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Empowering Rural Communities: The Impact of Grid- Connected Floating Solar Power Plants for Farmers.

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ABSTRACT:
Floating solar power plants are emerging as an innovative solution for farmers with limited land and water resources. This study explores the feasibility of an on-grid floating solar power plant for farmers, which offers a sustainable and costeffective source of energy while preserving land area and improving water quality. The study demonstrates that the on-grid floating solar power plant is technically feasible, economically viable, and environmentally beneficial, and has the potential to improve the livelihoods of farmers and contribute to the sustainable development of rural areas.

I. INTRODUCTION:

In India, there is an abundance of solar energy. Since solar energy can be transformed utilising solar panels into electrical energy. Since the demand for electricity is rising and the supply of fossil fuels is diminishing daily. The best way to generate electricity is by turning solar energy into electricity, which is why we must move toward renewable energy sources. Solar energy is free and readily available during the day, which are the main reasons why this is the greatest approach. It also does not contaminate the environment. Land availability, however, is a challenge. So, we are switching to floating solar power.

All fields now use technology. Additionally, farmers are integrating new technologies into their operations. For a range of farming operations, modern farmers needed power. Farmers might generate the energy required for farming and extra energy which we can give to the grid, using the concept of a floating solar power plant. It will be given to the MSCB, and this might be another source of revenue for farmers. There is no need for land to produce electricity in this process because farmers with lakes on their property can put solar power plants without supplying a lot of space.

Farmers can gain a lot of benefits by installing a floating solar power plant. It reduces algae growth and water evaporation in the lake. In Maharashtra, 80% of farmers are small-scale landowners, and they can install solar panels. In drought-stricken regions, the majority of farms have lakes, floating solar power plant project is more beneficial for these farmers.

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II. LITERATURE REVIEW:

Research on floating solar power plants has been conducted across various disciplines, including engineering, environmental science, and agriculture. Several studies have investigated the technical feasibility of floating solar power plants, focusing on factors such as the design, stability, and efficiency of the solar panels. For instance, Akbari et al. (2021) conducted a comprehensive study to evaluate the technical feasibility of a floating solar power plant in a pond. The results showed that the floating solar panels were stable and efficient, and that the technology could be a viable option for renewable energy generation.

Other studies have focused on the economic and environmental benefits of floating solar power plants for farmers. For example, Kim et al. (2020) investigated the economic feasibility of a floating solar power plant in a rural area. The study found that the installation of a floating solar power plant on a pond could result in significant cost savings for farmers, as it reduces the need for land and provides an additional source of income through the sale of excess energy to the grid. Moreover, the installation of floating solar panels on a

pond can also reduce water evaporation and improve the water quality, which can benefit both the environment and the farmers.

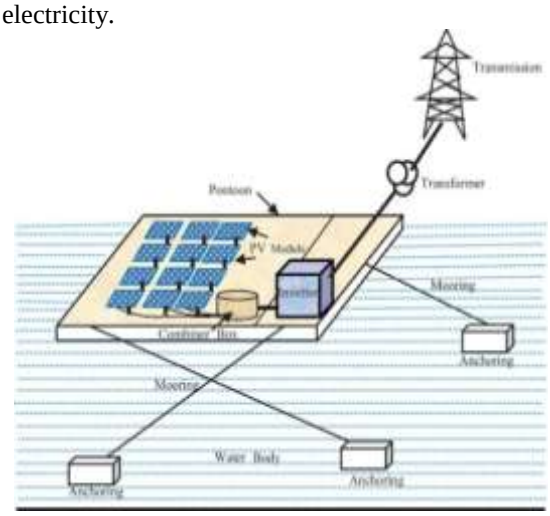
Several studies have also highlighted the potential of floating solar power plants for farmers to improve their agricultural productivity. For instance, Alam et al. (2021) found that the installation of floating solar panels on a pond can create a microclimate that is conducive to the growth of aquatic plants and fish, which can be used as a source of food and income for farmers. In addition, the shading effect of the floating solar panels can reduce the water temperature and evaporation, which can benefit crops and reduce water usage.

