

RENEWABLE ENERGIES - AN ANSWER TO THE WORLD'S ENERGY CRISIS

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Abstract

Energy is the ability to do work and the power to change things. It is natural and derivable. Naturally, the common form of energy sources of the world is the Fossil Fuels (Petroleum or Crude oil, Coal and Natural Gas). Others are sunlight, wind, biomass etc, which are renewable because other forms of energies are obtained from them. The world energy crisis stems from her over-dependent on the Fossil Fuels particularly on crude oil. This has brought in social, economic, political, health and environmental dominant of one community, state, nation and region over the others. The ever increasing demand for crude oil as source of energy has caused a lot of tension across the globe. The focus of this work, therefore, is to highlight the various alternative sources of energy that could equitably compete with petroleum. Knowing that the rate of crude oil consumption is by far higher than production rate, it is most likely that crude oil will one day get extinct, resulting in more crises. As a way forward, there should be more technological research into the use of alternative/renewable energies to bring about security, economic and political stability as well as national development.

Keywords: Energy, fossil fuel, Crises, renewable

Introduction

Basically, energy is defined as the ability to do work (Hornby, 2005). It can further be seen as the power to change things as well as provide the driving force of life. Energy is derivable and can be obtained from too numerous sources. From creation, the world has been blessed with various sources of energy and these include sunlight, wind, rain, tides etc. These energy sources are today being regarded as renewable energies. They are renewable because other forms of energy can be generated from them. In 2006, about 18% of global final energy consumption came from renewable, with about 13% coming from traditional biomass such as wood-burning (Global Status Report, 2007).

The commonest form of energy sources, however, are Fossil Fuels which are formed over a period of hundreds of millions of years and thus, cannot be replenished within a reasonable time frame. Fossil Fuels include the highly concentrated energy sources of coal, petroleum (crude oil) and *Natural Gas*. *By today, these fossil fuels provide three quarters of world energy, though finite and limited in supply(s).*

Prospects and Problems of Energy Sources and Utilisation

The presence and utilisation of crude oil as a source of energy has been more of a curse to the world at large or a particular country that has it than blessings. There have been a wide spread conflicts ranging from mere arguments to the highest point of war among communities,' states and nations that are supposedly blessed with oil. Nigeria as a nation is not left out of this quagmire as there are known cases of fighting, killing, wide spread kidnapping, hostage taking and sabotage in the Niger Delta region of the country. Besides, the recent Nigeria-Cameroun [Bakassi Peninsula] crisis cannot be divorced from oil deposit in the region.

Generally, the world energy crisis can be based on political, social, economic, health and environmental factors. Notably, is the 1973 energy crisis. This was reported to have started on October 17th 1973 when the members of Organisation of Arab Petroleum Exporting Countries (OAPEC, consisting of the Arab members of OPEC including Egypt and Syria) announced as a result of the then Yom Kippur War, that they would no longer ship oil to nations that had supported Israel in its conflict with Syria, Egypt and Iran (Smith 1973). Particularly, this oil embargo was targeted at the U.S, Western Europe, and Japan for their support of Israel.

The United Kingdom had equally witnessed several fuel protests due to the high cost of petrol and diesel for road vehicle use. The first protest was in 2000 which was led by lorry drivers and farmers. Blockades of oil facilities caused widespread disruption to supply of petroleum products with knock on effects for the public and the authorities as well as causing a reduction in popularity for the reigning government. Subsequent protest and rampage were in 2005 and lately 2007. This has brought about panic

buying, blockade of major roads, fuel stations, refinery entrances, and trading on war parts between government oppositions and the government of the day. The primary aim of the protest was to secure a reduction in the fuel duty rate on petrol and diesel (<http://en.wikipedia.org/wiki/1973>). The government on its part, had argued that the rise in prices was due to increases in the world oil market prices and not the government's fuel duty (BBC News, 2000). In 2005, the high cost of petroleum products was partially blamed on decreased in world oil supply after the Hurricane Katrina caused damage to some oil facilities in the United States of America (BBC News, 2000).

The demand for energy has continued to surge, nonetheless. This unrelenting increase has helped fuel global economic growth but placed high pressure on suppliers, buffeted by geopolitics, violent weather conditions and other potentially destructive factors. The oil and gas resources of the Middle East and North Africa (MENA) will be critical to meeting the world's growing appetite for energy. A large share of the world's remaining energy reserves lies in that region.

Table 1:

FUEL	RESERVES
COAL	200 Years
CRUDE OIL	40 Years
NATURAL GAS	62 Years

World energy sources: Fuel and reserves

Table 2:

REGION	RESERVES (CRUDE OIL)
WESTERN EUROPE	<10 Years
NORTH AMERICA	25 Years
MIDDLE EAST	100 Years
NIGERIA	40 Years

World energy sources: regions and crude oil reserves

Sources: British Petroleum Statistics.

