

ENERGY CRISIS AND SUSTAINABLE DEVELOPMENT IN NIGERIA

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Abstract

Energy is indispensable in modern living and activities. Consistent energy supply is essential for development strides that must be made in developing economies. This study reviews energy crisis, which underpins underdevelopment in Nigeria, and recommends alternative energy sources for the country.

Introduction

Energy is an essential component of modern society. All production and manufacturing activities revolve around it (Tyler, 2002). It is used in industries, agriculture, production, material processing, communications and others. Consistent energy supply is essential, especially in an increasing industrious and business centric country, such as Nigeria (Ngilari, 2009).

Energy plays an important role in Nigerian economy, which depends on crude oil. Nigeria has a large energy reservoir, having the 10th largest oil reserve in the world. Increased dependence on crude oil has provided employment, infrastructure, opportunities for strategic alliances with other countries, and revenue. On the other hand, it has led to unfortunate economic lapses and setbacks in socio-economic development. The process of refining crude oils is quite expensive and

requires a lot of capital investment. It is often the case that resources for other sectors of the economy are shifted to the petroleum industry.

A peculiar problem becomes the potential decline in the demand of crude oil from the international market, especially as other countries seek alternative sources of energy that are cheaper and more environmentally friendly. Secondly, crude oil exploration generates environmental hazards and internal political agitations that have taken lives and property in the oil producing region of Nigeria.

Although, Nigeria exports about 2.2 million barrels of crude oil a day, it is submerged in energy crisis, being unable to provide energy for its citizens. At best, citizens in most regions receive only 6 hours supply of electricity daily on the average. There are many rural areas in the country that are yet to even have access to any electrical power grid. They still rely on some other sources of energy, like fuel-wood. Fuel-wood combustion results in emission of poisonous gaseous substances. Nigeria is one of the world's largest producers of carbon emissions, closely associated with global warming. Others, who can afford it, acquire privately owned electric power generators, which are barely cost-effective.

Nigeria has over 150 million people. The population connected to the grid system lacks power supply over 60% of the time. Worse still, 40% of the population is connected to the grid. There is simply insufficient electricity generated to support the entire population. Yet, electricity plays a key role in sustainable development. It powers economic and social progress of a modern economy. Electricity utilities redistribute at the community level and at the broader societal level the economic value created by the industry through the technical and commercial processes involved in the generation and distribution of electricity, and its subsequent application in the end uses. Through remuneration to employees, dividends to owners and taxation to the state, the electricity power sector creates a significant number of jobs, and services from other businesses. A consistent, reliable supply of electricity is a prerequisite for economic development, social security and public welfare. Low access to electricity remains a constraint to

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social services, such as health and education in developing countries. Extension of electrification is important for poverty alleviation, both in the individual household and at the societal level, as well as for a positive effect on the environment.

Different power generation technologies impact the environment differently. Fossil-fuelled generation pollutes the air with emissions; nuclear power produces radioactive waste; and hydropower impacts on river systems, wetlands and biodiversity. The current privatization of the Nigeria Electric Power Authority was to improve on the energy crisis in the country, but this has not yielded much result. To overcome its current power shortages and achieve the objective of being among the top 20 economies in the world by 2020, Nigeria urgently needs alternative energy sources that will provide regular electricity for both domestic and industrial usage (Africa News, 2009).

Sustainable development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being and preserving natural resources and ecosystem on which we and future generations depend. It is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other. The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as the present generation's. Many observers believe that participatory democracy, undominated by vested interests, is a prerequisite for achieving sustainable development.

Sustainable development applied to electricity includes maximizing its contribution to economic and social development, while minimizing its environmental impact. This can be achieved by promoting available accessible and affordable electricity to benefit the economy, the environment and society; using electricity wisely; maximizing economic use of low-and zero-carbon emitting electricity generation options and maximizing the efficiency and minimizing the

environmental impacts of the generation, transmission, distribution and use of electricity in a cost-effective manner (WBCSD, 2002).

This work attempts to review energy crisis in Nigeria. It seeks the answers to the questions bordering on where Nigeria would source more energy to cater for the ever increasing demand by its ever increasing population. It suggests renewable energy in the alternative, to enhance sustainable development in Nigeria. After this brief introduction, the rest of the paper is structured as follows: definition of terms, literature review, desirability and limitations of Nigeria's oil, addressing Nigeria's energy crisis, consideration for change, conclusion and recommendations.