III. METHODOLOGY:

The utilisation of land is decreased when solar panels are installed. Solar panels placed on the water's surface can conserve land space and be used for other things. The surface area of water cannot be used for any other reason, but by employing floating solar, we can use that area to produce energy. On the earth, water covers over 71% of the surface, making it unusable for other purposes. However, we can use that area to generate electrical energy. Use the land area for activities such as farming or other.

On grid floating solar system means connection of solar system given to the local utility grids. For agricultural uses, the energy produced by floating solar systems is more than sufficient. So, by connecting to the grid, we can supply extra energy generated to the grid and, if solar cannot produce the energy required for farming (In non-sunny days), we can draw electricity from the grid. It provides farmers new Income source. This is most beneficial use of floating solar power system. A grid system is used to link solar panels to the nearby utility grids via net metering.

Through a billing system known as net metering, owners of solar energy systems receive credit for the electricity they contribute to the grid. Farmers benefit economically from it. Solar panels can generate more energy during the day than is necessary, and net metering enables the export of that energy to the grids. It lowers the cost of electricity.



Case study:

As a starting point for our research, we used the floating solar ponds that farmers employ on their farms as a substitute for the power plants there. I studied the random data about these ponds that is presented below in a diagrammatic manner.

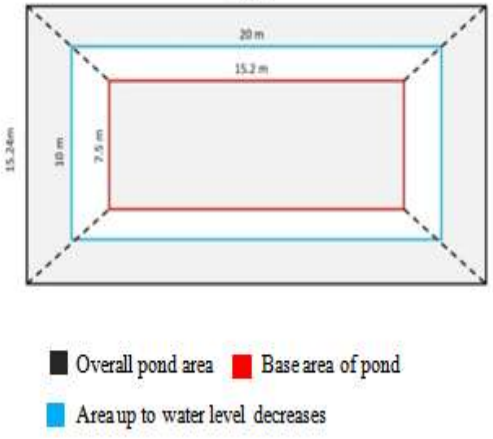


Fig. 1.1 Pond Structure

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Depth – 4.5m Length – 30.48m
Breadth – 15.24m Water capacity – 55,000ltr
Bottom Width – 7.5m Bottom length – 15.2m
Slope ration – 1:1

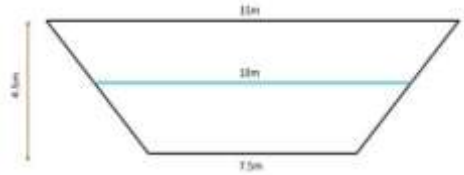

Fig. 1.2 Side View of Pond

Now,
Total Area of Pond = l*b
=15.24m * 30.48m
=464.51 sq.m

Solar panels must be adjusted in area as the water level drops; therefore, If the area lowers up to 2.5 m times the 20 m length of the water, then the water level in the pond becomes 10 m wide; and therefore, only that much area should have solar panels installed.
Area to install Solar Panels = 10m*20m
=200sq.m
We are employing Loom solar panels, each of which is 2 sq. m in size and 1 m wide and 2 m tall. It produces 440 w of energy.
We can install 64 solar panels depending on the length and width of the panel.
At the length of 20m = 8 panels (2m in length)
At the breadth of 10m = 8 panels (1m in breadth)
Actually, we can put 10 panels, but to allow for pontoon movement, we can only install 8.
Now, 1 panel generates = 440w
Hence, For 64 panels,
Energy Generation = 440 * 64
= 28160w = 37.36hp
As 1 HP = 745.7w
Therefore, we can produce 37.76 HP of electricity by employing a floating solar power plant on the pond.
By putting up solar panels on the water's surface, we preserved 200 square metres of space.

- 200sq.m = 2152. 78sq.ft = 1.97 guntha ~ 2 guntha.

Currently, land prices According to the Area, 1 lack rupees is the price for 1 guntha.

