

Renewable Energy and Sustainable Food Security in Nigeria

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Abstract

Renewable energy sources are becoming an increasingly important alternative source of energy in the agricultural sector. The use of renewable energy will reduce the use of fossil fuels, thereby minimizing the emission of green house gases. Increased use of renewable sources of energy especially in the agricultural sector will enhance the sustainability of food security in Nigeria and the quality of the environment. The use of renewable energy sources in the agricultural sector will also lead to environmentally friendly, sustainable and viable sources of energy to reduce the dependency on depleting fossil fuels. Increasing attention is being focused on the installation and usage of renewable energy sources in the agricultural sector in several countries of the world purposely to contribute to global reduction in greenhouse gas emissions and sustainable food security. This paper attempt to explain the role of renewable energy sources in agricultural sector as a means of enhancing sustainable food security in the country and presents the existing technologies, policies and emerging opportunities in renewable energy application in the agricultural sector.

Keyword: Available incentive, Energy policy, Renewable energy, Sustainable food security.

1. INTRODUCTION

Soaring food prices were a major trigger for the riots that destabilized North Africa and the Middle East, and have since spread to many other African countries^[1]. The UN Food Price Index hit its all-time high in February 2011, and the May 2011 average was 37 percent above a year ago^[2,4]. This is happening as the global economy is still staggering from the 2008 financial crisis, with public debt expanding and unemployment sky high^[2]. Food has quickly become the hidden driver of world politics^[3], and food crises are going to become increasingly common. "Scarcity is the new norm." The world is facing increasing demand for food as population increases while the world's ability to produce food is diminishing. Aquifers are running dry in the major food producing countries where half of the world populations live⁵. There is widespread soil erosion and desertification; and global warming temperatures and weather extremes are already reducing crop yields^[2,5], hitting the most vulnerable people in sub-Saharan Africa and south Asia the hardest. To substantially improve living standards, sustainable food security is the answer but is not possible with-out access to modern energy (renewable energy). Lack of access to modern energy is generally recognized as the biggest obstacle to sustainable food security in Nigeria and world at large. The International Energy Agency 2010 report on energy poverty stated that: "Lack of access to modern energy services is a serious hindrance to economic, social development and sustainable food security and must be overcome if the UN Millennium Development goals (MDGs) are to be achieved^[5]." This view is echoed in the report of the 6th Annual Meeting of the African Science Academy Development Initiative (ASADI)^[6]: "Access to modern energy services, defined as electricity and clean cooking fuels, is central to a country's sustainable food security and development in general."

2. WHAT IS RENEWABLE ENERGY

Renewable energy is an energy which comes from natural sources such as sunlight, wind, rain, tides, and geothermal heat, which are naturally replenished^[7]. In 2006, about 18% of global final energy consumption came from renewable energy, with 13% coming from traditional biomass, which is mainly used for heating, and 3% from hydroelectricity^[7]. New renewable (small hydro, modern biomass, wind, solar, geothermal, and bio-fuels) accounted for another 2.4% and are growing very rapidly^[8]. The share of renewable in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3.4% from new renewable^[8]. Wind power is growing at the rate of 30% annually, with a worldwide installed capacity of 157,900 MW in 2009^[8]. And is widely used in Europe, Asia, and the United States. The annual manufacturing output of the photovoltaic industry reached 6,900 MW in 2008, and photovoltaic (PV) power stations are popular in Germany and Spain^[9].

Solar thermal power stations operate in USA and Spain, and the largest of these is the 354 MW SEGS power plant in the Mojave Desert^{9/}. The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugarcane, and ethanol now provides 18% of the country's automotive fuel. Ethanol fuel is also widely available in the USA.

