

An approach to the energy mix in Onitsha as it affects the environment

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ABSTRACT

The findings from this work show that no single energy resource can sustainably meet the energy demands of Onitsha as the business hub of Anambra State. Integrating all exploitable energy sources is a viable way of achieving stability in energy supply for Onitsha, Anambra State Nigeria. Hence, the paper focuses on the role of energy mix in sustainable development of Onitsha the commercial hub of Anambra State, Nigeria and as it affects the environment. The impact of existing energy mix; crude oil, coal, electricity and renewable Energy on sustainable development of Onitsha is considered in this work. A sample of 375 respondents was randomly chosen in the study area based on the population. Questionnaire was designed and administered to inhabitants of the study area to enable the researchers ascertain information on the effect of energy mix on the economy and the environment and possible remedies. The Pearson's product moment analysis correlation and Chi-square test were applied in the hypothesis testing. The result shows that huge amount of effluents are discharged on the environment in using fossil energy products thereby polluting the environment. This leads to radiative forcing which causes global warming. Also, the energy mix has not significantly influenced sustainable development given that electricity generation is inadequate and coal is no longer in use. To ensure proper recovery, the study recommends that government makes available alternative energy sources through subsidy re-investment in addition to the conventional power to save the environment; with this, waste becomes wealth towards a sustainable economy in Onitsha.

Keywords: Energy mix, Sustainable development, Fossil energy, Global warming and Onitsha.

INTRODUCTION

Onitsha town is made up of Onitsha North and South Local Governments of Anambra State, Nigeria. Onitsha lies at the Coordinates of 6°10'N 6°47'E/6.167°N 6.783°E. Onitsha has continued to develop, and by 2001 had an estimated population of 511,000 with a metropolitan population of 1,003,000, [1]. It is currently one of the fastest growing cities in the world. The interest in Onitsha is because it is the financial hub of Anambra State.

The economic growth and sustainable development of any nation is highly dependent on the available energy mix. Power has been a major challenge in Nigeria and her economy. Hydro-powers and thermal plants were introduced in Nigeria between 1960 and 1979. No other successful attempt was made to increase the energy generating capacity till 1999 when President Olusegun Obasanjo commenced the power sector reform. This was achieved through the introduction of deregulation policy geared towards promoting independent power generation [2]. Some private companies and states were issued with licenses to establish power projects to achieve energy target of 10,000MW by 2010. Latter, few independent power plants were built by some state government and major oil and gas companies, particularly in Niger Delta, [3]. In spite of this, electricity supply by the end of 2010 was far below the projection leaving most Nigerians without electricity for industrial and domestic uses for example Anambra State. Energy is vital to every aspect of the socio-economic life. Most advanced nations have achieved remarkable degree of stability and efficiency in energy supply and management. Increasing the energy sources of a state or nation enhances sustained growth in all sectors of the economy including small-medium scale enterprises (SMEs). There is need to improve in the energy utilization through efficient conversion of energy resources into useful energy and conservation. Stability in energy supply sustains growth in agriculture and industry, leading to increase in per capita income. Added with constant improvement in transport systems, educational opportunities, health care delivery and

other social services lead to sustainable development. There is every need to diversify energy generation of any nation, because no single source is capable of providing all the energy requirements for sustainable development in the wake of steady increase in population, urbanization and industrialization, [4].

Nigeria since independence has witnessed a significant increase in the rate of urbanization and growth in the transport sector without a corresponding increase in the supply of energy. For instance, Onitsha rose from 76,000 before the civil war to 511,000 in 2001. In attempt to solve energy supply constraints, there is need to consider the environmental friendliness of the source of energy, sustainability and efficiency. This is why the energy mix of Onitsha, an urban centre in Anambra State is considered.

1.1 Fuel Energy

There are different forms of fuel energy. Fuel is any source of heat energy. It includes all combustible substances obtainable in bulk which may be burned by means of atmospheric air in such a manner as to render the heat evolved capable of being economically applied to domestic and industrial purposes. Fuel is divided into (a) naturally occurring or primary fuels and (b) secondary or prepared fuels. They may be in solid, liquid or gaseous forms. Examples of primary fuels are wood (Biomass), charcoal, peat, lignite, briquettes, coal, coke, oil, shale and petroleum etc. In this paper we considered few fuel members and other forms of energy that could be obtained or used in Onitsha.

