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A REVIEW PAPER ON FARM POWER AND ENERGY IN AGRICULTURE

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Abstract

Farm power is used to operate various forms of machinery such as tillage, plant safety, planting, threshing and harvesting machinery, as well as other stationary jobs such as irrigation, threshers, sellers, cleaners, graders, and so on. The direct and indirect energy demands of agriculture can be separated. Land planning, planting, harvesting, irrigation, food production, post-harvest processing, storage, and transportation of agricultural outputs and inputs are all examples of direct energy needs. In present time farm power helps in agriculture in different stages and helps to do comfort farming with the help of different farm power. In this paper the author discussed the farm power and energy used in agriculture and how farm power helps in agriculture at different levels. In this review paper, author also discussed human power, mechanical power, animal power, electrical energy, solar energy and renewable energy. In the future the farm power will be used in large amounts which will help people in the field of agriculture.

Key words: Agriculture, Energy, Farm Power, Human, Productivity.

Introduction

Farm Power is a critical input in the agriculture for timely fields operations that increase land productivity and development. Farm power is used to operate various forms of machinery such as tillage, plant safety, planting threshing and harvesting machinery, as well as other stationary job such as irrigation, threshers, cleaners, sellers, graders, and so on. On the farm, power is needed to operate various tools and implements as well as to perform several farm operations. Although mobile powers is used to perform various field tasks, stationary powers is used to raise water & operate irrigation machinery, as well as to operate threshers, decorticators, graders, cleaners, and another post-harvest operation. Humans, draught animals, power tillers, tractors, and self-propelled machines provide mobile farm power, while oil engines (kerosene, diesel, gas) and electric motors provide stationary farm power[1].

The accessibility of sufficient farming power is critical for timely farming operations that increase productivity and production while also minimizing crop losses. With increased cropping intensity, improvement time is significantly reduced & it is impossible to thresh and harvest the standing crops on the one hand, while also preparing seed beds and performing timely sowing operation for the following crops on another, in the restricted time available, except sufficient farming power is obtainable.

This expansion is largely due to agricultural technology developed during the green revolution, which was backed up by agricultural scientists, including agricultural engineers, and aided by favorable policy, generous public funding for agricultural research and development, and farmers' tireless efforts. For the farm, a power is needed to operate various tools and implements as well as to perform several farm operations. Although mobile power also used to perform various fields tasks, stationary power used to raise water & operate irrigation machinery, as well as to operate threshers, decorticators, shellers, graders, cleaners, and another post-harvest processes. Humans, draught animals, power tillers, tractors, and self-propelled machines provide mobile farm power, while oil engines (diesel, kerosene, gas) & electric motors provide stationary farming power[2]. The accessibility of sufficient farming power is critical for timely farming operations that increase productivity and production while also minimizing crop losses.

With increased cropping intensity, turnaround time is significantly abridged and it is impossible to thresh and harvest the standing crops on the one hand, while also preparing seed beds and performing timely sowing operation for the following crops on another, in the incomplete time accessible, unless sufficient farming power

is available. More power is also needed for precision farming, conservation tillage, increasing irrigation area, straw management, and agricultural diversification. There has been a strong link between increased productivity and the availability of farm power. In general, states with a greater abundance of farm power have higher output than other states.

The labour and land ratio has been gradually rising over time, and as a result, technological advancements resulting from the mechanization process have been land-saving in nature, with an emphasis on increasing land productivity. As a result, India's mechanization process did not pursue the process of generating surplus labour from the agricultural sector for use in the industrial sector.

While the number of agricultural employees as a percentage of the rural populations has decreased from around 70.4 percent in 2014 to around 60.7 percent in 2018, the numbers of agricultural employees available in the rural ranges has increased in absolute terms from 116 million in 2017-18 to 249 million in 2018-19, registering an annual compound growth rate of 7.4%. Even though they are not completely employed during the year, these agricultural employees are involved in a variety of farm operation and rely on agriculture for the livelihood[3]. The price of manufacture of most crop in our country is very high as juxtapose to the developed countries due to excess labour involvement in various farm operations.

Human Power:

Human's power is the energy or work produced by the humans body. It may also apply to human's productivity (rate of work per unit of time). Human-powered machinery is occasionally used to produce and store electrical energy for use in situations where there is no other source of electricity.