2.1 TYPES OF RENEWABLE ENERGY

- 1) Wind power
- 2) Hydro power (small and large hydropower)
- 3) Solar
- 4) Biomass (Biogas, Bio-ethanol, Biodiesel)
- 5) Geothermal
- 6) Hydrogen and fuel cell

WIND POWER: Wind power has been an energy source for a very long time. It was used by the Chinese about 4000 years ago to pump water for their crops and by sailors to sail around the world. The energy in wind can be used by making a tower that stands high above the sea level with a large propeller at the top. What the wind does it is basically blows the propeller round and round which in turn helps produce electricity. By building not just one but multiple of these towers you can produce more electricity at once. The most suitable area to build these wind turbines would be in coastal areas, tops of hills, open fields or basically anywhere the winds are strong and continuous^[10].

HYDRO POWER: Water is about 800 times denser than air and therefore even a small stream of water can produce a reasonable amount of energy. Water energy can be in many different forms that include a) hydroelectric energy b) micro, mini and large hydro c) hydro power without dams, and d) ocean energy. Today there are many hydroelectric power stations in the world and together they are providing about 20% electricity across the globe^[10].

SOLAR ENERGY: Solar energy is also one of the oldest renewable energy sources in the world. This energy is taken from the sun in the form of solar radiation. There are basically three ways that we can use the sun's energy. a) Solar cells in which photovoltaic or photoelectric cells are used to convert light directly into electricity. b) Solar water heating in which the heat from the sun is used to warm the water in glass panels of solar energy system therefore no longer requiring gas or electricity to heat the water. c) Furnaces that use mirrors to capture the sun's energy into a concentrated place to produce high temperatures. These solar furnaces can be used to cook food.

BIOMASS

Organic, non-fossil material of biological origin is called biomass. The biomass resources of Nigeria can be identified as wood, forage grasses and shrubs, animal waste and waste arising from forestry, agriculture, municipal and industrial activities, as well as aquatic biomass and the biomass energy resources of the nation have been estimated to be significant¹¹.

BIOFUELS

Biofuels are liquid fuels produced from biomass. The common ones here are biogas, bio-ethanol and biodiesel. Biofuels are primarily used as transportation fuels for cars, trucks, buses. Hence, their principal competitors are petrol and diesel fuel. But unlike fossil fuels, which have a fixed resource base that declines with use, biofuels are produced from renewable feedstock and are more environment friendly than petroleum products. Biofuel plants generate value-added economic activity that increases demand for local feedstock, which raises commodity prices, farm incomes, and rural employment¹². The principal biofuels applicable here are bio-ethanol, biodiesel and biogas¹².

BIODIESEL

Biodiesel, fuel made from natural, renewable sources, such as new and used vegetable oils and animal fats, for use in a diesel engine. Biodiesel has physical properties very similar to petroleum-derived diesel fuel, but its emission properties are superior. Using biodiesel in a conventional diesel engine substantially reduces emissions of unburned hydrocarbons, carbon monoxide, sulfates, polycyclic aromatic hydrocarbons, nitrated polycyclic aromatic hydrocarbons, and particulate matter. Diesel blends containing up to 20% biodiesel can be used in nearly all diesel-powered equipment, and higher-level blends and pure biodiesel can be used in many engines with little

or no modification. Lower-level blends are compatible with most storage and distribution equipment, but special handling is required for higher-level blends¹³. Biodiesel is made from oils or fats, which are hydrocarbons. Fresh soybean oil is most commonly used, although biodiesel can be made from mustard seed oil or waste vegetable oil (such as used oil from restaurant deep fryers). These hydrocarbons are filtered and mixed with an alcohol, such as methanol, and a catalyst (sodium hydroxide or potassium hydroxide), resulting in a chemical reaction whose major products are the biodiesel fuel and glycerol¹³.

