GreenPowerMonitor
a DNV GL company

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Solar's Next Wave:

Floating PV Expands Renewable Energy Generation Options

In 2014, the installed capacity of floating solar was only 10 MW, and in 2020, it has grown 100 times to more than 1.1 GW. Floating solar gives industry stakeholders a new option that leaves valuable land available for other applications. But, installing PV on bodies of water is easier said than done; sophisticated technology is required for the success of these projects. GreenPowerMonitor, a DNV GL company and a leader in solutions for floating solar plants, has partnered with Moxa to develop an integrated solution to efficiently operate and maintain floating solar PV farms.

Global Reach, Local Benefits

The renewable energy industry has reached an exciting juncture, gaining momentum with the infusion of solar, wind, and hydro power. According to the International Energy Agency, the share of renewables in global electricity generation jumped to nearly 28% in Q1, 2020. One of the most promising innovations to gain traction in the last few years is the floating-solar technology.

Floating solar, also known as floating PV (photovoltaic), involves installing solar panels on floating platforms on bodies of water. Compared with ground-mounted installations, these can achieve better efficiency as water can help keep the PV panels cool. “Whenever the temperature of the PV panels goes beyond 25˚C, their efficiency decreases.” Albert Carrera, Regional Manager APAC for GPM observes. Floating solar is particularly suitable for areas where land is not easily available but the demand for power is high and at the same time there is a dire need to conserve water. Examples include irrigation reservoirs, hydroelectric dams, water-treatment facilities, tailings ponds, and even aquaculture ponds. These bodies of water will also benefit from the PV-panels by way of reduced eutrophication and algal growth, water conservation, and better utilization of the water resource itself. When floating solar combines with hydroelectric power to form hybrid systems, benefits like utilization of existing electricity transmission infrastructure, close proximity to demand centers, and improved energy yield become even more pronounced.

Floating solar can open new opportunities for scaling up the solar power generating capacity, especially in countries with high population density and competing uses for available land. At present, countries including China, Japan, Taiwan, and South Korea have installed floating solar plants with a total capacity of 2,400 MW , enough to power 240,000 households. Data indicates that the installed capacity of floating solar has grown a hundredfold worldwide in just 6 years. It is estimated that the potential total global capacity for deploying floating solar on man-made and natural inland bodies of water alone could be as high as 4 TW.

Advantages of Combining Floating Solar with Hydroelectric Power

- **Better utilization of existing transmission infrastructure**
- **Opportunity to manage variability of solar energy**
- **Improved energy yield**
- **Close proximity to demand centers**
- **Abundance of water to meet requirements**

Wind, Water, and Wildlife—

A Host of O&M Challenges

Although floating solar plants have shown good potential and a bright future, there are some key challenges that need to be overcome. Constructing durable PV platforms is the first challenge. It's not as easy as building a solar farm on land; many factors, such as the right location to install the PV piles, anchoring them to the ground, and dealing with mooring issues, need to be considered. The next challenge is operation and maintenance (O&M). "It is certainly not as straightforward as a ground-mounted installation where everything is easily accessible. There are some unique challenges that need to be overcome to access the sensors and panels installed on the PV islands to carry out maintenance tasks." points out Carrera. Therefore, O&M needs to be carried out by certified personnel. Maintenance personnel may have to take boats to the floating structures or islands that are typically far away from land to perform their tasks. The weather also sets limitations on the O&M work that can be carried out as the safety of the maintenance crew is important. For example, the wind loads need to be monitored to check for high wind conditions to avoid. Since it's an unstable and unpredictable environment, Carrera shares that "You need to swim when you fall in to the water."

Without IIoT-based technologies in place, plant owners have to rely heavily on regular inspections where on-duty employees perform daily inspections on each equipment. These inspections become fixed expenditures regardless of the equipment condition. Time is often wasted on routine checkups for functioning devices or on traveling between the shore and the deployment site for the correct repair tools. And, when there is an unexpected power sag, the cause and location of which cannot be identified onshore, the inspectors must check each individual floating module until the faulty one is found. It's as if trying to find a needle in a haystack, long and tedious.

In addition, the high humidity and salinity in the environment can lead to corrosion and, therefore, a shorter lifespan for onboard electronic equipment. These challenges present the need for IIoT-based technology for efficient and reliable O&M.

