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Uses of solar energy in modern agriculture

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Abstract:

Given that fossil fuels will one day end, there is a need to find alternative fuels. Renewable energy is an alternative to fossil fuels and nowadays attracts a lot of attention. Among renewable energy sources, solar energy is the most important because it is available worldwide. This energy source is also used in various industries including agriculture and can be used to grow crops in the world's most remote corners. In addition, this fuel does not cause pollution, such as other fossil fuels The use of solar energy can be active in all agricultural fields. This will certainly help meet the growing need for agricultural products as the population grows. However, agricultural land is known to have a fixed area, and sometimes, agricultural products cannot be cultivated. This greenhouse is a method used nowadays and the use of solar energy can help build solar greenhouses in areas far from the city. Other solar applications include irrigation, drying products and ventilation outlets. In this study, researchers discussed some of the benefits of solar energy in agriculture.

Keywords: solar energy - modern agriculture - Home Energy

Introduction:

The energy sector has a direct impact on a country's economic development. At present, 85-90% of the world's primary energy is produced from fossil fuels. There is limited storage of fossil fuels and one of the important causes of the recession in the global economy is the continued increase in the price of such fuels. In order to solve the problem of declining economy and issues related to the energy sector, the entire world focuses on the effective use of renewable energy resources such as solar, wind, thermal and hydropower. Fossil energy supplies became available about 200 years ago. In addition, the shortage of agricultural land, freshwater, fossil energy (fertilizer and irrigation) and biological resources is now ravaging agricultural production in many parts of the world.

Energy began to decline and this trend intensified after the year 2000. The use of renewable energy in agricultural systems has several different applications. Renewable energy applications also include power generation for a number of agricultural work: water pumping for irrigation, livestock conservation or household use; lighting of farm buildings; Operation of processing processes and other uses. These forms of renewable energy include solar energy, wind and water energy, oil from plants, wood from sustainable sources, other forms of biomass (plant materials) and biogas (gas produced from manure fermentation and crop residues). The basis of all agricultural production depends on the unique ability of plants to convert solar energy into stored chemical energy. Solar energy is the most suitable option among other renewables because the level of solar energy is in line with the demand for air condition. Also, solar technologies have a long history. A range of techniques have been developed to generate steam by capturing the heat of the sun to power engines and irrigation pumps. Taking into account the importance of solar energy and the growing attention given by humans to renewable energy, this paper looks at the solar energy system in agriculture.

There are two ways to convert solar energy into electric energy; A system that uses photovoltaic technology and another system that uses solar heating systems. In the photovoltaic system, sunlight is converted directly into electricity by semiconductors. In addition, in the heating method, electrical energy can be converted through thermodynamic processes, with the help of heat exchange equipment, into mechanical energy. These methods are central and decentralized. The photovoltaic method leads to more investments. However, in recent years with progress in solar energy, thermal methods are used to supply power. Photovoltaics have been used in space satellites to generate electricity since the

late 1950s. In this technology, solar rays collected via small panels of photovoltaic semiconductors are converted into electricity. Photovoltaics can be built in two ways: center and flat plate. Solar cells are the most common type of flat panels where light is immediately brought to semiconductors and converted into electricity. However, in concentrated cells, sunlight is directed first through the inverter, concentrated, and then the solar cell connects together. Solar cells are formed by solar modules. Power cells and solar modules may only be sufficient to charge the battery and build an output system that significantly requires those units working together and at the same time. Because solar cells are connected together and units are made, the appropriate voltage and current creation units are also connected in a series and in parallel with that unit made in this way called the solar matrix.

Preserving food by drying is one of the oldest and most widespread methods that can be used to enhance the strength of food. Drying food removes moisture so that the product can be stored for a long time and protected from corruption. By reducing micro enzyme activity and reducing the speed of chemical reactions, drying increases the shelf life of the product. In addition, reducing the weight and volume of materials and packaging, facilitates the transport and storage of products and reduces the cost of such procedures. In case of drying, in addition to preventing loss, marketing can be monitored at sensitive times and the potatoes many consumers need (such as barracks, restaurants, etc.) can be delivered in dryer form. The Sun's use of dry crops and cereals is one of the oldest applications used for solar energy. Solar dryers protect grains, fruits and vegetables, reduce losses, dry faster and more consistently, and produce a better quality product than outdoor roads.

