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AGRICULTURAL PRACTICES USINGAPPLICATION OF RENEWABLE ENERGY

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Abstract

Agricultural practises in developing countries are often done by hand using blunt tools, whereas fossil fuel consumption in developed countries has resulted in substantial global warming and environmental degradation. The aim of the study was to determine how much renewable energy is used in agricultural operations, as well as its limitations and possible solutions. Renewable energy source investigated include biomass, geothermal, wind, solar, hydropower, and fuelwood. Sustainable energy farming in agriculture to minimise the amount of carbon released into the atmosphere by transforming fossil fuel burning to renewable energy sources.Agriculturalists produces capital international input and combining them with energy-saving techniques. Green energy helps producers storecash while correspondingly fighting the impacts of worldwide warming. Wind, hydropower as well assolar power, besides biomass are examples of possible renewable energy sources for the rural agriculture market. They can be used to reduce the energy gap in countrysideas well ascity area while simultaneously slowing the rate of environmental deterioration.In order to generate, manage, monitor, and assess renewable energy, adequate is required to educate and transfer this knowledge to countryside area. The increasing request for food, along with the volatile chargeon fossil fuel, has spurred a search for environmentally friendly energy sources.Energy is a major expense in the production management. The utilization of a sustainable energy grid to track green-house environment lowers consumption offuel besides increases the sustainability of green-house construction.

Key words: Agriculture, Biomass, Clean Energy, Geothermal, Hydropower, Renewable Energy

Introduction

Energy services are critical for socioeconomic development and poverty eradication since they are needed in almost every sector of the economy. Among less developed, emerging, and developed countries, energy usage and applications for such activities as agricultural production differ greatly.Most of the world's agriculture was performed by hand with rudimentary tools in less developed and developing countries, and it still is [1]. Energy is both the fuel and the feedstock for agriculture, and energy that can change economies is a basic need for human development.It is available in a number of ways, each of which can be categorised as renewable or non-renewable (Fig. 1). In order to survive in a globalised economy, agriculture's new demands are for modernization and sustainability, and one of the problems that prices [2].Green-house farming is a booming manufacturing in numerousnations, but it is plagued by a lack of productivity, despite the fact that it delivers an alternatebesidessupplementaryways of meeting worldwide food request.

Heating and cooling cycles are the main energy demands in greenhouses for food production. Red-hotrelic fuels (palm oil, ethanol, coal, liquefied petroleum, wood fuel, besides liquefied natural gas), that release more carbon dioxide, by utilizing an electric heater, thatdevour far more key energy, are the most common ways of producing heat.Cooling systems for greenhouses are becoming more common, particularly in nations of Latin American where cooling method are conventional fail to deliver the ideal condition aimed atharvestprogressthroughout the summer [3]. As a result, developing better heating–cooling systems that also allow for lower energy demand and/or the use of renewable energy sources is important.Agricultural greenhouses face two major challenges: increasing energy production and lowering carbon dioxide emission. Wind as well assolar energy is a couple ofutmostfeasible green energy alternatives in the world owing to the abundance besides topological compensations, which is, aimed at local power generation in distant and inaccessiblezones, despite the fact that their elevation is hindered to some extent[4].

The difficultiesto overcome by assimilatinga couple or three renewable energy causes (supposed hybrid system) per adequate energy saving. The biggest benefit of a wind–solarsystem is that it increases system reliability. Furthermore, as opposed to a single power generation device, the storage battery bank's necessary capacity can be reduced.In green-house-dependentmanufacture, chilling as well asheating system is required, with the green-house heat accounting for 70% of the total production cost during the winter months. However, conventional energy consumption has decreased significantly.As a result, common choice among farmers since they allow them to extend the growing season at a low cost. To protect plants from the cold in colder climates is usually substitute solar [5].