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Ecology Meets Technology—

Streamlined Solutions for Managing the Onboard Equipment

To date, GPM manages more than 32 GW of renewables (solar, energy storage, and wind) in over 72 countries. With its rich experience in the field of renewables, GPM is devoted to designing solutions for the floating solar industry that can address the many challenges faced by asset owners and plant operators. The best way to resolve these issues and challenges is through technology that enables operators to detect and resolve problems remotely. Such a solution includes sensors, intelligent analytics, and monitoring to ease the burden placed on operators, and support to keep their equipment fully operational at all times.

GPM has provided such a solution to dozens of floating solar farm owners. The solution leverages IIoT connectivity to allow plant owners to monitor the power generation and equipment conditions in real time through GPM's SCADA platform. Plant owners can also perform maintenance checks on devices when they malfunction. A ticketing function integrated with the GPM SCADA platform enables operators to track all activities and service requests. This component can be linked directly with alarms to create automatic tickets and provide a seamless maintenance system.

Another benefit of the GPM platform is the inclusion of integrated sensors that collect data and perform analysis to compare the ground-mounted with floating solar projects. "Having this kind of data can give asset owners clues on investing more on floating solar rather than ground-mounted projects or vice versa", says Carrera. Moreover, by comparing the device functionality under different circumstances, new machine-learning algorithms can be developed that allow the owners to preemptively determine the potential failure rate and perform predictive maintenance on the devices to avoid permanent damage. For example, when the temperature inside a device rises due to an increase in humidity, the lifespan could be significantly reduced. This information helps the owners gain a predictive insight so that they can issue a warning when the humidity set point is about to be reached and automatically trigger counter measures.

SOLUTION

Strength in Collaboration—

A Harsh Environment Could be Our Opportunity to Shine

GPM brings a comprehensive solution to its customers through its collaboration with its IIoT connectivity hardware partner, Moxa. Moxa's communication and computing devices are proven to be consistently reliable and durable in harsh environments, even in outdoor deployments on water bodies. In a floating solar installation, there is no shade as everything is directly exposed to the sun. Therefore, all equipment deployed should be designed to operate reliably in high temperatures. Moxa's communication and computing devices can operate in temperatures as high as 75℃, ensuring smooth and uninterrupted operations. Furthermore, Moxa has a proven track record of high-quality durable products and its commitment to customers. Carrera shares "Even though water and electricity are not good friends, we are not facing any equipment issues on the PV islands because of the low replacement rate of Moxa products." With these features, Moxa is able to back the promise of long-term service that GPM makes to its customers. Carrera further observes, "We can achieve this thanks to our partnership with Moxa. We consider our collaboration with our hardware partner Moxa a critical part of our future success."

For the past 10 years, GPM has collaborated with Moxa on an ongoing basis to bring high-quality hardware to its global customers. The two companies have partnered on over 2,000 projects, including 15 floating solar PV installations in Japan and Europe. GPM has integrated Moxa hardware products and data-connectivity technologies into their solution, including: Moxa UC Series industrial fanless computer used as the data logger, ioLogik Series I/O family to read sensor information in transformer stations, and EDS Series managed Ethernet switches with Turbo Ring self-healing redundancy technology over fiber optics to build a reliable network to transmit data to power assets such as inverters. In addition, GPM regularly shares information with Moxa about additional features and products that Moxa could develop for PV solar farm deployments.

"We believe there is strength in collaboration, and we see Moxa as a key partner in delivering the solutions our customers need."

Albert Carrera

Regional Manager APAC, GPM

RESULTS

A Perfect Fusion for the Future of Renewables

The combination of robust hardware, efficient operations, and state-of-the-art technological solutions is leading to a greater proportion of renewable energy, especially floating solar, in the grid. This perfect fusion of light and water can provide many benefits to the planet such as the ability to generate clean power where land is scarce.

Additionally, as Carrera notes, “Floating solar installations provide environmental benefits as the floating solar islands reduce evaporation from the water surface. This process is particularly beneficial in areas susceptible to drought. The technology also helps reduce the presence of toxic algae blooms.”

GPM’s comprehensive solution helps plant builders and owners meet the technical challenges associated with the installation, use, and maintenance of floating solar plants. Through the course of performing numerous installations, GPM has also improved its solutions. For instance, the communication and monitoring functions have evolved to minimize communication noise by selecting the right converters with solar filtering and the right protocols.