1.1.1 Coal

Coal was discovered in Enugu, Nigeria in 1909. The Ogbete drift mine opened six years later. The Ogbete mine's operations and others in the country were merged into a new corporation in 1950. The NCC was tasked with exploiting coal resources, and held a monopoly on coal and coke mining, production, and sales until 1999.

The mining of coal started in Nigeria in the same 1909 and recorded an output of 24,500 tons in 1916, [5]. Production increased to 905,000 tons in 1958-1959 making over 70% of commercial energy consumption of the country. This coal was mainly consumed by Nigerian Railway Corporation, although this demand died following the discovery of oil which replaced coal-burning trains with diesel-powered engines. This made emphasis on coal to diminish and coal production declined to 52,700 tons by 1983 and 14,390 tons by 2000. In 2001, coal made up just 0.02% of commercial energy consumption in Nigeria [6]. The proven coal reserves in Nigeria is about 639 million metric tons, inferred reserves 2.75 billion metric tons, underground production potential 200,000 to 600,000 metric tons per year and surface production potential 400,000 to 800,000 metric tonnes per year, World Bank (1983). We have about 22 coal fields in Nigeria spread across 13 States consisting of approximately 49% sub-bituminous coal, 39% bituminous coal and 12% Lignite Coals, National Energy Policy (2003) and the Nigerian Coal Corp., not dated. Coal which is a form of fossil energy is not environmental friendly because it contributes to the buildup of green house gases and as such should not be encouraged.

Records show that coal is not found in Onitsha and as such is not used as a source of power. Interview report across the residents of Onitsha is as shown on the table 1.1.

Table 1.1: Interview Report across the Residents of Onitsha.

| | Count | | Total |
|--------------------------------|-------|--------|-------|
| | Male | Female | |
| I use coal as source of energy | | | |
| Yes | ---- | ----- | ----- |
| No | 180 | 56 | 236 |

1.1.2 Crude Oil/ Petroleum

The discovery of crude oil which is a fossil energy source at Oloibiri, Delta State in 1956 replaced the use of coal as source power. At present, oil accounts for over 95% of export earnings and over 65% of government revenue according to the International Monetary Fund- IMF ., [7]. Petroleum production and export, which play a dominant role in Nigeria's economy accounts for about 90% of gross domestic earnings making Nigeria the "13th oil producer in the world", [8]. The estimated oil reserve in Nigeria is about 37.2 billion barrels situated along the Niger River Delta and offshore in Bight of Benin, Gulf of Guinea and Bight of Bonny. Production capacity as at 2009 was over 2.2 million barrels per day making Nigeria the largest oil producer in Africa, [7]. The oil boom in the early 1970s drew the country's attention away from agriculture, which was the main source of income and contributed an average of 72% of GDP between 1955 and 1969, [9]. Since then, oil has been dominant in the energy scene of the country at all levels of economic activities. Crude oil for now is not found in Onitsha but its fractions are highly consumed in Onitsha. The crude fractions as we know like Diesel Oil, Premium Motor Spirit (PMS), Dual Purpose

Kero (Kerosine) are not environmentally friendly. The recent flood disaster experienced in Onitsha is a function of climate change precipitated by greenhouse build up.

1.1.3 Natural Gas

Natural gas is also a form of fossil energy. This gas which was once flared during the process of refining of crude oil is now a valuable resource and is used in powering heavy engines. Gas proven reserves are estimated at about 163 trillion standard cubic feet, which is enormously larger than oil resources in energy terms, [5]. The largest natural gas reserve in Africa is found in Nigeria but the sector is still underdeveloped as most of the gas (about 80%) is still presently flared, despite a fine per 1000cf of gas flared imposed by the Nigerian Government in the 1980s, [3]. About, 19.2 trillion cubic feet of gas was flared between 1960 and 2004 and some 2bn cf annually with a daily flare of 2.5 million cf since 2005. Each year, 19 % of total gas flared globally is from Nigeria. Although, natural gas is a cleaner and environmentally safer source of energy than oil, it still contributes to the buildup of the green house gases which in turn leads to the heating of the earth surface. In Onitsha, some people power their buildings/houses with natural gas extracts and diesel.

