FACTSHEET
„FLOATING“ PHOTOVOLTAICS

Floating PV

Most photovoltaic systems are installed as grid-connected generation systems or for self-consumption in locations where the weather is favorable for many hours of sunshine per year, and primarily on the ground or on roofs. Inland waters such as reservoirs and the sea remain unused. Here, floating photovoltaic systems (= floating PV) offer new opportunities. The restructuring of the energy supply and the expansion of photovoltaics is leading to the evaluation of land potential. In addition to agriculture (agri-PV), the use of roofs, facades and traffic areas, lakes and coastal regions offer additional opportunities for land management with photovoltaics.

How does a floating photovoltaic system work?

In most floating PV systems, floating bodies made of plastic (e.g. HDPE) form a platform on which PV modules are mounted. The platform is anchored with mooring lines. The generation power is transmitted to the transfer stations on land via an undersea cable. Floating PV systems have many similarities with conventional PV systems, but also some differences, particularly with regard to anchoring, the flotation system and the energy dissipation from the system.

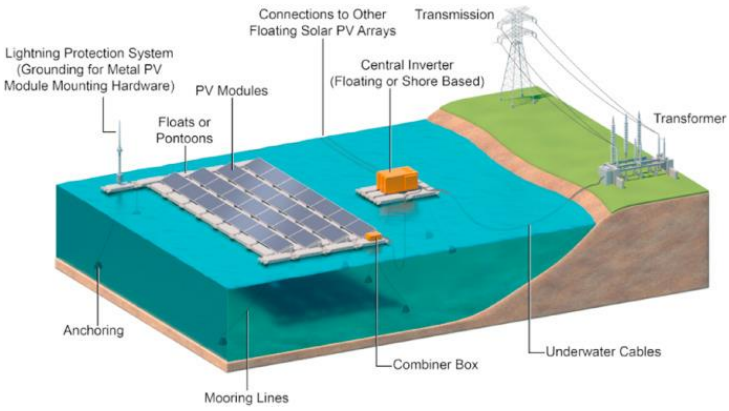

Fig.1: Schematic of a typical floating PV system with key components, Source: N. Lee et a l. / Renewable Energy 162 (2020) 1415-1427

Floating PV – Potential

Most of the existing capacity and the forecast growth in the floating PV market is in Asia. However, floating PV systems are also already being successfully implemented in Europe, especially on artificial bodies of water, such as reservoirs, where synergies with existing hydropower use can be achieved.

Previous studies (World Bank et al. 2019) estimate the global potential of floating PV at 400 to 1,000 GW and, in combination with hydropower, at 4,400 to 5,700 GW.

Fig.2: Possible application of a floating PV system
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What types of floating PV are available?

- Floating bodies as support and mounting elements for PV modules: In these systems, the PV panels are located above the flotation system. It is important to determine the maximum angle of inclination in order to compensate for the increased costs of the anchoring systems, with possible increases in production and optimization.
- Floating bodies as supporting elements on metal substructures and PV modules attached to them: These systems have a steel or aluminum structure supported by a floating system on which the photovoltaic modules are supported. This enables a better cooling effect and therefore a higher yield.
- Floating body in the form of a membrane with a support and mounting element for PV modules: In these systems, the modules rest directly on the membrane in contact with the water. Although the loads are lower, electricity production may be lower depending on the location of the system.
- Other systems and concepts: Systems with alternative materials, mostly consisting of steel and concrete, currently with a lower degree of implementation.

Opportunities and challenges of floating PV

The use of photovoltaics on bodies of water "Floating PV" is being used more and more to reduce land use conflicts. In addition, floating photovoltaics also has a number of advantages over conventional solar systems. It is not yet possible to fully assess any negative effects of this type of construction. Despite growing feasibility and market interest in floating PV, it is a nascent application with research potential.

Opportunities for application

- Reduces evaporation
- Protection against algae - especially in summer, these systems protect against excessive algae growth by reducing eutrophication
- Prevents erosion - floating photovoltaics prevent gusts of wind from eroding the banks.
- Positive factors on electricity production and synergy effects, especially in combination with hydro and pumped storage power plants
- Increase in PV yield due to the water cooling effect
- Climate resilience of the water body

Challenges and need for optimization

- Cost-intensive anchoring
- 15-20% higher investment costs compared to ground-mounted systems
- Possible impairment of performance and durability due to biofouling, bird droppings, mechanical tensile forces
- Possible impact on aquatic ecology (oxygen content, nutrient availability, plant growth)
- Maintenance of mooring lines and breakwater systems (costs for boat and dives)
- Limited inclination of current float models, which can have a significant impact on production depending on location
- Possible limitation that only a limited product range of PV modules is suitable for floating PV application

Technical aspects that need to be taken into consideration...

- Wind load
- Swell (breakwaters reduce the influence)
- Snow load (buoyancy)
- Tidal range, possibly changing water level
- Anchoring concepts and number of anchors
- Long-term stability of plastics over 25 years
- Abrasion-resistant connections to avoid microplastics
- Inverter on platform or on land
- Cabling as submarine cable
- (with strain relief, buoy marking)
- Maintenance aspects

Links

- Lee, N.; Grunwald U.;Rosenlieb,E.; Mirletz,H.; Aznar,A.; Spencer,R. & Cox,S. (2020):Hybrid floating solar photovoltaics-hydropower systems: Benefits and global assessment of technical potential, in:Renewable Energy 162, S.1415-1427
- World Bank Group, ESMAP, SERIS (2019): Where sun meets water: floating solar handbook for practitioners, [online]http://documents.worldbank.org/curated/en/418961572293438109/Where-Sun-Meets-Water-Floating-SolarHandbook-for-Practitioners [zuletzt abgerufen am 11.11.2022]
- Iberdrola (2022): Do you know about floating photovoltaic solar energy?, [online]https://www.iberdrola.com/innovation/floating-photovoltaic [zuletzt abgerufen am 11.11.2022]

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