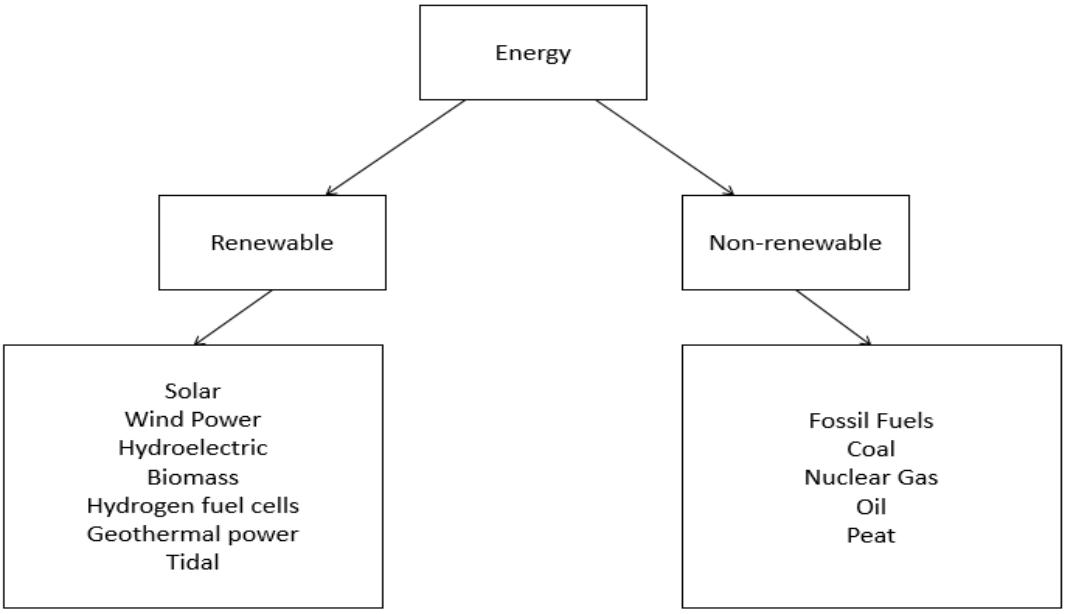

Fig. 1: Sources of Energy

In Nigeria, hand axes are worked with human power, drawn instruments are worked with animal power, post-harvest handling and processing machinery is powered with fossil fuel, and irrigation is done with pumps. Absence of exact approximations for the nation'sentire energy utilization, but when it comes to conventional (non-renewable) energy sources, only fuel wood is used widely in rural areas.Agriculture requires energy as a primary source of supply for the production and processing of food and fibre for human use, which is accomplished by turning various energy sources into food and fibre. The energy consumption of the agricultural sector can be classified into two categories: primary and indirect energy consumption.Agriculture uses energy both directly (in the form of gasoline or electricity) and indirectly (in the form of fertilisers and chemicals generated off the farm) to power machinery and machinery, heat or cool houses, and light up lights on the farm[6].

The amount of energy used in agricultural production varies a lot depending on the form of operation, the production methods used, the geographic location of the production area, and environmental factors including soil and climatic factors. Energy utilities such as electricity, oils, natural gas, and coke, as well as other sectors, have become increasingly important in agriculture.Low oil prices in relation to the resource it was replacing can be blamed in part for the rise in energy use and capital-intensive technologies that resulted. In order to hold agriculture afloat, automation and mechanisation of agricultural operations increase energy demand, necessitating productive and careful energy use.Furthermore, considering the lack of suitable agricultural land, the only way for farmers to increase total productivity will be to make better use of their capital [7].

Due to the agricultural sector's dependence on energy to feed an ever-increasing population amid limited natural resources, as well as the impact of energy use on the environment and human health, it is important to investigate the scale of energy use for various agricultural activities.If human population growth persists at its current rate of 1.5 trillion, fossil oil stocks would be incapable to sustain a reliable nourishmentstock, leaving

fossil energy sources scarce and unaffordable. As a result, the primary aim of this analysis was to look at the current state of sustainable energy use in agricultural production, as well as any future concerns that could emerge.