1.1.4 Generator

In Onitsha generators are used as alternative source of power but due to the power is held by Power Holden Company of Nigeria (PHCN); the conventional power is not available, it then appears that generator which is fossil energy powered is a major source of power and as such has untold consequences on the environment. Tables 1.2-1.7 below show the response of the residents of Onitsha on the use of generator.

Table 1.2: Number of Respondents to the Reason for using Generator as Source of Power

I use generator because * SEX Crosstabulation

| Count | | SEX | | Total |
|-------------------------|--------------------------------|------|--------|-------|
| | | Male | Female | |
| I use generator because | The absence of PHCN in my Area | 17 | 13 | 30 |
| | PHCN is not always steady | 92 | 22 | 114 |
| | PHCN always have low voltage | 62 | 13 | 75 |
| | PHCN bills are always high | 8 | 8 | 16 |
| Total | | 179 | 56 | 235 |

Out of 235 respondents, 10% (17) of the male population said they use generator due to the absence of PHCN in their houses, 51% (92) use generator because PHCN energy is not always steady, 35% (62) use generator because PHCN energy is always low and 5% said the PHCN bills are always high. From the female folk 23% (13) said they use generator because of absence of PHCN in their houses, 39% (22) said they use generator because PHCN is not always steady, 23% (13) said the use generator because PHCN voltage is often low and 14%(8) use generator because PHCN bills are always high. The level of agreement in the male and female responses to the reason for using generator indicates that the use of generator is on the high side and as such emission level is high as shown on table 1.2.

Table 1.3: Number of Respondents who use generator as source of Power their House

Crosstab

| Count | | SEX | | Total |
|--------------------------------------------------|-----|------|--------|-------|
| | | Male | Female | |
| I use generator as a source of power in my house | Yes | 153 | 44 | 197 |
| | No | 25 | 12 | 37 |
| Total | | 178 | 56 | 234 |

On table 1.3, out of 234 respondents, 86% (153) of the male population said they use generators as sources of power in their houses, 14% (25) said that they do not use generators in their house as sources of power. From the female

folk 79% (44) said they use generators in their houses as a sources of power, 21% said they do not use generators as sources of power. The level of agreement in the male and female responses to the use of generators as sources of power show that people depend more on using generator set than using the conventional energy.

Table 1.4: Number of Respondents who use Generator in their Office

Crosstab

Count

| | | SEX | | Total |
|-----------------|-----|------|--------|-------|
| | | Male | Female | |
| I use generator | Yes | 148 | 38 | 186 |
| in my office | No | 34 | 18 | 52 |
| Total | | 182 | 56 | 238 |

Table 1.4 shows that out of 238 respondents, 81% (148) of the male population said they use generators in their offices, 18% (34) said that they do not use generators in their offices. From the female folk 68% (38) said they use generators in their offices, 32% said they do not use generators in their offices. The level of agreement in the male and female responses show that many residents use generators in their offices.

Table 1.5: Number of Respondents whose Houses are within Onitsha

Crosstab

Count

| | | SEX | | Total |
|--------------------|-----|------|--------|-------|
| | | Male | Female | |
| My house is within | Yes | 176 | 50 | 226 |
| onitsha | No | 8 | 6 | 14 |
| Total | | 184 | 56 | 240 |

On table 1.5, out of 240 respondents, 96% (176) of the male population said their houses are within Onitsha, 4% said their houses are not within Onitsha. From the female folk 89% (50) said their houses are within Onitsha, 11% said their houses are not within Onitsha. The level of agreement in the male and female responses shows that many of the respondents have their houses in Onitsha.

Table 1.6: Number of Respondents whose Offices are within Onitsha

Crosstab

Count

| | | SEX | | Total |
|---------------------|-----|------|--------|-------|
| | | Male | Female | |
| My office is within | Yes | 166 | 46 | 212 |
| onitsha | No | 17 | 9 | 26 |
| Total | | 183 | 55 | 238 |

1.7: Number of Respondent who use Petrol Powered Generator.

