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ARTICLE

Renewable energy: A game changer for India's agricultural sector

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Abstract : Agriculture is the sole provider of human food. Most farm machines are driven by fossil fuels, which contribute to greenhouse gas emissions and, in turn, accelerate climate change. Such environmental damage can be mitigated by the promotion of renewable resources such as solar, wind, biomass, tidal, geo-thermal, small-scale hydro, biofuels and wave-generated power. These renewable resources have a huge potential for the agriculture industry. The farmers should be encouraged by subsidies to use renewable energy technology. The concept of sustainable agriculture lies on a delicate balance of maximizing crop productivity and maintaining economic stability, while minimizing the utilization of finite natural resources and detrimental environmental impacts. This article explains in detail the role of renewable energy in farming by economic development and jobs in manufacturing, installation and most important benefit is increase of farmer's income.

Key Words : The environmental benefits of renewable energy, Natural sources, Increase - farmer's income

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INTRODUCTION

Renewable energy is useful for bright future of India. Four fact sheets on renewable energy and agriculture are now available for farmers and clean energy advocates, giving valuable information on renewable energy technologies and the rural economic development opportunities they could create. An increasing number of farmers and ranchers are now adding to their incomes by harvesting the wind that blows across their land to make electricity. And new options are becoming available.

Renewable energy and farming are a winning combination. Wind, solar and biomass energy can be harvested forever, providing farmers with a long-term source of income. Renewable energy can be used on the farm to replace other fuels or sold as a "cash crop."

Renewable energy can also help reduce pollution, global warming, and dependence on imported fuels. This information describes renewable energy options for farmers and ranchers and how they can help make renewable a growing source of energy and rural income in the India.

Solar energy:

The amount of energy from the sun that reaches Earth each day is enormous. All the energy stored in Earth's reserves of coal, oil and natural gas is equal to the energy from only 20 days of sunshine. While desert areas such as Kutch and Rajasthan get more sun than

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other parts of the India, most areas receive enough sunshine to make solar energy practical. Solar energy can be used in agriculture in a number of ways, saving money, increasing self-reliance and reducing pollution. Solar energy can cut a farm's electricity and heating bills. Solar heat collectors can be used to dry crops and warm homes, livestock buildings and greenhouses. Solar water heaters can provide hot water for dairy operations, pen cleaning and homes. Photovoltaics (solar electric panels) can power farm operations and remote water pumps, lights and electric fences. Buildings and barns can be renovated to capture natural daylight, instead of using electric lights. Solar power is often less expensive than extending power lines.

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Puttingthe sun to work on the farm:

Solar energy can be used in agriculture in a number of ways, saving money, increasing self-reliance and reducing pollution.

Solar power controls this irrigation system:

One of the simplest ways to use solar energy is to design or renovate buildings and barns to use natural daylight instead of electric lights. Dairy operations using "long day" lighting to increase production can save money with skylights and other sun-lighting options.

The sun's heat can also be used to warm homes and livestock buildings. In confinement operations, a steady supply of fresh air is critical to maintaining animal health, but this can result in substantial heating bills. "Active" solar heating systems, which use heat boxes and fans, can warm the air, saving on fuel. "Passive" solar designs, where the building is designed to take advantage of the sun automatically, are often the most cost-effective approach.

Solar water heaters can provide low- to medium-temperature hot water for pen cleaning. Dairy operations can use solar heated water to clean equipment and to warm and stimulate cows' udders. For homes or farms with electric or propane water heaters, solar collectors can save hundreds of rupees per year.

Crop and grain drying:

Using the sun to dry crops and grain is one of the oldest applications of solar energy. Solar drying equipment can dry crops faster and more evenly than leaving them in the field after harvest, with the added advantage of avoiding damage by birds, pests and weather.

A typical solar dryer consists of an enclosure or shed, screened drying trays or racks and a solar collector. In a simple design, south-facing windows let sun into the shed. Other designs use a dark-colored box with a glass cover to capture the heat. Natural convection or a fan moves hot air through the crops to dry them.

