

Renewable, Alternate, Green, and Sustainable Energy - Lifeline for Ghana

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This article will use an eclectic approach in the discussion of alternate energy sources for Ghana.

When the big bang cosmological event happened four and half billion years ago, according to the experts such as Stephen Hawking, our sun was born as a big blazing star of gases among other billions of suns, and it has continued in its blaze over the sky ever since, non-diminishing in its intensity, and giving life to all living things on earth.

No wonder, some ancient people of Egypt, Babylon, Persia, and the Aztec-Maya civilizations, among many others, worshiped the sun-god which was called by different names as Ra in Egypt, Marduk in Persia, among others. Monuments of the Pyramids, the Stonehenge in SW England, and massive sun dials on the landscape in South America, of the archaeological remains of the Aztec-Maya civilizations, attest to sun-worship in ancient times.

The world then was heliocentric. Whilst scientists on the one hand believe in the big bang hypothesis as well as Darwinian evolutionary theory, the existence of dark matter, the black hole, quarks, among other unexplained scientific phenomena, religious people on the other hand, Christians and Judaists, believe in the creational accounts in the holy tomes, contrasting the ideas of scientists.

There lies a dichotomy between fact, value, faith, and fiction. However, the fact remains that everything originally existed in gaseous form until some coalescing gases solidified to form planets, asteroids, and the gaseous comets and stars of the universe. In religious speak, God created the world in six days and rested on the Sabbath day or the seventh day. This is found in the first chapter of the Book of Genesis in the bible.

In basic science, matter exists in four forms of plasma, gas, liquid, and solid, and it is said that nothing can be destroyed nor created, because everything transforms from one state of matter to another. Therefore, there must be a constant in an equation somewhere which always achieves a balance or equilibrium.

Newton established years ago that the force of attraction between two bodies is equal to a gravitational constant, multiplied by the masses of the bodies, divided by the square of the distance between them: $F = G M_1 M_2 / d^2$. Here, the variables are distance and force, since the masses are constants. Einstein gave us his relativity theory as $E = mc^2$ where 'c' is the velocity of light (in a vacuum, which is estimated at 300,000 kilometres per second), and 'm' is mass.

Thus, there is a direct proportionality between mass and energy, since velocity of light is constant. Thus, the bigger the mass, the greater the energy generated, and also the greater the displacement in the space/time continuum. However, it depends on the chemical composition of that mass, whether it is radioactive or not. In quantum physics, we negate Schumpeter's assertion that, 'to be small is beautiful'. The two theories of Newton and Einstein seem to have some things in common.

While Newton's theory establishes an inverse relationship between Force (F) and distance (d), Einstein's theory establishes a direct relationship between Energy (E) and mass (m). I think they are two sides of the same coin. Einstein's theory places more emphasis on time and motion in the time-space-motion continuum and trilogy, which gives us the basis for atomic or nuclear fission and fusion in a reactor where a mass of radioactive material is bombarded and accelerated in nuclear reaction to release vast amounts of energy. We can apply this knowledge to the atomic clock, cancerous growth, atomic energy, agriculture, telecommunications, and many other scientific and technological applications, not least energy production and electricity.

While Newton's theory was focused on static inter-space relationships, Einstein's theory was dynamic, and it explored the workings in those Newtonian spaces with regard to motion and time. Thus, Newton was like a designer of a car model which had no life, and Einstein was like the engineer and technologist who put life into that car model, and made it real, and made it move.

One wonders whether these two theories can be deployed to produce energy. I am not a scientist, so do not ask me how, but I believe we can tap energy from gravitational pull of the heavenly orbiting bodies or from the light they emanate, or from their radioactivity. Nuclear physics has already shown us how atomic fission and fusion works to produce enormous amounts of power. The world owes a great debt of gratitude to Einstein, whose work came out in 1905 to revolutionize physics, relating time, space, and motion of masses or bodies to a continuum, but basically, related to the trilogy of time, distance, and speed relationship, which we learnt in basic mathematics, mechanics, and science. Over to you, you scientists out there.

Solar energy is said to be blue, clean, reliable and renewable. In Ghana, the Fantes call the sun, 'Omaa ndam', which translates literally as, 'giver of sharpness' or 'the thing which gives sharpness to life', or 'quickener of actions'. Readers will notice the

Fante word 'ndam' to be closer to the English word 'dynamo' or 'dynamic'. We have similar words such as 'fun' (pronounced foon) for dead body, akin to the English word, 'funeral', with the same sound as the pronunciation of the first three letters of the word, 'funeral'.

The other word in Fante for dead body is 'mum', (pronounced moom), which also means the dumb. It is closer to mummy (Egyptian mummies). My tribesman, Ayi Kwei Armah, has written extensively on these aspects of the similarity of some Akan words with some ancient Egyptian words, testifying to our origins. Light in Akan is 'kan' or 'han', darkness is sum (soom). Ghanaians want 'kan' or 'han' from their energy company, ECG (Electricity Company of Ghana), and not 'sum' or Dumsor.