Solar drying technology uses an alternative that can process vegetables and fruits in healthy conditions according to national and international standards and without energy costs. It saves energy and time, takes up less space, improves product quality, makes operation more efficient and protects environment. Its configurations (continue from the next line), capacity, and cost of dried products. It reviewed several solar dryers and compared their performance and applicability in rural areas. Sharma provided a comprehensive review of various designs, details of construction and operation principles for a wide range of practically realized designs for solar drying systems, and a systematic approach to classification of solar dryers was developed. Ramona provided a review of new technologies, models and experimental investigations of solar dryers.

The use of solar energy in agricultural homes is difficult in some places and the cost is very high. In order to reduce the costs, solar energy can be used

because it is available in all locations and can provide electricity and fuel, the house can provide home lighting lamps and other devices using the energy used. But the question is cooking and heating water heaters: what should one do? It is true to fix such problems using solar cookers and water heaters.

Solar Home Energy:

A smooth photovoltaic building worn and became one of the most famous houses. It is more widely used in areas where there is no electrical grid. Photovoltaic panels are installed on the surface or walls for sunlight. Solar power is produced at the same location and can also provide additional energy. This technology is cheaper and promising and can produce more power for home. The following figure is a model configured to refer to buildings with photovoltaic power. For areas where electricity grids are not very useful, they help the region supply the least electricity problems. Ventilation systems for agricultural applications so, the application of photovoltaics can be the best option because if the grid power is disrupted, the photovoltaic will save energy, and therefore potentially save thousands of birds. Direct current motors can also work directly using photovoltaic power and eliminate the use of expensive reflector. The Taiwanese government increases the benefits for livestock farmers who use solar power to generate electricity specifically for pig farms to attract other farmers to build solar farms. A final report on Delaware's poultry farms reveals the economic and technical aspects of the application of PV for poultry husbandry. It also notes that PV provides additional benefits, such as supply security, economic and environmental advantages over grid electricity supply and traditional energy sources.

Water heaters are one of the most popular solar applications for household, industrial and similar solar dryers, water heating systems are also available in natural convection and forced load system, the shape shows one water heater solar water heaters are divided into two categories: direct and indirect. In direct water heaters, water is consumed in the current pool, becomes hot and then is consumed, but in indirect water heater, spent water is used to heat the liquid. The disadvantage of direct solar water heaters is that after a period the collector is banned by a crime.

Solar Agricultural Applications:

Solar energy can provide or complete many agricultural energy requirements. Drying crops and cereals: The use of sun to dry crops and cereals is one of the oldest and most commonly used applications of solar energy. Simplest and lowest cost technique is to allow crops to dry normally in the field,

or spread grain and fruit outside the sun after harvest. The disadvantage of these methods is that crops and cereals. It is exposed to damage from birds, rodents, wind, rain, dust pollution and wind-blown dirt. More complex solar dryers protect grains and fruits, reduce losses, dry faster and more consistently, produce better quality product than outdoor. Promoting sustainable agriculture is one of the United Nations' development goals for achieving food security to meet the growing global demand for food. Because of the critical importance of the agriculture sector, significant technological developments have played a pivotal role in sustainable agriculture by adding value in agricultural products and meeting energy demand from machinery and irrigation. These developments include improved farming practices, agro-processing units, the operation of solar-based machinery and irrigation systems. Furthermore, the emergence of new technologies and climate-smart solutions with low carbon impacts has significantly addressed ever-increasing fuel costs and changing climate needs. Solar irrigation pumps and photovoltaic-based agricultural machinery are a typical example of this. Awareness of these technological developments is essential to overcome energy issues, energy availability for sustainable farming activities at the farm level, and the socio-economic upgrading of the agricultural community to meet future food needs.

Therefore, this research attempts to provide technologies for direct and indirect use of solar energy in the agricultural sector. Typical examples of direct use of solar energy such as greenhouses or tunnel cultivation to grow crops and vegetables and the use of solar dryers to dry agricultural products were discussed comprehensively. Similarly, tube wells, tractors, solar-powered lights, etc., are few important examples of indirect use of solar energy and have also been discussed in this chapter. Indirect use was made possible by converting solar energy into electric energy with the help of photovoltaic devices, called "solar cells." Radio frequency-controlled seed transplant and diffusion machines that provide an environmentally friendly method are also discussed. Furthermore, there is a comprehensive discussion on solar-based technologies in general as well as the regional context, given their possible expansion and addressing expected issues. The use of photovoltaics in agriculture is expected to be a significant contribution in the near future that requires urgent planning of potential benefits and effective use at the farm level. Therefore, coexistence between "agricultural circular cells" will be necessary for developments in agriculture and agro-industry.