While the cost of a solar collector can be high, using the collector to heat other buildings at other times of the year makes it more cost-effective. And small, low-cost dryers are easy to make out of simple materials.

At one installation in Switzerland, a farmer added a dark metal roof to a hay barn to serve as a solar collector, with a fan to draw the hot air through the barn. This eliminated the need for an oil or electric heater, saving $4,100 per year in reduced energy and maintenance costs. Moreover, since the farmer did the work himself, the up-front cost was only one-eighth of what an oil heater would have cost.

If a farm has a crop dryer already in place, it may make sense to install a low-cost solar heater to supplement a propane or oil heater. The farmer would save on fuel costs while still being able to dry crops in cloudy weather.

Greenhouse heating:

Commercial greenhouses often rely on the sun for lighting, but on gas or oil heaters to maintain constant temperatures. A solar greenhouse uses building materials to collect and store solar energy as heat. Insulation retains the heat for use during the night and on cloudy days. To capture the most sunlight, a solar greenhouse generally faces south, while its northern side is well insulated, with few or no windows. A gas or oil heater may be used as a backup.

Remote electricity supply:

Sunlight can also generate electricity. Photovoltaic (PV) panels are often a cheaper option than new electric lines for providing power to remote locations. And because they require no fuel and have no moving parts, they are more convenient to operate and maintain than diesel or gasoline generators. In some areas, the distance from a power source at which PV becomes more

economical than new transformers and electric lines is surprisingly short - often as little as 50 feet. PV systems are a highly reliable and low-maintenance option for electric fences, lights and water pumps. Although current prices for solar panels make them too expensive for most crop irrigation systems, photovoltaic systems are economical for remote livestock water supply, pond aeration and small irrigation systems. In addition, the cost of PV is projected to decline significantly over time, which will make more applications cost-effective.

Biomass energy:

Biomass energy is produced from plants and organic wastes - everything from crops, trees and crop residues to manure. Crops grown for energy could be produced in large quantities, just as food crops are. While corn is currently the most widely used energy crop, native prairie grasses such as switchgrass or fast-growing trees such as poplar and willow are likely to become the most popular in the future. These perennial crops require less maintenance and fewer inputs than do annual row crops such as corn, so they are cheaper and more sustainable to produce.

Crops and biomass wastes can be converted to energy on the farm or sold to energy companies that produce fuel for cars and tractors and heat and power for homes and businesses. According to the Indian ministry of power use of biomass energy could provide as much as Many more rupies new income for farmers and rural communities and reduce global warming. Biomass energy has the potential to supply a significant portion of America's energy needs, while revitalizing rural economies, increasing energy independence and reducing pollution. Farmers would gain a valuable new outlet for their products. Rural communities could become entirely self-sufficient when it comes to energy, using locally grown crops and residues to fuel cars and tractors and to heat and power homes and buildings.

Opportunities for biomass energy are growing.A number of states also provide incentives for biomass energy.

Biomass energy sources on the farm:

Biomass residues:

Agricultural activities generate large amounts of biomass residues. While most crop residues are left in the field to reduce erosion and recycle nutrients back into the soil, some could be used to produce energy without harming the soil. Other wastes such as whey from cheese production and manure from livestock operations can also be profitably used to produce energy while reducing disposal costs and pollution.

Energy crops:

Crops grown for energy could be produced in large quantities, just as food crops are. While corn is currently the most widely used energy crop, native trees and grasses are likely to become the most popular in the future. These perennial crops require less maintenance and fewer inputs than do annual row crops, so they are cheaper and more sustainable to produce.

Grasses:

Switchgrass appears to be the most promising herbaceous energy crop. It produces high yields and can be harvested annually for several years before replanting. Other native varieties that grow quickly, such as big bluestem,and wheat grass, could also be profitable.

