

SOLAR ENERGY AND ITS APPLICATIONS IN NIGERIA.**J. O. COKER**

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ABSTRACT

Solar energy is the energy transmitted from the sun in the form of electromagnetic radiation, which requires no medium for its transmission. The earth receives about one – half of one billionth of the total solar output. The sun is largely responsible for almost all of our conventional energy sources. For example, photosynthesis of plants and algae supported ancient life that later became fossil fuels. Even, hydroelectric power would not be possible without the evaporation of water. Unfortunately, solar energy itself has not been fully accepted as a safe, efficient and understandable source of energy.

The time is ripe, however, for all of us to become aware of the direct contributions solar energy can make to our lives and economy, most especially during this time of erratic power supply by the National Electric Power Authority, (NEPA).

Some of the applications of solar energy in Nigeria are in Village electrification, residential / commercial building, water pumping and purification, agricultural utilization, heating sources, industrial utilization etc.

INTRODUCTION

There are different forms of energy in the universe but the solar energy is the energy from the sun that is the primary source of energy. There can never be a true "energy shortage" as demonstrated by Einstein, everything in the universe is energy, heat, light, matter and as one energy is used up it is been replaced by another form of energy that is, transformation of energy.

If a good solar station is designed with efficient storage system and if the Federal Government could subsidize solar energy production to make it less difficult to compete with other fuel energy industries this natural energy cannot become scarce in future.

Hence, Solar energy is the alternative energy resource without environmental degradation and safety risk compare with nuclear or fossil energy. The objectives of the paper is to consider the conversion of solar energy to electrical energy (through photovoltaic cell), solar energy storage, review of solar energy and current, and possible future applications in Nigeria.

METHODOLOGY**(a) SOLAR ENERGY CONVERSION.**

Solar energy can be converted to electrical energy through Photovoltaic solar cells.

Photovoltaic Solar Cells or Modules: as the word implies (photo = light, voltaic = electricity) convert in ex-haustible Solar energy (sunlight)

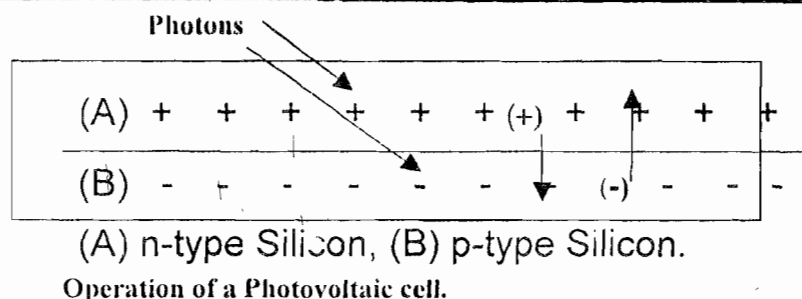
directly into electric energy (electricity). These cells are made of special materials called Semiconductors such as Silicon, which is currently the most common used.

Single crystal Silicon isn't the only material used in photovoltaic cells. Poly crystalline Silicon or Amorphous Silicon can be used in an attempt to cut manufacturing costs. Other materials used include gallium arsenide, copper indium diselenide and cadmium telluride.

Basically, when light, in the form of photons, hits the cell, an electron is set loose, and result in a free hole as well. If free electron and free hole happen to wander into its range of influence, the field will send the electron to the N side and the hole to the P side.

This causes further disruption of electrical neutrality, and if an external current path is provided, electrons will flow through the path to their original side (the P side) to unite with holes that the electric field sent there, doing work along the way. The electron flow provides the current, and the cell's electric field causes a voltage and both defines the power that the solar cell can produce.

Photovoltaic systems are wonderful technology that makes it possible to fully enjoy the power of sunlight, independent, reliable, ecologically safe energy sources that operate everywhere the sun shines.



(b) SOLAR ENERGY STORAGE

This is very important especially when the sun isn't shining or during the rainfall cloudy days, as well as altitude, humidity and other more subtle factors. Therefore, to have enough electricity supply all the year, we need energy storage in form of batteries.

The most commonly used deep cycle batteries are lead – acid batteries (both sealed and vented) and nickel – cadmium batteries although expensive, but last longer and can be discharged more completely without harm.

Generally, photovoltaic batteries have to discharge smaller current for a longer period (such as all night), while being charged during the day.

An inverter is also needed in the system, a device that converts direct current to alternating current used by the household appliances.

APPLICATIONS OF SOLAR ENERGY IN NIGERIA

Nigeria is a West African nation of approximately 130 million people. It is a developing nation, as is made clear by its high birth and death rates, low literacy rate, lack of powerful and effective Federal Government, and minimal infrastructure. In attempt to improve the infrastructure of Nigeria, the Nigeria Government has tried to privatize the communication and energy (i.e. electric power plants and oil refineries) industries.

Electrical infrastructure is extremely scarce in Nigeria. Only 40% of Nigerians have access to electricity. Although more than 70% of the population lives in rural areas, only 10% are connected to the grid. Hence, electric consumers have had to figure out other ways of generating electricity. Increasing inflation rates and foreign exchange rates have increased the cost of materials and labour needed for grid extensions by at least 400% since 1989.