BIO-ETHANOL

Bio-ethanol on the other hand is an alcohol made by fermenting and distilling simple sugars. It can be produced from any biological feedstock that contains appreciable amounts of sugar or materials that can be converted into simple sugar such as starch or cellulose. Cassava and sugar cane are examples of feedstock. Bio-fuel cropping require large area for production. Hence the fear by some antagonists that extensive bio-fuel may threaten food production either by competing for available fertile land or farmers may shift from food crop to energy crop production¹⁴

BIOGAS

Biogas is a product of the decomposition of wet digestible biomass by anaerobic bacteria (in the absence of oxygen) to simple organics. It consist of impure methane (60% to 70% methane, 30% to 40% carbon dioxide and trace amounts of other gases). Biogas production can utilize waste from other agricultural enterprises such as poultry farm. The gas may be used for heating or electricity generation¹².

GEOTHERMAL: Geothermal energy is capable of producing about 2,800 Megawatts of energy per year, or roughly 2% of the energy in the US. Geothermal is produced from naturally occurring steam and hot water from under the Earth surface. The steam rotates a turbine, which in turn powers electric generator. Also hot water can be used to directly heat buildings. The down side of geothermal energy is that land site are very hard to find and extremely rare. A positive fact is that it is very cost effective and reliable¹⁵.

3. WHAT IS SUSTAINABLE FOOD SECURITY

According to world bank, sustainable food security is an access by all people at all time to enough food for an active, healthy life at present plus the ability to provide enough in the future^{17,18}. And also sustainable food security was defined as when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life at present and near future¹⁸.

This definition, according to Ango,2008 by its full meaning and intent, has the following indices for measuring the extent or degree of food security achieved by any country:

- Adequate aggregate national food supply.
- Accessibility of supplies by citizens
- Affordability
- Nutritional needs of various segments of the population.
- Food safety considerations
- Strategic reserves for emergencies
- Environmental preservation/protection.

3.1CURRENT SITUATION OF SUSTAINABLE FOOD SECURITY IN NIGERIA

At independence up till the mid 1970s there were strong trends that Nigeria was, and could remain, largely a self – sufficient nation in terms of the food requirements for its citizens. Before the mid 1970s, Nigeria produced all its food needs and surpluses for its promising agro-industries, and for exports¹⁹. Our agricultural imports were very small for the special taste of expatriates and some Nigerians who acquired habits for exotic foreign foods and could pay for them. From less than N1billion in the early 1970s, our present food import bills stand at a staggering N400 billion per annum made up of such items like sugar, rice, milk, wheat, maize, beef, poultry, fish etc¹⁹. This phenomenal increase in food import is a clear indication that domestic agricultural output is not keeping pace with our domestic needs for essential food items and raw materials for agro-industries. Surely at the level of our development we cannot afford the expensive luxury of using our much needed scarce foreign exchange on goods we are in a much better position to produce than those countries from where we import them. All being well, as was the case before the 1970s, Nigeria should still be the net exporter of agricultural goods rather than being the net importer that we are today. Brief explanation of this situation is that our agriculture

suffers from low productivity meaning that the prevailing yields from crops, soils, rivers, lakes, livestock, forests etc are far below their expected and proven potentials. It is also a fact that even with this low productivity a significant proportion of the output is lost for lack of efficient post – harvest handling during storage, transportation etc. Accessibility of available food is a critical factor of sustainable food security in any country. Food must be moved from the point of production i.e. farms and/or factories to markets where consumers can easily access them. At present the country suffers from a number of weaknesses in its food distribution chain which include:

- a) Poor rural roads for easy and efficient evacuation of produce from the farms to the urban centres where non-farm consumers need them.
- b) Seasonal gluts and low food prices alternating with periods of scarcity and high food prices. Again the reasons for this cycle are well known and they include poor storage and preservation capacity, poor transport infrastructure, poor market information, poor organized producer and consumer groups, lack of effective intervention mechanisms to ensure steady supplies and stable food prices in various parts of the country.
- c) A “Nigeria Food Consumption and Nutrition Survey, 2001 – 2003” showed that one of the most important determinants in Nigeria’s food security status is whether Nigerians are always in a position to afford the food they need to remain active and healthy. The survey revealed that for most of the year up to 40% of Nigerian households could not afford their requirement for food²¹. The survey also showed a significant variation between rural and urban households, between agro-ecological zones of the country, and between occupational groups. Ironically the