- For 2 guntha cost = Rs.2,00,000

Installation cost for Regular Solar Panel on land Area:

- Cost of 1 solar Panel(440w) = Rs.20,000
- Cost for 64 panels = 64 * 20000 = Rs.12,80,000
- Installation cost for 1 guntha = Rs. 20,000
- Now, For 2 guntha = Rs. 40,000
- Total Installation cost for solar panel on land = 12,80,000 + 40,000
= Rs. 13,20,000

Installation cost for Floating Solar Power Plant:
As we calculated above,

- Cost for the solar Panel = Rs.12,80,000

Now,
Cost for the Pontoons:
We require 60 Pontoons,

- Cost for 1 Pontoon = Rs. 3000
- Cost for 60 Pontoons = Rs. 1,80,000
- Installation cost for plant = Rs.60,000
- Total Installation cost for Floating Solar Power =4,224Units

Farmer requires 7.5 Hp for the Running motor Efficiently.
Hence, Need of Energy for farmers for 1 month
= 7.5 hp * 30 days
= 225 Hp
= 165.48723kw
=165487 W

Therefore, for 1-month farmers requires 165 units on an average.
Excess energy we get = Total energy produced – Energy required for farming
= 4224 – 165
= 4059 Units
From above calculations we can supply 4059 units per month to the MSCB.
Therefore, For 1 year,
Energy will be supplied to MSCB = 4059 * 12
= 48,708 Units
Now, as per MSCB Charges, they will take our 1-unit energy for Rs. 7.03
Hence, the amount gets per year = 48,708 * 7.03
= Rs. 3,43,345
Plant = 12,80,000 + 1,80,000 + 60,000
But in our India there are 300 sunny days.
= Rs.15,20,000

Commercial Calculation:
Trough Net-Metering we have connected our floating solar system to nearby utility grids.
As per calculations 37.36 Hp energy generated per hour.
We know, 37.36Hp = 28160 W
If we consider 5 hrs a day then,
Total energy generated per day = 28160 * 5
= 1,40,800 W
But, 1000W = 1Unit
Therefore, 1,40,800 W = 140.8 Units

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In 1 month total energy units generated = 140.8 * 30
Therefore, Energy generated in 300 days
= 140.8 * 300
= 42,240 Units
This energy will be supplied to the MSCB for Rs. 7.03 per unit
Therefore, total amount gets in 300 days = 42,240 * 7.03
= Rs. 2,95,260

Farmers will earn up to Rs. 2,95,260 per year from this floating solar power plant.

Farmers will benefit even if the floating solar panel installation is expensive. It provides the farmers with a new source of revenue. Farmer income is capped at Rs. 2,95,260 so the farmer will recoup the installation costs in about 5 years.

IV. CONCLUSION:

Our study suggests that the installation of solar power Renewable Energy Rajasthan Technical plants on water surfaces can be a beneficial solution for University Kota, India farmers who have ponds in their farms. By utilizing water surfaces for solar power generation, farmers can preserve their land area, which can then be used for other farming purposes.

In addition, this can provide an alternative source of income for farmers while contributing to sustainable energy production.

Our research indicates that the installation of solar power plants on water surfaces can also offer several other advantages, including higher energy production efficiency due to the cooling effect of the water, reduced water evaporation, and decreased algae growth. These factors can lead to increased solar energy output and better water management for farmers.

Overall, the implementation of solar power plants on water surfaces can contribute to the overall growth and development of the agricultural sector while promoting sustainable energy practices. Further research and development in this area can help to optimize this technology and expand its use in different parts of the world.

V. RESULT:

Floating solar power plants are a promising option for farmers who have limited land availability or wish to utilize water bodies on their farms, such as irrigation canals or ponds, for generating renewable energy. These installations can help farmers reduce their energy costs and improve the profitability of their operations.

Additionally, the use of floating solar panels on water bodies can also help reduce water evaporation, thereby conserving water resources. Furthermore, the shading provided by the panels can help control algal growth, thereby improving the water quality and enhancing fishery production.

However, the planning and implementation of floating solar power plants should take into consideration various factors, such as the potential environmental impacts on water bodies and aquatic life, the effect of weather conditions such as storms and high winds, and the maintenance requirements of the systems. The factors must be carefully evaluated to ensure the success and sustainability of floating solar power plants as a viable option for farmers.

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