Literature Review

According to Chel*et al*Energy that is free of pollution Farming is the process of reducing the overall volume of pollution emitted into the environment as CO2 gas by the use of green energy technologies in agriculture. When combined with energy-saving practises, agriculturalists produce electricity and developsmoothsupplementaryautonomous by dippingexterior sources. Renewable energy saves farmers money, moreover, it also benefits the environment.Wind, solar power, and hydropower are examples of potential renewable source [8] examples of potential renewable energy sources for the rural agriculture sector.

Table 1: Renewable Energy Sources

Energy Source	**% Used**	**Description**	**End Product**
Biomass	53	Farm wastes and animal wastes are burned	Heat besides gas
Hydropower	35.9	Dams transport water from higher to lower elevations	Electricity
Wind	4.9	Wind turbines capture the wind	Electricity
Geothermal	4.9	The earth's mantle's hot water and a capped drain	Heat besides electricity
Solar	1	The sun's heat is absorbed and stored.	Heat besides electricity
Emerging Technologies			
Hydrogen fuel	Hydrogen gas is burned		Ability to pass
Nanotechnology	Utilizing the special properties of materials on a molecular or atomic scale		Electricity
Ancient Technologies			
Water	Water wheels, dams, weight		Powerbesides motion
Wind	Windmills, sails		Powerbesides motion
Kinetic Energy	Animals, human exertion		Powerbesides motion

With a small initial expenditure, electricity is produced according to Anne *et al*.In industrialised areas, six major forms of renewable energy have been used for this reason (Table 1).Renewable technology may be either cutting-edge advances in power generation or older systems that are still found in some areas of the world. Numerous renewable energy source does not supply available energy straight; external apparatus may be needed to convert one type of energy to another [9].

Sambo *et al.*[10] listed the potential renewable energy sources and capability for agricultural production and processing (Table 2). Global population growth, along with the industrialization of developing countries, has resulted in a significant study have focused on producing as well as a specific energy source. In addition, insufficient aquatic supplies besides improper water distribution, as well as the impact of climate change, have shown that greenhouse farming cost-effective may be constructed a favourable environment (lighting,relative humidity as well asair temperature) in order to accomplish high yields at a low cost.

Tong *et al.*found usage a greenhouse with heat pumps from January to March was 0.22 to 0.559MJ-meter^2, whereas heater was 0.42–0.76MJm^2. Similarly, the hourly carbon dioxide emission in the region of 9.49–24gm^2, while those with no heat pumps having 9.49–24gm^2.

Electricity is the cornerstone of sustainable growth in the developed world, used into agriculture besides manufacturing. As a result, to diminishcarbon dioxide emission besides heating cost, energy efficiency concerns have required.Ground-coupled heat pump systems (GCHPS) for example, have been suggested by many researchers. The system could be kept operating smoothly with the aid of heat pump. However, fruit, soil, as well as energy management is highly critical.Solar energy has risen in prominence in recent decades as a result of both technological advances and government policies that support the production and usage of renewable energy sources [11].

Table 2:Processing In Rural Areas Besides Sources Of Potential Energy For Agricultural Production [10]

Energy Source	**Reserves/Potential**	**Energy capacity**
Fuelwood	79.9 million m^3/year	5.9 x 10^9 MJ
Sawdust	2 million tons/year	31,432,999 MJ
Crop residue	82.9 million tons/year	5.29 x 10^{11} MJ
Animal waste	227,499 tons daily	2.19 x 10^9 MJ
Biogas	5.9 million m^3 daily	2.7 m^3 produces 78.99 MJ
Wind	1.9– 3.9 m/s at 9.9m height	5 MW
Solar	7 hours daily	5.99– 6.99 kWh/m^2 per day
Small hydropower	0.1489 billion tons	743.2 MW

Discussion

Agricultural Practices Used Renewable Energy Sources:

1. Biomass:

Biomass is the term for products that are utilized to make gasoline, while Biofuel is the term for the fuel made from biological materials. Biofuel is a form of renewable energy that is made from field crop and used to power automobiles and make vehicle fuel (also known as Biofuel or Biodiesel), and it can also be burned for heat or energising.Biodigesters; a relatively simple closed system for waste decomposition would be needed for biomass processing. Significant amounts of agricultural wastes, such as animal ploughed the soil with the aid of a bio digester.Biogas is currently underutilised a lack of knowledge and a lack of funds to purchase the required conversion equipment.

