



EMERGING ENERGY SOLUTIONS

A series on emerging energy trends and opportunities from IFC

Floating Solar Photovoltaic on the Rise

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As a clean, green, renewable source of energy, solar photovoltaic power is an essential pillar in efforts to address climate change. Solar panels—mounted on rooftops or as part of solar farms—are a common sight today. Some of these are vast, such as the 1,650-megawatt [Benban Solar Park in Egypt](#), which was completed in November 2019. IFC invested and mobilized more than \$650 million in the project.

But solar panels do not necessarily have to be mounted on the ground. Solar panels can also be mounted on platforms that float on bodies of water, such as reservoirs, lakes, and sometimes, if conditions are right, on the surfaces of oceans or seas.

It should come as no surprise to learn that floating solar farms are more challenging and costly to build and operate than land-based ones. Yet floating solar capacity is growing, and quickly—from 70 megawatts of peak power (MWp) in 2015 to 1,300 in 2018. Today, there are more than 300 floating solar installations worldwide. [A report by Wood Mackenzie](#), a global research firm, estimates that global demand for floating solar power is expected to grow by 22 percent year-over-year on average from 2019 through 2024.

WHY FLOATING SOLAR?

A significant benefit of floating solar is that it doesn't take up valuable space on land—meaning that it can be used for other purposes, such as farming or construction. Installing floating solar farms on bodies of water, such as reservoirs, avoids this issue.

Another benefit is that bodies of water exert a cooling effect, which improves the performance of solar photovoltaic panels by 5–10 percent. Over time, this translates into significant cost savings. Other potential benefits include reduced shading, reduced civil works, reduced grid interconnection costs, reduced water evaporation, improved water quality, and reduced algal blooming.

The potential for further growth in floating solar photovoltaic power generation is significant. Hydropower reservoirs alone cover a surface of more than 250 thousand square kilometers worldwide—enough to host enough floating solar capacity to

produce 2.5 times the electricity produced by all the underlying hydropower capacity. Combining hydropower generation with floating solar panels can yield promising results.

In Portugal, an [array of 840 floating solar panels were installed on the reservoir](#) of a hydropower facility on the Rabagão river with a capacity of 220 kilowatts exceeded expectations, according to EDP Renewables, a global renewable energy company. The additional power output from the floating solar array can smooth out the output of the hydroelectric plant. The existence of power distribution infrastructure on location is an additional plus.

CHALLENGES

Given these benefits, does floating solar always make sense? Not necessarily. Despite its potential, floating solar represents less than 0.5 percent of total solar

photovoltaic installations globally. Its benefits must be balanced against an increase of 20–25 percent in system costs, mainly driven by floating structures, anchoring and mooring systems, and, to a lesser extent, development costs.

Floating systems present specific challenges related to anchoring and mooring them in place, accounting for possible water level variations, the reservoir's bed type and depth, and extreme weather situations such as high winds and waves. Accordingly, engineering and construction costs are usually higher than those of a ground-mounted solar farm. There are also additional safety issues. Since floating solar involves water and electricity, more consideration must be given to cable management and insulation testing than on land, especially when cables are in contact with water.

Another consideration is that a floating solar plant has moving parts that are subject to constant friction and mechanical stress. Systems that are poorly designed and maintained could suffer from catastrophic failures. Floating installations are also at risk of degradation and corrosion due to moisture, especially in more aggressive coastal environments. Appropriate quality standards for the selection of PV components that would survive 25 years in harsh operating environments should be applied.

Site selection is another critical consideration. Developing floating solar projects requires a thorough understanding of water-bed topography and its suitability for setting up anchors for floats. Anchoring serves to spread loads generated by wind and waves to minimize movements of the solar island to avoid the risk of it from hitting the banks or being blown away during storms. Extensive technical studies must be conducted to assess suitable island and anchoring design, overall technical feasibility, and commercial viability of the project.

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THE MARKET TODAY

Floating solar farms are a recent development. The first installations were put in place in Japan in 2017—largely in small to midsize installations (under 5 MWp). Since then, it has commissioned some 180 MWp of floating solar projects. Korea and the United Kingdom have a similar history with installed capacities of 80 and 12 MWp, respectively. China commissioned three-quarters of capacity between 2016 and 2018 (almost one gigawatt of peak power)—the six biggest projects alone add up to more than 700 MWp. The rest of the world accounts for a total of 40 MWp of floating solar projects spread across more than 20 countries. Bangladesh, India, Indonesia, Laos, Malaysia, Sri Lanka, Thailand, and Vietnam have also announced larger floating solar projects.

GOING FORWARD

Generating renewable energy through floating solar farms is likely to grow as an important part of the effort to address climate change. As the technology develops, the costs and technical challenges are expected to fall. Demand for floating solar power will also increase, especially in response to global population growth and urbanization. Will floating solar photovoltaic generation prove to be the solution to climate and power challenges? Perhaps not, but it will be an essential part of the toolbox for addressing these issues.

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