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Sustainable Agriculture and Sustainable Development through Solar Water Pumps: Sangli District Study

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Abstract

Currently, many modern technologies are being used in the agricultural sector to provide water to agriculture. However, for this, a large amount of electricity is required. Also, diesel is used to run pumps in some places. Running pumps based on electricity and diesel is a more expensive matter. Compared to diesel pumps, using solar pumps is becoming a clean, cheap and environmentally friendly alternative. In the present research paper, what is the exact impact of using solar pumps on agricultural sustainability and development in Sangli district? Is the goal of agricultural sustainability achieved? It has been studied.

Secondary data material has been used in this study. Descriptive and analytical research methods have been chosen for this study. The data of solar pumps in some talukas of Sangli district has been obtained through secondary data. This study has shown that the production capacity of farmers has increased. Due to this, diesel costs and electricity bills have decreased. Also, solar pumps completely reduce carbon emissions. This has helped in improving the standard of living of farmers.

This research concludes that solar pumps are important for sustainable agriculture as well as sustainable development in rural areas.

Keywords: *Solar water pump, sustainable agriculture, sustainable development, Sangli district*

Introduction

India is an agricultural country. The Indian economy mainly depends on agriculture. Most of the people in India earn their livelihood from agriculture. Turmeric, sugarcane, vegetables, grapes, pomegranates, etc. are grown in Sangli district of Maharashtra. Some parts of Sangli district have water while some parts are drought-prone. Currently, water is being supplied to all areas under Mhaishal and many irrigation schemes. To carry that water to the fields Farmers have to spend a lot of money on various diesels. Also, providing water with the help of traditional diesel pumps is more expensive and environmentally dangerous.

Solar water pumps are being used as the best alternative to this. In this, electricity is generated through sunlight and water is transported to the fields through the pump. Due to this, the financial expenditure of farmers on diesel and electricity bills has been reduced. Also, the concept of environmentally friendly sustainable agriculture is becoming possible. Sustainable agriculture is helping to bring about sustainable development. Because solar energy is an inexhaustible energy, that is, renewable energy. Since there is no pollution through solar pumps, it helps to keep the environment clean.

Need for Study:-

Drought conditions arise in some areas of Sangli district. Due to this, people face shortage of drinking water and water is not available for agriculture. In places where water is available, however, the electricity bill and the financial cost of diesel make it unaffordable for farmers. It is also necessary to reduce dependence on electricity. This study is needed for sustainable agriculture and to reduce the amount of pollution in the environment.

The rural economy is strengthened through solar water pumps. This study is needed to know exactly what and how solar water pumps affect sustainable agriculture and sustainable development.

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Objectives

- To know the extent to which solar water pumps have been used in Sangli district.
- To study the impact of solar water pumps on sustainable agriculture.
- Toanalyze the economic, social and environmental impacts of solar water pumps on sustainable development.To identify the problems faced by farmers and suggest policy solutions to them.

Research Methods:-

Scope of the study:-

This study is limited to Sangli district. It focuses on the use of solar water pumps, irrigation systems, sustainable agriculture and sustainable development etc.

Research Type/Methodology:-

Descriptive and analytical methods have been selected for this study. For this, this study has been done on the basis of tables, percentages, analysis and graphs of statistics of Sangli district.

Data:-

This study is based on secondary information. The secondary data used for this study are reports of the Ministry of New and Renewable Energy, reports of the Maharashtra Government Agriculture and Energy Department, annual reports of SangliZillaParishad, various research articles, research essays.

Period:-

The period from 2020 to 2025 has been selected for this study.

Study Area:

Sangli district is located in the western part of Maharashtra. This district is situated on the banks of the Krishna river. Sangli district is located between 16 degrees 45 to 17 degrees 37 north latitude and 73 degrees 41 to 75 degrees 41 east longitude.

Area:-

The total area of the district is approximately 8578 sq km and the total population is around 28 lakhs. (Estimated 2011)

The climate of Sangli is tropical. Main crops grown in Sangli district are turmeric, sugarcane, grapes, pomegranate, vegetables, jowar etc.

Analysis Method:-

Increase in production through solar pumps, economic growth, sustainable agriculture and development are studied in this. Tables, charts and graphs of the data required for this have been drawn. Percentages are also included in it.

Data and Analysis:-

Year Solar	Estimated Solar Pump Installation	Source
2020	300-400 Pump	Agrovan Report
2021-22	1000-2000 pumps	PM-KUSUM scheme.(Expansion- Approx.)
2023	3000 pump	increases application proof
2024	3061 Pumps in operation	Agron-agriculture News
2025	1140 pumps (till February)	Esakal report

Analysis:-

- From 2020 to 2022, solar pumps gradually started being used in agriculture in Sangli district.
- In 2023, the number of solar pumps increased due to government schemes and policies.
- In 2024, 3061 pumps were installed under the PM KusumYojana.
- In the beginning of the year 2025, 1140 pumps were operationalized.

Taluka-wise number of solar pumps (up to 2025)

Taluka	Solar Pump Number	Major Crops
Miraj	1500	Sugarcane,Vegetables
Kavathemankal	1200	Grapes,Pomegranates
Jat	900	Sorghum,Vegetables
Islampur	800	Sugarcane,Soybeans
Khanapur	700	Pomegranates,Vegetables
Walwa	1000	Sugarcane, Grapes

Shirala	500	Rice, pulses
Total	6600+	-

- The lowest number of solar pumps in Sangli district is in Shirala (500) taluka.
- The highest number of solar pumps in Sangli district is in Miraj (1500) taluka.