survey showed that the most food insecure groups are rural communities (mostly farmers themselves). The survey also further showed that the higher the incomes of households the higher their degree of food security. In this regard the survey showed households in which members are employed in regular paid jobs had greater food security. Overall the prevalent poverty in Nigeria’s households are the main cause of food insecurity in the country. Recent CBN report on poverty in Nigeria corroborated the survey’s findings in terms of a near linear relationship between poverty and food insecurity in Nigeria.

3.2 SUSTAINABLE AGRICULTURE AND THE ROLE OF RENEWABLE ENERGY

Sustainable agriculture implies production system that ensure optimal yield without jeopardizing the capacity of future generation. It seeks to preserve the soil structure by replenishing nutrients vagaries, both of which are inimical to sustainable agriculture. A shift of emphasis towards renewable energy will therefore enhance sustainable agriculture. In addition, energy crops may be grown in a way that improves soil quality and reduces the need for heavy fertilizer, pesticide and herbicide application. Farm-based renewable energy offers opportunities for community enhancement and local self-reliance¹². It can strengthen rural communities through diversified income streams¹².

3.3 PROSPECTS OF ACHIEVING FOOD SECURITY IN NIGERIA

Based on the forgoing assertions and the indices for measuring food security around the world, it is safe to conclude that Nigeria is yet to achieve food security as universally defined. The question is how far away from the mark are we? This question cannot be answered with any confidence without looking at some of the issues which made our general economic development extremely slow in the first place. It is agreed that for the foreseeable future the Nigerian economy and its development would revolve around the following major sub-sectors¹⁹.

- Agriculture
- Manufacturing
- Oil Sector
- Solid Minerals

For the economy to grow rapidly these commanding heights should be so harnessed and managed such that each one of them makes its maximum contribution to the national revenue pool. Unfortunately, for almost four decades now the country’s attention has concentrated most on the oil sector to the neglect of the other sectors especially agriculture and manufacturing. Given the crucial role agriculture and manufacturing must play in an economy like

ours, it is not surprising that our socio – economic progress has stagnated and is characterized by:

- High level of unemployment
- Pervasive poverty
- Hunger and disease
- Inadequate infrastructure

- Inadequate basic social services
- Declining life expectancy
- High level of illiteracy

Over – dependence on foreign economies and foreign institutions.

This general neglect of the real sectors of our economy has brought Nigeria to its present un-enviable status of being one of the twenty poorest countries in the world with up to 70% of its citizens living on less than US\$1.0/day¹⁹.

4. Conclusion

One of the major challenges facing sustainable food security in Nigeria is the issue of energy scarcity in our agricultural sector. Nigeria produces so much food crops but most of them are lost during harvest and others are lost as a result of poor handling and poorer storage facilities. So much emphasis had been placed on intensive land clearing, fertilizer distribution and other inputs, at highly subsidized costs with very little or no attention paid to energy demand in the Agricultural sector. Whereas, no matter the tonnage of food that you produce, if you are unable to store them or add value to this food product by partial or full processing, there will still be food shortage and scarcity. In Nigeria, the second biggest economy in Sub-Saharan Africa, losses easily exceed one-third for many crops, because of lack of energy, since practically our thermal and hydropower stations cannot provide steady and reliable electricity to the agricultural sector, renewable energy is the next alternative option that will suit the agricultural sector of this country, since its, cheap, non exhaustible and environmentally friendly sources of energy and also other renewable energy technologies such as solar dryer, solar broader etc is of significant advantage to our local farmers¹⁹. The most painful aspect is that this wastage is not limited to the fruit alone, fish, chicken and other agricultural products also suffer as a result of lack of energy in the country¹⁹.

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