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Floating Solar Makes its First Splash in the Market

BY BRYONY COLLINS,
BLOOMBERG NEW ENERGY FINANCE

"The last 6-8 months have seen a tremendous surge of interest [in floating solar]," remarks the director of **Solaris Synergy**, an Israel-based developer of a floating-grid designed to support solar panels on water. The sector has surged from pilot projects of kilowatt-scale to commercially-operating projects of a few megawatts in the past year alone.

It is not hard to see why: water-mounted solar power can offer a number of advantages over its land and rooftop equivalents. Benefits include an increase in efficiency due to the cooling effects of water, coupled with a reduction in evaporation and algae growth resulting from shade provided by the panels. In places where land is at a premium, bodies of water such as irrigation ponds and water treatment facilities, provide cheaper real estate on which to "set adrift" solar panels.

The latest forecasts from Bloomberg New Energy Finance show the global solar market growing to more than 380 gigawatts in 2017, an increase of around 130 gigawatts in just two years. In this climate of plunging prices for solar panels it is only natural that the industry is seeing an increasing number of applications for their use.

Jenny Chase, chief solar analyst at the London-based research firm, said: "There is no reason why a solar panel should not be mounted on a pontoon, nor is it prohibitively expensive where the water is fresh (salt water or water full of organic material may be corrosive to the panels) and relatively still. In places where evaporation is a huge problem, the pontoons can help that too."

Japan is ahead of the game in water-based solar, largely due to its small land mass. **Kyocera Corp.** and **Century Tokyo Leasing Corp.** have recently completed three plants with a combined capacity of 5.2 megawatts in the country's Hyogo prefecture. Meanwhile, **Kyocera TCL Solar** is developing floating solar projects of approximately 60 megawatts in the Asian nation, and it's not alone: Singapore, Australia, California, Brazil and parts of Europe are all looking to get involved in water-based PV.

REC Solar ASA, the Norway-based PV panel maker, claims that assembly and maintenance costs for floating solar are comparable with ground-mounted systems. Kyocera supported this argument in an e-mailed statement to Bloomberg New Energy Finance: "Construction time and labor is minimal compared with land-mounted or roof-mounted solar projects because civil engineering work is unnecessary, and it is easier to construct the mounts."

In Japan, ground-mounted installation must also meet regulations on ability to withstand strong seismic activities, something that is not required for water-based solar. Kyocera said that "utilizing unused bodies of water" provides an extra source of income for real estate owners, and confronts the issue of land scarcity in Japan.

Cary Hayes, vice-president of sales at **Pristine Sun LLC**, a California-based developer set to install the largest floating solar plant in the U.S., said that water lease costs are likely to be lower than for land. In an e-mailed statement to Clean Energy and Carbon Brief, he wrote: "[In the case of California], leasing the top of ponds is approximately half to one quarter the cost of land leases." Hayes also stated: "Floating solar will help increase energy production through the natural cooling effect of the wastewater treatment ponds, resulting in improved power production and reduced stress on the solar system, leading to longer project life."

One of the main differentials between floating and land-based solar is the potentially high cost of building a floating platform. Solaris Synergy says it has avoided this by designing a floating-grid, constructed from stainless steel wire, wherein panels float individually in separate frames. Director **Shlomo Caine** told Clean Energy and Carbon Brief: "The frames that hold the PV panels and the floats that support them are designed to enable the panels to adapt to changing wind conditions."

The array is also better able to cope with large changes in water level, making them ideal for application in a hydroelectric dam. Caine said: "A lot of companies that are producing hydro-electric power are very keen on utilizing their water bodies to also produce solar electricity, because on the back end they already have all the grid connection and hydroelectric stations. There is also a lot of interest from off-grid clients [such as] mining companies that have quarries filled with water [they wish to use] to produce electricity. The Brazilian government is talking about a tender for 350 megawatts specifically for solar on water. It is interested in it for grid applications, but also for applications in remote farming communities."

Source: Kyocera Corporation

Kyocera Corporation's 2.3 megawatt floating solar power plant in Kasai City, Japan. Kyocera's silicon solar modules are installed on Ciel et Terre's Hydrelio© floating solar platforms.

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According to data from Bloomberg New Energy Finance, 65 percent of Brazil's electricity needs are sourced from hydroelectric dams. However, the South American nation has been suffering from the worst drought for 80 years and many of these reserves have been severely depleted. Additional energy produced through floating solar could be an answer, provided of course that there remained sufficient water in the reservoir. The 350-megawatt project of which Caine speaks, is planned for the Balbina hydroelectric plant in the Amazon.

