

AC 2009-1442: DEPLOYMENT OF ALTERNATE SOURCES OF ENERGY IN GHANA

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Deployment of Sustainable Alternate Source of Energy in Ghana

Abstract

Developing nations generally do not have the industrial infrastructure that expel large amounts of greenhouse gases into the atmosphere as a result of manufacturing processes, while this can be said of developed nations. Automobiles also contribute to this effect, and here too, developing nations do not have nearly as many cars on the road as developed nations do. For similar reasons, developing nations do not contribute in a major way to the greenhouse effect and global warming, which are world-wide phenomena that impact all continents and nations. The fact that global warming impacts the whole world makes it imperative that all nations contribute to the resolution of the problems it poses.

In considering the positions that some African nations face and the global problem of emissions into the atmosphere, it is essential to take into account some recent developments. In focusing on Ghana, there is a recent discovery of oil off the coast of Ghana, and already the nation is anticipating the wealth and prosperity this will bring to Ghana. For a poor and developing nation, the attraction of the wealth can be characterized as strong. Even so, it is essential that the people and government of Ghana temper their excitement of the anticipated prosperity with the sobering thought of the negative impact burning of fossil fuels and resultant emissions have on the atmosphere. This strongly points to the need of alternate sources of energy that support the green revolution.

The nation Ghana is well within the Tropic of Cancer, 5° to 12° north of the equator. This places the nation where its people can take full advantage of solar energy by use of solar technologies. While other universities such as Kwame Nkrumah University of Science and Technology (KNUST) are engaged in such activities, this paper discusses the efforts being made by the University of Cape Coast (UCC) in supporting the government's effort to employ solar energy as a sustainable alternate source of energy.

Introduction

The issue of global warming and its effect on the Arctic presents a problem that is being taken seriously by governmental agencies such as the US Environmental Protection Agency (EPA)¹. In an article by the Natural Resources Defense Council (NRDC) titled *Global Warming puts the Arctic on Thin Ice*², some of the questions asked that have *yes* as a response are *Will Arctic ice melt have any effects beyond the polar region?* and *Can we do anything to stop global warming?* The first of the two questions indicates that the one event of the ice melting at the Arctic can have global impact and the second question indicates that a global joint effort is needed to counter global warming. For this reason it does not matter whether any nation is a major or minor contributor, the essential point is that all nations should participate in resolving this issue.

This point has been articulated by the Minister of Tourism and Diasporan Relations in stating that “The tourism industry itself must take action to reduce its contribution to global greenhouse gas emissions” in her address to the participants at the “Tourism: Responding to the Challenges of Climate Change” conference³. In her address, she also ‘urged the tourism sector in Ghana to safeguard its future by resorting to non-carbon dioxide emission sources of energy which tended to cause dangerous imbalances in world climate conditions’. This suggests that the government and people of Ghana, not only appreciate the global nature of the problem, but intend to contribute to solution.

Sources of Energy in Ghana

For the most part, electricity has been the main source of energy in Ghana for several years but this has been hydroelectric generation. The generation takes place at the Akosombo dam by the Volta River Authority. This is therefore a clean source that does not contribute to green house emissions. In recent years however, there has been an oil find that initial speculation indicates could be extensive. This raises the issue of the use to which fossil fuel could be put to in Ghana.

Geogise has stated in an article titled Global Warming that “Causes of warming: The chief causes are burning fossil fuels, such as coal, oil, and natural gas, and releasing them into the atmosphere, and the emission of carbon dioxide and other greenhouse gases due to human activities such as industrial processes, **fossil fuel** combustion, and deforestation.”⁴. The factors stated such as burning of fossil fuel and deforestation in the statement above relates to activities in all nations including developing nations such as Ghana.

In relation to this issue, Ghanaians are showing a keen sense of awareness concerning the attendant problems to the oil find. A cautionary note was delivered by the Minister Designate for Energy at his vetting by stating that “the oil find could become a blessing only if its production, revenue, the environment and security issues were properly managed”⁵. In his presentation, ‘he gave further assurance of challenging Ghanaians within government’s financial capabilities for a wider use of solar energy’. By making reference to the use of solar energy, the Minister Designate was acknowledging the importance in balancing the application of different energy sources in supplying the needs of Ghana. Ghana is therefore establishing its potential as a player in global issues.

