Journal of The Gujarat Research Society

ISSN: 0374-8588
Volume 21 Issue 10, October 2019

Benefits and Challenges for Floating PV Systems

Amit Kumar Sharma
Department of Physics
Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India

ABSTRACT: ***The significant growth in energy consumption, the rapid decline of fossil fuels, and environmental issues around the globe have contributed to the need for large-scale design and development of solar PV plants. Application of solar photovoltaics (PV) has the responsibility of extreme land requirements and will still be a luxury product. Implementing solar PV systems on water sources such as coasts, wetlands, lagoons, rivers, drainage ponds, waste water treatment plants, wineries, fish farms, dams and canals may be an appealing choice for maintaining precious land & water. Compared to overland mounted solar panels, floating form solar photovoltaic panels have various benefits, including less barriers to blocking sunshine, comfort, energy consumption, greater efficiency of power generation due to the lower temperature below the panels. In addition, solar construction supports the marine ecosystem because the shade of the plant avoids unnecessary evaporation of water, reduces the growth of algae and potentially increases the quality of water. This paper provides further insight into the floating PV technology, its current state and different choices for design.***

Keywords: Energy, Floating, Photo Voltaic Systems, Renewable, Solar Energy, Alternative source.

INTRODUCTION

Renewable energy sources have been rising increasingly all over the world in recent years. Owing to its ubiquitousness and sustainability, solar energy is perceived to be one of the most attractive energy options. Solar energy is available naturally and tremendously across the globe. Photovoltaic (PV) devices are the most prevalent application for the use of solar energy. In the field of renewable energy, photovoltaic (PV) modules are one of the most efficient, affordable, and environmentally friendly goods. Solar PV construction has the difficulty of extreme land requirements that are still a luxury product [1].In different parts of the nation, large water bodies are available that can lower the cost of saving land and operational costs for power production expenditures. Thus, by using accessible bodies of water, solar PV systems could become a quite reasonable solution to utilizing solar energy to help improve the production feasibility of solar projects. From a renewable source, photovoltaic electricity achieves a low efficiency of less than 15 percent throughout its long life. Because of the water cooling effect, floating solar produces more energy than ground-mount and rooftop (solar) systems [2].By shading the water, it also lowers reservoir evaporation and algae formation. Using high-density polyethylene that can survive ultraviolet rays and degradation, the floating platforms are 100% recyclable[1].

Concept of floating PVsystem

Installing solar photovoltaic systems over water bodies using floating technology is a recent concept. The integration of PV plant technology and floating technology helps in power generation. The construction of photo-voltaic power stations over productive land eliminates this system. The floating PV plant consists of a mooring system, solar panels and wires, a pontoon or independent floats. According to an analysis, this efficient coverage of the pontoon and PV frames on the dams led to water evaporation from the dam being

ISSN: 0374-8588
Volume 21 Issue 10, October 2019

decreased.Study in Australia shows that during evaporation, up to 40 percent of open reservoir water may be wasted [4]. PV efficient conversion efficiency in operating conditions, that influences the production of electricity and is thus the most valuable commodity of the element, is the most crucial consideration regarded for the output assessment of the FPV[2].

Benefits of Floating solar PV systems Vs land based systems

- Compared to traditional solar panels, floating form solar photovoltaic panels have various benefits, including convenience and energy efficiency. Due to their lower temperature under the plates, floating form solar photovoltaic panels have better power generation performance relative to overland mounted solar panels.
- Shading effect, decrease in algae formation, natural water surface reflectivity, decreased penetration of sunlight; Lower water temperatures have a positive impact on Floating Solar PV output.
- Floating solar panels will minimize water evaporation by up to 33 percent on natural lakes and ponds and by about 50 percent on man-made installations by minimizing water evaporation, conserving water by decreasing water temperature and decrease the amount of water area ex-posed to air.
- Save fertile land for forestry, logging, tourism, and other land-incentive practices and transform untapped and non-revenue water-generating surfaces into profitable solar power plants. Technology can lead to significant savings in property values and reduce expenditures for power production[3].
- The floating solar system provides a holistic solution to being solar-friendly real estate for marine freshwater bodies, isolated islands, hydroelectric projects, agricultural wetlands, quarry and mine pools, drainage reservoirs and water treatment sites.
- Floating solar is cost-competitive with roof and ground-based single-axis solar monitoring devices and utilizes the same solar panels that are currently available.
- Floating solar systems count for government incentives, loans and subsidy schemes similar to land-based solar in most nations [7].
- Water is readily available for cleaning the panels (& thus increasing efficiency). The benefit that water derives from the solar panel installation above the water surface also adds to the universal adoption of floating solar panels.
- Although the floatation structure can be installed without heavy machinery, the construction is relatively simple to execute. Due to relatively restricted site planning requirements, installation time and related costs were considerably reduced[4].

