

Energy resources and the future : The Role of Renewable Energy and Energy Efficiency

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Introduction

Access to energy is inevitable for poverty alleviation and if we must achieve developmental targets and meet the millennium development goals (MDGs). There are apparently links between poverty and access to energy; the citizens of many poor nations of the world have extremely low access to energy and the richer countries consume far more energy than the poor countries, suggesting that access to energy is the dividing line between the rich and the poor countries of the world. Apparently access to energy is directly proportional to good living standard. Yet about 2 billion people globally live without access to modern energy services¹ and they are concentrated mainly in rural and peri-urban areas in developing countries in Africa and Asia. The energy-deprived people are the world's most impoverished, living on less than \$2 per day¹ with majority living in sub-Sahara Africa.

In Nigeria, with a rural population of over 60%, centralized energy system exists. The country has been solely dependent on the exploitation of oil to meet its development expenditure; in 2001, oil revenue alone accounted for 98.7% of total export contributing only 10.6% to GDP. Irrespective of Nigeria's position as the sixth largest petroleum oil exporter and a leading gas exporter, the nation suffers enormous energy crisis manifesting in various forms: about 60 -70 % of the nation's population are excluded from the national electricity grid⁵. Moreover, the grid is plagued by rather frequent power outages that last for several hours daily in places that are connected to the grid. Still, the grid electrical energy is generated from unsustainable sources (large hydro power stations and a growing number of thermal gas stations).

Over 60% of the country's population depends on fuelwood for cooking and other domestic uses⁶. The consumption of fuelwood is worsened by the use of inefficient cookstoves, which have very low thermal efficiency and produce smoke hazardous to human health. Increasing and unsustainable fuelwood consumption contributes to deforestation leading to desertification and soil erosion. Women and children are most affected making them vulnerable to respiratory disorders and other adverse health conditions. Worldwide, 1.6 million people die each year due to the health and respiratory effects from indoor air pollution⁷. When fuels become scarcer, female children over male children are withdrawn from school to support family energy needs. Illiterate women have more children, larger and poorer families and this reinforces the cycle of poverty and under development. The provision of accessible energy options will therefore save them time and hard labour. Time

previously used for wood collection and related chores can then be applied in other productive activities such as adult literacy and skills training.

The World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 recognized the important role of energy for reaching the millennium development goals. Access to affordable, reliable and sustainable energy is essential to sustainable development. An adequate solving of energy problems will contribute to achieving progress across all pillars of sustainable development: economic, social and environmental and in meeting the UN Millennium Goals. Although there are no MDGs on access to energy, WSSD recognized that inadequate access to energy is both a cause and an effect of poverty, and recommended the following:

“Take joint actions and improve efforts to work together at all levels to improve access to reliable and affordable energy services for sustainable development sufficient to facilitate the achievement of the Millennium Development Goals, including the goal of halving the proportion of people in poverty by 2015, and as a means to generate other important services that mitigate poverty, bearing in mind that access to energy facilitates the eradication of poverty”.

Renewable Energy and Energy Efficiency

We cannot talk about renewable energy without energy efficiency. Let me illustrate the relationship between them with an equation as shown below:

Renewable Energy + Energy Efficiency = Sustainable Development

The relationship can be compared to a biological relation where it takes a man and a woman to produce children. To achieve sustainability in the development of renewable energy, it should go along side with energy efficiency.

Renewable energies include wind, ocean wave and tides, solar, biomass, rivers, geothermal (heat of the earth), etc. They are ‘renewable’ because they are regularly replenished by natural processes and are therefore in endless supply. They also can operate without polluting the environment. Technologies have been developed to harness these energies and such technologies are called renewable energy technologies (RETs) or sometime also called “clean technologies” or “green energy”. Because renewable energy are constantly being replenished from natural sources, they have security of supply, unlike fossil fuels, which are negotiated on the international market and subject to international competition, sometimes may even resulting in wars and shortages. They have important advantages which could be stated as follows:

- Their rate of use does not affect their availability in future, thus they are inexhaustible.
- The resources are generally well distributed all over the world, even though wide spatial and temporal variations occur. Thus all regions of the world have reasonable access to one or more forms of renewable energy supply.
- They are clean and pollution-free, and therefore are sustainable natural form of energy.
- They can be cheaply and continuously harvested and therefore sustainable source of energy.

Unlike the nuclear and fossil fuels plants, which belong to big companies, governments, or state owned enterprises, renewable energy can be set up in small units and is therefore suitable for community management and ownership. In this way, value from renewable

energy projects can be kept in the community. In Nigeria, this has particular relevance since the electricity grid does not extend to many rural areas and it is prohibitively expensive to extend the grid to remote areas. This presents a unique opportunity to construct power plants closer to where they are actually needed. In this way, much needed income, skill transfer and manufacturing opportunities for small businesses would be injected into rural communities.

