



OPTIMAL BENEFITS OF UTILIZING RENEWABLE ENERGY TECHNOLOGIES IN NIGERIA AND THE CIBS QUADRANGLE: A REVIEW

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ABSTRACT

With rapid population growth and increase in industrial activities, more energy is consumed, resulting in environmental pollution and economic difficulties, therefore, the need for utilising renewable energy resources has emerged globally and it is possible that China, India, Brazil and South Africa (CIBS) would develop renewable energy technologies that are more appropriate for the needs of developing countries. Nigeria for example has adequate fuel supplies (world's sixth largest exporter of crude oil) yet more than 70 percent of its inhabitants do not have access to electricity for their domestic needs. This paper presents some potential of solar power at six sites in each of the geopolitical zones of Nigeria. The sites are Owerri (5° 29'N, 7° 1' E), Port-Harcourt (4° 47' N, 7° 0' E), Lagos (6° 26' N, 3° 17' E), Abuja (9° 3' N, 7° 15' E), Maiduguri (11° 51' N, 13° 9' E) and Sokoto (13° 3' N, 5° 14' E) that are located in different climatic zones of Nigeria. The solar electricity potential at all the sites were over 3000 Wh/m²/day which is enough to meet typical domestic energy needs of typical households. It has been discussed how other African countries can apply the results to meet their electrical energy needs that will have a multiplier effect of improving the living standard of the people while preserving the environment, maintain sustainability and generate employment boosted by strong political will and collaborative links with the CIBS quadrangle.

Keywords: CIBS, Africa, renewable energy, sustainable development

INTRODUCTION

Over the past few years, the solar energy industry in the United States of America, which includes manufacturers and distributors of photovoltaic products, concentrating solar power and solar heating technology, witnessed unprecedented growth (SEIA, 2008). The year 2007 was a record year for solar energy, with 314 megawatts of new solar energy devices installed in the U.S. This is an increase of 125 percent from 2006. This growth pumped over \$2 billion into the U.S. economy and created 6,000 new jobs and Wall Street invested billions of dollars in solar energy companies, foreseeing the growing global demand for clean, renewable energy sources (Mrayyan, 2004; SEIA, 2008).

Energy is the lifeblood of economies around the world and global economic growth depends on adequate, reliable and affordable supplies of energy. Key foreign policy objectives, including support for democracy, trade, sustainable economic development, poverty reduction and environmental protection rely on the provision of safe, reliable and affordable energy supplies (Eleri, 1993). Today's global energy market is increasingly influenced by the location of the resources and the political and economic environment of the region; growing demand from the developing world, particularly from China and India; manipulation of resources for no energy foreign policy objectives; and the lack of capital investment (Gaunt, 2003; Malterre, 2008; Mathews, 2008).

Nigeria receives abundant solar energy that can be usefully harnessed with an annual average

daily solar radiation of about 5250 Wh/m²/day. This varies between 3500 Wh/m²/day at the coastal areas and 7000 Wh/m²/day at the northern boundary (Chineke and Igwiro, 2008). The average amount of sunshine hours all over the country is about 6.5 hours. To enhance the developmental trend there is every need to support the existing unreliable energy sector with a sustainable source of power supply (Chineke *et al.*, 2001; Okoro and Maduneme, 2006; Chineke and Igwiro, 2008). The aim of this study is to show some renewable energy potentials for Nigeria and the optimal benefits of utilizing renewable energy across Africa with strong collaboration with the China, India, Brazil and Southern more developed economies.

On the Choice of Energy Options

Fossil based energy had indeed been very popular in Nigeria. At some point, it was thought to be inexhaustible. But it is now known it is not the case (Adeoti *et al.*, 2001; Karekezi and Kithyoma, 2002; Sebitosi and Pillay, 2008). In addition to the problem of finiteness, environmental concerns should also accompany the choice of energy options. Hence, situation where petrol diesel generators run the Nigerian economy cannot be said to be sustainable to say the least (Nwofor *et al.*, 2007).

Regarding the role of the CIBS, we see that among the countries where China already has oil exploration and/or supply contacts are Kazakhstan, Iran, Saudi Arabia, Sudan, Nigeria, Angola and Venezuela for oil; and Turkmenistan, Burma, Bolivia and Algeria for gas (Boekestein and Henderson 2005).

