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Use of Non-Conventional Energy Sources in Micro-Irrigation

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INTRODUCTION

The growing demands of energy and water particularly in the present agricultural sector have necessitated the adoption of reliable, environment-friendly and water saving technologies so as to combat against the energy crisis and water stress in near future. It has been established that conventional sources of energy like oil, gas, coal etc. will not be able to provide the desired levels of energy security to mankind in foreseeable future. Hence, there is a global consensus for exploitation and utilization of different renewable energy resources. Renewable energy represents an area of tremendous opportunity for our state Odisha as it has been endowed with plenty of renewable energy resources from the point of view of its geographical location. Development of conventional forms of energy for meeting the growing energy needs of society at a reasonable cost is the responsibility of the Government. However, limited fossil fuel resources and associated environmental problems have emphasized the need for new sustainable energy supply options. We are still heavily depending on coal and oil for meeting our energy demand which contributes to smog, acid rain and greenhouse gases' emission. Last 25 years has been a period of intense activities related to research, development, production of alternate sources of energy with a view to achieve energy security and environmental protection. Though major energy sources for electrical power are coal and natural gas, development and promotion of non-conventional sources of energy such as solar, wind and bio-energy, are also getting sustained attention now-a-days. Sustainable sources of energy in agricultural sector are also presently the urgent need of the hour in order to attain assured irrigation and to achieve food security for the fast growing population of our nation. Hence popularization and approach for switching over slowly from conventional to non-conventional sources of energy should be the present day's strategy of the society so far as the economic feasibility, social desirability and environmental soundness are concerned. In this paper, the use of some non-conventional sources of energy particularly in the agricultural activities has been discussed briefly in order to provide the appropriate insights among the farming community to adopt with highly reliable, non-polluting and naturally available energy sources for overall sustainable development.

SOLAR WATER PUMPING

Solar photo voltaic water pumping may be adopted on an increasing scale where other energy sources are not available. Electrical and diesel powered water pumping systems are now-a-days widely used for irrigation applications. The continuous exhaustion of conventional energy sources and their environmental impacts have created an interest in choosing solar photo-voltaic pumping system in a sustainable manner. Farmers are still using hand pumps for irrigating small patch of land. Electric and diesel operated pump sets are mostly used for lifting water from dug well, bore well and other irrigation systems. Lifting of water by hand pump

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is a most tedious and labour consuming operation. Similarly, non availability and erratic supply of grid connected electricity in the remote areas and rising cost of diesel day by day necessitate the search of a reliable source of energy for assured irrigation. Installation of electric pump sets is not at all possible at most of the locations as the agricultural fields are far away from the electric grid station. In addition, the electric tariff is increasing in every year and thus increasing the cost of water pumping operation. Further, the repair and maintenance cost of electric motor operated pump sets is generally more than that of solar photo voltaic water pumping system. When not much research work was conducted on solar photo voltaic water pumping system, then, diesel pumping system was very popular among the farming community due to its low cost and portability. During this time, the diesel cost was also cheaper. But it caused environmental pollution and global warming by releasing a considerable amount of CO_2 into the atmosphere. The repair and maintenance cost of diesel pump set is also more than that of solar photo voltaic water pumping system. Hence, solar photo voltaic water pumping system is today a superior option left for the farming community as its pumping cost is cheaper as compared to electric and diesel pump sets. Moreover, the risk of environmental pollution is less and its repair and maintenance cost is very low. It can be installed at any location as per the desire of the farmers as solar energy is available profusely and free of cost in the nature.

BIOGAS TECHNOLOGY

Energy is an indispensable part of modern society and can serve as one of the most important indicators of socio-economic development. Despite advancements in technology, however, majority of people, primarily in the rural areas still continue to meet their energy needs for cooking through traditional means by burning biomass resources (i.e., firewood, crop residues and animal dung) in the most inefficient conventional cook stoves. Such practices are known to be the source of significant environmental, social, economic and public health issues. To achieve sustainable development in these regions, it is imperative that access to clean and affordable (renewable) energy is made available. In this context, upgrading existing biomass resources (i.e., animal manure, crop residues ,kitchen waste and green wastes) to cleaner and more efficient energy carriers (such as biogas from anaerobic digestion) has unique potential to provide clean and reliable energy, while simultaneously preserving the local and global environment. Hence, the use of existing biomass such as kitchen waste, cattle dung, crop residues, green wastes, and the organic fraction of industrial and municipal wastes for producing clean and renewable energy through anaerobic digestion (AD) both in rural and urban areas would improve human health, the local environment and the socio-economic conditions. AD is a biological process that converts organic matter into energy-rich biogas in the absence of oxygen. Biogas, a mixture primarily consisting of CH_4 and CO_2 can be used as a clean renewable energy source for cooking, generating heat and electricity, and can be upgraded into biomethane for use as a transportation fuel as well. Biogas digestate, a nutrient-rich residue following digestion, can be used as a soil conditioner and/or organic fertilizer. Thus, AD through biogas technology can play a significant role in addressing all of the aforementioned concerns of effective waste management and reliable energy generation along with simultaneously increasing agricultural productivity

