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SWOT analysis of floating solar plants

Abstract

Floating photovoltaic (FPV) systems are an emerging technology suitable for energy generation in water bodies. Especially since floating photovoltaic system has its facility floating on water surface, it is extremely important to review the present status and future needs for techno innovations for solar power generation with value-added applications. The paper focuses on SWOT i.e. strengths, weaknesses, opportunities and threats areas for economic growth and increased use of floating solar technology.

Keywords: floating PV system, on-site survey, resources survey of photovoltaic, tracking-type floating PV

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Introduction

Solar PV modules: flat and rigid PV modules (mainly Si crystalline made)[1–5] or thin-film flexible PV[5–10] are widely reported in the literature for power generation. A critical issue in using land-based PV systems is related to the dust, temperature, shadow and performance variability due to limited control of operating conditions.Recent application of Solar includes Solar PV tree, Airport infrastructure, BIPV, BIPVT, CSP Technology[11–15] Performance analysis of the solar PV Systems,[10] based on energy and exergy analysis is used to assess the technical and economic viability.[16–20] The recent explosive growth of massive solar plants in some of the world's most remote deserts has stolen some of the spotlights from smaller solar installations that float on water.[21–25]

The impetus for developing floating solar PV over land-based plants stems from increasing prices for undeveloped land with good solar potential, in some cases undermining the economic viability of solar projects. In contrast, water-based plants would not face the same pressure because of much lower competition for potential sites. Floating solar PV is fast emerging as an alternative to conventional ground mounted photo-voltaic systems which are land intensive. It has various benefits like conserving water through the reduction of evaporation, increased generation due to a cooling effect on the panels and requires lesser installation time than conventional land mounted ones. Floating solar PV has drawn interest in recent years because of the potential synergies, with some developers claiming such systems could be as much as 50% more efficient than land-based solar. The technology is also simpler and offers greater yield than landed-based solar PV. The panels are mounted on floating platforms and are more resistant to overheating that can reduce solar PV output. The technology can be deployed for about 15% less per megawatt than comparable land-based systems. Floating solar can actually help preserve them by reducing evaporation during hot days in the summer. The environmental impact would likely be minimized by using the reservoirs and waste treatment ponds, though the long-term maintenance requirements and durability of floating solar PV are yet to be seen, initial results are promising: the system can withstand typhoons without significant damage. These could be installed on saline water environments too. Installation potential of such type of systems is huge because of abundant availability of water bodies and lack of enough land.

To analyze the SWOT for a floatovoltaic system this paper will first present the concept of float voltaic. Secondly, analysis of various strength, opportunities, weakness and threats of Floating PV will be presented and conclusions will be drawn.

Basics and Overview of Floating Solar Power plants

Floating Solar Power is an innovative concept in energy technology to meet the needs of our time. The floating PV system is a new method of solar-energy generation utilizing water surface available on dams, reservoirs, and other bodies of water resulting from the combination of PV technology and floating technology (Figure 1). The floating PV plant consists of a floating system, mooring system, PV system and underwater cables.[26–28]

1. Floating System: A floating body (Structure + Floater) that allows installation of PV module.
2. Mooring System: This allows adjusting water level fluctuations while maintaining its position in a southward direction.
3. PV System: PV Generation equipment, similar to electric junction boxes, which are installed on top of the floating system.
4. Underwater Cable: To transfer generated power from water bodies to the substation.

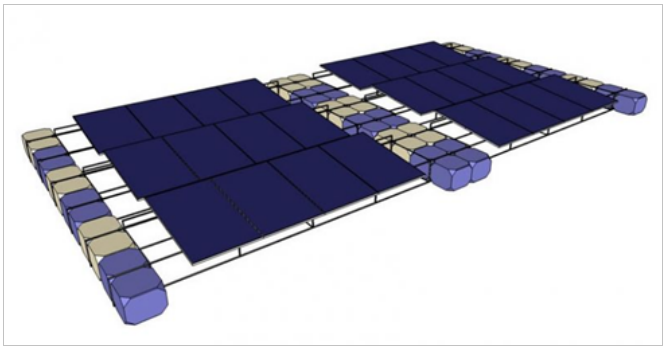

Figure 1 Floating solar installation.

