ASSIGNMENT ONE

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CHE 574

# ALTERNATIVE ENERGY SOURCES

SUBMITTED TO

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# 1 QUESTION ONE

## With adequate Mathematical relations, explain the various forms of Energy.

Energy exists in many different forms. Examples of these are: light energy, heat energy, mechanical energy, gravitational energy, electrical energy, sound energy, chemical energy, nuclear or atomic energy and so on. Each form can be converted or changed into the other forms.

Although there are many specific types of energy, the two major forms are Kinetic Energy and Potential Energy.

- Kinetic energy is the energy in moving objects or mass or otherwise energy possessed by a body by virtue of its motion as learnt from high school Physics. Examples include mechanical energy, electrical energy etc.
- Potential energy is any form of energy that has stored potential that can be put to future use. Examples include nuclear energy, chemical energy, etc.

## The specific forms of energy are as under listed;

### Chemical Energy

Chemical energy is energy stored in the bonds of chemical compounds (atoms and molecules). Chemical energy is released in a chemical reaction, often in the form of heat. For example, we use the chemical energy in fuels like wood, coal by burning them.

### Electrical Energy

Electrical energy is the energy carried by moving electrons in an electric conductor. It is one of the most common and useful forms of energy. Example – Lightening. Other forms of energy are also converted to electrical energy. For example, power plants convert chemical energy stored in fuels like coal into electricity through various changes in its form.

### Mechanical Energy

Mechanical energy is the energy a substance or system has because of its motion. For example, machines use mechanical energy to do work.

### Thermal energy

Thermal energy is the energy a substance or system has related to its temperature, i.e., the energy of moving or vibrating molecules. For example, we use the solar radiation to cook food.

### Nuclear energy

Nuclear energy is the energy that is trapped inside each atom. Nuclear energy can be produced either by the fusion (combining atoms) or fission (splitting of atoms) process. The fission process is the widely used method.

Uranium is the key raw material. Uranium is mined from many places around the world. It is processed (to get enriched uranium, i.e. the radioactive isotope) into tiny pellets. These pellets are loaded into long rods that are put into the power plant's reactor. Inside the reactor of an atomic power plant, uranium atoms are split apart in controlled chain reaction. Other fissile material includes plutonium and thorium. (Vikaspedia, 2017)

$$ {}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{236}_{92}U \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}U + 3{}^{1}_{0}n \qquad \textbf{(1-1)} $$

In a chain reaction, particles released by the splitting of the atom strike other uranium atoms and split them. The particles released by this further split other atoms in a chain process. In nuclear power plants, control rods are used to keep the splitting regulated, so that it does not occur too fast. These are called moderators.

The chain reaction gives off heat energy. This heat energy is used to boil heavy water in the core of the reactor. So, instead of burning a fuel, nuclear power plants use the energy released by the chain reaction to change the energy of atoms into heat energy. The heavy water from around the nuclear core is sent to another section of the power plant. Here it heats another set of pipes filled with water to make steam. The steam in this second set of pipes rotates a turbine to generate electricity.

## 2 QUESTION TWO

**Distinguish between the sustainable energy and resources and non-sustainable energy and resources.**

Sustainable energy is a form of energy that meet our today's demand of energy without putting them in danger of getting expired or depleted and can be used over and over again. Sustainable energy should be widely encouraged as it do not cause any harm to the environment and is available widely free of cost.

It is the practice of using energy in a way that "meets the needs of the present without compromising the ability of future generations to meet their own needs. All renewable energy sources like solar, wind, geothermal, hydropower and ocean energy are sustainable as they are stable and available in plenty.

Sun will continue to provide sunlight till we all are here on earth, heat caused by sun will continue to produce winds, earth will continue to produce heat from inside and will not cool down anytime soon, movement of earth, sun and moon will not stop and this will keep on producing tides and the process of evaporation will cause water to evaporate that will fall down in the form of rain or ice which will go through rivers or streams and merge in the oceans and can be used to produce energy through hydropower. This clearly states that all these renewable energy sources are sustainable and will continue to provide energy to the coming generations. (Conserve Energy Future, 2019)

Examples of sustainable Energy and resources include Solar Energy, Wind Energy, Geothermal Energy, Ocean Energy, Biomass Enegy, Hydroeletric Power etc.

On the other hand, Fossil fuels are not considered as sustainable energy sources because they are limited, cause immense pollution by releasing harmful gases and are not available everywhere on earth. Fossil fuels normally include coal, oil and natural gas.