Draught Animal Power (DAP):

Draught animal strength, primarily derived from milch animals, has long been a valuable source of tractive energy for agriculture, rural agro-processing, and transportation in India and other developing Asian, African, and Latin American countries. Tillage, weeding, sowing, water raising, threshing (by the animal trampling), sugarcane crushing, oil extraction and transport were all dependent on this power source in traditional Indian agriculture. Draught animal utilize dramatically in the power-intensive operations such as oil extraction, water lifting, and threshing, thanks to the modernization of the agriculture production system and use the mechanical power resources.

The obtainable time frame, alternatives accessible (including custom recruiting services) and related economics all play a role in determining the type of farm power to be used for a given activity[4]. Machines like tractors and combines are difficult to run in sloppy hill regions and on small fields, so draught animal use, in addition to human power, is likely to continue. Increased animal care costs have compelled farmers to minimise the number of draught animals they own as much as possible. Aside from its economic value, livestock has a symbiotic relationship with rural people.

Mobile Power from Tractors and Power Tillers:

Additional power is available primarily from power and tractors tillers to meet the growing demand for mobile power for appropriate farm operation and increased cropping intensity. Self-propelled reapers and combines for the useful harvesting operations since they provide mobile fuel[5].

India is currently the world's largest tractor maker country. In the nation, more than 20 tractor manufacturers produce approximately 60 models of tractors in various horsepower ranges. During the last 50 years, India's tractor population has increased from 0.037 million units in 2017-2018 to 4.464 million units in 2019-20, with an annual compound growth rate of about 10%.

Stationary Power from Diesel Engines and Electric Motors:

Electric motors and diesel engines are used in agriculture as stationary power sources for irrigation machinery, threshers, and other stationary machines. Farmers primarily use diesel engines and electric motors to raise irrigation water and operate stationary farm machines such as threshers and chaff cutters. Since the green revolution, the populations of these prime movers have exploded.

The farm power in agriculture in different Power area like: i) Diesel Engine ii) Draught Animal Power (DAP) iii) Electric Motors iv) Human Power v) Tractors and vi) Total Power shown in Figure 1.

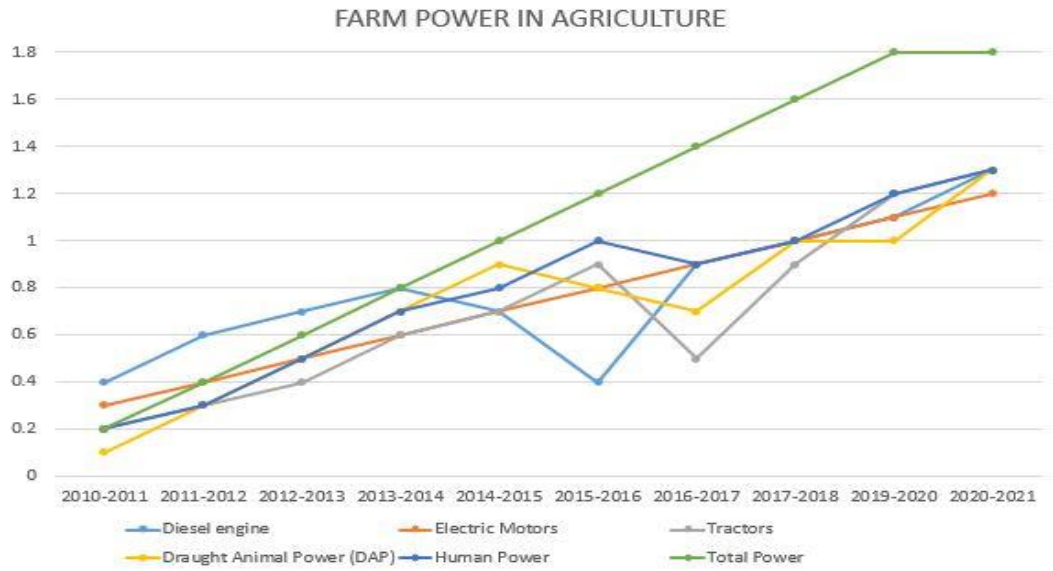

Figure 1: This graph shows the farm power in agriculture in different Power area like: i) Diesel Engine ii) Draught Animal Power (DAP) iii) Electric Motors iv) Human Power v) Tractors and vi) Total Power

Energy use in Agriculture:

Agriculture has changed from manual labour to automation since the industrial revolution. Agriculture's use of machinery and chemicals has made energy one of its most important inputs. Agriculture has often used solar energy, storing it in its produce, which is then used as food, fuel, or other materials.