Switch hay, corn, and other fast-growing plants, on the other hand, may be to heat buildings or turned to current using vapor. Farmers who want to burn pellets for fuel will need to work together to purchase a pelletizer.Several researchers, on the other hand, have designed and manufactured a variety of pelletizers for efficiently producing biomass from agricultural wastes and materials, including:pigeon droppings, mixed weed species, field wastes, alfalfa, onion bulbs,Cassava tubers, cassava leaves and sewage sludge, animal dung, rattan furniture waste, sludge, sludge, Coal tailings, spent mushroom waste, and banana and plantain peels microbial flora of animal wastes, starchy wastes, large bluestem, wheat straw, corn Stover, as well assorghum stalk,

cassava peels with massive livestock waste, sorghum stalk, corn Stover,food waste and manure, water hyacinth, wheat straw, cassava bagasse, sugarcane bagasse, agro-residues and waste paper.

Biomass has been used to produce electricity in the past and more recently, and it has shown its ability to supplement current hydropower production in order to meet rising demand. Among the many benefits of biomass, legislation and structural frameworks find it impossible to produce and expand for the common good.As a result, existing policies and regulatory frameworks must be revisited in order to better promote the use of this clean energy supply for efficient and long-term domestic and industrial purposes.Extensive research and development into the economic value of biomass, as well as the discovery of extraeffective ways of handling agricultural are needed to ensure energy conservation.

2. Geothermal Energy:

The term geothermal comes from two Greek words: "geo," which means "earth," and "thermos," which means "gas," and refers to the intensity produced from the earth's fire. The radioactive decay of minerals and the absorption of solar radiation at the surface produce it. Geothermal energy is about 5,5000 degrees Celsius at the Earth's core, which is almost as hot as the sun's surface.In many parts of the world, especially near plate boundaries or tectonically active regions, geothermal energy is used, and it has been used extensively in agriculture for greenhouse heating in the last 25 years. The world's largest array of geothermal power plants can be found in California's Geysers region.El Salvador, Kenya, the Philippines, Iceland, and Costa Rica are among the five countries that rely on geothermal energy for more than 15% of their energy in 2004.

Temperatures vary from 30 to 350 degrees Celsius, and geothermal energy may be dry steam, two-phase (steam and water), or pure liquid water. To extract geothermal heat from the ground, water is used as a transport medium. Plates 1a and 1b depict a typical geothermal power plant and its application to greenhouse heating processes.The annual energy demand in the world today is estimated to be about 18 trillion Watts. Agriculture's energy demand has increased as a result of mechanised crop processing methods. Furthermore, in temperate climates, after labour costs, electricity is typically the biggest overhead expense in greenhouse crop cultivation.Heating absorbs nearly 75% of overall energy, electricity 15%, and car transportation 10%.

To provide better conditions for crop production in greenhouse cultivation using electricity, must all be regulated. Although there are differences in care and approach to the growth of geothermal energy use between countries, no one has all the answers, according to Popov ski *et al*.As a result, one cannot be deceived by the comparatively good condition in certain countries (Italy, Iceland, New Zealand, and so on), because severe issues still remain. The following are some of the disadvantages of geothermal energy, according to Popov ski *et al*.:high investment costs, a high degree of experience across different scientific fields, a high level of organisation, and the need for environmental protection, as geothermal brines can pollute the atmosphere both chemically and thermally.

Greenhouse cooking, aquaculture, and crop drying, as well as recreational and therapeutic uses, are among the most common geothermal energy applications. The thermodynamic and chemical properties of geothermal fluid are critical to its application. These properties are determined by the geothermal field from which the fluid originated. Geothermal fluids have been described in a variety of ways by various academics.All year long, geothermal heat pumps will ground temperatures as well asexchange air, while buildings are kept cool in the summer besides damp in the winter period is only half or one decade if costless fuel is available. Geothermal systems are suitable for n because of the lengthy mining process.