While, in principle, Chinese demand is likely to bring economic welfare benefits to such resource-rich countries, in practice that is only true where the revenues are redistributed and/or invested in productive projects. According to Henderson (2008), it is only in Venezuela where such revenues are currently redistributed to meet the needs of other sectors. It is possible that China, India, Brazil and South Africa would develop technologies that are more appropriate for the factor endowments and the economic needs of developing countries. Similarly, China, India, Brazil and South Africa are potential sources of finance for development. Their foreign aid programmes, particularly in Africa, constitute a modest beginning. At this juncture, China is clearly the largest supplier of labour-intensive manufactured goods in the world market. Even if not as large as China, India is also a significant supplier of labour-intensive manufactured goods in the world market. Brazil and South Africa are important suppliers of natural resource-based manufactures. China, India and Brazil are emerging suppliers of capital goods. There can be little doubt that manufactured exports from China, India, Brazil and South Africa span almost the entire range of manufactured exports in which other developing countries could have a potential comparative advantage (Nayyar, 2008). The countries of Africa can gain immensely from the experience of the CIBS once the political will is there. Their efforts may be more sustainable when there is a close monitoring of their aids to the less-endowed members of the developing economies.

RESULTS AND DISCUSSION

One most intriguing thing is the potential of the sector to create jobs, for example, if there are 80 utility-scale solar energy projects that represent about 56,000 megawatts of new electric power that will mean about 20 thousand permanent jobs. As these projects move forward, they will create hundreds of thousands of construction jobs. It is important that our governments take steps immediately to extend and expand the renewable energy sector of their various countries (Okoro and Maduneme, 2006). The "fuel" to drive the Southern Engine of Global Growth will be an increased investment in the renewable energy sector which will create jobs, improve our energy independence, ensure energy security, and begin to address the biggest environmental issue that we face today - global warming. We are in an energy emergency the focus is not just about gas prices. Energy affects everything, and a mass transition to renewable, sustainable, clean sources of energy is way overdue.

Though an essentially contested concept, it is safe to acknowledge that the attainment of sustainable development requires that the growth and well-being of present generations are brought about in such ways that the ability of future people to meet their own needs will not be compromised. The

availability of safe and sound energy as a factor of production is a key element in such a development process. Despite the abundance of energy resources, acute shortages of energy services have become endemic in Nigeria. According to a 2008 poll, more than 87% of Nigerians want to support renewable energy, recognizing its potential to create jobs and economic growth and the ability to give a national energy security. The results are shown in Figure 1, which represents the energy preference options by a cross-section of Nigerians (650 respondents) in the oil-rich Niger Delta region of Nigeria.

Fig. 2 shows the response from the respondents on whether the government should make renewable energy source a top priority. It is time for government to listen to the will of the "restive" Niger Delta people and pass common-sense policies like the renewable energy investment tax credit/rebates. That will check restiveness, and make not only the region but the whole of Nigeria and other developing economies stand to gain from the economic and political ties with the "CIBS Quadrangle".

In Figure 3 is shown the six cities representing the six geopolitical zones of the country, Abuja (North central), Maiduguri (North east), Sokoto (North west), Lagos (South west), Owerri (South east) and Port Harcourt (South south). It is obvious that the level of solar power available for rural and urban photovoltaic application is high for Nigeria. The lowest value of 3110 Wh/m², recorded at Port-Harcourt in the peak rainfall month of July is higher than our domestic load requirement of 2324 Wh per day. The northern sites of Abuja (Nigeria's federal capital where having a generator set for home and businesses is almost compulsory), Sokoto and Maiduguri all have abundant potentials for solar electricity utilization. This then means that it will take strong political will for the optimal utilization of the enormous renewable energy available to be actualized.

To most developed economies, oil is a "past technology" and if the Nigerian youths have to be discouraged from migrating in large numbers to the "Northern engines", its economy has to be lubricated using Renewable energy. Given the low income levels of the rural poor and the costs involved in maintaining PV systems, effective policies and incentives for low-income earners are fundamental steps toward improvement in the quality of life and widening of access (Chineke and Igwiro, 2008; Obeng et al., 2008). Although the generality of the Nigerian public know that renewable energy is cheaper than conventional energy sources in the long-run as well as environmental friendly (see Figure 1), it will be difficult for now, for the common man, without government's political will to afford the sustainable green energy, say solar photovoltaic. It will cost about \$206.18 to have a monthly electricity of 47.5 KWh from say photovoltaic (Chineke and Igwiro, 2008).