Definition of terms

Energy is the capacity to do work. In moving or growing, each system is doing work, and using energy. Every living organism does work, and needs energy from food or photosynthesis. Humans also create machines that do work for them, and that derive energy from fuels. Some of many forms of energy are 1) *mechanical* energy, which includes *potential* energy, that is energy stored in a system and *kinetic* energy, that is energy from the movement of the matter; 2) *radiant* or *solar* energy from the light and warmth of the sun; 3) *thermal* energy is energy associated with the heat of object; 4) *chemical* energy is the energy stored in the chemical bonds of molecules; 5) *electromagnetic* energy is associated with light waves (including radio waves, microwaves, x-rays, infrared waves); 6) *mass* (or *nuclear*) energy is the energy found in the nuclear structure of atoms. One form of energy can be converted from one form to another.

Literature Review

National Electric Power Authority (NEPA) was established in 1972 by the government-sponsored merger of the Electric Corporation of Nigeria (ECN) and the Niger Dams Authority (NDA). NEPA has since operated as a government-controlled monopoly in the domain of power generation, transmission and distribution. Nigeria generates about

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3,000 mega watts of electricity, against 10,000 mw which it requires, triggering a massive power shortfall. Individuals, commercial and industrial consumers rely on generators for most for their energy needs (Ikeme and Obas, 2005).

Although the government has recognized the need for more electricity, it has had great difficulty funding this endeavour. As an attempt to rectify this situation, the government divided the National Electric Power Authority (NEPA) into two sectors in 2005, one in charge of the generation of power and the other in charge of the distribution of power. As part of this division, the government sought to privatize these sectors in an effort to finance and organize the needed development of infrastructure. This effort on the part of the government takes place in the face of a general population opposed to the prospect of privatization (Ikeme and Obas, 2005).

Alternative energy sources advocated for Nigeria are renewable energy sources, like solar, coal, hydropower, and wind. Photovoltaic systems convert solar energy to direct current electricity. This will be particularly advantageous to the northern regions that average a temperature of 29 to 34 degrees centigrade most times of the year. Hydroelectricity power generation should be implemented using the oscillatory water current of the Niger and Benue Rivers.

Wind energy results from the conversion of wind to electrical energy. The conversion is carried out by wind turbines or converters. The potential wind and solar power of developing countries is much bigger than the 50,000 MWs of total installed power from those sources in the entire world (Debo,2008). Energy commission of Nigeria is currently developing renewable energy devices, like wind electricity converters, among others. Wind electricity on a global scale, accounts for only 0.4 of total world's electricity production. Global energy consumption from 1990 to 1997 shows that wind electricity has the highest annual growth rate (Table 5.1). Wind electricity provides one of the cheapest, safest, cleanest, and reliable sources of electricity. German and Japan are presently the leading developers of wind power (Funke, 2008).

Table 5.1: *Trends in global Energy Consumption from 1990 to 1997*

Energy sources	Annual Growth Rate (%)
Wind power	22
Solar photovoltaic	16
Geothermal power	4
Hydroelectricity power	2
Oil	2
Natural Gas	2
Nuclear power	1
Coal	0

(Source:

www.physics.pomona.edu/COURSES/phys17/papers/international.pdf

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Desirability and Limitations of Nigeria's Oil

The unique combination of many desirable and useful characteristics of the oil in Nigeria include (a) current availability (b) high net energy recovery (c) high density (d) ease of transportation and storage, and (e) great versatility in end use. Its limitations are (i) environmental hazards (ii) shocks arising from price fluctuation, and (iii) a finite resource (like all other fossil fuels).

Addressing Nigeria's Energy Crisis

Renewable energy sources have become imperative alternatives, especially given that an increased emphasis on domestic renewable energy sources will further boost energy security, while reducing emission (*Thisday*, 2007). Renewable energy options include wood/other biomass, hydro, solar, wind, wave, tidal, fusion, etc.