Agricultural Production and Energy*:*

Agriculture is the energy transfer mechanism in and of itself, converting solar energy into food energy for human and feeds for animals by photosynthesis[6]. Primitive agriculture entailed spreading seeds across the land area and acknowledging the meagre yield that resulted. Energy is needed in modern agriculture at all stages of development, including direct energy use in the farm machinery, irrigation, water management, harvesting and cultivation. Food processing, transportation and storage to markets are all examples of post-harvest energy use. In addition, mineral fertilizer and organic insecticides, pesticides and herbicides are among the several indirect or confiscated energy input used in the agriculture.

Although developed countries have promoted from these improvements in agricultural energy supply, developing countries that has not been so lucky. Throughout recent history, "energizing" the food manufacture chains has been a key features of agricultural growth, & it is a key factors in achieving food security. A developing countries has lagged behind developed countries in terms of streamlining their agricultural energy input.

The energy needed for food dispensation and transportation by the agro-industries is not included in the data for agricultural energy usage. These practises are estimated to use up to twice as much energy as agriculture. Many of these stages lack definitive evidence, which is a specific issue when analyzing energy statistics in developing

countries[7]. Furthermore, the data hide the effectiveness of these energy input in increasing agricultural productivity. So, the most interesting relationship are those between the quantities and nature of direct vitality input to agriculture & resulting productive production.

Agricultural Energy Needs:

Many developing countries' agricultural practises continue to rely heavily on animal and human resources. Since there is electrical energy and insufficient mechanical for the agriculture, and the potential improvements in agricultural productivity that could be achieved by deploying modern energy services are not being comprehended. The direct and indirect energy demands of agriculture can be separated. Land planning, planting, harvesting, irrigation, post-harvest processing, storage, food production, and transportation of agricultural outputs and inputs are all examples of direct energy needs. Sequestered energy in fertilizers, pesticides, herbicides, and insecticides meets indirect energy needs[8].

In order to provide energy for agriculture, mankind has adapted a number of resources.The water wheel is a mechanical device that has been in operation for over 2,000 years, and windmills have been around for over 1,000 years. Animal breeze power derived from the interbreeding of livestock, horses, & different animals has happened for over 8,000 years, animal draught powers derived from the domestication of horses, cattle & different animals has existed for over 8,000 years, and the animal strong bow power derived from the interbreeding. Direct solar energy for drying and biomass fuels for heating have been used in agriculture for decades.[9].

Human and animal labour account for the majority of direct energy input in the developing countries, especially in the maintenance agriculture area. Human works has a small output, but human are adaptable, dexterous & capable of making decisions while working[10]. Humans have an edge in professional operations like transplanting, harvesting fruits, weeding, and vegetables and dealing with fiber because of this. Soil preparation and water lifting require less ability but a greater amount of energy.

Discussion

Farming power is a very indispensable input in the agriculture fields. Operations in agriculture are done timely to increase productivity of the lands and its production. Farming power is utilized in operating several types of the machinery like harvesting, plant protection etc. On this basic the farm power can be divided into categories.

- Tractive Work:

It includes seed bed preparation, harvesting, activation, transportation.

- *Stationary Work:*

This types of include mainly field work like cutting threshing, winnowing, irrigation, sifting and irrigation of what the fields

There are many sources of farm power that are used in agricultural operations. These can be classified as:

Human Power:

Human power is the most important source of agriculture that cannot be started. Though through human power small operations like implementation tools, chaff cutting, water lifting, winnowing etc. are done. The biggest advantage of human power is that it is easily available for all types of works like harvesting post contracts etc. Though it has a drawback also, because of its less efficiency and more cost and fuel maintenance is required even when not in use[11]. The Human Power in Agriculture effect shown in Figure 2.