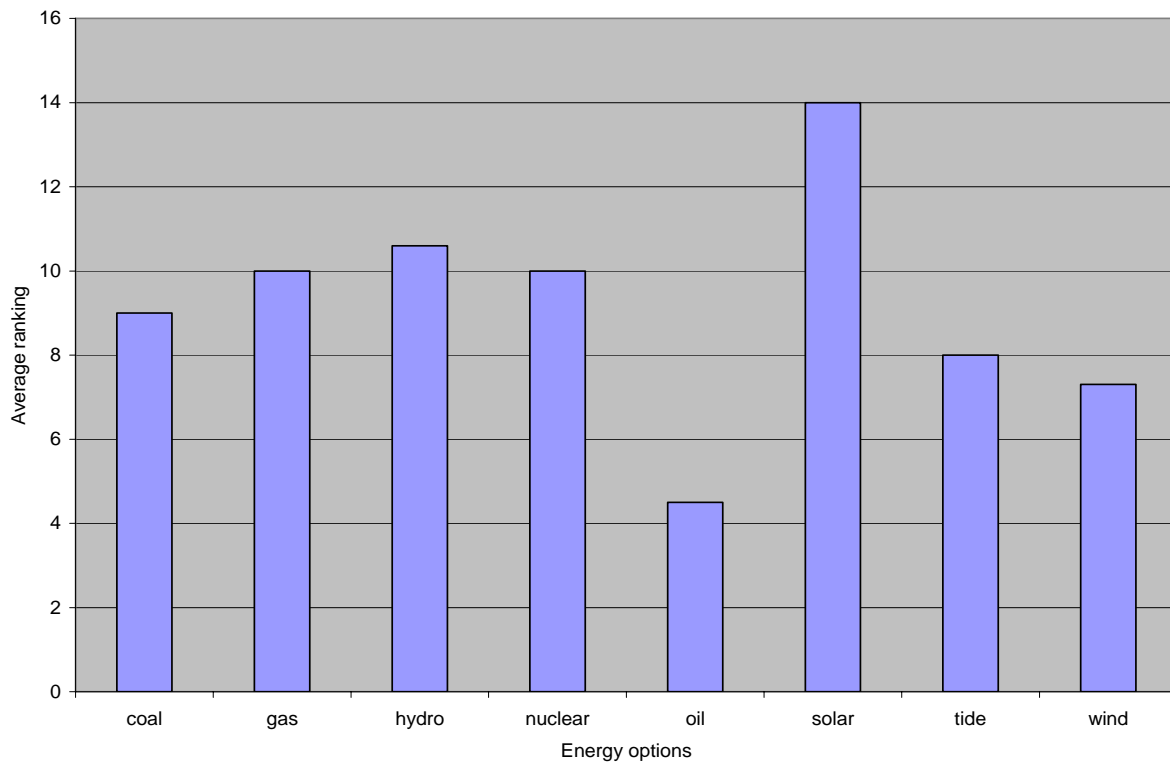


Figure 1: Energy preference options by a cross-section of Nigerians.