An analogy in grade school geography book, *Foundations of Geography* by Preece and Wood (I used that book from 1966 to 1970 to do my O Level Geography, as well as other ones by Jarret, Jasper Stembridge, *Peoples and Regions of the World*, R. B. Bunnnett's *Geography in Diagrams*, Monkhouse's *Physical Geography/Geomorphology*, Strahler, etc) states that the sun could be the size of a football, while the earth relatively would look like a small grain of groundnut. The sun is approximately 93 million miles away (depending on perihelion and aphelion), yet its glare and power on the earth is awesome.

In contrast, the moon is just about 239,000 miles from the earth (depending on apogee and perigee), yet it has no burning power. This is because the moon is a solid spheroid, while the sun is a ball of burning hydrogen, helium, oxygen, plasma, nitrogen, iron, magnesium, among other gases. It is a star. It is conjectured that when the moon was formed, it was only 14,000 miles away (ref: content.time.com/time/specials/pack...). What a wonder of creation by the Creator! A theory which exists states that the universe is forever expanding, and our Milky Way system is moving towards the star Vega (Geography Lecture notes at Legon, 1976).

The tides in the oceans are said to be caused by the combined gravitational pull of the sun and the moon. Tidal energy is also renewable, clean, and sustainable. So also are solar, and wind energies. The sun's heat causes water bodies to evaporate and form clouds which come as rain in the hydrological cycle. Thus, insolation or the amount of the sun's energy which hits the earth's surface and atmosphere is paramount for sustenance of all life forms. However, a greater amount of the sun's energy or insolation is lost to space, and also part of it is reflected back to space by the high albedo of the clouds (1976 Geography Lecture notes at Legon).

Hydro-Electric Power (HEP) which is generated from dams on rivers has become unreliable due to global warming and incidence of drought in some parts of the world, causing river and lake levels to be below the required levels needed to turn all

the turbines. In this article, alternate and clean sources of energy will be discussed in relationship to the difficulties Ghanaians are going through, as regards load-shedding, blackouts, and the 'Dumsor' (Off-on) syndrome, apparently caused by demand exceeding installed capacity or supply of electricity in Ghana.

Dirty energy has long since been associated with the hydrocarbons or fossil fuels such as coal, petrol, and diesel. These are the heaviest pollutants of the atmosphere. At least LNG, which occurs above coal and oil deposits in the geosynclines, is also relatively a neater source of energy, except that it has to be drilled at high cost, unlike tapping the universally available solar, wind, and tidal energy sources. Of course, one would also argue that the technology which is involved in tapping solar, wind, and tidal energies could be prohibitive in cost in the short run and not readily accessible by poor developing countries, but then, in the long run, they may be cost-effective, and environmentally friendly.

The most dangerous sources of power are nuclear energy, and chemical energy (recall Fukushima Nuclear Disaster in N.E. Japan 2011, Chernobyl Disaster in Ukraine 1986, Union Carbide's Bhopal chemical leak in India in 1984, Gulf of Mexico Oil Spill involving BP, and Alaska Oil Spill involving Exxon-Mobil Valdez 1989, among others). Besides, these fossil fuel, nuclear, and chemical energy sources are non-renewable, non-sustainable, and non-ecologically friendly because they are obtained from mining, chemical, and mechanical reactions and actions.

It is up to us in Ghana to look up to diversifying our energy sources and moving with modern trends in the industry. HEP and the traditional fossil fuel sources are becoming obsolete and less trendy. Besides, they are very expensive. Look at the high volatility in oil prices juxtaposed against the high cost of extraction in geosynclines at offshore sites such as the Gulf of Mexico and the North Sea, while on the one hand, the sandy shales onshore are relatively cheaper to work on in places such as Texas, California, Saudi Arabia, Iran, Iraq, Libya, and Canada.

Solar Energy

The new energy sources which Ghana should look to developing on a serious note to overcome the power deficit are solar, wind, tidal, and geothermal. In this article, emphasis will be on the first three sources. It is however reassuring to learn that a UK company is developing a 2.1 billion dollars photo-voltaic plant at Atuabo in the Western Region. The UK, a temperate country with less amount of insolation than Ghana, is one of the leading generators of solar energy in the world. Solar energy is also known as blue energy.

It involves tapping of electricity using solar panels or photo-voltaic cells mounted on roof-tops to concentrate and capture the light energy of the sun, which is then

converted into mechanical/kinetic energy, and then to electric energy for storage as well as instant usage. We should be seeing solar-powered cars soon. Another method is by thermal stations where solar energy is used to produce steam to turn turbines to generate electricity. In the UK, the government has subsidized households to install solar panels on their houses to generate their own domestic energy, and the surplus is fed into the national grid. The prospect for solar energy use in Ghana is very bright indeed, Ghana being a tropical country with 365 days of sunlight, unlike countries in the temperate and frigid zones which have fewer days of insolation.