Crosstab

Count

| | | SEX | | Total |
|--------------|-----|------|--------|-------|
| | | Male | Female | |
| My generator | Yes | 168 | 50 | 218 |
| uses petrol | No | 12 | 6 | 18 |
| Total | | 180 | 56 | 236 |

Out of 238 respondents, 91% (166) of the male population said their offices are within Onitsha, 9% (17) said their offices are not within Onitsha. From the female folk 77% (46) said their offices are within Onitsha, 9% (9) said their

offices are not within Onitsha as shown on table 1.6. The level of agreement in the male and female responses shows that many of the respondents have their offices in Onitsha.

On table 1.7, out of 236 respondents, 93% (168) of the male population said their generators use petrol, 6% said their generators do not use petrol. From the female folk 89% (50) said their generators use petrol and 11% (6) said their generators do not use petrol. The level of agreement in the male and female responses shows that many of the respondents use petrol powered generators while a few use diesels or other sources indicating that the environment has highly been tampered with.

2.1 Renewable Energy Sources in Nigeria

In addition to conventional energy sources Nigeria is also endowed with abundant alternative and renewable energy potentials in solar, hydro, wind, biomass, wave/tidal, geo-thermal etc. The current environmental threat experienced in Nigeria in the recent times which affected the 36 states of Nigeria plus Abuja shows that there is every need to develop alternative and environmentally friendly energy sources. Renewable energy sources are particularly ideal for Onitsha since it is located close to River Niger. At Onitsha in Anambra state only few individual are aware of renewable energy and have access to it. Photovoltaic technology which is a clean form of Energy consist of solar panels, a battery, a charge controller, and an inverter. The lifetime of the panels is typically 20 to 25 years, which is considered the lifetime of the total system. The battery allows power to be supplied at night or during cloudy weather. Two types of batteries can be used, deep-cycle and starter batteries. Deep-cycle batteries are more efficient and most commonly used, but starter batteries are already available in Nigeria due to their use in cars. A deep-cycle battery lasts between three and eight years. The charge controller regulates the current added to and drawn from the battery in order to maximize the battery lifetime and for user safety. Because photovoltaic systems produce a direct current, the inverter is necessary only if the end uses of electricity require an alternating current. Table 2.1 shows the number of people who have access to solar energy as a source of power at Onitsha.

Table 2.1: Number of Respondents who use Solar Energy as Source of Energy.
Count

| | Sex | | Total |
|---------------------------------|------|--------|-------|
| | Male | Female | |
| I use Solar as source of energy | | | |
| Yes | 25 | 8 | 33 |
| No | 155 | 48 | 203 |
| Total | 180 | 56 | 236 |

2.2 Hydropower

The main source of energy supply in Nigeria is Hydro power. This is what that falsely sustains the energy need of Onitsha. The conventional power which is transmitted through the national grid has its base in hydro electricity. The Rivers Niger and Benue and their tributaries form the core of the Nigerian river system with potential for large-scale (greater than 100MW) hydropower development. Several small rivers and streams also provide opportunities for small-scale (less than 10MW) hydropower projects. Estimate of total exploitable large-scale hydropower potential in Nigeria is over 10,000MW, capable of producing 36,000GWh of electricity annually only about one fifth had been developed as at 2001. Also, estimate of exploitable small-scale hydropower potential is at 734MW. Small hydropower plants for electricity provision are suitable in remote areas. By 1999, hydropower represented about 32% of the installed grid-connected electricity generation capacity, [5]. In as much as Onitsha is situated close to the Niger where hydro electricity can easily be accessed, the Federal government has not deemed it wise to think in that direction.

Table 2.2: Number of Respondents that use Conventional Energy as Source of Power
Count

| | Sex | | Total |
|--------------------------------------------------------|------|--------|-------|
| | Male | Female | |
| I use conventional source of energy as source of power | | | |
| Yes | 160 | 60 | 220 |
| No | 10 | 6 | 16 |
| Total | 170 | 66 | 236 |

2.3 Biomass Energy

The biomass materials in Nigeria include: wood, forage grasses and shrubs, animal waste, agricultural and forestry residue, municipal and industrial waste, as well as aquatic biomass, [5]. The biomass of Onitsha is included in this estimate. Biomass materials can be transformed into fuel briquettes, a cleaner source of fuel than direct combustion for both domestic and industrial uses. Biomass can also be converted into cooking gas (which is a completely clean energy) through the use of bio digesters. Energy plants like Jatropa, sugarcane and maize are proven sources of

clean bio-fuel. Although, Onitsha has insignificant biomass because of development and industrialization but its biomass needs are sustained by the neighboring towns.