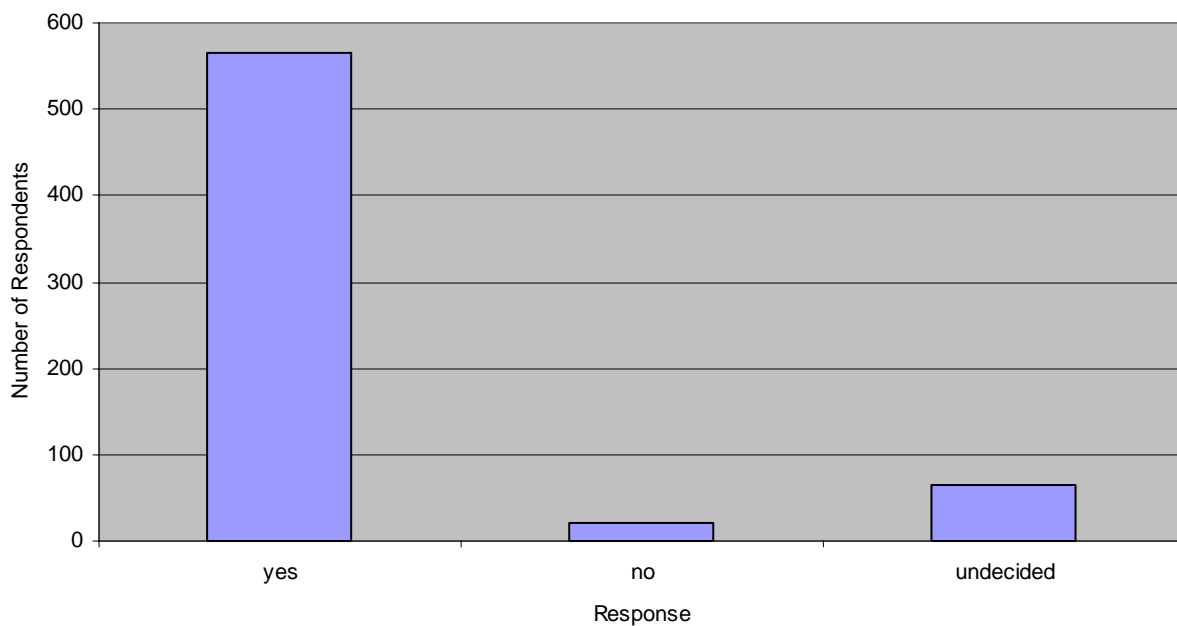


Figure 2: Response on whether government should make renewable energy a top priority.

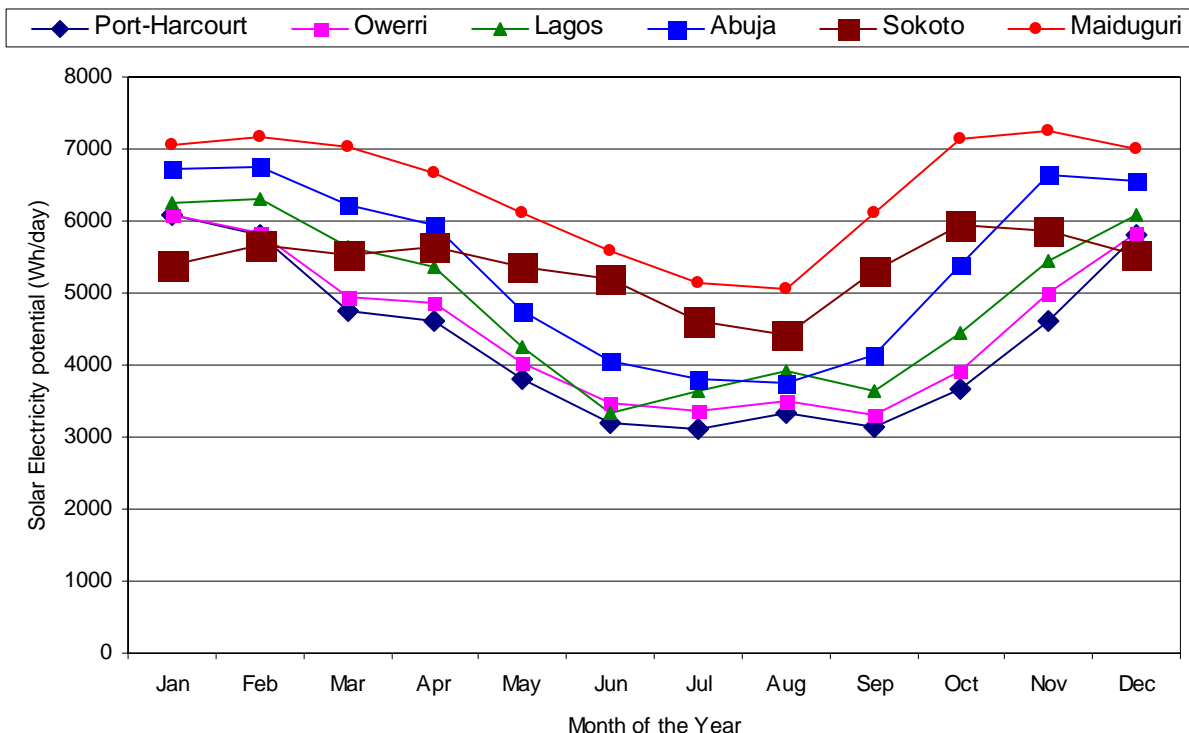


Figure 3: Photovoltaic potential for selected cities in Nigeria.