Impact on Sustainability (Sangli District)

Factors	Diesel Pump Offer	Solar pump usage	Change	source
Annual irrigation costs	25,000-30,000	Near water 0	90% reduction in costs	NABARD 2022
Water use	100%	65-70%	30% savings	IWMI, 2021
Crop production	100%	107-12(Source:- Agriculture Department, SangliZillaParishad, 2025)	7-25% increase	IWMI, 2022
CO2 emissions	2ton/pump/year	5%	100%, reduction	MNRE, 2021

- The annual irrigation cost for a diesel pump is Rs 25 to 30 thousand, while the annual cost for a solar pump is almost zero.
- Solar pumps save 30% water compared to diesel pumps.
- Solar pumps increase crop production by 7-25%.
- Solar pumps have reduced carbon emissions by 100%.

Benefits / Effects of Solar Pumps:-

Energy Saving:-

Compared to diesel and electric pumps, using a solar pump does not cost electricity. There is no need to spend on fuel to run a solar pump. This saves energy and reduces costs.

- In Sangli district, 42 thousand 762 farmers were using diesel pumps in 2020. (CEEW, 2023).
- The annual fuel cost of a diesel pump is on average Rs 25000 to 30000.
- But if you use solar pumps, this cost comes to zero, so the farmers save 20 to 25% of their expenses.
- Improvement in water use efficiency:-
- Based on CEEW, 2023, the water availability index of Sangli district is 0.85 (2021). That means water scarcity is serious.
- Farmers using solar pumps have used 30 to 35% water efficiently.
- Increase in crop diversity and agricultural production:-
- According to IWMI, 2021, the cultivation of grapes, vegetables and pomegranates has increased by 20 to 25% in the fields where solar pumps have been installed in Sangli district.
- Sugarcane crop production has increased by 7 to 8%.
- Sustainable agriculture and environmental impact:-
- ● 2 MW solar projects (2022) have been set up in Jattaluka. (Global Energy Monitor, 2025).
- ● Solar pumping pilot project in Mhaisal Lift Irrigation has benefited 75 thousand hectares of area. (IISD Bulletin, 2025)
- One solar pump reduces carbon emissions by 1.5 to 2 tonnes per year. (MNRE Report).
- Social and Economic Development:-
- According to NABARD 2022, the annual income of farmers using solar pumps has increased by Rs 15,000 to 20,000.
- Along with economic development, social development of farmers has also taken place.
- Government Schemes and Policy Support:-
- Under PM KusumYojana (2020-24), more than 3,000 solar pumps have been approved in Sangli
- district. (MNRE data)
- According to the MahaUrja Report 2022 of the Maharashtra State Government, the solar capacity in Sangli district has increased by 18%.

Government Schemes and Support:-

PradhanMantriKusumYojana (PM Kusum, 2019):- This scheme is a scheme of the Central Government. The main objective of this scheme is to reduce the electricity load for agriculture and provide solar pumps to farmers.

This scheme has three phases:-

1. **KusumYojana A:-** In this, solar energy is generated in the farm.
2. **KusumYojana B:-** In this phase, the old pump is converted into a solar pump.
3. **KusumYojana C:-** In this phase, a new solar pump is installed in the field.

For the PradhanMantriKusumYojana, the government provides subsidy to the farmers. Under the PradhanMantriKusumYojana, 60% subsidy is provided by the government, 30% loan is provided by the bank, and 10% has to be spent by the farmer.

Maharashtra State Government- Solar Pump Scheme:- Solar pumps are provided to the farmers through the Energy Department and the Agriculture Department. The state government has installed solar pumps to the farmers on taluka-wise subsidy in Sangli district. Priority has been given to install maximum solar pumps in the drought-prone areas of Sangli district (Jat, Kavathemankal and Atpadi). These include 3HP, 5HP, 7.5HP and 10 HP capacity pumps.

Results:- Under this scheme, more than 10,000 solar pumps have been installed in the fields in Sangli district in the last 5 years (2018 to 23). (Govt. of Maharashtra, MEDA Report). More than 70% of the farmers have started using solar pumps instead of electric motors.

Challenges :-

- High initial cost :- The farmer has to spend a lot initially to install a solar pump. Despite the government providing subsidy, the farmer has to spend at least Rs. 50,000 to 100,000 initially. This cost is not affordable for small farmers.
- Technical maintenance :- After installing a solar pump in the field, many problems arise such as cleaning the solar panel, changing the battery, repairing the motor, etc. Training is required for this. However, there is a shortage of trainers in rural areas.
- Lack of awareness :- Many farmers in rural areas are not fully aware of government schemes, subsidies, how to apply for solar pumps, and the capacity of the pump. This can lead to abuse by brokers and middlemen who install solar pumps.

Conclusion :-

- Traditional diesel pumps are still widely used in Sangli district.
- Due to the installation of solar pumps, the diesel cost of farmers has been reduced by 70%.
- From an environmental perspective, there is a significant reduction in carbon emissions.
- Increase in farmers' income and crop diversification is possible.
- Solar water pumps are a useful option through solar energy to achieve the goal of sustainable agriculture and sustainable development.

Recommendations:-

- The use of solar water pumps in farms should be increased in Sangli district through government schemes.
- Drip irrigation should be used along with solar irrigation for efficient use of water.
- Training centers should be started for farmers on maintenance and repair of solar water pumps and solar panels.
- Farmers should be made aware by providing information about the benefits of solar water pumps, sustainable agriculture and sustainable development, etc.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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