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Agricultural Techniques Utilizing Implementation of Renewable Energy

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ABSTRACT
Agricultural practises in poor nations are typically done by hand using blunt instruments, while fossil fuel use in wealthy countries has resulted in significant global warming and environmental damage. The objective of the research was to establish how much renewable energy is utilized in agricultural activities, as well as its limits and potential remedies. Renewable energy source explored include biomass, geothermal, wind, sun, hydropower, and fuelwood. Sustainable energy farming in agriculture to limit the quantity of carbon emitted into the environment by converting fossil fuel burning to renewable energy sources. Agriculturalists produces capital worldwide input and integrating them with energy-saving methods. Green energy lets companies save cash while simultaneously combating the effects of global warming. Wind, hydropower as well as solar electricity, plus biomass are examples of potential renewable energy sources for the rural agricultural industry. They may be utilized to decrease the energy gap in rural as well as metropolitan region while simultaneously reducing the pace of environmental degradation. In order to produce, manage, monitor, and evaluate renewable energy, sufficient is needed to educate and transmit this information to rural region. The rising need for food, combined with the fluctuating charge on fossil fuel, has driven a hunt for ecologically acceptable energy sources. Energy is a significant cost in the production management. The use of a sustainable energy grid to monitor green-house environment reduces consumption of fuel plus improves the sustainability of green-house building.

Keywords
Agriculture, Biomass, Clean Energy, Geothermal, Hydropower, Renewable Energy.

1. INTRODUCTION
Energy services are essential for socioeconomic growth and poverty eradication because they are required in virtually every area of the economy. Among less developed, developing, and developed nations, energy consumption and applications for such activities as agricultural production vary significantly. Most of the world's agriculture was done by hand using basic tools in less industrialized and emerging nations, and it still is [1]. Energy is both the fuel and the fodder for agriculture, and energy that can alter economies is a fundamental requirement for human progress. It is accessible in a variety of ways, each of which may be classified as renewable or non-renewable (Fig. 1). In order to remain in a globalised market, agriculture's new needs are for modernisation and sustainability, and one of the issues that costs[2].Green-house farming is a growing industry in many countries, however it is afflicted by a lack of productivity, despite the fact that it offers an alternative aside additional methods of fulfilling global food desire.

Heating and cooling cycles are the primary energy needs in greenhouses for food production. Red-hot archaic fuels (palm oil, ethanol, coal, liquefied petroleum, wood fuel, moreover liquefied natural gas), that release more carbon dioxide, by using an electric heater, that consume much more vital energy, are the most frequent methods of generating heat. Cooling systems for greenhouses are becoming increasingly popular, especially in countries of Latin American where cooling technique are traditional fail to provide the optimum condition targeted at harvest progress throughout the summer[3]. As a consequence, creating better heating–cooling systems that also allow for reduced energy consumption and/or the utilization of renewable energy sources is essential. Agricultural greenhouses have two main challenges: boosting energy output and reducing carbon dioxide emission. Wind as well as solar energy is a couple of uttermost viable green energy alternatives in the globe due to the quantity besides topographical compensations, which is, intended for local power production in remote and inaccessible zones, despite the fact that their elevation is restricted to some degree.
The challenges to overcome by integrating a couple or three renewable energy reasons (supposed hybrid system) per acceptable energy saving. The greatest advantage of a wind–solar system is that it improves system dependability. Furthermore, as compared to a single power generating unit, the storage battery bank's required capacity may be decreased. In green-house-dependent manufacturing, cooling as well as heating equipment is needed, with the green-house heat accounting for 70 percent of the overall production cost during the winter months. However, traditional energy use has dropped considerably. As a consequence, popular option among farmers because they enable them to prolong the growing season at a cheap cost. To protect plants from the cold in colder regions is typically replace solar[4].