Although the amount above translates to \$24,741.60 over a ten year period, the number of Nigerians that earn up to two hundred dollars monthly is less than 5 percent. It needs to be stated that 70 percent of Nigerians reside in the rural areas where an average monthly earning of 100 US dollars is a dream! Presently, Nigeria's minimum monthly wage is about 65 US dollars and the situation is not better in other parts of Africa. The result in Figure 2 shows that many people in Nigeria seem to prefer renewable energy with solar photovoltaic ranking higher. Chineke and Nwofor (2007) had presented a case of integrating solar, wind and tide to boost the total generated energy from the three sources that will enhance the nation's total electrical energy output and better the lots of the citizens. This can be replicated in other parts of Africa. A committed and transparent political will is needed for this southern engine of development to move forward. The governments of Africa or the political class can make the renewable energy sector accelerate and provide electricity, employment for the teeming unemployed mass while protecting the environment that is already groaning under the weight of climate change. One point needs to be stressed; government succeeds in anything they are determined to do. If African politicians put in one-third of the zeal and finance they invest to get elected or re-elected, the renewable energy sector will suffer a great leap! There is money for elections and for hiring political thugs, money for embezzlement and frivolities but none for renewable energy, which will satisfy the energy need of its greater population?

There is a need for collaboration between the developing countries to ensure that renewable energy

technologies are properly utilized. Since the CIBS quadrangle is more developed, they may lead as they are already doing in mobilizing the less-developed economies to develop their renewable energy sectors. They should not end at exporting their technologies to the upstream (the suppliers) but ensure that there is a follow-up consultancy say 24 hours a week and online support for users of their products. More importantly, the downstream sector, the users need to collaborate in terms of sharing ideas and experiences garnered at their various locations; homes, offices, businesses or establishments (for large-scale renewable energy use). This can be through a regional user group database to be maintained by the upstream renewable energy suppliers. In addition, the critical mass of professionals in the sector must be willing to make their research results and database open access (Canessa and Zennaro, 2008).

Conclusions

Energy is central to sustainable development and wealth creation efforts (Obeng et al., 2008). It affects all aspects of development -- social, economic, and environmental -- including livelihoods, access to water, agricultural productivity, health, population levels, education, and gender-related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services in developing countries. UNDP's efforts in energy for sustainable development support the achievement of the MDGs, especially MDG 1, reducing by half the proportion of people living in poverty by 2015.

Currently, Nigeria faces serious energy crisis due to declining electricity generation from domestic power plants which are basically dilapidated, obsolete, and unreliable and in an appalling state of disrepair, reflecting the poor maintenance culture in the country and gross inefficiency of the public utility provider (Ikeme and Ebohon, 2005). The situation is not different in other parts of Africa (Karekezi, 2002; Sebitosi and Pillay, 2008). Governments in the developing economies of Africa are called upon to step up efforts to examine the number of employment opportunities that could be generated by a viable renewable energy industry. It is worthy of mention that the amount of money being spent on research on Nigeria's space programme and politics has far surpassed the funds allocated to the development of renewable energies, such as wind, solar, biomass and hydropower. Sincerely, the renewable energy sector has "huge" job creation opportunities which will give hope to the millions of job seekers, some of them risking their lives, travelling through the desert to

migrate illegally to Europe. It is a well-known fact that employment in a renewable energy industry would also bring about fewer occupational hazards, when compared with uranium mining, for example and the oil spillage plus restiveness, currently associated with crude oil exploration and exploitation in the Niger Delta area of Nigeria.

This paper has reassessed the common proposition that energy can fuel growth and development across Africa with strong will and collaborative links with the CIBS quadrangle. The potential for renewable energy is high in Nigeria as has been shown in this study and other parts of Africa. The people want to opt for renewable energy to meet their electricity needs. The remaining thing is for the governments across the developing economies of Africa to have enough transparent political will to collaborate with the faster-developing economies of China, India, Brazil and South Africa to boost their electrical energy sector using the sustainable and highly abundant renewable energy (Matthews, 2008).

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