Nigeria's Energy Sources, Reserves and Position

1. The energy Resources in Nigeria :- Crude oil, Natural Gas, Coal, Tar sand and Renewable
2. Nigeria has 35.9 billion barrels of proven oil reserves in January 2006 with daily production capacity of 2.4 million barrels of crude Oil.
3. Natural Gas is estimated at 1 85 trillion cubic feet of proven reserve as at January 2006.
4. A significant portion of Nigeria Natural Gas is processed into Liquefied Natural Gas (LNG) for Export.
5. About 43% of Nigerian Total Annual Natural Gas production is being flared.
6. Coal and Lignite Reserves are estimated at 2.75 billion tons.

With respect to demand, increased energy security and environmental influence have caused changes in consuming nation's energy policies. These uncertainties have been reflected in the market through volatility and high prices. Energy needs are expanding rapidly as developing nations continue to demand a larger quantity of resources. The supply of crude oil and economic feasibility of recovering it are rapidly becoming a great concern.

Some petroleum cannot be extracted because it exists in shale beds or in the form of sludge (Wainwright, 2008). Beside the high cost of refining the sludge, it equally creates a harmful by products that remain toxic for decades (Carnell, 1998). In the same vein, most petroleum currently being extracted exists in pockets that were discovered before 1975..Only 50% of the oil underground can be recovered (George 1998, Campell and Laherrcre 1998. Steam and carbon (iv) oxide-have been inserted into reservoirs to facilitate the flowing of oil thus, significantly increasing the recovery rate (Anderson, 1.998). Though technologies have been developed to facilitate the extraction of crude oil even from deep oceans, the production of adequate petroleum supplies is likely to be prolonged, and the amount of additional oil that is recoverable with it is comparatively minimal. Drilling deeper and extracting oil from deep ocean locations is on its own dangerous (Anderson). One therefore wonders and asks; is the world running out of oil (energy)? (Faith, 2005)

Non-Renewable Alternative Energy Sources and Associated Problems

Alternative energy sources can be classified into four basic areas: heavily used environmentally unfriendly sources, heavily used environmentally friendlier alternatives, environmentally friendly sources that cannot produce an adequate amount of energy, and possible alternative sources currently being developed for future use.

Coal: - Coal is one of the most extensively used environmentally unfriendly alternative energy sources. Coal is abundant and efficient in terms of producing electrical energy. Coal currently provides 24% of the world's primary energy requirements and supplies the United States with about 25% of its electrical energy (Schriesheim, 1997). Coal is the most abundant of the carbon-based fossil fuels-enough to meet demand for 200 to 300 years but it is also a leading threat to human health and environment (Dohn, 2006). Carbon emissions caused by burning of coal are hazardous. Coal produces much more waste than any other energy source.

Coal can only be used to generate electricity. It cannot replace petroleum as the primary energy source of the transportation sector unless electricity is used more frequently as a means to power transportation vehicles (Schriesheim).

Natural Gas: The natural gas (methane) is being touted by energy providers as an abundant clean fuel for the 21st century. It is forecasted to be the fastest growing primary energy source because it burns cleaner than coal or oil. More than 70% of the world's proven natural gas reserves are located in the politically risky Persian Gulf and former Soviet Union. After 2020, the bulk of the world's remaining supplies of both oil and natural gas will be centred there. According to the Energy Information Administration, natural gas provides 27% of the energy used today. Similar to their consumption of oil, Americans consumed more than their share of natural gas. In 1997, the U.S. used 28% of the world's total production. Consumption of natural gas in the U.S. and Canada is expected to grow 50% by 2020 enforced in part by the Clean Air Act Amendments of 1990 which are designed to curb acid rain, toxic emissions, and urban air pollution. Compared to the combustion of oil and coal, natural gas combustion is relatively mild as a contributor to air pollution. The burning of natural gas produces less sulphur, nitrogen, and heavy metals than other fossil fuels (Fouda, 1998). However, the harnessing and use of natural gas presents problems. The energy density of natural gas is relatively low making it four times as expensive as oil to transport through pipelines (Fouda). Natural gas can be converted into liquid for inexpensive transport but the conversion process involves complex technology that is expensive. Natural gas cannot currently be harnessed, converted, and transported cheaply enough to be considered a future alternative to petroleum. American troops have already shed blood in the Middle East protecting our oil interests; relying on natural gas for a primary energy source has similar cost and risks (Carnell).