No less than 20% of Denmark's energy needs are met by electricity generated entirely by wind turbines. Other alternative energy sources deployed by the country include the burning of waste products or biomass in combined heat and power plants; electricity

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generated by escape of photovoltaic or solar energy cells; and geothermal turbines powered by the escape of underground steam. In fact, alternative energy technologies as well as conservation habits have become normal parts of life for the average Dane even as the country presently has the highest proportion of its electricity generated by renewable sources (Business Day, 2008). Denmark also has the world's most efficient clean-coal technology.

On the other hand, due to lack of reliable electricity, many Nigerians and companies supplement the electricity provided by the grid system with their own generators. In fact, almost everyone who can afford a generator owns one. According to one approximation, well over 90% businesses have generators (Energy Sector Management Assistance Program, 2005). The electricity from private generators is more expensive than that from the national power grid, thus raising the price of domestic goods. Efforts to alleviate this strain are met with opposition from the companies who import generators, as they have created an extremely lucrative industry.

In Nigeria and many other developing countries, providing energy to rural and urban areas has proved to be a great challenge. Policies towards increasing rural energy access have all along focused on grid extension and tanker distribution of petroleum products in Nigeria. With increasing population, the pressure on infrastructure for the supply of conventional energy resources will continue to increase. Also, conventional energy is depletable with extinction risk. In order to enhance the energy security of the country and establish a sustainable energy supply system, it is necessary to promote the policy of diversifying the energy supply, so as to include alternative or renewable resources and technologies into the nation's energy mix.

In rural areas, much of the energy production is from the burning of fuel-woods. This practice has a host of associated problems, such as the toxic emissions given off from this process, especially if done in doors, which is often the case. There is a trend of deforestation in Nigeria at 300,000 hectares per year (Bugaje, 1999). This is mainly due to the growth of the timber industry.

However, deforestation is propagated due to fuel-wood burning. The scarcity of wood as a result of deforestation makes the process of cooking with fuel-wood even more unsustainable (Kersten, 1998). The average time it takes one person (usually woman/girl) to collect enough wood for the day's meals (2.28) is 4-6 hours (Oparaku, 2003). With deforestation the time it takes to collect this wood will only get longer. The overall efficiency of the commonly used three stone stoves is less than 10% (Barnes, 1996). Despite the availability of more efficient stoves and cooking fuels, these alternatives have been adopted for both financial and cultural reasons.

The energy industry in Nigeria has severe environmental ramifications, mostly in the form of both pollution and deforestation. The most imminent energy issues for Nigeria are not related to the environment, but to social welfare. Although the immediate environmental ramifications of current practices now could translate into catastrophic impacts in the future, NEPA never considered environment as its main priority, but it had pledged to promote energy sector reform only in environmentally friendly means. The main contributors to the air pollution in Nigeria are the gas flares. The government pledged to cease these activities on December 31, 2008 (Lukman, 2003).

Outline of the government's strategy for energy development in an environmentally friendly means is putting adequate standards in place, strengthening the regulatory agencies, developing definitive goals that must be met, assessing the environmental impact of energy projects, providing alternatives to fuel-wood, and encouraging research and development (Lukman, 2003).

The challenges of the power sector in Nigeria are rooted in production, transmission, distribution and utilization. Overcoming these would boost the technological and industrial base of the country. Also, limited access to infrastructure, low connection rates, lack of capital investment, ineffective regulation, unclear distribution roles and vandalism of power cables are some of the other problems.

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“Amnesty is the possible key to resolving the energy crisis in Nigeria” (Daily Trust, 2009). Fixing the vandalized pipes and getting adequate gas will enable the government deliver its promise of producing 6,000 mega watts of energy. Vandalized pipes in the Niger Delta region cost the government 1,400 mega watts of gas daily and not being able to fix the pipes would continue to make the energy crisis in the country worse. Not much could be done because the host towns are not giving access to the contractors and the militants are not helping either to build new pipes.