In partnership with its parent company, DNV GL, GPM is engaged in a joint industry project (JIP) to further improve installations by bringing various stakeholders in the floating solar industry to the table to share their experiences and best practices. Carrera concludes “We believe the best practices generated from this JIP will be a great enabler to make the floating solar industry grow.” Looking ahead, GPM expects to stimulate future developments, such as hybrid/solar systems, which use a ‘teamwork’ approach to amplify the advantages of each individual power-generation source.

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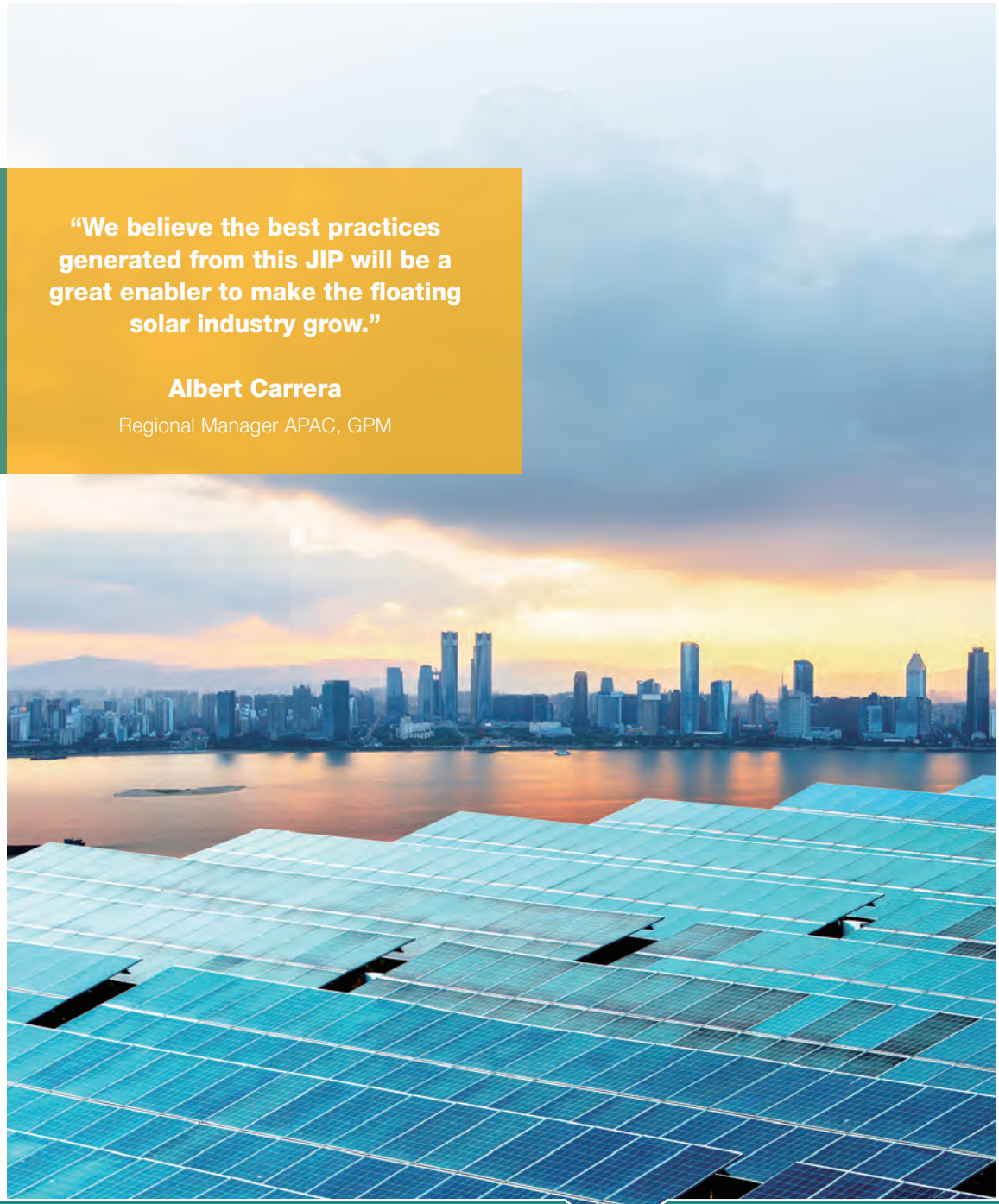
Albert Carrera

Regional Manager APAC, GPM



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