerry cans of petrol for private generators that are carelessly placed and operated at all hours either of business centers, lighting of the homes or attending to some domestic chores...”. Exposure to the fumes has caused deaths in many parts of the country in recent time, just as explosions and fires have resulted from careless handling. For instance, a national daily opined that the increasingly poor electricity supply in the country has exacerbated the problem of deaths from inhalation of generator fumes. Recently, eleven members of a household were reported to have died after inhaling carbon monoxide fumes from functioning generator in Obile community of Imo State. Also, another family of six perished in Benin City in Edo State through the same circumstances (Daily Sun Editorial, 2009).

### **REMEDIES/SUGGESTIONS**

After thorough investigation of this generator usage palaver in our cities and towns, some panaceas are hereby proffered as follows:

- i. Generators should not be placed upstairs while functioning so as to minimize vibration effects on the walls and floors. Many materials (including the ones used in building houses) exhibit resonance phenomenon. Any material which is a natural harmonic oscillator somewhere in the building whose oscillation has the frequency of the motor of the generating set may start to rattle in sympathy as the generating set roars on (Olenick et al., 1985) thereby damaging the building.
- ii. To avoid the exhaust gases from the electric power machines to mix and pollute the air we breathe, we can use pipes to channel the hot exhaust fumes above roof-tops. As the gases are hot, they will rise up at the end of the pipe since they would be less dense than the prevailing air around and by convectional process cannot descend lower heights to pollute the free air below.
- iii. The manufacturers of these energy gadgets should henceforth insert appropriate shock mechanism on the machines to absorb any vibrating or quaking shocks that might accrue up. We can also use old used tyres or latex foam to prevent severe vibrations.
- iv. The manufacturers could equally try to minimize sound production during designing and fabrication of their wares. This will undoubtedly reduce the volume of noise production.
- v. We should encourage ourselves (the inhabitants) to plant ornamental trees/plants to help absorb (though very slowly) some toxic gases like carbon dioxide around our habitat (Freer-Smith et al., 2004).
- vi. Lastly and most importantly, the Federal Government (FG) of Nigeria should, as a matter of utmost urgency, address the issue of power crisis in Nigeria. The FG should as well revive and resuscitate the PHCN to live up to expectation. If this is done, then remedies (i) to (iv) may no longer be necessary. Alternatively, the FG could through her agency Nigerian Electricity Regulatory Commission (NERC) protect the public interest and ensure adequate, safe, reliable and affordable electricity for all consumers (Iloeje, 2007).

Also, since Nigeria is within the solar-belt of the world (Asiegbu, 2001) intensive research programs should be mounted and vigorously pursued to evolve appropriate technologies to trap, store, and utilize the solar energy which is cheap, available, accessible, clean and environmental friendly form of energy.

## SUMMARY AND CONCLUSION

This year's FG budget for maintenance and fuelling of generating sets is not the best for us. The issue of expenditure on massive importation of generators and diesel has resulted into relocation of potential investors from Nigeria to other countries. Meanwhile, this short treatise has attempted to highlight the unconscious degradation of our environment in the urban settlements. The generators are supposed to help solve a particular problem which is to produce some electric power for our domestic chores in the homes but this has turned out to create its own peculiar problems which are greater than the ones it was meant to solve. Some solutions in form of suggestions have been proffered to daily users for generating sets, manufacturers and appropriate government authorities. If these suggestions are heeded to, pollution of our environment will be highly reduced if not completely eradicated. In as much as we need sustainable electric power in our homes it should not be at the expense and peril of our environment and good health.

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