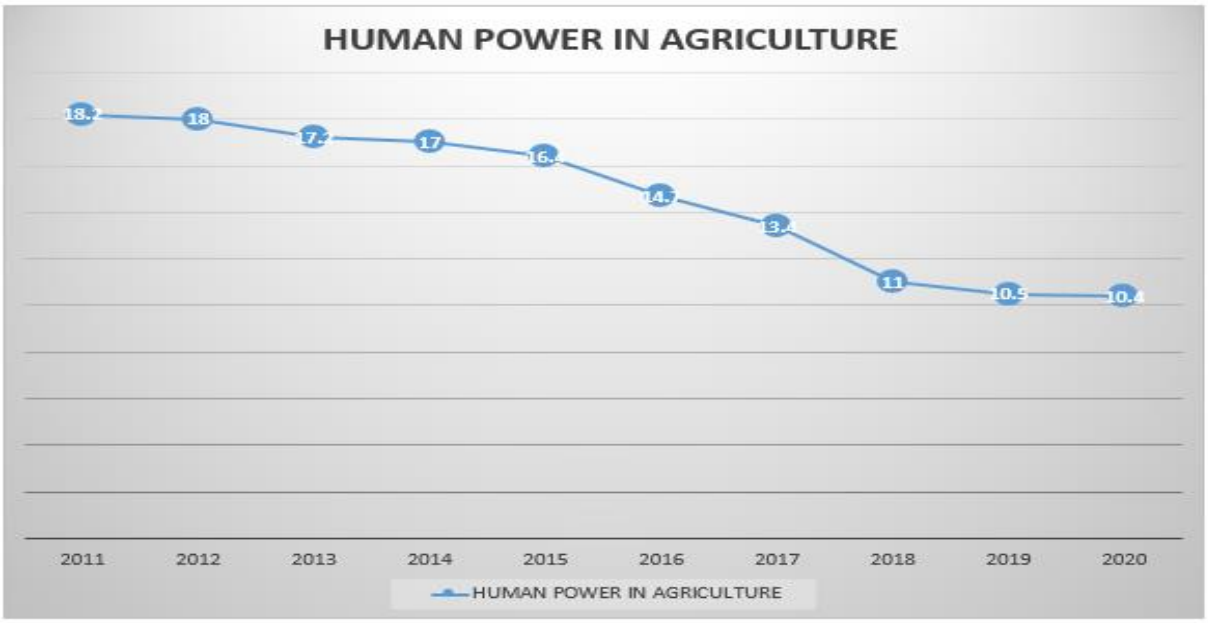

Figure 2: This Graph Shows the Human Power in Agriculture.

Animal Power:

Animals plays the important role in farm agriculture areas. Land preparation, crop threshing transport etc. are done with the animal help only. Even this can be said to be one of the oldest methods used in farming because when there were no vehicles, then animals were used for forming and transportation work. Buffalo, ox, donkey and horses play a very important role in this[12]. In the ancient time bullocks were used to generate power which was used in farming. Animal power is easily available also and can be used in multiple works like meat, milk, daily, products etc. but at the same time even animals require full maintenance so that they can work more efficiently, so sometimes it is very costly also and at the same time it is a very slow process too. The Animal Power in Agriculture shown in Figure 3.

