

Floating solar sets sail for common ground

Innovation | A new World Bank-SERIS floating solar handbook has sparked a debate around whether standardisation could speed the segment's voyage to mainstream success. A-listers welcome the guide but insist too strict a focus on streamlined design could hamper innovation. José Rojo Martín reports



Credit: Kyocera

Of all the stories global solar has produced in its soon-to-end 2019 of dizzying growth, the coming of age of floating PV surely deserves to hold a special spot.

Having passed the 1GW installed capacity mark in 2018, the budding segment went on to dazzle in 2019 by squeezing project milestones in Singapore (50MW), Vietnam (49MW), Thailand (45MW), South Korea (25MW), the Netherlands (23MWp), France (17MWp) and many others in just 10 months. Of those put forward, a single venture – South Korea's 2.1GW Saemangeum – could alone take the industry to heights few would have predicted a few years back.

To the list of good news, add the fact that floating solar now boasts its very own how-to. The work of the World Bank and the Solar Energy Research Institute of Singapore (SERIS), the "Floating Solar Handbook for Practitioners" released in October 2019 is meant to offer a basic framework for developers to assess how a multitude of factors – plant design, energy yields, financial risks, green impacts – can

hasten or hinder a project's journey from blueprint sketch to operational launch.

The bid to lay common ground is praised by all floating PV specialists *PV Tech Power* speaks to. All have witnessed the segment's unsteady shift towards far larger, more complex ventures. As the handbook notes, what floating PV wins in avoided land conflicts it loses with the rigours – corrosion, motion stress, natural hazards – that come with its harsher territory. Players coming into floating PV from other industries appreciate the guide's attempt to ease the way via the streamlining of processes.

"Standardisation is very important for any technology, something we've been pushing for with other sectors we're active in," says Lars Brandt, CEO of Sweden-headquartered mooring specialist Seaflex. The firm his father Bertil founded in 1960 has, he explains, spent years advocating for a more streamlined installation process in the marina mooring sector and others. He believes the philosophy is transferrable to the floating segment, which Seaflex started servicing around seven years ago.

A new handbook has been published to help standardise floating solar design and construction

According to Brandt, the firm has witnessed the evolution between its 112kW maiden floating PV mooring contract with New Jersey's Canoe Brook Solar in 2011 – "No one spoke about specific floats back then, it was all built on traditional pontoons," Brandt recalls – and its later work, including 1MW and 2MW ventures in South Korea. "The talk now is of megawatt, hundred megawatt sizes," he remarks. "The industry is taking really big steps forward ... with completely new companies entering the field."

As it balloons in size, the floating solar industry must try and negotiate a better interaction with the relentless forces that surround it, Brandt believes. By way of example, he points at FRESHER, an EU-funded R&D programme run by Swedish, Spanish and Portuguese centres seeking to bring down installation costs by innovating around anchoring design. "It's all about optimising that interplay," the Seaflex CEO says. "In order to be bankable, floating installations must be certifiable."

Standardisation, both lifeline and corset

The scale of the plant design and operation challenge has not escaped those surveying the floating PV industry at the World Bank and SERIS. Among the segment's top current obstacles is, their joint handbook warns, the "technical complexity of designing, building, and operating on and in water (especially electrical safety, anchoring and mooring issues, and operation and maintenance)." Cable routing and management is "more critical" than is the case for ground-mounted PV, the guide says.

The widespread gratitude towards the World Bank-SERIS work does not stop some from warning against too heavy a focus on standardisation, particularly with



Credit: Ocean Sun

Proponents of unconventional designs such as Ocean Sun's waterlily-like membranes are calling for standardisation not to go too far

design. Børge Bjørneklett, CEO of floating PV specialist Ocean Sun, appreciates the handbook's bid to streamline processes around site choices, funding and other areas but appears more sceptical when quizzed over the search for common ground around installation design.

"I see [the handbook] as a very useful document and I think SERIS have done a great job promoting floating solar," Bjørneklett tells *PV Tech Power*.

"However, I'm slightly afraid of the talk of standardisation around the floats themselves." Noting that the handbook barely mentions the membrane design that is Ocean Sun's trademark – the approach is only discussed once in the 155-page document – he shares concern for the ongoing work to develop IEC standards for floats.

"It will make it even harder for us to market our technology, which I genuinely believe is a lot better than existing designs," the CEO says, pitching Ocean Sun's waterlily-like designs – installed across Norway, Singapore, the Philippines and

soon in Albania – as cheaper thanks to lower polymer use and better-performing thanks to increased cooling. "It is difficult for small firms to enter the market right now," Bjørneklett says. "We don't have the home markets the bigger players started with."