Solar Technologies:

Solar technologies are commonly used in simple forms such as drying in the sun and enjoying sunlight since the birth of the Earth, and people use some other simple solar technologies including solar water heating and solar cookers by consuming direct sunlight or solar energy. Since the past few decades, solar energy has been used by converting it into electric energy with the help of devices called solar cells or photovoltaic devices. These devices are now set up in the hope of meeting energy needs and becoming a technical ladder. Another power conversion device is the thermal dual which consists of a pair of semiconducting wires with one connected end and other free ends and when connected, the final side is heated by solar energy more than the appearance of a potential difference across the free ends. Under the normal sunlight efficiency of thermocouples is very low but the concentrated sun energy can increase the heat dual efficiency. Solar cells convert sunlight energy directly into electricity while thermal dual converts heat from sunlight to electricity.

Solar Technologies in Agriculture:

Technology in agricultural farms is changing and improving rapidly. These developments improve agricultural machinery and equipment, farm facilities and buildings, for both crops and animals on farms. We all know that solar energy is the largest and cheapest energy supplier on Earth. Solar energy can easily achieve energy saving and supply on agricultural farms. Many devices and systems that absorb solar energy have been developed and operate in agricultural applications. This includes solar thermal and electrical devices such as solar spraying machine, solar greenhouse heating, solar crop dryers, solar water pumps, livestock ventilation, solar ventilation pumps, and solar electricity.

Solar spraying and seed transplant machines:

Solar pesticide spraying machine is designed for small farmers to improve their productivity. They can easily carry and handle these machines using rechargeable batteries and direct solar lighting options. Pesticide spraying activity is mostly done in the day, so these spraying machines can be used by directly capturing solar energy, preventing the installation of batteries in these machines. Solar-powered seed diffuser and transplant machines offer a simple and convenient way to spread and plant seeds in small fields, as well as in those areas where traditional machines are not available. It will be most beneficial for small farmers and the agricultural community. Thus, spraying solar-powered robotic pesticides and seed transplants will make it easier for farmers to leave heavy endurance machines, and will allow easy access to work in remote areas of the

countryside where public machinery is not readily available. Today, radio-controlled solar transplants are designed to provide farmers with eco-friendly seed planting and diffusion. These solar seeding machines work with the help of the blue tooth, which sow's seeds at a controlled depth and distance between seeds.

Solar Crops Drying:

One of the applications of solar energy in agriculture is a solar drying system that depends on a variety of options. Solar dryers are available in different shapes and structures. Different types of solar dryer are available for different applications, which are used to dry agricultural products such as potatoes, cereals, carrots and mushrooms. Depending on the order of heating active dryers and negative dryers are two main types. In active solar dryers, external means are used to convey solar heat, such as pumps and fans are used to flow solar energy from solar complex to crop drying beds, while negative dryer heat is circulated naturally by wind pressure, buoyancy force or combining these two.

Solar greenhouse heating:

In general, greenhouses around the world use sunlight to meet their lighting needs for photosynthesis, but they are not ready to use the sun for heat. Instead, they rely on traditional energy sources, such as oil or gas, to produce greenhouse temperatures for the growth of winter plants. However, solar-powered greenhouses were built to use solar energy for heating and lighting. Also, these greenhouses reduce damage from excess solar energy from the ocean to the greenhouse during hot sunny periods.

Solar Powered Tractors:

Tractor is an essential mechanism in agriculture, making agriculture much easier and increasing crop yields and production. The tractor transformed agriculture into agricultural farming by performing a lot of functions with the help of a variety of tools and equipment. Usually, tractors consume oil for its operation and operation, increasing the planting budget that also causes pollution in the atmosphere by producing carbon dioxide during combustion. Solar-powered tractors have become a good option that can work directly under the sun by consuming solar energy through the daytime photovoltaic system and can also continue working at night with the help of using energy stored in batteries. Although solar-powered tractors are in the initial development phase, the results are hopeful for a bright agricultural future.

Solar machinery and tractors:

Tractor is the most important and important technology and central machinery in any agricultural farm. The tractor provides the ability to perform many tasks, including ploughing, seeding, planting, fertilization, spraying, planting and harvesting on farms. Jars are also used to transport crops and materials in farms and the market. Modern agricultural developments and increased production can be done to meet the needs of the best human agriculture using multifunctional compact tractors. Tractors have a significant social and economic impact on agricultural activities.