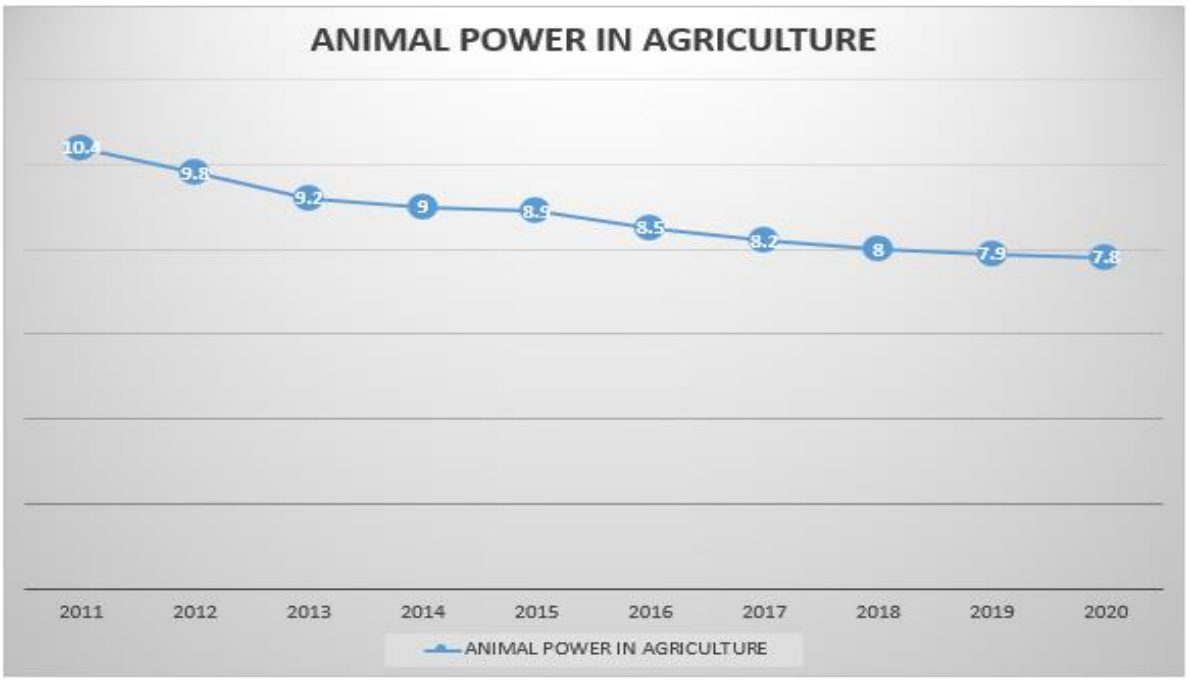

Figure 3: This Graph Shows the Animal Power Used in Agriculture.

Mechanical Power:

Mechanical power is something that includes some kind of mechanism process in its engines oil, tractors, self-prepared combines are the example of mechanical power. The Growth of the Mechanical Power in Agriculture is shown in Figure 4 the internal combustion engines are used for changing the liquid fuels into mechanical work engine are of 2 types:

i) Compression Ignition Engines: These types of engines are run on diesel.

ii) Spark Ignition Engines: These engines use petrol or kerosene as a fuel.

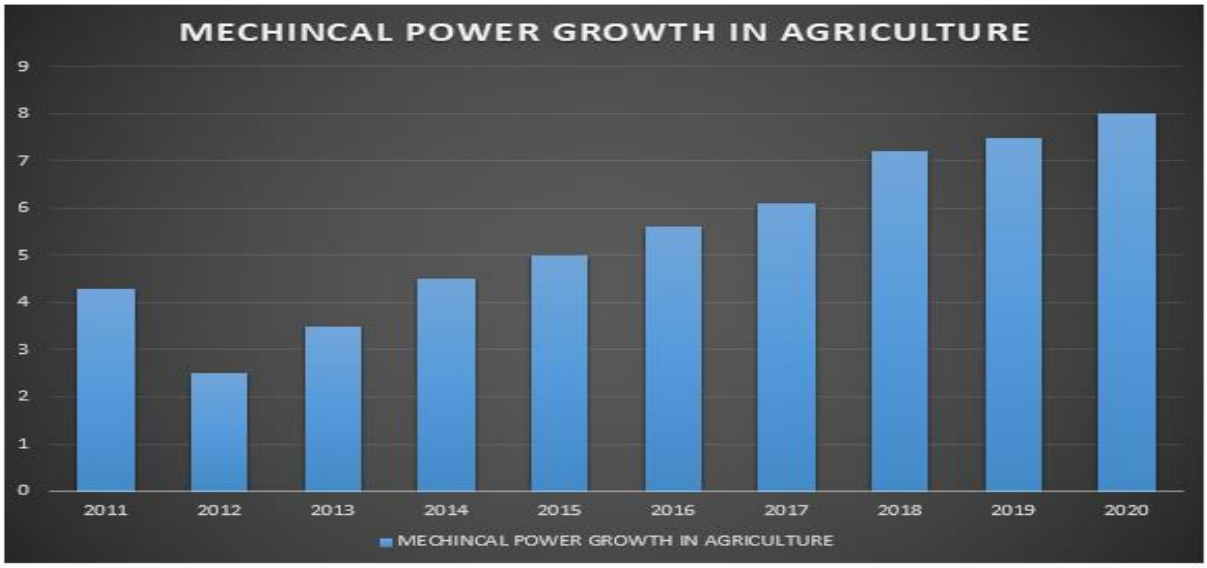

Figure 4: This Graph Shows the Growth of the Mechanical Power in Agriculture.

