Floating Solar Power Plant

Prof.Vishal S Vaidya[1], Sachin Harimkar[2], Vaibhav Kharche[3], Shyam Band[4], Sanket Mapari[5], Pratiksha Sapkal[6]
[1] Prof, Dept of Electrical Engineering
[2, 3, 4, 5, 6]Dept of Electrical Engineering
[1, 2, 3, 4, 5, 6] PadmDr. V B Kolte College of Engineering, Malkapur, Maharashtra, India

Abstract- *The limited fossil fuel resources and higher energy demand concentrates on solar energy, which is free of cost and an unlimited energy source, eco-friendly and sustainable to the environment. But during the execution of the solar project on the land,problems are faced by the government and partners of the scheme such as land availability, land development, land acquisition, substation capacities, evacuation also timely clearances for the project on land and evacuation- these are hurdles for completion of the project. Most of the locations projected by the government considering solar radiation data in the country are hot and dry regions. Though radiation appeared to be higher at this location, the energy yield of these points is less due to the heating of the solar panels and the higher temperature of the surface of solar cells. To overcome this problem an innovative idea has come in front for the installation of solar powerplants on the water that is canal tops, water bodies, lakes dam backwaters, and reservoirs, which generally belong to the government. The floating solar involves solar panels and other components that are fitted onto a platform with hollow plastic or tin drugs that enable it to float on water. The benefits of floating powerplants will be presented*

Keywords- Floating Solar Plant, Embedded system

I. INTRODUCTION

Recently, the market for solar energy is expanding due to the introduction of the RPS (Renewable Portfolio Standard). Thus, vigorous research is held on alternatives against the lack of sites to install Photovoltaic overland systems. The floating Photovoltaic system demonstrated in this is a new method of solar-energy generation utilizing water surface available on dams, reservoirs, and other bodies of water. This method has an advantage that allows efficient use of the nation's soil without bringing damage to the environment, which the pre-existing Photovoltaic systems cause when it is installed in farmlands or forests.[1]

India proposes the generation of solar power from renewable energy sources up to 1.75 GW and 1 GW of solar PV power in next 10 years. The country is forwarding as per the policies declared. As on date around 5000 MW has been commissioned in different parts of country, as per the Jawaharlal Nehru National Solar Mission. To match the targets declared, the progress noted so far is not sufficient and requires hard effort by each state and state departments to achieve the desired targets and make the country consuming green power in the world.[4] Floating solar PV plants are an emerging form of PV systems that float on the surface of irrigation canals, water reservoirs, quarry lakes, and tailing ponds. Several systems exist in France, India, Japan, Korea, the United Kingdom and the United States.[6] These systems reduce the need of valuable land area, save drinking water that would otherwise be lost through evaporation, and show a higher efficiency of solar energy conversion, as the panels are kept at a cooler temperature than they would be on land. The energy obtained from solar PV system is renewable, eco-friendly and sustainable with long life of system. There are various advantages of floating solar PV power plant compared to roof top and ground mounted such as better efficiency of solar panels due to cooling of panel by air above the water bodies, it reduces water evaporation and because of shading of water it reduces algae growth.[7]

II. LITERATURE REVIEW

- Borvik investigated two scaled torus floatation systems in a wave tank. One model is designed to be elastic, while the other was rigid.
- Winsvold performed scaled wave tank tests on a single torus model and a concentric multi torus model, applied regular wave theory for both concepts and irregular wave theory for the multitorus model, measured the wave elevation, mooring line tensions, and horizontal and vertical motions.
- Kim et al., documented a numerical analysis of the fluid-structure interaction conducted on one of the conventional fibre-reinforced plastic and HDPE floatation tubes using the ADINA FSI software , finite element and volume codes. Linear wave theory is applied, and wave periods and heights were varied.[3] The computational fluid dynamics analysis concluded that the structure influenced the oncoming waves, and that the maximum effective stresses occurred in the vertical and horizontal structural members at the front edge locations and when the crest of the wave passed the structure.
- Redón-Santafé et al. estimated the windinduced loadings on PV panels inclined at angles up to 30º and analysed the

variation of wind loadings with respect to reservoir length and width at the various inclination angles. The calculations are in accordance with the European wind action on structures standard UNE-EN 1991- 1-4, . The maximum wind force exerted on the panels, for the conditions found at the installation location in Spain, the 400 m length reservoir and the 1.65 x 1m solar panels, was at the 30º inclination configuration and had a magnitude of 370 kN.[5]