SWOT analysis

SWOT Analysis is the most renowned tool for analysis of the overall business and its environment. SWOT is an acronym for Strengths, Weaknesses, Opportunities and Threats. Strengths (S) and Weaknesses (W) are considered to be internal factors over some measure of control exist. Opportunities (O) and Threats (T) are considered to be external factors over which essentially no control exists. SWOT Analysis is a useful technique for understanding the Strengths and Weaknesses, and for identifying both the Opportunities open and the Threats faced. SWOT analysis is the foundation for evaluating the probable opportunities and threats from the external environment and the internal potential and the changing trends. It views all positive and negative factors inside and outside the project

that affect the success. It helps in the decision-making process and helps in forecasting/predicting the success of the project. The strength, weakness, opportunities and threats of Floating solar plants are highlighted in the following section.

Strength (internal, positive factors)

1. Floating solar power generating systems typically generate more electricity than ground-mount and rooftop systems due to the cooling effect of the water.[28]
2. The floating platforms are designed and engineered to withstand extreme physical stress, including typhoon and storm conditions.
3. LSA installations reduce water evaporation and algae growth by shading the water.
4. Geographically any water bodies with abundant sunlight can be used to install floating plants.
5. Floating platforms are 100% recyclable, utilizing high- density polyethylene, which can withstand ultraviolet rays and resists corrosion.
6. More module install compares with the other system.
7. Non-use (and disturbance) of land which conserves the local environment.
8. Easy to erect and faster deployment.

Opportunities (external, positive factors)

1. Growing innovations in Floating technology
2. Increasing concerns about land neutral energy generation and energy independence
3. Great potential and increasing awareness for floating PV.
4. Availability of water bodies and land issues are main accelerators for floating PV Solar Panels.
5. Increased efficiency of Floating PV over Land PV installed
6. Availability of trained manpower and Govt. Policies have boosted the confidence of investors.
7. Stable floating PV platforms results in minimum operation & maintenance cost.
8. The emergence of new markets and investments in India, China, Thailand, Malaysia and other developing countries.

Weakness (internal, negative factors)

1. Long-term maintenance requirements and durability of floating solar PV is yet to be seen.
2. Ecological and adverse impacts on water ecosystem.
3. Relatively young and immature technology.
4. Lack of experience and knowledge.
5. Lack of cooperation from local distribution utility.
6. Solar energy concentration levels on floating platform.
7. high waves and salt water possibly damage the solar panels over time.

Threat (external, negative factors)

1. Large dependency on land-based PV generation.
2. Lack of testing and standard procedures of floating solar.
3. Untested Technology for long run.
4. No promotion and support through a separate policy.
5. Cost concerns and lack of financial resources.
6. Cumbersome maintenance and repair.

Environmental effects of floating solar

Floating solar platform allows standard PV panels to be installed on large bodies of water such as drinking water reservoirs, quarry lakes, irrigation canals or remediation and tailing ponds. simple and affordable floating solar platform is particularly well suitable for energy and water-intensive industries who 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 which can benefit from the synergy that floating solar system creates between sun and water

Conclusion

Floating solar concept seems simple enough, but there are major technological hurdles. Floating solar application with challenges and opportunities has been discussed.

1. The SWOT analysis presented in this paper can be utilized as tool for future development of floating photovoltaic systems
2. To revolutionize floating solar, threats identified need to be tracked appropriately. However, the future seems bright for the floating solar technology
3. In the near future, the surface of the water bodies associated with hydroelectric dams, pumped storage installations, and cooling ponds of electric power plants—locations that typically have existing power grid connections will be totally covered with the floating system.
4. Floating Solar system is technically feasible and economically viable.

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None.

Conflicts of interests

The authors declare that there is no conflict of interest.

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