3. Hydropower:

Hydropower is the maximumdependable, profitable, and well-established renewable energy generation technology. Hydropower is the world's largest source of clean energy, accounting for about 16% of global electricity and more than four-fifths of renewable energy. More than 25 countries depend on hydropower for 90% of their electricity (99.3% in Norway), and 12 countries are fully reliant on it.Hydroelectric power provides the bulk of energy in 65 countries and contributes to the generation of electricity in over 150 more. Canada,

China, as well as the US are the nations with the most hydropower generation capacity. Hydropower's unrivalled "load trailing" capability is one of its most significant advantages (i.e. it can meet load fluctuations minute-by-minute).In addition to grid reliability and protection, capacity may be used from inflows (spinning reserve).

Hydropower is an ideal supplement to intermittent renewables since reservoir levels will be allowed to increase, allowing for periods where there is no wind or sunshine. Hydro will also be able to meet demand where there is a need for substantial supply ramping up or down due to changes in solar or wind output.Pumping water for irrigation, processing and storing agricultural goods, as well as lighting farm houses and the atmosphere, direct use of water for irrigation from hydropower dams, and dams for fish farming, which need electricity on the farm.Site-specific technology, season dependability, conflicts with fishing priorities to adapt it, and insufficient dam management leading to flooding of the dam's downstream field are some of the disadvantages.

4. Solar:

The sun is the most abundant source of light on the planet. Solar radiation falls at a rate of 120 petawatts per second into the Earth's atmosphere, ensuring that the amount of energy obtained from the Sun in a single day can satisfy the world's energy demand for more than 20 years. Solar energy is the most environmentally friendly, abundant, and accessible renewable energy source.Greenhouses are designed to provide the required light for plant photosynthesis while maintaining a consistent temperature. Solar energy could be converted to electricity using photovoltaic (PV) equipment. The electrical energy produced could be used to power environmental conservation equipment in greenhouses.The word "hydropower" usually refers to the generation of shaft power from naturally falling water. Direct mechanical applications or, more generally, power generation are also possible uses for the energy.

Solar energy can be used for passive heating in greenhouses, solar thermal heating in hot water systems, or photovoltaics can be converted and used to produce electricity (PV).Solar cookers come in a range of shapes and sizes, including intensified solar cookers, parabolic solar cookers, panel solar cookers, double exposure solar cookers, thermal storage style solar cookers, hot box solar cookers, and square and rectangular box type solar cookers. Lighting, electric fencing, small generators, fans, water injection, and battery charging can all be regulated by PV.In rural areas or on farms where power lines are not available, PV could be the only option. Nigeria is fortunate to have an abundant source of solar energy (5.5 kilowatt hours per square metre unit). However, just 0.005% of this amount is translated into electricity. The above-mentioned energy challenge can be met in large part if 1% of available solar energy can be harnessed.

Solar power has been successfully used for controlled drying of agricultural goods, domestic cooking, and irrigation pumping in rural areas of China, India, Finland, Kenya, and Bangladesh. In rural Nigeria, a scarcity of infrastructure and services is a limiting factor. All agricultural operation revolves around plants' ability to convert solar energy into stored chemical energy.Agricultural production output is determined by the amount of solar energy captured and converted into food per unit land area as a result of managing plant, land, water, and other resources. Agricultural efficiency can be increased by integrating solar energy with human, animal, and fossil energy power.Humans absorb about 30% of the total solar energy that leaves the earth in the form of fuel and forage, with the remaining 20% harvested as forest products. As a result, humans absorb nearly half of the solar energy that enters the earth for personal use.