Transition from fossil fuels to renewable energy will not result in net job losses or cause harm to the economy. Renewable energy technologies (RETs) are labour intensive, and can produce more jobs than fossil fuel or nuclear industries. When RETs are properly integrated into national development plans and implemented, they can substantially reduce greenhouse gas emission and simultaneously increase employment. Moreover, it will also enhance energy security by reducing reliance on oil, preserve the competitiveness of energy, lead to savings for consumers and provide transitional assistance to workers in negatively affected industries and communities. With the right approach, the interests of working families and the environment can come together.

What is Energy Efficiency?

Energy efficiency means improvement in practices and products that reduce the energy necessary to provide services like lighting, cooling, heating, manufacturing, cooking, transport, entertainment etc. Energy efficiency products essentially help to do more work with less energy⁸. Thus, the efficiency of an appliance or technology is determined by the amount of energy needed to provide the energy service. For instance, to light a room with an incandescent light bulb of 60 W for one hour requires 60 W/h (that is 60 watts per hour). A compact fluorescent light bulb would provide the same or better light at 11 W and only use 11 W/h. This means that 49 W (82% of energy) is saved for each hour the light is turned on. An old refrigerator would use around 250-300 kWh per year whereas the new model would use around 100 kWh per year.

In Nigeria today, a lot of energy is wasted because industries, power companies, offices and households use more energy than is actually necessary to fulfill their needs. The reason is because they use old and inefficient equipment and production processes; buildings are poorly designed; and because of bad practices or habits. With energy efficiency practices and products, the nation can save over 50% of the present energy consumed in the country. The energy presently generated in our country could be sufficient for the entire Nigerian population. Using energy more efficiently would:

Reduce electricity bills

- Leave more energy available to extend energy supply to all parts of the population
- Increase the efficiency and resilience of the economy – including reduced reliance on oil and thus improve balance of payments
- Improve industries' competitiveness internationally
- Minimize the building of new power stations and thus free up capital for other investments like health and welfare
- Reduce the negative environmental and human health impacts from energy production and use
- Increase employment through interventions e.g. in industry, housing, transport.

End-use Efficiency: End-use efficiency refers to technologies, appliances or practices that improve energy efficiency at the level of the final user. It includes electricity-using and thermal technologies such as motors, lighting, heating, air conditioning. It also includes technologies that help to conserve or better use energy such as insulation. End-use efficiency covers measure from improving the ability of houses to absorb and retain heat in winter and keep out heat in the summer to changing individual and business behaviour to include maintenance and repair of industrial production equipment.

Demand-side Management: refers to practices or policies usually implemented by utilities and energy planners that encourage users to use energy more efficiently or to move their energy use away from peak demands. The later is known as load shifting. Load shifting allows for more effective use of generating capacity and can significantly defer the need for building new generating stations.

Energy Management

Good energy management can contribute to energy efficiency and it includes:

- Ensuring that spare heat are not vented away but put into use
- Lighting is activated when required
- Carrying out energy audits i.e. measuring and analyzing the amount of energy used by a building or company to ensure that all aspects of energy management are optimized

Dispersed Generation

In Nigeria and in some parts of the world, energy is generated from a central location and distribute through long distances to other parts of the country. Energy is lost when transmitted through long distances. Energy losses due to grid transmission over long distances could be minimized if energy generation is dispersed. That is energy is generated locally and fed directly into distribution systems.

Energy Conservation

This refers to reducing the need for energy particular electricity to achieve greater overall efficiency. For example the use of solar water heater, which helps to capture thermal energy of the sun in panels and connected to a well insulated storage tanks. With the solar heater, the use of electricity to heat water will be minimized. Another example of energy conservation practices is the locating work places closer to public transport or closer to living areas.

Energy Efficiency in Transportation

An efficient and well organized public transport would help to conserve the use of energy in the transport sector. It will cut down the number of cars on the road thereby reducing congestion and travel time. If buses were on time, regular and comfortable, more people would use them.

Passive Designs in Energy Efficiency Houses

Passive designs in buildings means making use of nature to reduce energy consumption and other cost. This involves the correct orientation of buildings and roof design in other to use natural light during the day. It also involves the use of overhangs to keep out light during period of high sunlight intensity. Energy efficiency designs have other possibilities such designs that will enhance natural air flow, use of materials that will minimize heat flow etc.

Use of Incentives

Tariff structures can be used to encourage people to use less electricity and defer the use of appliances to periods when it is in least demand. Varying the rate of charge according to time of day encourage load-shifting for example the use of timers to activate appliances prior to peak demand. Change in behaviour can also help to conserve energy e.g. reducing the temperature in the washing machine will reduce energy consumption or use of modern appliances. Energy efficiency habit include turning off appliances when they are not in use.

Industrial Energy Use

Heavy industry is usually responsible for most energy consumption in many countries with consumption typically ten times higher than consumption in other areas. With energy efficiency improvement in production processes could reduce energy consumption. Improvement in efficiency at the point of electricity generation is possible with recent developments in plant conception and design.