Solar Agricultural Applications:

Solar energy can provide or complete many agricultural energy requirements. The use of sun to dry crops and cereals is one of the oldest crops and is widely used. The simplest and least expensive technique is to allow crops to dry naturally in the field, or spread grain and fruit in the sun after harvest. The disadvantage of these roads is that crops and cereals are damaged by birds, rodents, wind, rain and pollution by wind blowing, dust and soil. The basic components of the solar dryer are container or shed, covered drying trays or shelves, and solar collector. In the arid hot climate, collector may not be necessary. The south side of the case itself can be glazed to allow the sun to dry physically. The collector can be as simple as a glazed box inside dark color to Absorbing solar energy that heats the air. Heated air in the solar collector also moves by natural load or forcing a fan to do so, through the material that is dried.

There are a relatively small number of large solar crop dryers around the world. Because the cost of solar collector can be high, drying rates are not as manageable as they are with natural gas or propane-powered dryers. Using the collector at other times of the year, such as the heating farm building, has made the solar dryer more cost-effective. It is possible to make small and very low-cost dryers from simple materials. These systems can be useful for drying vegetables and home-use fruits. Livestock operations and diaries often have significant air and water heating needs. Modern pig and poultry farms raise animals in enclosed buildings, where it is necessary to carefully control the temperature and air quality to increase the health and growth of animals. These facilities need to regularly replace indoor air to remove toxic moisture gases, dust. Heating this air, when necessary, requires a large amount of energy. With proper planning and design the solar air/space heaters can be integrated into the farm buildings to heat the upcoming fresh air beforehand.

There are four basic types of solar water heater systems available. These systems share three similarities: glass (typical glass) on a dark surface to collect solar heat; one or two tanks for hot water storage; The plumbing associated with or without pumps to rotate heat transfer liquid from the tank to collectors and back again.

- the discharge of water pumping systems from the hot water tank through the solar collector,
- Where the sun heats it and returns to the tank. The valves automatically drain when sensors detect freezing temperatures.
- Rear drainage systems use a separate plumbing line filled with liquids to collect heat from the sun. These systems work strictly on gravity. When the temperature is close it freezes, the pump closes and the transport liquid returns to the tank solar store.
- Closed loop anti-freeze systems depend on anti-freeze solution to operate through cold and winter months. Anti-freezing solutions are separated from household water by double-walled thermal exchange.

Baking box batch systems are passive systems in which the storage tank also acts as a collector. One or two water reservoirs, painted black, are placed in a well-insulated box or other barn with a southern wall made of plastic or transparent glass with its address at the right angle. This allows the sun to shine directly on the tank and heat a batch of water. Isolated cover can provide freeze protection.

Solar Benefits:

The sun is the ultimate and unlimited source of energy. Solar energy is a renewable energy source emitted from the sun in the form of heat and light. This solar energy can be used with the help of advances in technology. This sunlight energy can be used with the help of solar panels, solar PV power, solar heating and solar cooking. The combination of solar energy and agriculture can help achieve sustainable agriculture. Many countries are currently implementing solar energy in agriculture to boost agriculture's inclusion.

Agriculture Technologies:

Solar Mower:

Many farmers use solar-powered mowers to cut crops or herbs just like regular grass cutters. Solar energy overcomes diesel mowers because they are harmful to the environment. The solar grass cutter consists of a solar panel used for battery charging and electrical circuits.

Solar Dryers:

Farmers use diesel or gas dryers to dry their crops so they can be packaged and sent to storage facilities. Few farmers use solar energy to dry crops after harvesting, this process is cost-effective as well as environmentally friendly. The solar dryer consists of solar collector, drying trails and shed. Farmers implement a solar-powered fan that blows hot air that circulates over the fan leading to dry crops.

Solar Tractors:

Tractors can be seen on each farm and are considered the farmer's basic equipment. Tractors usually operate with diesel or gas; Some scientists and researchers have implemented solar panels on top of the tractors so that these panels can receive maximum sunlight so that these heavy tractors can run on solar power. Solar panels associated with lithium battery mix change the entire field of agriculture. These tractors can be powered directly or indirectly by solar energy, few tractors operate on lithium batteries and these batteries are charged by solar panels, few tractors are carried out with solar panels on top and these solar panels power the tractor or charge the batteries while running the tractor.

Solar greenhouses:

Greenhouses are used in different farms and these homes require heat for crops. Solar panels implemented with these homes provide sufficient heat to improve crops and increase productivity growth. These green houses are used in winter so that crops can be grown in extreme weather conditions. These solar greenhouses work on solar energy that provides solar heaters for lightning and heating. These greenhouses help farmers grow fruits and vegetables in the season by maintaining the desired temperature.