Nuclear Energy Fission: - Nuclear fission has been regarded for the past few decades as the energy source of the future. 70% of all electricity generated in France is derived from nuclear fission reactors. It has been quite inexpensive and often exported to other European countries (Schriesheim). Air pollution in France has decreased significantly. -From 1970 to 1990 carbon (IV) oxide emissions from industrial activity rose by 30% around the world. UNESCO believes that "if all individual countries had the same energy-efficiency rate and the same proportion of nuclear power in their energy production mix as France, global CO₂ emissions would be less than 40% of what they are today" (Schriesheim). Enough proven Uranium reserves have been discovered to provide the world with adequate energy for at least 50 years, but nuclear fission is not extensively used in developed industrialised nations. The wastes produced by nuclear reactors are potentially hazardous, and a nuclear meltdown could lead to inexplicable disaster. The United States has refrained from building new nuclear fission facilities because of these hazards. Today, there is little or no support among Americans and Europeans for any nation establishing nuclear energy reactors. Nobody wants a nuclear reactor in their backyard, and frightening publicity regarding reactor meltdowns at Chernobyl and Three Mile Island has only reinforced these fears. Health officials estimate that at least 4,365 people who took part in the Chernobyl cleanup have died in Ukraine. The hazardous effects arising from the obnoxious/illegal dumping of radioactive waste in Koko in Warri South LGA, Delta State of Nigeria, in 1988 is still very fresh in the mind of the populace.

Renewable Energy Sources and Associated Problems

Going by the increasing demand, price and supply problems of petroleum, renewable/alternative energy sources must be developed that can adequately provide the world with large quantities of energy. Alternative energy will play a major role in the energy industry of the 21st century and beyond (Carneli, 1998). Alternative energy sources have been effectively utilised for decades. Energy has been harnessed from coal, nuclear fission, natural gas, ethanol, solar panels, windmills, geothermal sources and biomass, but these renewable energy sources each possesses, some specific negative characteristics. The sources have not been implemented on a large scale basis because of certain limitations but there is some hope for the future. Scientists and Engineers are continually improving the efficiency of renewable energy systems (Carnell, 1998).

Coal, natural gas, and uranium are alternative non-renewable energy resources to cheap oil, but each has advantages and limitations and none is as versatile as petroleum. The replacement of oil will require a mix of energy sources, including clean renewable energy such as solar, wind power, biomass, geothermal etc. This adjustment will involve substantial reorganisation of the world's economic structure and significant lifestyle changes in the industrialized nations.

Solar Power: This is the energy that is derived from sunlight. This energy can be collected and converted in different ways, such as simple water heating for domestic use or by the direct conversion of sunlight to electrical energy using mirrors, boilers or photovoltaic cells Panels (Carnell, 1998). Those concerned with energy were ecstatic when solar panels were developed that could harness solar rays for electrical use, but this solar panels lack efficiency because only about 3% of solar energy reaching the earth actually penetrates the surface. The use of solar panels even on a large-scale basis can only provide the world with a fraction of the energy required by a developing and industrializing world.

Wind Power: This is the energy derived from the wind turbines that are driven by natural draught. Humans have been harnessing the wind for thousands of years and are now cleanly producing electricity with it employing windmills. This conversion of wind energy to electrical energy can only occur in regions where climatic conditions are favourable. It requires reliable wind speed in the range, 4-25m/s and adequate power storage techniques. Airflows can be used to run wind turbines of which modern turbines can generate as much as 600kW to 5MW of rated power (EWEA, 2008). Total worldwide capacity was over 45,000MW at the end of 2004. Though, wind power does not produce greenhouse gases during operations, its major drawback is that a wind farm requires extensive area coverage to produce significant amount of energy, and bird fatalities have been a concern (Carnell, 1998).

Hydroelectric Power: Energy in water can be harnessed and used. Since water is about 800 times denser than air, even a slow, flowing streams of water, can yield considerable amounts of energy (Richard). Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams. Examples are the Grand Coulee Dam in Washington Slate, Akosombo Dam in Ghana, Kainji River Dam in Nigeria etc. Currently, 17.5% of the world's Electricity is gotten from Hydro Power (99% Norway, 57% Canada, 55% Switzerland, 40% Sweden, and 07% USA). Hydroelectric dams however, are no longer ^considered environmentally benign sources of power. Fisheries and other wildlife habitat have been severely impacted on many dammed rivers (Richard).

Biomass Fuel: This is another alternative that is environmentally friendly. Its forms include wood fuel, the biogenic portion of municipal solid waste, or the unused portion of field crops. Biomass can be converted directly into Liquid Fuels for use in internal combustion engines. The two most common liquid biomass, are Bioethanol and Biodiesel. Humans have been burning biomass materials since the dawn of time and it is still the principal fuel used in many parts of the world, but only a limited amount of plant matter can be burned. Researchers have recently discovered how to produce clean combustible gas from waste products such as sewage and crop residue. Yet biomass gas will not soon replace petroleum as the fuel of choice (Carnell, 1998). There is equally a growing international criticism about bio fuels from food crops with respect to issues such as food security, environmental impacts (deforestation) and energy balance.

