Energy Access: A Key to Rural Development in Nigeria

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ABSTRACT

This review work underscores the importance of energy access to development and particularly, modern energy services to rural development. Nigeria’s energy profile depicts both potentials and consumption patterns. Then, a comparison of electricity consumption per capita and GDP per capita, shows that electricity does contribute to growth in GDP. However, energy access (modern forms in focus) contained in a complementary social infrastructure programme will promote holistic, meaningful rural development in Nigeria.

INTRODUCTION

Arguably, modern cities of today were previously rural and rustic villages. This makes rural development paramount for national development. Growth in things in any society that translates to social development depends largely on adequate and regular energy supply, particularly in its modern forms such as electricity and modern fuels. In Nigeria, rural access to modern energy services is very abysmal. For example, electricity (apparently the most convenient form of energy usage) is widely scarce in rural areas; given that only 40% of the entire population has access to electricity [1,2]. Author states this antithetically that 60% to 70% has no access to electricity. Little wonder rural electrification rate was only 18% [3].

The connection between electricity supply and social development is long established [4-6]. Hence, electricity generating sets are common in public places and households: despite the fact that this practice is financially costly; environmentally risky and socially unsustainable.

Over 50% of the population lives in rural areas and more than 60% of this depends on fuel wood for energy needs [7,8]. The livelihood of over 65% of rural people, and overall national development is highly impeded due to a lack of access to electricity [9]. Electricity is required for effective delivery of basic services such as potable water, health care, telecommunication and education, as well as agro-industrial processes [10]. These amenities contribute in no mean way positively to poverty reduction and quality of life of any community. Similarly, modern cooking fuels such as LPG (liquefied petroleum gas) and kerosene are expensive and hard to afford by the poor. Renewable energy technologies (RE) such as solar PV (photovoltaic) are not widespread. Initial installation cost is high and awareness level seems to be still low. It is noteworthy here that there is no grid-connected RE electricity system in the country. All applications in use (particularly solar PV) are mainly stand-alone systems, which work minimally or do not work at all. This makes social impact assessment of renewable energy technologies use in Nigeria difficult [11]. Thus, most people still depend on firewood, which has causes annual loss of 3.6% or 350,000 hectares of wood lands [10].
Energy access enables the provision of basic needs, which are essential indices of socio-economic development by improving agricultural methods, and businesses that are responsible for creating goods and services that sustain society. Absence of electricity in particular, directly or indirectly impedes rural development. This paper highlights Nigeria’s energy potentials, consumption profile and the importance of improving rural access to modern energy systems, for sustainable rural development (Tables 1 and 2).

Table 1: Fossil energy.

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Proven reserve: 600 million metric tons</th>
<th>Inferred reserve: 3 billion metric tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>Proven reserve: 37.2 billion barrels</td>
<td>Production: 2.2 million barrels b/d as at 2009</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>Reserve: 5.2 billion cubic metres</td>
<td>Production: 25%</td>
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<td>Natural Gas</td>
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Table 2: Renewable energy potentials.

<table>
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<tr>
<th>Energy Type</th>
<th>Large-scale Power estimate: 10,000 MW</th>
<th>Small-scale power estimate: 734 MW</th>
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<tbody>
<tr>
<td>Hydropower</td>
<td>Annual average total solar radiation: 25.2 MJ/m²-day to 12.6 MJ/m²-day, North-South</td>
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<td></td>
<td>Average 6 hours of daily sunshine has energy capacity of around 5.08 * 1012 KWh</td>
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<tr>
<td>Solar</td>
<td>9,041,000 ha (9.9% of Nigeria’s landmass); 200 million tons of dry biomass from forage grasses and shrubs, equivalent of 2.28 * 106MJ of energy; 6.1 million tons of dry biomass from crop residues with energy content 5.3 * 1011MJ; 227.500 tons of animal wastes daily with energy content of 2.2 * 109MJ</td>
<td></td>
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<tr>
<td>Wind</td>
<td>Average wind speed in Nigeria is 3.0 m/s to 5.12 m/s, South to North, at 10m height. Maximum extractable power per unit area is 4.51 to 21.97 watts per square metre apiece</td>
<td></td>
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MATERIALS AND METHODS

Data from government institutions and international bodies (e.g., Energy Commission of Nigeria, US Energy Information Administration, US Central Intelligence Agency, World Bank etc) and journal articles are referenced to justify the argument in this review paper.

