International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 03 | March - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Literature on Floating Solar Power Plant

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Abstract: Due to the high demand and constant depletion of fossil fuel, we need to focus on renewable energy source, which is natural energy. Hydro and wind are also renewable energy sources, but they are specific in location as compared to this solar energy, which can be installed at any location. The main problem with solar is that it requires a lot of land, which is scarce and expensive. However, with this floating solar system, we can install it on water bodies, which not only reduces the land cost, but also improves the efficiency of the solar panels by cooling the water and reducing its evaporation. In this project, we are doing a study on the floating structure that is a solar floating system.

Key words: Renewable Energy, Floating Solar System, Solar Panel.

1. Introduction

Many of the world's floating PV plants are located on relatively quiet free-surface waters like inland lakes or hydropower storage tanks. Their main advantages are an increased power production due to lower panel temperature and an absence of need for land space [1]. Floating solar power systems are designed to be installed on the surface of bodies of water, such as lakes and ponds. They are made up of floating system, also known as 'pontoon' (floater), which is the strong structure that holds the solar panel. Floating solar panels are able to generate more power than land-based solar systems because of the cooling effects of the water. The proximity of the solar panels to the water helps them to stay cool and absorbs more solar energy. Land can be used for a variety of productive purposes, including agriculture, housing, and tourism. The installation of a large-scale solar plant would restrict this use. The energy performance would increase by at least 13 percent. The installation process would involve clearing the trees and forest from the land, which is against the promise of green energy production. The floating solar system requires only water surface to save the valuable land, and it also helps in the evaporation of the water. We have already found that floating bodies over water surface can avoid evaporation.

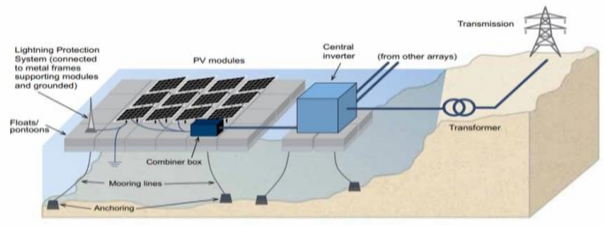

Figure 1: Schematic representation of a typical large-scale FPV system with its key components [2]

Figure 1: represents the schematic representation of floating solar system, the process similar to the land solar system.

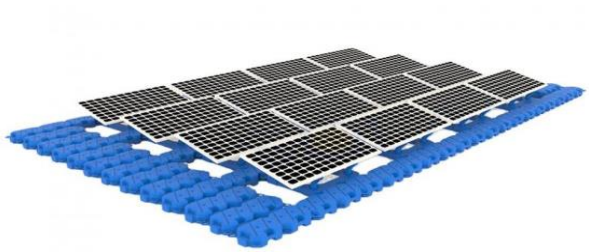

Figure 2: schematic representation of solar floating PV mounting system [3]

Figure 2 represents the real image of pontoon that holds the solar panel with certain inclination angle of solar panel. This system also consists of walkway, with the help of walkway we can easily stand on this.

2. Literature review

(Wagh et al. 2017), discuss the article is a review of solar photo-voltaic power plants installed floating on water bodies like canals, reservoirs, lakes, and dam backwaters. Installing solar power plants on water helps address issues faced with land-based installations like land availability, development and acquisition, substation capacity, and delays in clearances. While locations with high solar radiation are suitable, the energy yield is actually lower there due to heating of solar panels and higher cell temperatures. Floating solar plants offer a solution by utilizing otherwise unused water surfaces [4]. **(Sen, Sharma, and Muni 2015),** This research paper discusses the design parameters of a 10kW floating solar power plant. It proposes using floating solar platforms installed on water bodies as a way to generate solar power without occupying valuable land area. The paper aims to study the design of the floating platforms and also analysed the impact of the plant on the local ecosystem, especially the effect of panel shading[5]. **(Ingole et al. 2020),** This article reviews various floating solar power plants that have been installed around the world. It discusses how floating solar panels can help maximize usable land area for energy generation. Some benefits mentioned are saving land space and overcoming limitations of land availability, development, and clearances. However, locations with high solar radiation may experience lower energy yields due to panel overheating. To remedy this, installing solar panels on bodies of water is presented as an innovative solution[6]. **(Savatkar, 2023),** This document discusses the design and study of a floating solar power plant project. It aims to reuse plastic waste and generate electricity from the solar energy in a renewable way. The objectives are to reduce water evaporation, save land, and generate clean energy without adverse environmental effects. It describes the various components of a floating solar PV system like pontoons, mooring system, solar modules, and cabling. Floating solar panels have higher efficiencies than land-based ones as water cools the panels[7]. **(Washington DC, 2019),** "Where Sun Meets Water: Floating Solar Market Report." studies conducted by the Solar Energy Research Institute of Singapore (SERIS) has the stature of a research institute at the level of the NUS states the Site identification, Energy yield analysis, Engineering design, Financial and legal consideration, Environmental and social consideration, Procurement

and construction, Testing and commission, Operation and maintenance, Conclusion and next steps[8].

3. Material and Method:

"The materials used in the constructions of a solar floater must be able withstanding exposure to water and sunlight without deteriorating over time. The material used in this project is high-density polyethylene (HDPE). The constructions process typically involving assembling the frame of the floater, attaching the solar panels, and installing any necessary electrical components. The finished product must able to withstand harsh weather conditions and remain functional for many years.