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U.S.-based **Infratech Industries Inc.** has so far installed floating solar in areas short on water. Its 4-megawatt project near Jamestown, Australia, powers the area's water facility, and cost 17.5 million Australian dollars ($13 million) to build. Elsewhere, the company is soon to begin construction on an 800-kilowatt floating solar array in Holtville, California, which will generate power to run pumps at the ponds and water treatment facility. Savings are forecast to be around $100,000 over the 25-year contract.

Infratech has developed a system where water filtration systems are attached to the raft, directly powered by the solar panels, with excess energy sent to the grid or to energy storage. **Felicia Whiting**, director at Infratech, said: "We utilize water treatment solutions in our floating solar so we can actively treat the water [at the same time as generating energy through the panels], so [it becomes both] an energy solution and a water solution." Infratech says the combination of tracking, cooling and concentrating systems in its floating solar technology can lead to increased efficiencies of up to 60 percent more than land-based equivalents. Eventually, scaling projects up will bring costs down: "A 10-megawatt scale project would be very comparable with land based solar," said Whiting.

Whiting has a positive view on the potential for submerged solar panels. Placing panels within the water, she claims, could lead to "an increase in the energy yield [due to] the refraction effect in the water," while maintenance could become simpler in that "you don't have constant exposure and splashing." However, **Steve O'Neil,** CEO of REC, said that he thinks that submerged solar would have a "limited application. You'd need a different sort of technology than silicon solar cells to capture the wavelengths [of sunlight in water]."

REC is one of the first manufacturers of silicon solar panels to guarantee its panels' performance in fresh-water floating solar applications for 25 years, the same performance guarantee as for land-based. In conversation with Clean Energy and Carbon Brief, O'Neil explained: "We tested our panels as they are, without any special modifications like additional water proofing and were pleased to see that the panels performed well enough [for us to extend] the guarantee for freshwater situations… We just have to run the testing longer to give us the confidence on salt water." O'Neil pointed out that with 70 percent of the earth's surface covered by water, there is a big incentive to develop solar panels able to withstand salinity and ocean stress. He says that the weakest parts on a solar panel, the cables and connectors, are "fairly easy to waterproof against salt water." The real problem is how to transport energy from miles out at sea, back to shore.

REC is one of nine consortia taking part in a floating PV test-bed project at Tengeh reservoir in Singapore, managed by the Solar Energy Research Institute of Singapore. The aim is for the project to have a peak capacity of 4 megawatts, and its participants will compare the costs, benefits and challenges of different floating PV technologies.

REC solar panels will be integrated in the non-corrosive, recyclable and UV-resistant floating platform made by France-based **Ciel et Terre International SAS**. "Everything about the system we like," said O'Neil. Kyocera has also procured Ciel et Terre's floating platforms for its projects as they do not effect water quality, making it easier to receive approval for a floating solar array. The arrays can be installed on different types of anchoring systems, including anchors to the water bed.

In a telephone interview with Clean Energy and Carbon Brief, **Harold Meurisse**, international business developer at Ciel et Terre, said that a direct price comparison between floating and rooftop or ground-mounted systems is not indicative of reality. "It is a totally different kind of project," says Meurisse, "Capex can be higher from the outset, [although at times it can] even compete with traditional solar mounting structures. On the other hand, opex will be a lot less, and overall production can be a lot more [due to increased efficiencies through the cooling effect]. If we localize manufacturing, capex can also be reduced through transport saving, but it depends on the local production capacity, geography and size of the project as well." Ciel et Terre has more than 44 megawatts of projects, either in operation or planned for installation by the end of the year – its main markets are Japan, the U.S., China, Korea and Brazil – while it is also working on around 10 megawatts of projects in the U.K.

"There are plenty of applications we can use depending on the country," said Meurisse, emphasizing the flexibility of floating solar to complement hydroelectric production in Brazil, reduce evaporation on Californian reservoirs, or partner with irrigation dams in the U.K. "In some countries, we are already more competitive than ground-mounted systems", said Meurisse. He added that this was the case in particular "where land is expensive and rare" or where "land [requires] a lot of civil engineering work like excavation, deforestation or seismic foundation [to house land-based solar]; or land where it is costly to dismantle if you have concrete foundations or you need to do grass maintenance."

Floating solar is still at a fledgling stage in comparison to land-based, and so projects are being developed where there is a real need – in areas short of land availability or at risk of drought. Nevertheless, in somewhere like California, with its 268 waste treatment plants, 1,400 dams and 1,300 reservoirs, the potential for the sector is "vast", said Hayes. Pristine Sun intends to "develop more of these projects throughout the [U.S.]," on the back of their 12.5-megawatt array in Sonoma County, California.

Note: This article will also be available to Bloomberg New Energy Finance clients at www.bnef.com.