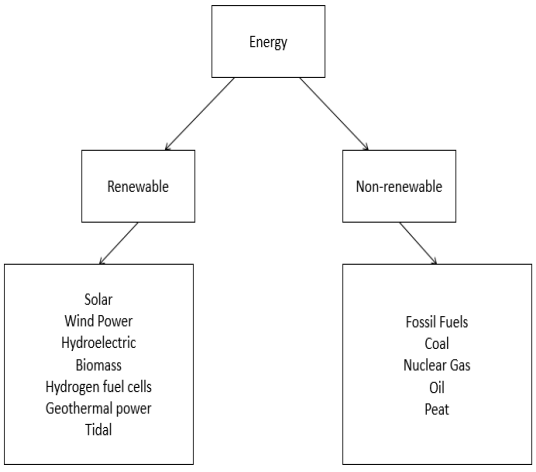

Figure 1: Sources of Energy

In Nigeria, hand axes are worked with human power, pulled instruments are worked with animal power, post-harvest handling and processing equipment is driven with fossil fuel, and irrigation is done using pumps. Absence of precise estimates for the nation's total energy consumption, but when it comes to conventional (non-renewable) energy sources, only fuel wood is utilized extensively in rural regions. Agriculture needs energy as a major source of supply for the production and processing of food and fibre for human consumption, which is achieved by converting different energy sources into food and fibre. The energy consumption of the agriculture industry may be divided into two categories: primary and indirect energy consumption. Agriculture utilizes energy both directly (in the form of gasoline or electricity) and indirectly (in the form of fertilisers and chemicals produced outside the farm) to operate equipment and machinery, heat or cool buildings, and light up lights on the farm[4].

The quantity of energy consumed in agricultural production varies a lot depending on the type of operation, the production techniques employed, the geographic location of the production region, and environmental variables including soil and climatic elements. Energy utilities such as electricity, petroleum, natural gas, and coke, as well as other industries, have grown more essential in agriculture. Low oil costs in comparison to the resource it was replacing may be blamed in part for the increase in energy consumption and capital-intensive technologies that followed. In order to keep agriculture afloat, automation and mechanisation of agricultural activities increase energy consumption, requiring productive and cautious energy usage. Furthermore, given the scarcity of appropriate agricultural land, the only option for farmers to improve overall output will be to make better use of their capital.

Due to the agricultural sector's reliance on energy to feed an ever-increasing population amid limited natural resources, as well as the effect of energy consumption on the environment and human health, it is essential to study the magnitude of energy use for different agricultural operations. If human population expansion continues at its present pace of 1.5 trillion, fossil oil reserves would be unable to support a stable nutrition supply, making fossil energy sources rare and expensive. As a consequence, the main objective of this study was to look at the present status of sustainable energy usage in agricultural production, as well as potential future problems that might arise.

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 modest initial cost, electricity is generated. In industrialised regions, six main sources of renewable energy have been utilized for this purpose (Table 1). Renewable technology may be either cutting-edge advancements in power production or older technologies that are still present in certain parts of the globe. Numerous renewable energy source does not provide accessible energy direct; additional equipment may be required to convert one kind of energy to another.

The possible renewable energy sources and capabilities for agriculture production and processing (Table 2). Global population increase, coupled with the industrialization of emerging nations, has resulted in a major research have concentrated on generating as well as a particular 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 as air temperature) in order to accomplish high yields at a low cost.Tong et al. observed consumption a greenhouse with heat pumps from January to March was 0.22 to 0.559 MJ-meter^2, while heater was 0.42–0.76 MJm^2. Similarly, the hourly carbon dioxide emission in the area of 9.49–24gm2, whereas those with no heat pumps had 9.49–24gm^2.

Electricity is the cornerstone of sustainable development in the industrialized world, utilized into agriculture alongside industry. As a consequence, to decrease carbon dioxide output besides heating expense, energy efficiency issues are needed. Ground-coupled heat pump systems (GCHPS) for example, have been proposed by several researchers. The system may be maintained running properly with the assistance of heat pump. However, fruit, soil, as well as energy management is extremely important. Solar energy has grown in popularity in recent decades as a consequence of both technical advancements and government policies that promote the production and use of renewable energy sources[6].