Properties of HDPE material:

1. Flexible

2. Translucent / waxy

3. Weatherproof

4. good low temperature toughness (to -60'C)

5. easy to process by most methods

6. low cost

7. good chemical resistant

As we see the properties of HDPE materials is suitable for solar floating systems so that we used HDPE material in this project.

4. Methodology:

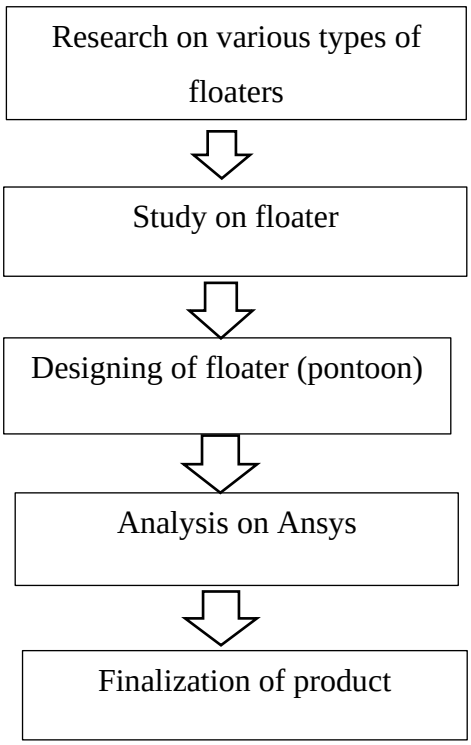

Figure 3: Flow Chart of Methodology Process

Research on various types of floaters:

we study on various types of floaters for getting knowledge about floater specification like material, dimensions, inclination angle and load carrying capacity.

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Figure 4: floating structure assembly [3]

Table 1: model specification [3]

Tilt angle	5/10/15°
Module type	Portrait or landscape
Max snow load	1.4 KN/m^2
Max wind load	60 m/s
Material	HDPE
Loading capacity	150kg/m^2

II. solar float design using LDPE material by Megha Nagrale.

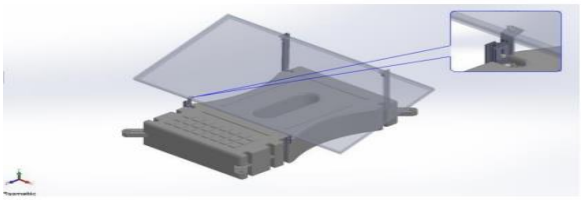

Figure 5: solar float assembly [9]

Table 2: model specification [9]

Material	LDPE
Tilt angle	24°
Wind speed	47 m/s

III. Xiamen jesfer industry & trade co., Ltd.

Figure 6: PV floating mounting structure system [3]

Table 3:model specification [3]

Material	HDPE
Wind Speed	51m/s
Tilt angle	10° or 15°
Module type	Landscape
Snow load	1 KN/M^2

Study on Floater:

We conducted study on different types of floaters for getting the knowledge about different design parameter.

Classification of FPV system:

There are two types of FPV system:

1. Pontoon Type:

FPV systems be pontoon-type, where an intermediate floating platform holds the rigid PV modules out-of-water.

2. Superficial Type:

FPV systems can be superficial, where the PV modules are directly installed over the water surface[10].

Designing of Floater:

We build the floater with the intention of:

1. Decreasing accidents brought on by air drag,

2. Making the floating structure simple to assemble and disassemble, and

3. Increasing its weight carrying capability.

1: Decreasing accidents brought on by air drag: We learned that there have been several accidents caused

by design flaws, installation errors, and disasters like floods, storms, hurricanes, etc. while studying various kinds of floaters. And we notice that a lot of accidents occur due to air drag. The drag force of air in the gap between the panel and floater caused the floater to tilt, resulting in accidents. We designed the structure so that the panel was directly mounted on the floater, so there is no gap; hence, almost no drag force is exerted, causing the tilting of the structure.

2: Making the floating structure simple to assemble and disassemble: While researching the floaters, we found that there were several accidents that took place because of short circuits. Because of short-circuit floaters and solar panels, they catch fire. To avoid such accidents, we designed a floater that is easy to assemble and disassemble. Therefore, it will be simple to disassemble the floaters and solar panels that stop the fire from the short circuit if such an accident occurs. This could stop significant mishaps.

3: Increasing its weight carrying capability: With the same weight as the existing floaters, ours can carry panels with 72 cells.

5. Discussion:

Design consideration: There are a few key things to consider when designing your solar floater. The first is buoyancy. A solar floater needs to be able to hold the weight of your solar panels and other equipment while staying stable on the surface of the water. Another important factor to consider is the location and orientation of your solar panels. Your solar panels should be placed in a way that maximizes the amount of sunlight they receive throughout the day. Wind direction and waves should also be taken into consideration.[8]

Tilt Angle: The optimal tilt angle depends on the latitude of your site. Generally speaking, solar modules are tilted at angles near the latitude of your location to capture the most direct sunlight. Tilt angles should be no more than 15 degrees. Tilt angles at this angle allow for the “self-cleaning” effect where there are frequent enough rains to wash off significant amounts of dust and dirt on your PV module surfaces..[8]

6. Conclusion:

We learnt about floaters, what floaters are & how it is advantageous over conventional solar energy technology.

The drag force of air in the gap between the panel and floater caused the floater to tilt resulting in accidents, as we learned the types of FPV System, we designed a floating structure which is a superficial type but with certain inclination angle.

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