

Application of Renewable Energy Source for Farming Sector in India

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ABSTRACT:

India is a country that has 60 percent of its population dependent on Agriculture or other farm related activities. This sector is highly energy intensive and a large portion of the farmers income goes into various activities at the farm, which involves outflow of income in the energy requirement fulfillment. If this sector adopts renewable energy for its activities it can become a win-win situation for both the farmer and the energy sector. There are various applications of energy in a farm and to support these there are also various solar aided technologies available to fulfill these requirements. Through solar energy a farm owner can bring down the electricity bill along with bill of liquid or gas fuels. The solar photovoltaic technology can be adopted for power generation. Solar thermal technology can be adopted for heating and cooling requirements at the farm.

Keywords : Solar Energy, Agriculture, renewable energy

INTRODUCTION

Solar energy is a renewable and sustainable source of energy. It plays a vital role in creating a clean and energy efficient future. Amongst the various benefits of solar energy, the added advantages are it is free of cost, inexhaustible, nonpolluting and a great cost benefit to the user. The economic growth of any country is directly affected by its energy sector. When a farm uses electricity, which is generated elsewhere usually through burning some type of fossil fuel as nowadays 85 to 90 % of world's primary energy is produced from fossil fuels. Other pollutants such as carbon dioxide, Sulphur dioxide and nitrogen dioxide are released into the atmosphere. These gases are highly polluting and create a greenhouse effect in the earth's atmosphere. By using solar aided technologies, we can reduce emission of these polluting gases to a great extent. The emission of these pollutants could significantly

alter the earth's environment thereby resulting to global warming.

Similarly, when a farm uses diesel, wood biomass or coal for its heating applications similar polluting gases are released which again add to the dangers of environmental pollution along with great health risks to the user. Solar energy has great potential to be used in agriculture sector of our country. The major areas where solar energy can be utilized are power generations through photovoltaic technology. The power generated can be utilized for running pump set, lighting of electric bulbs and other appliances. Farm house appliances such as geysers, refrigerators and others can also run on this power. Electric fencing can also be provided around the farm using this technology. The other areas where solar energy can be utilized is the thermal energy production. Steam can be generated for various end uses such as boiling, cooking or heating required for various works at the farm. Solar energy is the most befitting choice in comparison to other renewable energy sources as most parts of India lie within the 300 sunny days range and its availability is in abundance for appropriate utilization.

Solar Energy Technology Applications In Agriculture

Solar technologies can be broadly categorized in two parts. One part is power generation which is electricity and the second part is thermal energy generation to generate electricity. There are various technologies that are available to generate electricity.

PHOTOVOLTIC TECHNOLOGY

Solar photovoltaic cells have been in use for power generation since late 1950s when these were used in space satellites for electricity generation. To produce electricity through this technology flat panels of photovoltaic cells are installed in shadow free area where sunlight falls

directly on these panels. The solar cells in the panels are semi-conductors which convert the sun's heat energy to electric energy. The benefit of this technology is that it can generate electricity even at lower temperature as well. The electricity produced can be used in various ways such as captive energy (off grid), through power storage (battery feeding), grid feeding (electricity generated is transmitted to dictum grid). Through this technology farms that are in remote areas with no electricity or those which wish to remain off grid can greatly benefit. This power generated has various applications in a farm.

SOLAR WATER PUMPS: The pumps are designed in such way that they are compatible with solar power generated. These pumps are used for irrigation, domestic use in fish farm, cattle barn and poultry. These pumps have come in various power capacities for all different requirements of the farm. A solar water pumping system is very cost-effective method of water pumping. When a farm is sustaining itself off grid a solar water pump that draws its energy requirement through photovoltaic power generation system is very useful for the agricultural practices as well as domestic purposes. A solar water pumping system that includes of 128watt PV array and submersible pump can provide 750-1000 gallons of water per day from a 200 foot bore well (EREC,2003)

SOLAR POLY HOUSE: Now a days Poly house farming is being widely practiced in agriculture. This is so in order to get maximum and good quality crops in minimum space. In this process atmospheric conditions are created through mechanisation to protect the yield. All this activity such as airflow control, drip irrigation system, moisture maintenance mist pumps and lighting etc requires large volume of electrical energy. This energy requirement can be supplemented through the use of power generated by the help of photovoltaic technology.