Table 2.3: Number of Respondents that Use Biomass as Source of Energy.

| Count | Sex | | Total |
|-----------------------------------|------|--------|-------|
| | Male | Female | |
| I use biomass as source of energy | | | |
| Yes | 45 | 155 | 200 |
| No | 11 | 25 | 36 |
| Total | 56 | 405 | 236 |

2.4 Wind Energy

Wind energy is a renewable alternative energy that can provide electricity to homes and communities not presently connected to the grid. Windmills were used in Nigeria as early as the mid 1960s. In the northern regions like Sokoto and Garo, over 20 homes and a school used windmills to pump water. The following decades saw the prices of fossil fuels drop and with cheap energy that made investment in windmills ceased and the infrastructure deteriorated. The existing infrastructure is obsolete, but research into the feasibility of wind power in certain regions has suggested that physical potential for this type of power generation is high in some regions of Nigeria, [10]. Studies done on wind energy potentials in Nigeria shows that 98 percent probability of having 2.0 meter per second/hourly wind speed available between 1994 and 2003 in Umudike, Abia State with a maximum extractable speed estimated at 11.3 kilowatts [11]. There was enough wind speed to generate power for Maiduguri, Borno State and its environs where the estimated energy densities at 25 meters in height were between 4.712 and 27.449-megawatt hours per month [12]. The wind energy potential in Nigeria ranges from 2.32 m/s in the coastal city of Port Harcourt to 3.89 m/s in the arid region around Sokoto with a maximum extractable power per unit area for the two sites estimated at 4.51 and 21.97 watts per square metre of blade area, respectively [6]. Similar study would still prove that wind energy can be harnessed in Onitsha owing to its location. My questionnaire search proved that wind energy is not used in Onitsha in spite of its nearness to River Niger.

Table 2.5: Number of Respondents that Use Wind as Source of Energy.

| Count | Sex | | Total |
|--------------------------------|------|--------|-------|
| | Male | Female | |
| I use wind as source of energy | | | |
| Yes | --- | ---- | ---- |
| No | 180 | 56 | 236 |

2.5 Nuclear Energy

Nigeria's nuclear energy could not be used as a source of power in Onitsha because Federal government has not started harnessing it. Uranium is largely deposits on the Jos, Plateau and environs since 1947 [5]. By 1979, about 617,000 km² of land area had been covered by aerial radiometric surveys and another 90,000 km² by other surveys. The government of Nigeria should not earnestly jump into the nuclear technologies without carefully considering its merits and demerits.

Table 2.6: Number of Respondents that Use Nuclear Energy as Source of Energy.

| Count | Sex | | Total |
|------------------------------------------|------|--------|-------|
| | Male | Female | |
| I use nuclear energy as source of energy | | | |
| Yes | ---- | ---- | ---- |
| No | 180 | 56 | 236 |
| Total | 180 | 56 | 236 |

CONCLUSION

This study has shown that Onitsha has not got the proper energy mix. This is a function of the poverty level in Nigeria. Nigeria, since independence lacked a coherent and comprehensive energy policy thrust. Independent energy policies existed however in individual sub-sectors in the energy industry (electricity, oil & gas and solid minerals), which generated conflicts at the expense of the national economy. The Energy Commission of Nigeria (ECN) developed a Draft National Energy Policy for the first time in 1993, which was reviewed in 1996 and adopted in 2003. This study shows that huge amount of effluents are discharged on the environment in using fossil energy products thereby polluting the environment which leads to radiative forcing that causes global warming. Also, the energy mix has not significantly influenced sustainable development given that electricity generation is inadequate and coal is no longer in use. To ensure proper recovery, the study recommends that government makes available

alternative energy sources through subsidy re-investment in addition to the conventional power to save the environment; with this, waste becomes wealth towards a sustainable economy in Onitsha, Anambra State Nigeria.

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