Also, problems associated with each aspect of the energy sector include that of hydropower. The current infrastructure of the hydro plants is far below their projected capacity. The output of the hydro plants is highly oscillatory according to the seasonal droughts. The trends of climate change have led to a continual loss of water. Since the power output of hydro plants is dependent upon the flow of the river, with less water, there is less potential energy to harness, making hydropower a less desirable energy source (Ngala *et al*, 2007). Two rivers, Niger and Benue, account for the major of hydropower generation. Prior to entering Nigeria, the rivers pass through Cameroon. In order to obtain the maximum amount of energy from these rivers, Nigeria must provide incentives to prevent Niger from installing their own dams on the rivers. Thus, a portion of the energy generated by the hydro plants is exported to Niger to compensate for their agreement not to build dams along the rivers. Therefore, Nigeria receives even less of the already dwindling electricity generated from existing hydropower.

The grid structure is unstable and vulnerable to sabotage. With the grid structure, people are able to connect their residence or industrial enterprise to the grid without a meter, leading to power leakage during transmission. There are zoning issues that wreck havoc on the system. In some cases, a property zoned to a residence could be used for industrial purposes, which often require more energy. This discrepancy can overwhelm the grid and cause a transformer to explode. Due to the prospect of privatization, there is propensity to

physically sabotage the grid system through dismantling parts of the grid itself.

Consideration for change

To fill the void of electricity, the country has numerous options, given their ample supply of natural resources. One way would be to invest in more oil and gas exploration and utilize more of these sources for direct internal use. Long-term investment in renewable energies, like solar and wind, has the potential to contribute significantly to the electricity deficiency (Anyanwu and Iwuagwu, 1995). These technologies, however, have high upfront costs (Okoro *et al*, 2007). The adoption of renewable technologies will require reducing the current subsidies on fossil fuels and the import duties on renewable technologies (Ikeme, 2005).

The theoretical framework of the energy policy outlined by the Nigerian government seems promising, but there is a discontinuity, however, between implementation and theory, rooted in the population's aversion to privatization. Structural reform cannot take place until financial support is in place. This financial support must come in the form of private investments. Financial and subsequently structural reform, however, cannot be implemented until the sabotage of current effort of privatizing the energy sector ceases. A sweeping change of the public's perception of the government at large is required. Increased transparency and education about government processes may decrease feelings of alienation. If the negative perception of privatization could be replaced with trust in government electrification efforts, structural reform could proceed for sustainable development in the country.

Recommendations and Conclusion

The situation of power shortage in Nigeria could be improved by acquiring modern technology structures to bring about an increase in the capacity of electricity being generated. The country owns about

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five refineries that operate no more than half of their capacity. The government needs to manage these refineries instead of having the oil refined outside the country. As regards to preserving the useful life of the refineries and likewise existing infrastructure, vandalization is a common setback. Those responsible should realize that it is only to the nation's detriment, as more money that could have been put to good use elsewhere is spent on fixing the damages. Consequently, it diminishes the morale of the government, as is reflected in its reluctance to make future investments in such infrastructure. This act should be prohibited and made punishable by law. Citizens also ought to adopt the sheer moral responsibility of respecting public property for a common good.

In terms of strategy, alternative renewable energy is the way to go in order to take maximum advantage of our location on the equator, reduce global warming and undesirable climate change as well as place our economy on a robust stand.

The government should find a comprehensive and durable solution to address the root causes of the crisis by providing access to good health and schools to the people of the Niger Delta region. Policies and measures should be developed to create clear frameworks and incentives within which the electricity industry can operate. There is no doubt that investing in micro community-based alternative energy solutions that increasingly make fuller use of biomass, water, sun and wind will ultimately guarantee reliability, stability and efficiency of energy supply in Nigeria.

Nigeria must necessarily enhance energy security and establish a sustainable supply system by diversifying its supply system to include alternative or renewable sources, which the country has in abundance. Doing this will in fact decentralize the supply system leading to local implication and management as well as enhance socio-economic development. It is equally a known fact that alternative or renewable energy sources show significant promise in helping to reduce the amount of toxins that are by-products of energy use. Not only do they protect against the harmful by-products, but using them

helps to preserve many of the natural resources that are currently used as sources of energy. Knowing these challenges currently faced in sourcing oil and gas to power electricity and especially following the Niger Delta crisis, Nigeria should facilitate thinking seriously of diversifying into other sources of energy. States in Northern Nigeria in particular, where alternative or renewable energy sources are in abundance, should be in the vanguard of this initiative? Alternative and renewable energy sources must be sought before the economy of this country is completely grounded.

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