Renewable Energy and Energy Efficiency as Climate Change Mitigation Measures

The Intergovernmental Panel on Climate Change, a body set up in 1988 by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP) to provide authoritative information about climate change phenomenon, asserts that the warming of the last 100 years was unusual and unlikely to be natural in origin. IPCC has attributed the warming of at least the second half of the century to an increase in the emission of greenhouse gases into the atmosphere. Human activity is largely responsible for the emission of these gases into the atmosphere: CO₂ is produced by the burning of fossil fuels (coal, oil and gas) as well as land-use activities such as deforestation; methane is produced by cattle, rice agriculture, fossil fuel use and landfills; and nitrous oxide is produced by the chemical industry, cattle feed lots and agricultural soils. As humans have increased their levels of production and consumption, greenhouse gas emissions have also increased; since 1750, at the time of the Industrial Revolution, CO₂ emission has increased by 31 %, methane by 151 % and nitrous oxide by 17%. Moreover, the emissions of these gases continue to rise steadily⁹.

Nigeria is one of the highest emitter of green house gases in Africa. The practice of flaring gas by the oil companies operating in Nigeria has been a major means through which GHGs are released into the atmosphere. Carbon dioxide emissions in the area are among the highest in the world¹⁰. Some 45.8 billion kilowatts of heat are discharged into the atmosphere of the Niger Delta from flaring 1.8 billion cubic feet of gas every day¹⁰. Gas flaring has raised temperatures and rendered large areas uninhabitable. Between 1970 and 1986, a total of about 125.5 million cubic meters of gas was produced in the Niger Delta region, about 102.3 (81.7%) million cubic meters were flared while only 2.6 million cubic meters were used as fuel by oil producing companies and about 14.6 million cubic meters were sold to other consumers¹². The use of renewable energy sources will reduce over dependency on the burning of fossil fuel. Moreover, instead of flaring gas in Nigeria, the gases can be converted to methanol and used as fuel for both domestic and industrial use. With good energy efficiency practices and products, the burning of fossil fuel for energy will be greatly minimized.

Renewable Energy Potential in Nigeria

Nigeria has high potential to harness energy from renewable sources. The country falls within the tropics of Cancer and Capricorn where the abundance of sunlight is inevitable. This energy whose reservoir is the sun is one of the energy resources whose availability is infinite if it is developed. Furthermore, unlike the conventional energy resources, solar energy development is not as capital intensive. Therefore, it is fundamental to proffer the strategy of diversifying energy resource development outside the conventional energy resource. This means that, the proceeds of the sale of the conventional energy resources which are in high demand should directly be channeled towards the development of other non-conventional, less capital intensive and non-hazardous energy resources in Nigeria. With the abundance supply of solar energy in Nigeria, efforts need to be geared towards research and development of solar electricity conversion by both direct and indirect methods.

Wind energy is a secondary form of solar energy. Experts reported that approximately 2.5% of solar energy captured by the atmosphere is being converted into wind. The development of wind power plants is being undertaken by many countries for the generation of electricity in their quest to exploit renewable energy sources and Nigeria should not be left out. With wind energy available at an annual average speed of 2.0 m/s near the coast to 4.0 m/s at the northern borders, the country possess enormous potential to develop and utilize energy from the wind for electricity generation. The coastal regions of the south and the northern part of the country are possible suitable sites for wind energy exploitation. There is need to embark on research to determine actual values for wind energy potential.

The potential for bioenergies development is high. As mentioned earlier, Nigeria has all the vegetational regions of West Africa except that of the desert. Agriculture is the dominant economic activity, which contributes 41% of Nigeria's GDP and employs the highest labour in Nigeria. Roughly 75 percent (74 million hectares) of Nigeria's total land (98 million hectares) is arable and about 40 percent of this is cultivated, leaving the remaining 60% of arable land idle. Nigeria's farmland is cultivable and would have medium for good productivity if properly managed. Policy, institutional and technological approach is inevitable to harness bioenergy potential in Nigeria.

What are our challenges?

1. lack of policies
2. lack of awareness creation
3. lack of trained personnel in the relevant governmental agencies
4. attitudinal change of policy makers and end users of energy
5. lack of energy efficiency agency

Conclusion and Recommendation

It is obvious that there is need for Nigeria to explore alternative source of energy especially to reach out to the people that do not have access to electricity and other modern energy services. It is also established that renewable energy and energy efficiency are two components that should go together to achieve sustainable development. The need to conserve the present energy generated in the country using energy efficiency products and

practices is essential for sustainable development. It is recommended therefore that the country should:

- Develop policies on energy efficiency and integrate them into current energy policies
- Promote energy efficiency products and practices at the side of end users and energy generation
- Create awareness on renewable energy and energy efficiency
- Establish agency to promote the use of energy efficiency products and ensure energy efficiency practices
- Develop and imbibe energy efficiency technologies
- Develop appropriate drivers for the implementation of energy efficiency policy

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