## 3 QUESTION THREE

With the aid of appropriate chart, briefly discuss the typical energy resource mix for sustainable energy development and provide your own view, the case for the Nigerian

Environment. Renewable energy sources supply 14% of the total world energy demand. They are biomass, hydropower, geothermal, wind and Marine energies. The renewables are the primary, domestic and clean or inexhaustible energy resources. The percentage share of biomass was 62.1% of total renewable energy sources in 1995. Large scale hydropower supplies 20 percent of global electricity. (Demirbas, 2006)

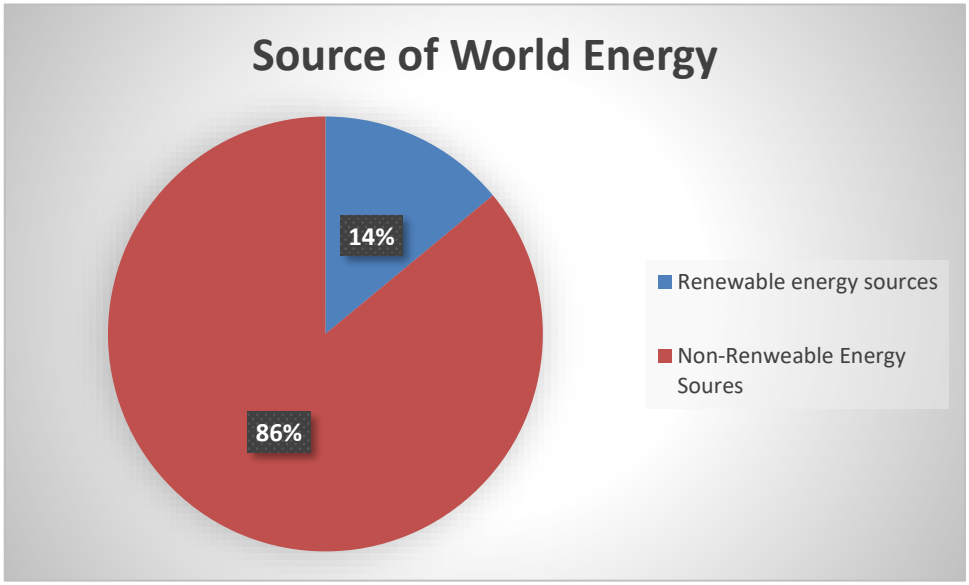


Figure 3-1: Source of World Energy

## 3.1 NIGERIAN CASE-STUDY

Nigeria is Africa's energy giant. It is the continent's most prolific oil-producing country, which, along with Libya, accounts for two-thirds of Africa's crude oil reserves. It ranks second to Algeria in natural gas. Most of Africa's bitumen and lignite reserves are found in Nigeria. In its mix of conventional energy reserves, Nigeria is simply unmatched by any other country on the African continent. It is not surprising therefore that energy export is the mainstay of the Nigerian economy. Also, primary energy resources dominate the nation's industrial raw material endowment.

Several energy resources are available in Nigeria in abundant proportions. The country possesses the world's sixth largest reserve of crude oil. Nigeria has an estimated oil reserve of 36.2 billion barrels. It is increasingly an important gas province with proven reserves of nearly 5,000 billion m3. The oil and gas reserves are mainly found and located along the

Niger Delta, Gulf of Guinea, and Bight of Bonny. Most of the exploration activities are focused in deep and ultra-deep offshore areas with planned activities in the Chad basin, in the northeast. Coal and lignite reserves are estimated to be 2.7 billion tons, while tar sand reserves represent 31 billion barrels of oil equivalent. The identified hydroelectricity sites have an estimated capacity of about 14,250 MW. Nigeria has significant biomass resources to meet both traditional and modern energy uses, including electricity generation.

There has been a supply and demand gap as a result of the inadequate development and inefficient management of the energy sector. The supply of electricity, the country's most used energy resource, has been erratic.

To balance the obvious difference, Nigeria has to bring to her forefront, the use of sustainable energy and resources.

Sustainable energy involves the provision of energy services in a sustainable manner, which in turn necessitates that energy services be provided for all people in ways that, now and in the future, are sufficient to provide the basic necessities, affordable, not detrimental to the environment, and acceptable to communities and people. Linkages between sustainable energy and factors such as efficiency and economic growth have been investigated.

No country in modern times has succeeded in substantially reducing poverty without adequately increasing the provision and use of energy to make material progress. Indeed, by not ensuring a minimum access to energy services for a broad segment of the population, economic development of developing countries such as Nigeria beyond the level of subsistence has proven to be a real challenge.

At the national level, energy propels economic development by serving as the launch pad for industrial growth and, via transport and communications, providing access to international markets and trade.

