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Solar Photovoltaic Technology: The Most Efficient and Economical Way to Empower and Electrify the Urban Towns in Anambra State

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Abstract
Anambra State is blessed with abundant sunlight. Energy is an essential ingredient for socio-economic development and economic growth. From the foregoing, renewable energy potentials in the studied urban towns in Anambra State, have been assessed and evaluated, and it was clear that energy is an essential input to all aspects of modern life. It is indeed the life wire of industrial production, the fuel for transportation as well as for the generation of electricity. The study reveals that Anambra State receives 5.08 × 1012kwh of energy per day from the sun and if solar energy applies with just 5% efficiency is used to cover only 1% of the Anambra State surface area, then 2.54 × 106Mwh of electrical energy can be obtained from solar energy. This amount of electric energy is equivalent to 4.66 million barrels of oil per day.
Keywords: *Solar Energy, Renewable Energy, photovoltaic technology, Anambra State, and Economic Development*

INTRODUCTION

The close relationship between the proximity of energy resources to the potential use, coupled with the higher cost of convectional energy sources have led to a considerable interest in the development and application of renewable energy resources. It is now universally accepted that fossil fuels are finite and it is only a matter of time before their reserves become exhausted. The need for supplementary or even alternative that ideally will be non-deplete able energy source have since been recognized. These non-depletable sources are replenishable and are also referred to as renewable energy sources as they are available in cyclic or periodic basis.
Solar energy which has estimated worldwide average power potentials of 24w per square metre of the earth's surface;

Figure 1; Map of Anambra state.

Solar Energy:

In the studied areas solar energy is the most promising of the renewable energy source in view of its apparent limitless potential.
The sun radiates its energy at the rate of about 3.8 × 1023kw per second. Most of this energy is transmitted radial as electromagnetic radiation which comes to about 1.5kw/m^3 at the boundary of the atmosphere.

After transversely the atmosphere a square metre of the earth's surface can receive as much as 1kw of solar power, averagely to about 0.5 over all hours of daylight. Studies relevant to the availability of the solar energy resources in Anambra State have fully indicated its viability for practical use.

Although solar radiation intensely appear rather dislike when compared with the volumetric concentration of energy in fossil fuels, it has been confirmed that Anambra State receives 5.08 × 1012kwh of energy per day from the sun and if solar energy applies with just 5% efficiency are used to cover only 1% of the Anambra State surface area then 2.54 × 106Mwh of electrical energy can be obtained from solar energy. This amount of electric energy is equivalent to 4.66 million barrels of oil per day.

Fig. 2: Diagram of mounted solar panels in use.

Solar energy technologies are divided into two broad groups namely: **solar thermal** and **solar photovoltaic**. In solar thermal applications, solar energy, as electromagnetic waves is first converted into heat energy. The heat energy may then be used either directly as heat, or converted into "cold" or even into electrical or mechanical energy forms. Typical such applications are in drying, cooking, heating, distillation, cooling and refrigeration as well as electricity generation in thermal power plant.

In **solar photovoltaic application**, the solar radiation is converted directly into electricity. The most common method of doing this is through the use of silicon solar cell. The technique was first observed in 1939. Its development had been closely tied to the space programme of western world.

The power generating unit is the solar module which consists of several solar cells electrically linked together on a base plate. On the whole the major components of a photovoltaic system include the arrays which consist of the photovoltaic conversion devices, then interconnections and support, power conducting equipments that convert the dc to ac and provided regulated outputs of voltage and current controls, which automatically manage the operation of the total system as well as the optional storage for stand-alone (non-grid) systems.

In recent times, the commercial viability of photovoltaic system have been recognized and concerted international efforts, research and development have led to increase in efficiency and reliability as well as reduction in cost.

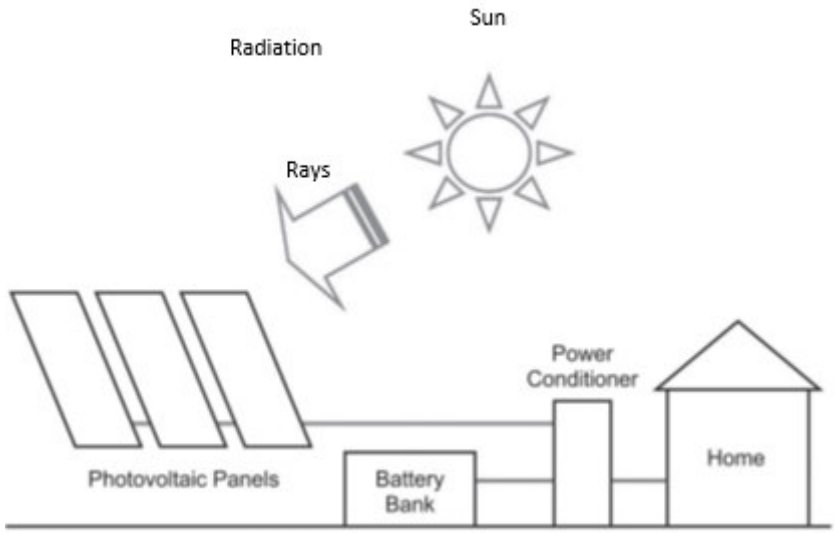

Fig. 3: Simple Off-grid residential photovoltaic system

CONCLUSION AND RECOMMENDATIONS

The studies showed that photovoltaic technology was the most efficient and economical way to empower and electrify the urban towns. Diesel generators have a high failure rate due to the unaffordable expenses of fuel and upkeep, and the studied areas lack the resources for localized wind, hydropower generators and geothermal potentials. There is plenty of solar radiation in the project areas:

The designs and implementation of the project should encompass technical, financial and organizational component to ensure sustainability. It was found out that trained technicians Engineers live in each of the studied urban areas in Anambra state and should be charged with basic upkeep of the systems.

Technicians with a higher level of education and training should be employed to supervise and train the village technicians as well as to handle more complex repairs. Each user should be charged a monthly fee that will be calculated to supply all the funds needed for operation and maintenance costs. The collected funds will be use to buy supplies, pay the technicians and cover the administrative cost of the project.

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