5. Wind:

Wind turbines can provide a large portion of a farm's average power needs, but they must be located in high-wind areas and normally need at least one acre of land.The benefits of a wind turbine would outweigh the costs of installation, despite their high cost. If local energy prices are high, you choose a turbine that is appropriate for the wind speed in your region, as well as how you intend to use and run the engine. Wind energy is available while solar energy is scarce.As hot air rises from the earth's atmosphere, raising air flow, it is at its most strong in the fall, winter, and spring, as well as at night. Wind power can easily be adapted for rural agricultural production activities by residents living along Nigeria's coastlines and in dry regions.This saves time and money

by reducing the amount of human capital needed for activities such as rice mill winnowing. Wind is not always present in Nigeria, which limits its use for many agricultural activities.

Agricultural practises in developing countries are often done by hand using blunt tools, whereas fossil fuel consumption in developed countries has resulted in substantial global warming and environmental degradation. The aim of the study was to determine how much renewable energy is used in agricultural operations, as well as its limitations and possible solutions. Renewable energy source investigated include biomass, geothermal, wind, solar, hydropower, and fuelwood. Sustainable energy farming in agriculture to minimise the amount of carbon released into the atmosphere by transforming fossil fuel burning to renewable energy sources. Agriculturalists produces capital international input and combining them with energy-saving techniques. Green energy helps producers store cash while correspondingly fighting the impacts of worldwide warming. Wind, hydropower as well as solar power, besides biomass are examples of possible renewable energy sources for the rural agriculture market. They can be used to reduce the energy gap in countryside as well as city area while simultaneously slowing the rate of environmental deterioration. In order to generate, manage, monitor, and assess renewable energy, adequate is required to educate and transfer this knowledge to countryside area. The increasing request for food, along with the volatile charge on fossil fuel, has spurred a search for environmentally friendly energy sources. Energy is a major expense in the production management. The utilization of a sustainable energy grid to track green-house environment lowers consumption of fuel besides increases the sustainability of green-house construction.

6. Fuel wood:

Around half of Nigeria's total energy usage for agriculture and other domestic food manufacturing activities comes from fuel wood. The current reserve capacity of 80 million cubic metres a year, according to estimates, is underutilised. Just a small amount of the wood is efficiently used in traditional stoves.Improved wood/solid fuel stoves and coal briquettes of varying designs have been found to have a thermal efficiency of 10 to 20%, compared to 5 to 7% for traditional stoves. The wood/fuel stoves can be used for cooking, smoking, and preserving fish.Unrestricted usage, on the other hand, may result in erosion, soil depletion, desertification, and carbon emissions, among other environmental issues.

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Due to the agricultural sector's dependence on energy to feed an ever-increasing population amid limited natural resources, as well as the impact of energy use on the environment and human health, it is important to investigate the scale of energy use for various agricultural activities.If human population growth persists at its current rate of 1.5 trillion, fossil oil stocks would be unable to support a reliable food supply, leaving fossil energy sources scarce and unaffordable. As a result, the primary aim of this analysis was to look at the current state of sustainable energy use in agricultural production, as well as any future concerns that could emerge.

Conclusion

Human capacity and the use of draught animals are the most common inputs in Nigeria's rural agricultural development and processing operations. The shortcomings, opportunities, and emerging implementations of sustainable sources biomass, geothermal, hydropower,solar and wind for agricultural activities were examined in this study.This energy source has the potential to reduce energy shortages created by a variety of agricultural practises in both rural and urban areas, as well as delay. However, in order to advise, educate, and move this information to rural areas, adequate services are required.Local associations, such as farming cooperatives,

should be enhanced to increase cognizance of sustainable energy source and to guarantee the security and long-term sustainability of farm production as well as processing facilities.

There are a variety of renewable energy generation technologies available today, includingnuclear, wind, biomass, and hydro, but wind and solar energy, in particular, is becoming more relevant in the study, plan, as well asproduction of novel products.However, the radioactive elements used in its development limit the technology's environmental effects. As part of this proposal, significant contribution iscompleted in the field of PV material, with an emphasis on those that can be used as a very large built up area permeablecoating and are manufactured utilizing thin-film technology.Its aim is to use cost-effective technique to make PV products with a third as well assecond generation absorbent coating.

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