However, the ordinary Ghanaian finds solar panels to be expensive. Some years back, university students at KNUST and Legon in Ghana invented solar-powered cooking stoves. I wonder why these have not been commercialized to hit the Ghanaian market. It will obviate the need to use charcoal whose use causes many trees to be cut and burnt. Majority of Ghanaians in rural areas cook by using firewood or charcoal in braziers or coal-pots. This is very wasteful of our trees and the vegetative cover, which has led to massive erosion, land degradation, formation of carapaces, lateritic soils, and badlands.

Solar energy in the UK is tapped in summer and stored for usage in winter. The UK produces a lot of solar energy as their technology has advanced a lot. If we convert to using solar energy in Ghana, we shall save a lot of money and reduce considerably on environmental damage. The Ghana Environmental Protection Authority should be in the forefront in championing the use of alternate sources of energy in Ghana. They should lobby parliament to pass a law to ask companies and institutions to draw up 10-year plans on how they plan to use alternate or renewable energies such as solar, wind, tidal, and other cheaper, safer, cleaner, sustainable, and eco-friendly sources of energy. Solar energy can be tapped anywhere in the world without locational restrictions, so it is versatile or flexible, as it can be tapped both terrestrially onshore, and offshore.

Leading solar energy producing countries are Germany, China, USA, Japan, Russia, France, Ukraine, Spain, South Korea, South Africa, Morocco, and Algeria.

Wind Energy

Another source of clean renewable and alternate energy is wind energy. Wind parks or wind farms in the world are mainly located **offshore** as there are no obstructions to the wind on the sea. Wind vanes or mills are built and as the wind blows, the blades are propelled and they create mechanical/kinetic energy which is transformed or converted into electrical energy by turbines. The countries in the world which harvest vast amounts of wind-based electricity are Germany, Denmark, China, Netherlands, Belgium, Spain, and South Korea, among many others. Ghana has vast potential in tapping wind-based energy by building wind parks and farms along the stretch of 539

kilometres coastline from Half Assini in the west to Aflao in the east. Wind power is green or environmentally-friendly.

Tidal Energy

Apart from wind power, we also have tidal power derived from the ebb and flooding of the tides in the ocean. Keta and Sekondi areas of Ghana's coastline are areas of intense marine erosion, necessitating the building of marine **barriers**, because of strong sea currents. This threat can be turned into opportunity by siting tidal power stations in those areas. The oceans are vast, and unlike rivers, are not affected by droughts. Besides, ocean resources are global commons and can be universally accessed. Currently, the power blues in Ghana are partially attributed to low levels of water in the Volta Lake and River.

VRA and ECG have to conduct global surveys and plan earnestly how we can shift away from HEP-dependent power to alternate and renewable sources such as solar, wind, tidal, and geothermal power. The leading producers of tidal power in the world are France, South Korea, UK, Russia, Israel, and Philippines, among others. Russia has proposed tidal power plants at Mezenskaya, Tugurskaya and Penzhinskaya. The proposed Mezenskaya plant will generate a colossal output of 87,000 MW of power, which perhaps can supply the whole of Africa.

Our scientists and technologists such as **Dr Christian Kow Gharban in the UK** and others at the Ministry of Power, and Ministry of Energy, should be contacted to come up with plans on how to wean us off the over-dependence on fossil fuel-based power sources, which cost us a lot in foreign exchange when we import. In the interim, we could switch over to LNG (**Liquefied** Natural Gas) from our own oil fields, but in the long run, we need to switch to the renewable energy sources of solar, wind, and tidal power.

Geothermal Energy

The last form of renewable energy is geothermal energy which is found in areas of intense volcanic activity such as the Pacific Rim of Fire in places such as Japan, Hawaii, New Zealand, Indonesia, California, among others. The fissures and fault lines in the earth's crust in those places cause molten magma from the interior of the earth to escape towards the surface of the earth, and when trapped, it warms underground water bodies which gush out as geysers or hot springs and spas. These can be tapped to produce enormous amounts of electricity.

Benefits of Renewable Energy

In conclusion, we need to diversify and complement our current energy sources in Ghana so as to meet the annual demand deficit of 10% or 250 MW. We need to be proactive and embrace these renewable energies as quickly as possible as they will lead to decentralization of power supply, create more jobs, lead to lower costs, cleaner environments, and reduce our carbon footprint, thus helping to save our planet. They will create wealth for private providers. The owners of these power sources will not have to deal with ECG or VRA directly as they will be in control of their power sources. Thus, there will be no bureaucracy and Dumsor. The scarce resources of government will be freed for more urgent needs.

Sources:

1. [education.nationalgeographic.com/ed-tidal energy](http://education.nationalgeographic.com/ed-tidal-energy)
2. www.alternative-energy-news.info/tech

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