DOMESTIC USAGE:In order to make the power generated through solar energy available during non-sunny days or hours inverters and batteries are provided for energy storage. Through this all the equipment's in a farmer's houses such as lights, fans, refrigerators, television sets and other appliances can function. Thereby making the house totally an off-grid house.

SOLAR THERMAL TECHNOLOGY: Through this technology the heat from the sun is directly used for various applications by using different equipment's. This can supplement many farm

energy requirements . Following are the processes where heat energy is required along with a brief description regarding the equipment that can be helpful for such requirements.

AGROPRODUCE AND GRAIN DRYING USING SOLAR DRYER:

For this purpose the farmer after harvesting the crops allows it to dry under open sun in order to minimize the moisture content of various grain crops. This is necessary for storing the grains for a longer period as the moisture will not allow extended period of storage. While in open the crop is exposed to and may get damaged by rains, windblown dust, dirt and other impurities, contamination through insects. These are all losses to the farmer. In order to protect crops from such losses, the farmer can use solar dryer. In a solar dryer heat from sun is harnessed in evacuated glass tubes where the temperature further rises due to concentration and this heat is blown into a chamber attached with the tubes by using a pump. The objective of a solar dryer is to provide ample heat i.e. more than ambient heat under given humidity. The solar dryer along with space heating system designed and developed by national institute of solar energy. The solar dryer increases the vapour pressure of the moisture confined within the product and decreases the relative humidity of the drying air so that the moisture carrying capacity of the air can be increased. Dehydrators can be classified according to their operating temperatures: Low temperature dehydrator, Moderate temperature dehydrator and High temperature dehydrator. A farmer may choose the type and technology as per his requirements depending upon the farm's produce volume. In addition, if the produce is in large volume then either the collector area of the dehydrator may be increased or a high temperature dehydrator with greater air flow and lesser time can also be used. solar dryer with Evacuated Tube Collector (ETC) is one of the best types of drying techniques to dry fruits and vegetables. It is also observed that most of the dryers use only flat plate collectors but ETC has many advantages as compare to flat plate collectors such as high efficiency and better performance even in bad weather.

SOLAR WATER HEATING SYSTEM: Now a day's solar water heaters are being widely used for domestic hot water requirements such as bathing, cooking, dish washing, laundry etc. The requirement of hot water in farming practices such as dairy farming, fish farming, poultry farming is also very huge. This requirement can also be met through use of solar technology. A field of

parabolic concentrators such as turf technology or dish type parabolic concentrator can be installed and through this hot water is obtained. This hot water can be further taken to its application points. These points can be for the domestic purpose or in farm applications.

SPACE HEATING: During winter season temperatures in poultry coups, fish ponds and cattle pens has to be maintained in order to protect the live stock from extreme cold. This practice involves high usage of electricity or fossil fuel is burnt in order to generate heat in these holding facilities. This use of electricity of fuels can be replaced by running heat radiators operating on hot water. In this system hot water obtained through a solar field can be run through a coil radiator in these holding areas and temperature in these can be maintained. This will provide a great saving on fuel bills to the farmers.

SOLAR STEAM COOKING SYSTEM: Now a days we see the new generation in an agriculturist family is gaining related education from various agricultural universities. This is because the young generation of today understands that without incorporating new techniques of farming and without adopting modern technologies for value addition in farm produce, it is becoming more difficult to sustain in this profession. Due to this we also witness rise in the field of food processing industry, wherein the form of agriculture produce is changed to enhance its usage in terms of the produce's shelf life. This can be explained using examples such as fruits being dried, jams made of fruits, juices and fruits concentrate. Similarly, vegetables are marketed as dried, semi cooked form, pickles, ketchups. Vegetables are also marketed in form of chips and powders. For this the vegetables and fruits are either boiled, steamed or cooked. While doing this process lot of energy is required which may be inform of electricity or use of fossil fuel. These fossil fuels have great cost which impacts the profit margin in the business. As the cost of fuel involved in the process is close to 35 to 40 percent. This can be brought down considerably if solar steam cooking system is adopted and integrated in the production process. In solar steam cooking system large parabolic dish are fixed in series which act as the collector surface. The sun light falling on the collector surface is reflected on to receiver placed in front of

the dish. As there are multiple concentrators in series similarly there are multiple receivers. These receivers are also connected in series to one another through one large diameter pipeline. This pipeline can be fed with water, oil or air. These three are called the medium.

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