DISCUSSIONS

Figure 1 shows that biomass and waste dominated the energy consumption landscape in Nigeria by 2011. In spite of the abundance of fossil and renewable energy resources, most Nigerians still struggle with a dire lack of access to modern energy systems. Even the affluent cannot find enough energy to purchase, for example grid-based electricity. About 95 million people, mostly in rural areas, still fully depend on direct biomass combustion for domestic energy needs. Thus, in Figure 1 (line chart showing consumption profile by resource from EIA, 2013) biomass constitute a whopping 83%; oil, natural gas and hydro consist of 11%, 5% and 1% respectively. On the other hand, there is widespread use of electricity generators, particularly, ‘I pass my neighbour’, which poses harm to health, environment, economy and social development. The scenario of energy abundance and scarcity is a real paradox in Nigeria.
Household sector consumes more energy (65%) than commercial and industrial sectors combined. Major household energy needs are cooking (91%), lighting (6%) and (3%) for basic appliances like television, fan and pressing iron. Cooking is the highest energy need of families and this met by biomass materials particularly, fuel wood. Many urban dwellers also depend on charcoal and kerosene. Lack of roads to transport kerosene and cooking gas, or for rural grid extension leads to high costs.

Nigeria’s electricity consumption per capita is grossly low at 25 Watts. Ghana and South Africa have 62 Watts and 826 Watts respectively. Table 3 shows per capita electricity consumption and GDP, both of which are global development indices. Energy scarcity is ubiquitous in Nigeria particularly in rural areas. Usually, women and children experience drudgery in domestic lives, health problems, reduced or lack of reading hours, low productivity in agriculture and SMEs (small medium enterprises) and so on.

Electricity, as an engine of growth, impacts directly on a range of socio-economic activities and living standards. Electricity access remains a viable tool to measure GDP substantially (Table 3). For example, Barkat et al. noted that electrified irrigation boosted agriculture, industries and personal income in rural Bangladesh. McMenemy et al. and Adhikari concurred that micro-hydro power (MHP) and solar home systems improved rural living standards in Nepal. Kirubi et al. complemented that rural electrification in Kenya improved service delivery at local schools and clinics: reading hours, storage of medicines and residency of medical doctors.

<table>
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<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tr>
<td>Electricity per capita</td>
<td>120</td>
<td>135</td>
<td>149</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>1.091</td>
<td>2.294</td>
<td>2.519</td>
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In Figure 2, electricity consumption per capita increased steadily by 13% in 3-years. GDP per capita rose sharply by 110% in 2009-2010 and plummeted to 10% in 2010-2011. The 2009-2010 profile suggests that a rise in per capita electricity use leads to a rise in GDP per capita, but the sharp slump in GDP per capita in 2010-2011 contradicts. So, per capita electricity use alone may not increase GDP per capita; this tends to be vis a vis other social infrastructure.
CONCLUSION

Modern energy access is vital to improve rural living standards. Its benefits can be seen in agro-industry, healthcare, portable water, education, domestic output and income. Grid, mini-grids or isolated RE systems inspired socio-economic growth in many countries: Bangladesh, India, Kenya, Nepal, South Africa etc. Nigeria has a plethora of variety of energy resources, which could be explored and mixed for national development. Decentralized grid policy with RE in view is vital and suitable in vast countries with dispersed rural areas.\textsuperscript{28-30}

References