The connection between energy, the environment, and sustainable development is worth highlighting. Energy supply and use are related to climate change as well as such environmental concerns as air pollution, ozone depletion, forest destruction, and emissions of radioactive substances. These issues must be addressed if society is to develop while maintaining a healthy and clean environment. Ideally, a society seeking sustainable development should use only energy resources which have no environmental impact.

However, since all energy resources lead to some environmental impact, an improved efficiency and environmental stewardship can help overcome many of the concerns regarding the limitations imposed on sustainable development by environmental emissions and their negative impacts.

Energy is directly linked to the broader concept of sustainability and affects most of civilization. That is particularly evident since energy resources drive much if not most of the world's economic activity, in virtually all economic sectors. Also, energy resources, whether carbon-based or renewable, are obtained from the environment, and wastes from energy processes (production, transport, storage, utilization) are typically released to the environment. Given the intimate ties between energy and the key components of sustainable development, the attainment of energy sustainability is being increasingly recognized as a critical aspect of achieving sustainable development. (Chigasa, Chubueze, & Moses, 2012)

Use of renewable natural resources, combined with efficient supply and use of fossil fuels with cleaner technologies, can help reduce the environmental effects of energy use and help Nigeria replacing the existing, inefficient fossil fuel technologies that pollute the environment. As a complementary measure, careful management of energy resources is important to promote economic growth, protect ecosystems and provide sustainable natural resources.

Thus, energy sustainability is considered to involve the sustainable use of energy in the overall energy system. This system includes processes and technologies for the harvesting of energy sources, their conversion to useful energy forms, to provide energy services such as operating communications systems, lighting buildings, and cooking.

The reform of the energy sector is critical to sustainable development in Nigeria. This includes reviewing and reforming subsidies, establishing credible regulatory frameworks, developing policy environments through regulatory interventions, and creating market-based approaches. It is equally very strategic to the development of the Nigerian economy. In addition to its macroeconomic importance, it has major roles to play in reducing poverty, improving productivity, and enhancing the general quality of life. If Nigeria is to take the path of sustainable energy, it is important to accurately and technically model the energy demand and supply scenarios and their impacts on the economy, resources, and society

along with the environment, for both medium and long terms. From such analyses, we can derive information that is vital for policy construction and investment. (Sunday, 2012)

Nigeria is one of the highest emitters of greenhouse gases in Africa. The practice of flaring gas by the oil companies operating in Nigeria has been a major means through which greenhouse gases are released into the atmosphere. Carbon dioxide emissions in this area are among the highest in the world. Some 45.8 billion kW of heat are discharged into the atmosphere of the Niger Delta from flaring 1.8 billion ft3 of gas every day[58]. Gas flaring has raised temperatures and rendered large areas uninhabitable. Between 1970 and 1986, a total of about 125.5 million m3 of gas was produced in the Niger Delta region, about 102.3 (81.7 %) million m3 were flared, while only 2.6 million m3 were used as fuel by oil-producing companies and about 14.6 million m3 were sold to other consumers. (Wikipedia, 2019)

The use of renewable energy sources will reduce the over dependence on the burning of fossil fuel. Moreover, instead of flaring gas in Nigeria, the gases can be converted to methanol and used as a fuel for both domestic and industrial use. With good energy efficiency practices and products, the burning of fossil fuel for energy will be greatly minimized.

From the energy outlook of Nigeria, it is very clear that the energy demand is very high and is increasing geometrically while the supply remains inadequate, insecure, and irregular and is decreasing with time; the mix has hitherto been dominated by fossil resources which are fast being depleted apart from being environmentally non-friendly. The energy supply mix must thus be diversified through installing an appropriate infrastructure and creating full awareness to promote and develop the abundant renewable energy resources present in the country as well as to enhance the security of supply.

There is clear evidence that Nigeria is blessed with abundant resources of fossil fuels as well as renewable energy resources. The major challenge is an inefficient usage of energy in the country. As a result, there is an urgent need to encourage the evolvement of an energy mix that will emphasize the conservation of petroleum resources in such a manner enabling their continued exportation for foreign earnings for as many years as possible.

The opportunities for conserving energy in our various sectors - office building and residential areas, manufacturing industries, transportation, electricity generation and distribution, and electricity equipment and appliances - were presented in this work. The various areas where savings in energy can be made have also been identified. Several guidelines and measures have been suggested to conserve energy in these areas, and if the guidelines and measures are strictly adhered to, then substantive savings in energy will be carried out.

In order to ensure the sustainability of energy supply and subsequently the sustainable economic development of the country, the government has to intensify the further implementation of renewable energy and energy efficiency programs.

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