SOLAR PHOTOVOLTAIC AND EARTH AIR HEAT EXCHANGER SYSTEM FOR PROTECTED CULTIVATION IN GREENHOUSES

Cultivation of crops is mainly climate dependent in normal conditions. Hence, all vegetables have their own seasons in which they can be grown. But with the adoption of green house technology, farmers can be able to grow various vegetables during off season to fetch a good market value. As there are many small and marginal farmers in Odisha, hence the suitability of a low-tech naturally ventilated greenhouse integrated with solar photovoltaic and earth air heat exchanger system for heating and cooling purposes may be viable proposition for off-season vegetable cultivation in coastal Odisha because of their high demand.

Thermal energy of earth can be extracted though out the year for heating during winter period and cooling during summer season for maintaining required temperature of air inside greenhouse for better growth and yield from the plants.

INCLUSION OF DRIP WATERING SYSTEM IN ZERO ENERGY COOL CHAMBER

A considerable amount of perishable horticultural produce is wasted every year in our state due to lack of appropriate storage facilities. In a tropical climatic condition, maintenance of low temperature is a great problem. Mechanical cooling is energy intensive, expensive and not easy to install and run in rural areas. The zero energy cool chambers (ZECC), utilizing the principle of evaporative cooling is reported to maintain relatively low temperature and high humidity compared to ambient conditions which is required for short term storage of fruits and vegetables. Evaporative cooled storage structures are designed to reduce air temperature in cooling applications through the process of evaporation of water. Odisha ranks second in the country in the production of vegetables and a good amount of fruits are also produced in tribal areas of the State. The wide variation in the coastal environmental conditions poses huge difficulty in storing fresh fruits and vegetables. The majority of farmers is usually small and marginal categories and have poor resource availability. In the absence of proper storage technique, the farmers usually sell their vegetables in the local markets soon after the harvest. This situation very often compels for a distress sale of the products at very low price. Zero energy cool chamber (ZECC) with drip irrigation system through gravity flow is becoming more effective for safe storage of vegetables. Drip irrigation system is used for uniform wetting of sand layer for proper evaporation to occur resulting into decrease in temperature and increase of humidity in zero energy cool chamber. Application of water in the chamber plays a vital role in regulating temperature and RH. Too dry cool chamber will not provide the desired cooling effect and too moist chamber causes unnecessary wastage of water and may sometimes lead to fungus growth. Therefore, it is necessary to find out the optimum quantity of water needed under different situations of seasonal variations to achieve effective performance of the chamber.

ENHANCED DRAFT BULLOCK ENERGY UTILIZATION IN STATIONARY POST HARVEST OPERATIONS

Draft animal power has been traditionally the main source of power in Indian Agriculture. Draft animals are mainly used for tillage operations as well as transport in rural areas through animal cart especially for short distances. The total annual use of bullocks is less than 300 hours in the state of Odisha. But the potential use of bullocks in a year is nearly 800 hours. To enhance the utilization of bullock, there is the need of developing suitable matching implements and bullock power operated stationary machines requiring around 1 hp (0.8 kW) power for doing various post harvest operations like threshing, winnowing, chaff cutting, sugarcane crushing, oil expelling, pulses milling, coconut dehusking, water lifting etc. This would ultimately reduce the economic burden of owning a pair of bullocks and also to decrease the use of non-renewable energies in agricultural post harvest operations. Effective utilization of draft bullock during idle period of the year would provide an additional livelihood for the small and marginal farmers and poses less dependence on grid supply electrical energy.

WIND ENERGY UTILIZATION

Odisha being a coastal state has higher potential for wind energy. Current installation capacity stands at 2.0 MW. Odisha has a wind power potential of 1700MW. The Govt of Odisha is actively pursuing to boost wind power generation in the state, however it has not progressed like other states primarily because Odisha having a huge coal reserve and number of existing and upcoming thermal power plants is becoming a power surplus state. The Orissa Renewable Energy Development Agency (OREDA) will soon come up with two MW capacity wind power generation unit at the industrial town of Daman Jodi in Koraput district. The nodal agency for exploring renewable energy source in the State had identified six places like

Gopalpur and Chhatrapur in Ganjam district, Chandipur in Balasore, Paradip in Jagatsinghpur, Puri and Daman Jodi. Chandipur has the huge potential to exploit the natural resources as the place is assessed to have wind speed. State has a potential to generate 1700 MW power through wind energy.

CONCLUSIONS

There is no doubt that renewable sources of energy would play critical role in ensuring energy security of the country. There is enormous potential to generate energy from renewable sources like solar and wind. The government of India has been very actively involved in promoting renewable energy. It has been observed that the size of wind turbine has increased and the cost of production has decreased. It is high time for the government to develop a comprehensive renewable energy policy and design support schemes for the benefit of the farming community.

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