Table 2: Processing In Rural Areas Besides Sources Of Potential Energy For Agricultural Production [7]

Energy Source	Reserves/Potential	Energy capacity
Fuelwood	79.9 million m3/year	5.9 x 109 MJ
Sawdust	2 million tons/year	31,432,999 MJ
Crop residue	82.9 million tons/year	5.29 x 1011 MJ
Animal waste	227,499 tons daily	2.19 x 109 MJ
Biogas	5.9 million m3 daily	2.7 m3 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/m2 per day
Small hydropower	0.1489 billion tons	743.2 MW

2. DISCUSSION

2.1 Agricultural Practices Used Renewable Energy Sources

2.1.1. Biomass

Biomass is the word for goods that are used to produce gasoline, whereas Biofuel is the term for the fuel made from biological resources. Biofuel is a type of renewable energy that is produced from field crop and used to power cars and make vehicle fuel (also known as Biofuel or Biodiesel), and it may also be burnt for heat or energising. Bio digesters; a very basic closed system for waste decomposition would be required for biomass processing. Significant quantities of agricultural wastes, such as livestock churned the soil with the help of a bio digester. Biogas is presently underutilised a lack of expertise and a lack of money to buy the necessary conversion equipment[8].

Switch hay, maize, and other fast-growing plants, on the other hand, may be used heat buildings or converted to current utilizing vapour. Farmers that wish to burn pellets for fuel will need to join together to buy 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 as sorghum 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 utilized to generate energy in the past and more recently, and it has proven its potential to augment existing hydropower output in order to satisfy increasing demand. Among the numerous advantages of biomass, laws and structural frameworks find it difficult to generate and expand for the common good. As a consequence, current laws and regulatory frameworks must be reviewed in order to better encourage the use of this clean energy source for efficient and long-term residential and industrial uses. Extensive research and development into the economic worth of biomass, as well as the discovery of additional effective methods of managing agriculture are required to guarantee energy conservation.

2.1.2. Geothermal Energy

The name geothermal derives from two Greek words: geo which means earth and thermos which means gas and alludes to the intensity generated by the earth's fire. The radioactive disintegration of minerals and the absorption of solar radiation at the surface generate it. Geothermal energy is approximately 5000 degrees Celsius in the Earth's core, which is nearly as hot as the sun's surface. In many areas of the globe, particularly near plate borders or tectonically active regions, geothermal energy is utilized, and it has been used widely in agriculture for greenhouse heating in the past 25 years. The world's biggest array of geothermal power plants may be located in California's Geysers area. El Salvador, Kenya, the Philippines, Iceland, and Costa Rica are among the five nations that depend on geothermal energy for more than 15 percent of their energy in 2004[9].

Temperatures range from 30 to 350 degrees Celsius, and geothermal energy may be dry steam, two-phase (steam and water), or pure liquid water. To collect geothermal heat from the earth, water is utilized as a transport medium. Plates 1a and 1b show a typical geothermal power plant and its application to greenhouse heating operations. The yearly energy consumption in the globe today is estimated to be approximately 18 trillion Watts. Agriculture's energy consumption has risen as a consequence of mechanised agricultural processing techniques. Furthermore, in temperate regions, after labour expenses, power is usually the largest overhead expenditure in greenhouse crop production. Heating consumes approximately 75 percent of total energy, electricity 15 percent, and vehicle transportation 10 percent.

To offer better circumstances for crop production in greenhouse cultivation utilizing electricity, must all be controlled? Although there are variations in attention and attitude to the development of geothermal energy usage across nations, no one has all the answers, according to Popov ski et al. As a consequence, one cannot be misled by the relatively excellent situation in some nations (Italy, Iceland, New Zealand, and so on), since serious problems nevertheless exist. 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 medicinal purposes, are among the most frequent geothermal energy applications. The thermodynamic

and chemical characteristics of geothermal fluid are essential to its use. These characteristics are dictated by the geothermal field from whence the fluid came. Geothermal fluids have been characterized in a number of ways by different scholars. All year long, geothermal heat pumps will ground temperatures as well as exchange air, while buildings are maintained cool in the summer plus wet in the winter time is just half or one decade if costless fuel is accessible. Geothermal systems are appropriate for n because of the long mining process.

2.1.3. Hydropower

Hydropower is the greatest reliable, lucrative, and well-established renewable energy production method. Hydropower is the world's biggest source of clean energy, accounting for approximately 16 percent of global electricity and more than four-fifths of renewable energy. More than 25 nations rely on hydropower for 90 percent of their energy (99.3 percent in Norway), and 12 countries are completely dependent on it. Hydroelectric power supplies the majority of energy in 65 nations and contributes to the production of electricity in over 150 more. Canada, China, as well as the US are the countries having the greatest hydropower generating capacity. Hydropower's unmatched "load following" capacity is one of its most important benefits (i.e. it can meet load variations minute-by-minute). In addition to grid stability and protection, capacity may be utilized from inflows (spinning reserve)[10].