Now, most of the tractor are run by the diesel engines and they are utilized for sugarcane crushers, operating irrigation pump as winnowers etc. These have high efficiency and are not affected by weather conditions, and can operate in many conditions as compared to men and animals. Although they are very costly also because of fuel used in them, their repairing cost is very high and technical knowledge is required for their maintenance.

Electric Power:

Electric Power is one of the most important parts of power used in farming. Nowadays electric motors are used everywhere for water and other electric work. For the electricity required electric power is almost used everywhere from dairy industries, water pumping, cold storage to fruit industry, farm products processing and many other things and it is a very cheap form of power as compared to others and maintenance cost is also very low. But everything comes with a red flag. The same is with this power if it is not handled properly then it can cause great danger. The electrical power used in agriculture shown in Figure 5.

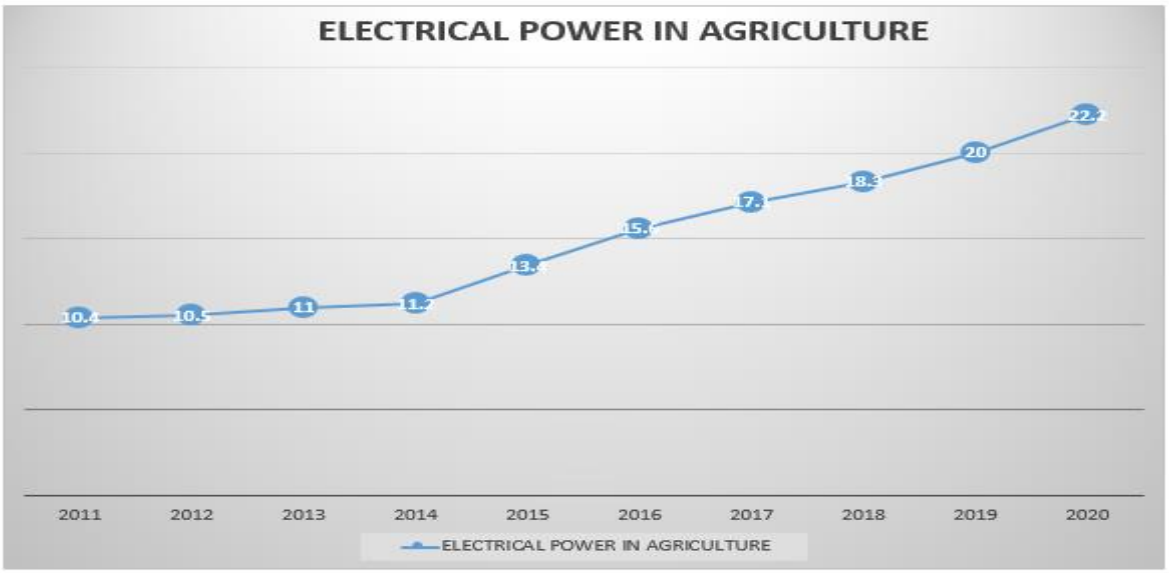

Figure 5: This Graph Shows the Electrical Power Used In Agriculture.

Renewable Energy:

Renewable means that can be used again and again. So this kind of energy is generated from the sources that are renewable like wind, sun, biomass, etc. Solar energy, wind energy used in agriculture and other household activities with proper equipment. Cooking water heating water pumping, electricity generation are some of the examples of renewable energy usage. The Renewable energy used in agriculture shown in Figure 6.