In view of this, the Nigerian Government has recognized the need to seek decentralized technologies, in order to meet the increasing

electricity demands of the people. Hence solar photovoltaic is an attractive method to try and solve Nigeria's energy problems because it offers modularity and requires no fuel, which makes it much more suitable for rural environments.

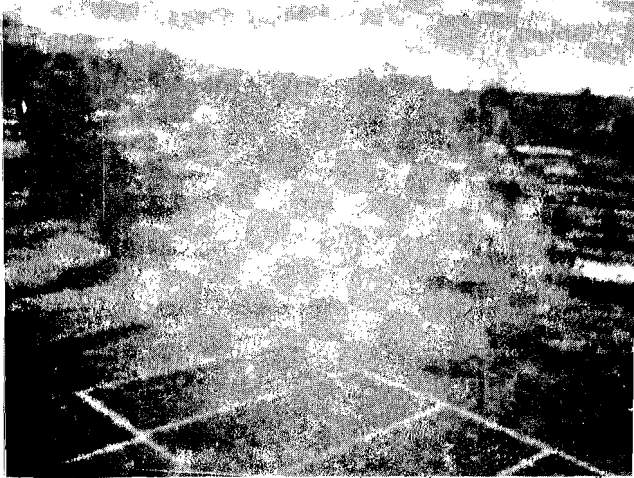
Additionally, photovoltaic plants require very basic and relatively simple operation and maintenance and have long life times with very little performance degradation.

One of the primary uses of photovoltaic applications in Nigeria was in water pumping and purification, which began, in the early 1980's. In 1982, a cost comparative study on photovoltaic system proved that photovoltaic was much less expensive even, in terms of maintenance to diesel powered water pumping system of the same power output which required fuel and services due to wear and tear.

One of the most important benefits of photovoltaic pumping is the ability to shut down the common open wells, which frequently expose the people to poor sanitation conditions and water – borne diseases. It also significantly reduced the distance that the rural dwellers had to travel to obtain clean water. The photovoltaic water pumping system efficiency is very high, and the system is durable and long lasting.

In 1991, Nigeria Telecommunications (NITEL) powered the first two stations in Nigeria, the Ugonoba and the Gwadabawa repeater stations, with solar photovoltaic systems. By 1997, more than 50 repeater stations in the Nigerian network were powered by solar photovoltaic systems.

The first installation of 22 photovoltaic – powered cellular phone systems was successfully installed across the country. The introduction of photovoltaic technology rids the country of the frequent failures associated with the long distance routes of the current telecommunications network, and provides a reliable source of energy even in the most remote areas of Nigeria. Hence, the benefit of photovoltaic powered telecommunications in relation to the existing network has been tremendous.



Iheakpu - Awka Village in Nigeria with solar power facilities

In 1998, solar power facilities were installed in the Iheakpu – Awka village, an example of the success of the village electrification project. This was possible because of its cost – effectiveness and declining production costs.

The current applications of photovoltaic solar systems in Nigeria are in residential and commercial buildings to power households and office equipments especially in some areas where there is erratic power supply. This has led to an increase in night time business and recreation due to sufficient luminosity. The patronage and income of commercial activities has also increased significantly, piquing the interest of others desiring the photovoltaic solar systems.

Photovoltaic solar systems are used in solar dryers for remote rural communities. They are also used in Yacht's and boats equipped with solar power systems thus free from noise and small of diesel engines, which need running to charge the electric batteries.

For future applications of solar energy in Nigeria, the energy commission of Nigeria is initiating a community – based solar energy project aimed at providing photovoltaic power as an alternative to the national grid.

This project aims to provide electricity to the 81% of the population not serviced by the National electric power Authority, so that the country can participate effectively in the global market. In addition, the Nigeria government is planning a project to deploy solar powered water purification systems and other photovoltaic technologies do villages throughout the country.

The actions of government to encourage the use of photovoltaic systems within Nigeria by providing incentives for industrialist and investors to invest in photovoltaic systems are a huge

advancement towards a much more stable energy infrastructure.

In order for photovoltaic power to have wide spread use in Nigeria, the government needs to employ educational activities promoting the benefits of photovoltaic – power: cost, social, and environmental.

CONCLUSION

One of Nigeria's main challenges, similar to many other developing countries, is how to provide energy to a rapidly growing population and industry that do not have a reliable source of electricity due to epileptic power supply and this has affected the economy of the nation.

Nowadays, to start any business even on a small scale, you have to think of generating plant which has constitute noise and air pollution to the environment.

The 400% increase in the cost of the electricity materials for grid connections and the increasing cost of fuel and petroleum also presents a favourable case for photovoltaic power in Nigeria.

Therefore, solar energy as an alternative energy source should be considered to be the optimal energy to provide the population of Nigeria with low cost energy required for lightning, supplying water and working of home appliances. This will enable us to conserve our valuable non – renewable fossil resources for future generations to enjoy and we can all live in a world of abundant energy without pollution.

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