Diversification in Applications

An intended date of 2015 for ‘adequate energy sources for industrialization and domestic use’ has been set, as reported in an article by Ghana News Agency⁶. This was in a statement by the then President of Ghana while receiving a report by the Ghana Atomic Energy Commission (GAEC). The then President also commented on the need for the country ‘to blend its energy sources’. The need to increase the energy production in Ghana became evident in 2007 when Ghana experienced shortage in electricity production that affected the whole nation. Professor Akaho, the Director General of GAEC made reference to this detail in a speech titled “Nuclear Power for Generating

Electricity in Ghana: Issues and Challenges”, published in an article titled “Ghana must draw plans to explore nuclear energy – Prof. Akaho”⁷. In this speech Professor Akaho stated “In the wake of Ghana’s energy crisis in 2007, President Kufuor set up a Nuclear Power Committee to prepare pre-feasibility studies on the country’s chances of expanding its power generation by including nuclear energy.” He also noted that the rising and volatile prices of fossil fuels were in part, a potential driver for use of nuclear energy. He stated that “the country should make its own national nuclear laws and legislations to deal with all aspects of nuclear safety, security, safeguards and liability for nuclear damages”. He however was not explicit in presenting a safe and secure disposal of nuclear wastes. The discovery of oil could therefore be viewed as achieving one of the steps towards the plans for nuclear energy power plant.

The Green Revolution

Current climatic conditions demand minimal use of any products that can expel green house gases into the atmosphere hence the use of solar energy as prescribed by the green revolution is a positive application. As noted above⁵, the Minister Designate for Energy addressed the use of solar energy. Solar energy is therefore one of the sources of energy that is exciting interest in the nation and academic institutions such as KNUST and UCC are taking up the challenge in devising products based on solar technology.

With respect to the efforts at UCC, one faculty member, Dr. Sam, has been very active in devising and presenting products that rely on solar energy as well as blend into the equatorial environment. It is worth noting at this point that because the nation is well within the tropics, Ghanaians have always relied on the sun in various uses. The local applications may be described as low technology in that it is mostly based on using the sun’s heat directly in drying different products. Converting the sun’s energy to electrical energy will extend the application as a utility. It can then be used to power home appliances as well as power computers. It can be used in industrial settings, in academic institutions, as well as in health case in the case of telemedicine. Having electricity in a rural village that does not have connectivity to the national grid will be a major boost to the lifestyle of the inhabitants. The possibilities of positive results are endless. The work with UCC is designing a solar energy system that will be used in an off-grid rural village.

From previous visits to UCC in the past, sources of energy other than fossil fuels is a topic that has been discussed among others. Some of the factors that have been considered are:

- the technology involved should be adaptable to the equatorial environment
- components needed should be in part or completely obtainable within the local area
- the system to be built should be low cost
- the system should be sustainable with little or no maintenance cost
- the system should be useful in both urban and rural areas, and
- the technology should be transferable to all interested parties in the local area.

All these factors conform to the expectations of the green revolution, and equally importantly acceptable to the people. This latter point was confirmed through discussions with some of the local people.

Rationale for Choice

The energy crisis in 2007 referred to above⁷ was precipitated by the lowering of the water level in the dam that is used for hydroelectric generation, and this was due to low levels of rainfall in that year. This exposed a weakness in the hydro generation that had not been encountered up until then. Even though oil has been found with expectations that it will last for several years, it is nonetheless of finite quantity and will not last forever. Though there has been a lot of discussion on nuclear generation, the financing of it remained a problem. The one source that has promise of sustained presence for years to come is the sun. In the equatorial region the solar irradiance is high and even during the rainy season there is incidence of sunshine interspersing the torrential rainfalls. This makes solar technology an appropriate choice for a nation like Ghana which is placed between latitudes 5° and 12° north of the equator.

An important factor in considering solar technology is that it can be customized to suit various sizes of building structures as well as to operate isolated pieces of equipment such as water pumps. Solar technology can be incorporated in the design of lanterns for personal use. It can therefore be scaled up or down to suit different applications.

Student Involvement

Solar technology is a well established technology that is employed in sophisticated systems by highly advanced organizations such as NASA. In the article “NASA Team Successfully Deploys Two Solar Sail Systems”⁸, “unique propulsion technology that could enable future deep space missions” is discussed. This suggests the opportunities that are available for student research starting from small scale individual or personal applications to highly sophisticated systems. A nation such as Ghana situated well within the equator and the Tropic of Cancer can therefore engage students in development and research in solar technology. Students at Penn State and their Ghanaian counterparts will be involved in cooperative projects that will be based on solar energy. The projects will be designed to have end products that can be used within the community. This will therefore be a form of community service for the students, as they contribute to the development of the nation. This serves yet another purpose.

The students are familiar with the environment they come from and can identify specific needs that they can design projects to resolve. Major among these is powering up and lighting the rural areas that are off-grid. Such areas will therefore have access to all the facilities and amenities that those living in urban areas have.

Conclusion

Ghana currently has hydroelectric as a source of energy and use fossil fuel products for some applications. Due to an energy crisis that was faced in 2007, the nation made it a national objective to develop other sources and not to rely on only those currently in use and solar energy is one of those discussed. As it supports the green revolution and is also a sustainable source, solar energy is favored by some Ghanaians. It is intended that students will be involved in the development of solar technology products in providing some societal needs.

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