Trees:

Some fast-growing trees make excellent energy crops, since they grow back repeatedly after being cut off close to the ground. These short-rotation woody crops can grow to 40 feet in less than eight years and can be harvested for 10 to 20 years before replanting.

Oil plants

Oil from plants such as soybeans and sunflowers can be used to make fuel. Like corn, however, these plants require more intensive management than other energy crops.

Protecting the land:

With thoughtful practice and management, perennial energy crops can improve the soil quality of land that has been overused for annual row crops. The deep roots of energy crops enhance the structure of the soil and increase its organic content. Since tilling occurs infrequently, the soil suffers little physical damage from machinery. One study estimates that converting a corn farm of average size to switchgrass could save 66 truckloads of soil from erosion each year.

Perennial energy crops need considerably less fertilizer, pesticide, herbicide and fungicide than annual row crops. Reduced chemical use helps protect ground and surface water from poisons and excessive aquatic plant growth. Furthermore, deep-rooted energy crops can serve as filters to protect waterways from chemical runoff from other fields and prevent sedimentation caused by erosion.

Finally, perennial energy crops can create more diverse habitats than annual row crops, attracting a wider variety of species such as birds, pollinators and other beneficial insects, and supporting larger populations. Furthermore, the long harvest window for energy crops enables farmers to avoid nesting or breeding seasons.

Converting biomass to energy:

Most biomass is converted to energy the same way it always has been by burning it. The heat can be used directly for heating buildings, crop drying, dairy operations and industrial processes. It can also be used to produce steam and generate electricity. For example, many electric generators and businesses burn biomass by itself or with other fuels in conventional power plants.

Biomass can also be converted into liquids or gases to produce electricity or transportation fuels. Ethanol is typically produced through fermentation and distillation, in a process much like that used to make beer. Soybean and canola oils can be chemically converted into a liquid fuel called biodiesel. These fuels can be used in conventional engines with little, if any, modification.

Biomass can be converted into a gas by heating it under pressure and without oxygen in a "gasifier." Manure too can be converted using a digester. The gas can then be burned to produce heat, steam, or electricity.

Other biogas applications are still in development, but show great potential. One promising technology is direct combustion in an advanced gas turbine to run a generator and produce electricity. This process is twice as efficient as simply burning raw biomass to produce electricity from steam. Researchers are also developing small, high-speed generators to run on biogas. These "microturbines" have no more than three moving parts and generate as little as 30 kilowatts, which could power a medium-sized farm. Several companies are also considering converting gasified biomass into ethanol as a less expensive alternative to fermentation.

Alternatively, biogas can be processed into hydrogen or methanol, which can then be chemically converted to electricity in a highly efficient fuel cell. Fuel cells can be large enough to power an entire farm or small enough to power a car or tractor.

An innovative experiment in Missouri provides one example of the possibilities. Corn is used to produce ethanol, and the waste from the process is fed to cows for dairy production. Cow manure fertilizes the corn and is also run through a digester to produce biogas. A fuel cell efficiently converts the biogas into electricity to run the operation. The end products are ethanol, electricity, and milk. All the waste products are used within the project to lower costs.

Wind power:

Farms have long used wind power to pump water and generate electricity. Recently, wind developers have installed large wind turbines on farms and ranches in a number of states to provide power to electric companies and consumers. Where there are strong winds. farmers in many more states could benefit, since some of the best wind resources are found on agricultural lands.

How the wind can help farmers:

Farmers and ranchers are in a unique position to benefit from the growth in the wind industry. To tap this market, farmers can lease land to wind developers, use the wind to generate power for their farms, or become wind power producers themselves.

Conclusion:

Generating energy that produces no greenhouse gas emissions from fossil fuels and reduces some types of air pollution.

Diversifying energy supply and reducing dependence on imported fuels.

Creating economic development and jobs in manufacturing, installation, and most important benefit is increase of farmer's income.

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