One of such "bigger players" strikes a similarly cautious tone when asked whether design standardisation is friend or foe for floating solar. "SERIS are doing a great job and we thank them for their work. Any emerging industry like this needs quality standards to avoid negative developments that would hurt confidence in the systems," says Bernard Prouvost, chair of floating PV household name Ciel et Terre. "Standardisation cannot be, however, a brake for success and innovation."

Ciel et Terre – which styles itself as the "creator" of floating PV – claims to have installed 230MWp-plus worth of its Hydrelion HDPE [High-density polyethylene] platforms worldwide. As project sizes increase, so does the need for flexibility, Prouvost believes. "We must ensure that

too much standardisation does not work against the innovation that is necessary to supply the market in big quantities and keep costs down," he says. "The technology should not be fixed too early."

Be water, my friend

As it leaves port and sails the choppy currents to mass-scale success, floating solar is being advised from many fronts to seek alliances with a sector that has called water bodies home for decades. That partnerships with hydropower hold great potential is a premise that runs front and centre in the World Bank-SERIS handbook. "Combining the dispatch of solar and hydropower could smooth the variability of the solar output while making better use of existing transmission assets – a benefit that could be particularly valuable in countries where grids are weak," the document enthuses.

The talk of synergies comes as no surprise to floating specialists. "The stress the handbook puts on floating solar's growth being linked to hydro dams is

really important. It's something we've been advocating for a long while," says Ciel et Terre's Prouvost, pointing at the firm's own hydro-side ventures in Brazil and Portugal. "The synergies are really evident and can bring lots of advantages to dam owners too. It's a great possible future, perhaps the most important future, for floating solar."

As Ocean Sun's Bjørneklett puts it, hydro alliances are the "easier" way in for smaller floating PV specialists. "[Hydro dam players] are often very solid institutions, with typically good access to finance and also their own engineers, which means they can do due diligence on the technology," the CEO says. "Because they very often have good control of the reservoirs, they tend to have great relations with local governments, grid operators and others. They are currently our priority."

As it happens, floating solar-hydropower partnerships are too being explored from the hydro side of the divide. Multiconsult's Bente Brunnes told a dedicated Intersolar Europe session, attended by *PV Tech Power* this year, of her firm's work to explore a 25MW floating PV add-on to a hydropower plant a consortium had rescued from ruin in Liberia. Interviewed by this publication in November, Brunnes elaborates on why she feels this is an avenue worth contemplating for either side.

"These alliances should be an interesting option for hydro players to look into, but also solar developers," says project manager Brunnes, herself an engineer with over a decade of work in the hydro sector. "With solar plants getting bigger, and the intermittency that comes with that, the synergies are very beneficial in terms of frequency regulation for countries facing challenges around shortages. They can use the reservoir very actively to store water during the day and use it at peak hours of the evening."

Brunnes does see obstacles in the smooth merger of floating PV with hydro dams, not least whether mooring systems are built to withstand the constant fluctuation in water levels. For his part, Ciel et Terre's Prouvost points at technical issues in certain environments – adapting to harsh shadows in deep, V-shaped valley dams such as Switzerland's can add to costs, the chairman says – and the regulatory headaches created by the fact that the dam owner is not always the water body owner.

Technology, Prouvost adds, could be key in maximising the synergies. "Adding smart systems and artificial intelligence can

help the dam owner decide when to use solar and when to use the water to ensure the market receives the right amount of energy at the right time and at the best price," the chairman points out. "There is some progress yet to be made around firms being able to build intelligence into the system."

The green conundrum

Another side-effect of floating PV's new-territory status is that developers remain, to some extent, in the dark about how their projects will impact ecosystems in the long term. As the World Bank-SERIS handbook puts it: "Because [floating PV] is a relatively new industry, additional studies, adaptive management, and long-term monitoring will be required to assess and understand the effects on water quality and aquatic flora and fauna."

Noting that long-term impacts on water quality are not established, the guide advocates for a "precautionary approach" over the next few years. This, the handbook explains, may entail setting "initial limits" on how much water surface is covered and avoiding developments in the high-biodiversity coastal strips nearest to shore. Some of the floating solar operators approached for this feature feel the philosophy is too restrictive, even if all regard green impact monitoring as key.

"I'm not so sure," confides Ciel et Terre's Prouvost. "Of course there should be consultation with local authorities and communities but we shouldn't say now, without testing it, that near-shore floating plants are bad for ecosystems." He points at studies by Ciel et Terre alongside Taiwanese universities which found, he says, that floating PV is compatible with fish farming. "It's obviously key that standards are put in place on pollution, biodiversity but let's not be too conservative," he adds.