Challenges/Issues ofFloating solar PV systems Vs land based systems

- In the construction of the floating solar plant, the greatest obstacle is the device architecture that has to be properly built to remain afloat and be able to withstand force. During the construction of a floating solar power station, the following issues will be resolved.
- The solar modules are surrounded by water since the efficiency of the device can be influenced by high moisture content.
- Because of erosion and unfavorable environmental effects, the reliability of the floating structure can be impaired.

ISSN: 0374-8588
Volume 21 Issue 10, October 2019

- Protection problem of transferring electricity from the surface of the water to the land area.
- Ecological considerations such as water quality, changing water depth, temperature fluctuations, water velocity, temperature, evaporation, oxygen, fish, algae growth and other living species should be able to address the floating system.
- Due to hurricanes, cyclones, waves and strong winds, floating solar systems can undergo sudden or irregular movements. These powers of nature need to be able to survive the floating PV system.
- In addition to high maintenance prices, the high initial construction costs are two of the main constraints for the growth of the floating solar panel industry.
- The cost of solar panel power generation is around 10 times more costly during its early phases than the other fossil fuel-based process.
- It is not feasible to mount floating solar panels in the water, as the sea tide influences the location of floating solar panels continuously.
- The strong wind speed at sea also influences the performance of the floating solar panel system's power generation efficiency.
- Floating solar plants require mooring systems for directional control to efficiently maintain the same azimuth (direction) and water location.
- Since the directional shift in solar modules decreases the output of electricity.
- In floating solar power plants, stress and vibration problems are more prominent due to wind, waves and external forces. Vibration will contribute to the creation of micro-cracks in modules that re-duce electricity output and reliability problems in turn.
- In the early stage of preparation, the participation of the media and the required agency to ensure public approval[5].

CONCLUSION

The idea of floating PV system stagnant on still water sources like reservoirs, streams, dams and reservoirs is illustrated in this article. It also measures the capacity factor across the globe of floating PV plants. From the analysis, the following findings are taken.

1. Since it could overcome the perpetual issue of ground, floating solar energy will prove a revolutionary move.
2. As these solar panels will float on water, they are expected to remain cool and hence produce more energy than those set up on ground.
3. Wide water bodies are present in India in states such as West Bengal, Assam, Orissa and Andhra Pradesh, Tamil Nadu and Kerala in the eastern, south-eastern and southeastern parts of the country. In these nations, this technology will be implemented, leading to substantial improvements in land prices and lowering the cost of power production, thus increasing the difference among thermal and solar energy.
4. Prolonged work on the architecture of the floating PV mechanism anchoring system is required to fully repair the buoyancy system.
5. It is important to study the impact of salt water on the PV structure and the efficiency of the module.
6. It is important to build a solar tracking device that can modify the floating PV system's tilt and azimuth angle.

ISSN: 0374-8588
Volume 21 Issue 10, October 2019

7. Most of the current projects have rigid crystalline PV modules that are unable to survive harsh water environments, so working on versatile thin film manufacturing must be examined in these brutal environments.
8. Advancements in the coming years of large megawatt-scale floating solar farms will make room for the production of offshore solar energy.
9. When constructing the solar panel, the overall wind velocity, water current, temperature cap, snow load, cyclone and typhoon must be addressed.
10. Floating solar plant production is 11 percent higher and water evaporation decreases by 70 percent, but such power station investments are 1.2 percent higher than traditional solar power plants.
11. It is possible to use remote sensing and GIS-based technologies to determine the capacity of floating solar PV projects.
12. Necessary protection precautions have to be taken to transport electricity from the water sources to the site.

REFERENCES

[1] N. L. Panwar, S. C. Kaushik, and S. Kothari, "Role of renewable energy sources in environmental protection: A review," *Renewable and Sustainable Energy Reviews*. 2011, doi: 10.1016/j.rser.2010.11.037.

[2] T. Tsoutsos, N. Frantzeskaki, and V. Gekas, "Environmental impacts from the solar energy technologies," *Energy Policy*, 2005, doi: 10.1016/S0301-4215(03)00241-6.

[3] M. Redón Santafé, J. B. Torregrosa Soler, F. J. Sánchez Romero, P. S. Ferrer Gisbert, J. J. Ferrán Gozálvez, and C. M. Ferrer Gisbert, "Theoretical and experimental analysis of a floating photovoltaic cover for water irrigation reservoirs," *Energy*, 2014, doi: 10.1016/j.energy.2014.01.083.

[4] Y. K. Choi, "A study on power generation analysis of floating PV system considering environmental impact," *International Journal of Software Engineering and its Applications*, 2014, doi: 10.14257/ijseia.2014.8.1.07.

[5] C. Ferrer-Gisbert, J. J. Ferrán-Gozálvez, M. Redón-Santafé, P. Ferrer-Gisbert, F. J. Sánchez-Romero, and J. B. Torregrosa-Soler, "A new photovoltaic floating cover system for water reservoirs," *Renewable Energy*, 2013, doi: 10.1016/j.renene.2013.04.007.