- Lee et al. applied 130 km/h static wind loadings during a finite element analysis in accordance with the IEC 61646 standard. estimated simplified wind loadings on FPV panels and note on the lack of meteorological wind properties below a height of 10 m above water surfaces. Which is an important thing to consider, as all of the existing FPV technologies have vertical heights lower than 10 m.
- Choi et al. conducted a scaled wind tunnel test on the structural members during the design of tracking-type FPV system
- Lee et al. optimised the structure by reducing the material requirement, increasing the panel capacity and the number of floatation tubes, which was then manufactured and tested.[8]
- Choi et al. includes additional information on the mooring system, floatation system and structural member connections. The design method used for structural assurance is the load and resistance factor design method (LRFD), which maybe considered as one of the limit state design methods (LSD).
- Yoo et al. documented the structural design and material suitability analysis for a vertical-tracking FPV system using a finite-element modeller. The design and fabrication method of the members are reported together with the system installation procedure.
- Trapani and Millar conducted a computational fluid dynamics 'CFD' analysis which assessed the aerodynamic and hydrodynamic interaction between regular waves and a flexible thin-film PV array.
- Ferrer-Gisbert et al. developed and installed a prototype FPV system for water irrigation purposes in the El Negret Reservoir, Agost, Alicante, Spain. In this paper, the design and analysis of a 20kW prototype system are presented. A key objective is to reduce water-evaporation and produce electricity.

III. METHODOLOGY

It is a new concept for power generation by Solar photovoltaic systems installed over the floating technology over water bodies. This technology replaces the installation of photovoltaic power plants over precious land Floating solar power plants are installed on water surfaces, so these panels are naturally cooled, and due to that the temperature rise of panels is less compared to rooftop solar power panels. So the lifetime of panels increases due to less stress on panels. Floating solar panels cost is slightly higher than the rooftop solar panels, but when it comes to scarcity of land in problem-based countries floating solar installation cost is negligible with production profits of useful land.[10] The floating solar power system also provides other environmental benefits like the prevention of evaporation of water. The systems can also improve water quality. Solar panels acts as roof for the water bodies, so the water will not exposed to sun and atmosphere, it adds beneficiation for drinking water plants. The organic matter growth such as algae will decrease, as solar panels acts as cover

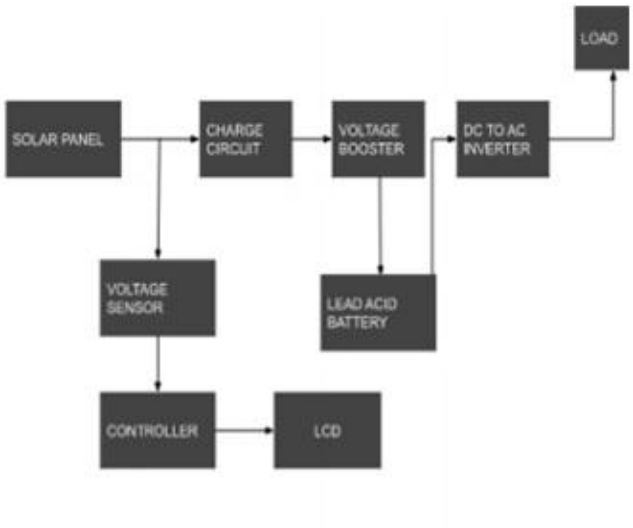

Figure:-system requirement

IV. HARDWARE REQUIREMENT

1. Solar Panel
2. Voltage Sensor
3. Controller
4. LCD
5. Charge circuit
6. Voltage Booster
7. Lead acidic battery
8. DC to AC converter
9. Load

V. SOFTWARE REQUIREMENT

1. Arduino IDE
2. Proteus

VI. EXPERIMENTAL SETUP

VII. RESULT

A Floating solar platform enables standard Photovoltaic panels to be installed on large water bodies such as dam backwater, reservoirs, lakes, irrigation canals, or remediation and ponds. An uncomplicated and inexpensive floating solar platform is especially well suitable for energy and water-intensive industries that cannot afford to waste either land or water. Wineries, dairy farms, fish farms, mining companies, wastewater treatment plants, irrigation districts, and water agencies are industries that can benefit from the synergy that floating solar system creates between water and sun.

VIII. CONCLUSION

With the advancement in solar photovoltaic system, the floating solar power plant plays a vital role. The advantage of the floating system is reduction of evaporation, thus helping preserve water levels during extreme summer. When panels are installed on floating platform, the heating problem of solar panel on land is solved to a great extent. This floating technology is long-lasting, cost-effective, flexible and less time for installation. The advantages and technical details of floating solar power plant arepresented in this paper. With this advancement, country like India can meet its power demand in future.

IX. FUTURE SCOPE

In the future, the use of floating solar power plants is expected to become more widespread, as it offers a viable solution to address the challenges of land occupation, limited land resources, and high temperatures that can negatively impact the energy output of traditional solar panels. The continued development of floating solar technology will likely result in more efficient and cost-effective systems, making it a competitive alternative to traditional energy sources.

Additionally, advancements in energy storage systems will allow for greater integration of floating solar power plants into the existing power grid, further contributing to the growth of renewable energy and reducing dependence on fossil fuels. With its potential for sustainable energy generation, floating solar power plants are poised to play a significant role in the future of energy production.

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