Solar and space water heaters:

Farmers use space and water heaters to provide livestock with desired temperatures. These heaters use solar energy to turn sunlight into thermal energy. The poultry and pig industry has many problems in providing heat and food as well as to maintain the income of the livestock industry. This solar water and space heater are needed to replace harmful dust and toxic gases with crops and plants. These heaters can also be used to sanitize or clean equipment in different areas.

Solar Electric Fences:

Crops and plants are mostly destroyed by animals such as cows, elephants, buffalo, etc., farmers around the world use some or other types of fence to secure their yields. The solar-powered fence consists of solar panels that provide electricity to the wires and when the animal or any living object touches the fence, it gives them the electric shock that prevents crops.

Solar Panels:

Solar panels consist of solar cells consisting of semiconductor materials. The main function of these solar cells is to convert the solar energy on which they fall into electricity. Cell count and load classification depend directly on each other. If the load increases, there is a need to increase the amount of solar cells. One of the main disadvantages of these panels is that they need to align the angle of sunlight to generate maximum output.

The importance of renewable energy for farms:

By comparing the efficiency of solar panel system generator with diesel generator, the possibility of farmers migrating from fossil fuels to renewable green energy sources has been explored, which could improve the quality and quantity of food processing for many types of farms. It can also provide energy for the operation of agricultural machinery, such as road transport, only a small number of agro-industry machine operators are aware of the challenges associated with fossil fuel depletion and global warming. This is the root cause of the climate change crisis.

Factors affecting solar energy performance:

The efficiency of solar panel production is influenced by several factors, such as:

- Loading resistance: the voltage by which the plate can operate is determined. The panel performance depends on the load strength, so the control system that monitors the maximum power point should balance the load voltage with the current operating specifications.
- The intensity of sunlight: the solar panel stream equals solar radiation.
- Cell temperature: The plate works less effectively, and the voltage decreases as the cell warms above the normal production temperature of 25 ° C. Thus, heat can be considered in response to electron motion. Panel at 80-90 ° C, for every temperature increase, lose 0.5% in efficiency. Therefore, to build the installation scheme to remove heat, the air flow above and below the plate is necessary to remove heat.

- Shading: Usually, precise shading of photovoltaic panels led to a significant reduction in production. It also supports that variables such as solar radiation and cell temperature affect the ability of the solar panel device. In addition to these factors, other contributing factors, including the robustness of other elements and other environmental factors, affect their efficiency. The local ecosystem refers to the environment in which human actions, including the urban environment, vegetation forms and weather patterns, have been directly or indirectly developed. All these factors will technically affect solar panel efficiency by reducing power production, from 2-50% in various fields.

Advantages and disadvantages of solar panel system in agricultural farms:

Advantages: There are many advantages to using renewable energy technology, such as solar panel water pumping system.

- No petrol prices
- Lack of noise and air waste,
- Lower maintenance costs and solar panel parts are cheaper than having a diesel engine generator.
- Safe, abundant and usable.

Can be used in a variety of sectors, including agriculture.

The use of solar panels in agriculture will address the problems associated with increasing population and lack of land, while at the same time encouraging the production of controlled agricultural activities to increase farmers' economic incomes and promote the climate by reducing atmospheric CO2 emissions

Defects: Installation and initial setting costs are the main defects of the use of solar panel systems. The current cost of photovoltaic electricity is commensurate with conventional power plants, as reported in the World Energy Assessment Report, a major obstacle to the widespread deployment of photovoltaic power. There are also many questions associated with greenhouse production, such as: the interior of climate management. Change the decision on supply control. The need to calibrate the system to change environmental conditions.

Conclusion:

It can be said from the literature that solar energy can provide a lasting solution to many of the problems facing the planet today, including, inter alia, climate change, energy scarcity, atmospheric conservation and drought. As this

article shows, most farmers in Africa on a continent have less acceptance of solar systems for agriculture. The African continent also enjoys an increasing radiation of sunshine and has a large area in the world.

Recommendations:

There are many recommendations or proposals to enhance the economic and environmental performance of solar panel systems in agriculture. The following guidelines are summarized below:

- Cell and unit transmission performance can be increased to reduce kilowatt-hour cost.
- It is important to use semi-transparent PVPs to improve the transfer of light to the crop.
- The use of concentrated cells in sunny areas is required to increase the long-term transformation performance of the device.
- In order to reduce the cost of manufacturing solar cells and components, the amount of materials needed to make cells can be limited.
- It must have a high framework of about 5 meters with solar panels along with different designs of solar panels to create shades on the planted ground.

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