Hydropower is an excellent complement to intermittent renewables because reservoir levels will be permitted to rise, allowing for times when there is no wind or sunlight. Hydro will also be able to fulfil demand when there is a requirement for considerable supply ramping up or down owing to variations in solar or wind production. Pumping water for irrigation, processing and storing agricultural products, as well as lighting farm buildings and the environment, direct use of water for irrigation from hydroelectric dams, and dams for fish farming, which require electricity on the farm. Site-specific technology, season reliability, conflicts with fishing objectives to modify it, and inadequate dam management leading to flooding of the dam's downstream area are some of the drawbacks.

2.1.4. Solar

The sun is the most plentiful source of light on the earth. Solar radiation falls at a rate of 120 Petawatts per second into the Earth's atmosphere, guaranteeing that the quantity of energy received from the Sun in a single day may fulfil the world's energy needs for more than 20 years. Solar energy is the most ecologically benign, plentiful, and accessible renewable energy source. Greenhouses are intended to supply the necessary light for plant photosynthesis while keeping a constant temperature. Solar energy may be converted to electricity utilizing Photovoltaic (PV) technology. The electrical energy generated may be utilized to power environmental conservation devices in greenhouses. The term "hydropower" generally refers to the production of shaft power from naturally flowing water. Direct mechanical applications or, more broadly, power production are other potential uses for the energy.

Solar energy may be utilized for passive heating in greenhouses, solar thermal heating in hot water systems, or photovoltaics can be converted and used to generate electricity (PV). Solar cookers come in a variety of forms and sizes, including enhanced sun 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 fences, tiny generators, fans, water injection, and battery charging may all be controlled by PV. In rural regions or on farms where electricity connections are not accessible, PV may be the sole alternative. Nigeria is lucky to have an abundant supply of solar energy (5.5 kilowatt hours per square metre unit). However, only 0.005 percent of this quantity is converted into energy. The above-mentioned energy problem may be addressed in significant part if 1 percent of available solar energy can be harnessed.

Solar electricity has been effectively utilized for controlled drying of agricultural products, household cooking, and irrigation pumping in rural regions of China, India, Finland, Kenya, and Bangladesh. In rural Nigeria, a lack of infrastructure and services is a limiting issue. All agricultural activity relies on plants' capacity to transform solar energy into stored chemical energy. Agricultural production output is defined by the quantity of solar energy collected and transformed into food per unit land area as a consequence of managing plant, land, water, and other resources. Agricultural efficiency may be improved by combining solar energy with human, animal, and fossil energy power. Humans take approximately 30 percent of the total solar energy that leaves the planet in the form of fuel and fodder, with the remaining 20 percent collected as forest products. As a consequence, people absorb almost half of the solar energy that reaches the planet for personal consumption.

3. CONCLUSION

Human capability and the usage of draught animals are the most frequent inputs in Nigeria's rural agricultural growth and processing activities. The limitations, possibilities, and developing implementations of sustainable sources biomass, geothermal, hydropower, solar and wind for agricultural operations were studied in this research. This energy source has the potential to decrease energy shortages caused by a range of agricultural practises in both rural and urban regions, as well as delay. However, in order to counsel, teach, and transfer this knowledge to rural regions, sufficient services are needed. Local organizations, such as agricultural cooperatives, should be strengthened to raise awareness of sustainable energy source and to ensure the security and long-term sustainability of farm output as well as processing facilities.

There are a number of renewable energy generating technologies accessible today, including nuclear, wind, biomass, and hydro, but wind and solar energy, in particular, is becoming increasingly important in the research, design, as well as manufacturing of innovative goods. However, the radioactive materials employed in its creation restrict the technology's environmental impacts. As part of this proposal, substantial contribution is accomplished in the field of PV material, with a focus on those that may be utilized as a very large built up area permeable coating and are produced using thin-film technology. Its goal is to utilize cost-effective method to produce PV goods with a third as well as second generation absorbent coating.

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