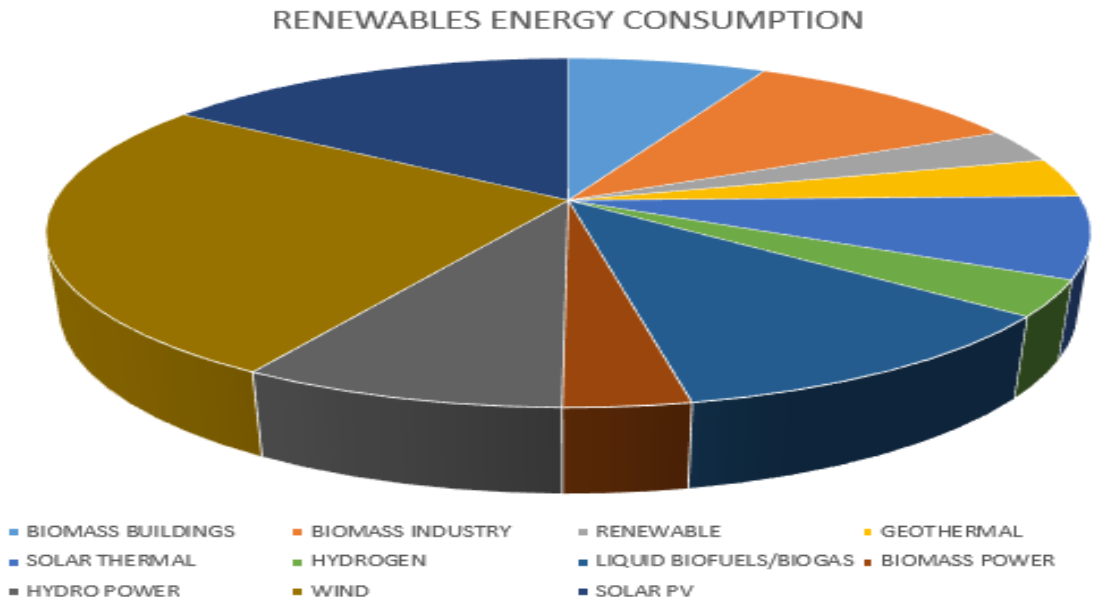

Figure 6: This Graph Shows the Renewable Energy Used in Agriculture.

- **Wind Energy:**

This energy is generated from sum with the help of solar plant of India KAMUTHI SOLAR POWER PROJECT is located in Tamil Nadu and it can supply energy for about 150,000 homes.

- **Biomass Energy:**

In this type of energy gasifies are used to produce gases and liquid fuel is produced through pyrolysis other examples of renewable energies are geothermal energy, tidal energy etc. which are used for producing heat and electricity. This is very important in farming because these are provided through nature and just need to capture them, so it does not require much effort and they can be renewed again and again.

Conclusion

In terms of raising production through timely farm operation, reducing losses, lowering costs of operations through good management of expensive inputs & improving the efficiency of natural resource, mechanization in agriculture holds the key to sustainable growth. It also helps to reduce drudgery in farm operations. The farming community has adopted mechanized agricultural practices and operations at varying levels of adoption, which reflects the various scenarios in different parts of the world. Farm power's is a critical inputs in agriculture area for timely field operation, such as operating irrigation machinery, shellers, threshers, graders, cleaners, and different post-harvest equipments, as well as for stationary job such as operating irrigation equipments, threshers, graders, cleaners, shellers, and different post-harvest equipments.

Humans, animals, power tillers, tractors, electric motors and diesel engines are all sources of farm power. Information about the obtainability of these power sources over time is critical for farm mechanization preparation and prediction, as it offers vast opportunities for producers, entrepreneurs, sales, and repair, among other things. Solar energy could generate hydrogen in the future to supply transportation fuels, chemicals, and electricity, as well as act as energy storage when the sun isn't shining. On a dairy farm, heating water and cooling milk will account for up to 40% of the energy used. Robots, moisture sensors, temperature, GPS technology and aerial photographs can all be utilize in the future of agriculture.

Farms would be more productive, effective, secure, and environmentally friendly as a result of these advanced devices, precision agriculture, and robotic systems. Reduced purchased inputs and increased marketed outputs could boost energy ratios in agricultural production. In the future, when resources are scarce and quality is declining, increased yields would be less important than diverting crops land from supplementary animal nourish to crop for straight human consumption. While we have the extravagance of high energy relations from the fossil fuels, the infrastructure and research required to grow agriculture based on renewable power sources should be developed now.

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