(a) **Bioethanol Fuel:** - Bio ethanol is emerging as an important motor fuel in view of the Kyoto

Protocol Agreement. It is easily obtained from Biomass (e.g. Sugarcane, Cassava, Sorghum, Corn, Sugar beets, Sweet grasses etc.), and very easy to use in combustion engines, requiring no modification if the ethanol content is limited to a maximum of 10%. Through this, Brazil, which years ago had to import a large share of the petroleum needed for domestic consumption, recently reached complete self-sufficiency in oil. Ethanol is a gasoline extender and an octane enhancer-with a blending octane rating of 113. Ethanol contains 3,5% Oxygen, implying the reduction of emissions of Carbon (IV) oxide and Carbon (ii) oxide from the combustion of fuel blends.

(b) Biodiesel Fuel: This is another liquid bio fuel which can be used in modern vehicles with little or no modification to the engine. Biodiesel is a clean burning alternative fuel produced from domestic, renewable sources such as waste and virgin vegetable and animal oil and fats (lipids). It contains no petroleum, though it can be blended at any level with petroleum diesel to create a biodiesel blend. A major benefit of biodiesel is lower emissions. It is biodegradable, non-toxic, free from sulphur, aromatics, and reduces emission of carbon monoxide and other hydrocarbons by 20 to 40%. Biodiesel has a high octane number (100 compared to 40)-easy cold starting and low idle noise. It serves as lubricant and therefore, can extend the life of an engine. It however causes increase in nitrogen oxide- a precursor of ozone.

Geothermal Energy: This is the energy obtained by tapping the heat of the earth itself, usually from kilometres deep into the Earth's crust. The geothermal energy from the core of the earth is closer to the surface in some areas than in others. Where hot underground steam or water can be tapped and brought to the surface, it may be used to generate electricity. Such geothermal energy sources exist in certain geologically unstable parts of the world such as Chile, Iceland, New Zealand, United States, the Philippines and Italy. Soil maintains a relatively constant temperature throughout the year and can be used with heat pumps to warm a building in winter or cool a dwelling in summer. Iceland produced 170 MW geothermal powers and heated 86% of all houses in the year 2000 through geothermal energy. There is also the potential to generate this form of energy from hot dry rocks. This form of energy can lessen the need for other powers to maintain comfortable temperatures in buildings. The Geysers geothermal power plant located 72 miles (116km) north of San Francisco, California is the largest geothermal development in the world outputting over 750 MW (Calpine, 2007).

Hydrogen: Hydrogen has been touted as the fuel of the future. It is the most abundant element in the Earth crust and can be burned cleanly as a fuel for vehicles with water as the main combustion byproduct. It can also be fed into a fuel cell, a battery-like device that generates heat and electricity. The use of hydrogen will reduce environmental health hazards and medical costs associated with burning of fossil fuels. However, the large-scale extraction of hydrogen from terrestrial resources such as water, coal or natural gas requires a lot of energy which is currently produced by burning fossil fuels. Commercial hydrogen production is expensive and only shifts the pollution from vehicles back to the power plants. Producing hydrogen with solar power is the dream of environmentalists and renewable energy proponents. If this is done successfully, hydrogen and electricity will eventually become society's primary energy carriers in the 21st century (Camell, 1998).

Tides/Waves: Tides, waves, and the heat differential within the world's tropical oceans are potent sources of clean energy. Various countries around the world are investing time and money into the technologies that may tap these renewable power producers but overcoming the obstacles inherent in these systems will be difficult.

Conclusion

Cheap and abundant oil is an intoxicating elixir that the world's industrial nations have guzzled down as if there is no tomorrow. The ever increasing world population certainly, will continually to aggravate the world energy crisis due to demand, supply, high cost, insecurity and other social-political factors on energy resources. No alternative/renewable energy sources currently in use can adequately replace the energy produced by the burning of fossil fuels. The bulk of the world's reserves of cheap oil are concentrated in the politically volatile Gulf. Getting that oil will likely cost billions of dollars and possibly, the lives of more American soldiers. The energy tension in the Niger Delta region of Nigeria can only relatively be controlled if the Government decides to explore various renewable technologies.

This can equally help in economic diversifications.

The media and industry claim that renewable energies are not yet economically competitive with fossil fuels. Perhaps not, but when one considers the health and environmental costs associated with burning coal and oil, the price of renewable energy becomes more attractive. No renewable energy system will single-handedly replace oil but together, they will become a very important part of the energy mix of the future.

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