Ocean Sun's Bjørneklett agrees, meanwhile, that minimising green impacts is a "sound principle" but argues that smaller systems pose little concern, particularly in artificial lakes. According to him, the firm has worked to certify its polymer structures in the Philippines projects to ensure they do not harm local biology. "When installations start covering a certain percentage, however, I do think a marine biologist should be brought along to survey the environmental impacts," the CEO remarks.

Quizzed over the merits of the handbook's precautionary approach rationale, Multiconsult's Brunnes appears

similarly ambivalent. "I think in general it's good to be cautious and assess how a floating PV addition impacts the dam, the surrounding agriculture that's existed for decades," she says. "But I'm not sure about the idea that if we don't have data then we cannot do it. It's of course important to learn from past experience but at one point you're going to have to start from somewhere."

Brunnes does welcome the handbook's focus on environmental risks, and advises firms to address questions including whether the floating plant stops sunlight from reaching the bottom of a water body, its impacts on endangered or migratory species and on the access of local communities. She agrees that data remains deficient and says the gap could be plugged via a collaborative approach: "If developers start monitoring, logging data to then share it globally it would be very beneficial. The unanswered questions are many and the way to get answers is to start with the research."

Show me the money

While all interviewees do see the value of hydropower co-location and sound environmental management, the sentiment is that for floating PV, true tailwinds can only come from a much talked-about acronym. That levelised cost of electricity (LCOE) will be the top enabler of the segment's commercial success was apparent at this year's Intersolar Europe session, with developers repeatedly asked by a critical audience to produce hard figures for project costs and returns

For smaller proponents of unconventional designs, the difficulty can lie in proving that different can also mean bankable. "The challenge for us has been to properly validate and document our systems in the eyes of clients and investors," says Ocean Sun's Bjørneklett, who explains the firm has engaged or plans to engage third-party players to help certify its trademark membranes. "Clients, however, or at least those who work with us, have spent years looking at the different floating PV designs and identified ours as the most favourable," he adds.

The stronger foothold of more established names does not save them from challenges either, though. Ciel et Terre's Prouvost notes the influx of rivals in recent years – sparking disputes around patents he says are always "difficult to defend" – and the headaches created by the rise of larger projects, driven by developers' need

to ensure profitability is not dented by lower electricity costs. "We're now working on projects of 100MW and even upwards of that," the chair says. "It's a change in the system, and manufacturing must be able to provide the market with enough quantities."

Whether new or old, all floating PV specialists currently face the same adverse market dynamic. Ciel et Terre's Prouvost points at the shift from feed-in tariffs to competitive tenders underway across much of global solar, which forces floating players to compete against ground-mount PV, wind and other entrenched technologies. "We see capex differences of 10% with ground-mounted. It's not that huge but it can make a difference in winning a tender," Prouvost says. "Through R&D we are lowering our manufacturing costs but not as quickly as solar panel prices are decreasing."

For her part, Multiconsult's Brunes warns that regulatory, planning and technical requirements will mount as project sizes increase, potentially dilating the already lengthy timetables floating PV faces to hit financial close. She believes the segment's inherently more complex



The recently completed 14.5MWp Sekdoorn plant in the Netherlands was designed to optimise the levelised cost of electricity, according to developer Baywa r.e.

designs could mean it will always be pricier than ground-mount PV but adds that floating PV's side benefits could tempt investors, particularly when the novelty factor wears off and understanding improves.

Others may not put that much stock in standardisation but to Brunes, the potential is clear. "Of course, it's important not to limit competitiveness as that is key for floating PV to build up. If this is about achieving identical solutions, innovation would be damaged," the project manager says. "The way I think about standardisation is adopting a set of rules to define the

forces plants must be able to withstand, how to calculate energy yields and so forth. Setting expectations for the quality projects must achieve, rather than how they must be designed or shaped, would be very beneficial"

Whatever the speed of travel, whether standardisation will bring headwinds or tailwinds, those placing bets on floating solar do not doubt it is destined to travel far. The handbook's "conservative" estimates of a 400GWp technical potential augur the segment a golden future. Optimists include Ocean Sun's Bjørneklett – he expects the industry to hit grid parity "very soon" – and Ciel et Terre's Prouvost, who believes the line has already been passed in countries such as Japan. Seaflex's Brandt mirrors the bright outlook. "Already now we're keeping pace with ground-mounted solar and in a couple of years, we'll be below," he predicts. ■

"Floating Solar Handbook for Practitioners" is available to download at <http://documents.worldbank.org/curated/en/418961572293438109/pdf/Where-Sun-Meets-Water-Floating-Solar-Handbook-for-Practitioners.pdf>



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