Powering a Sustainable Future with TR 100:2022 – Floating Photovoltaic Power Plants

Sembcorp Tengeh Floating Solar Farm

Floating Photovoltaic Power Plants Emerging as Promising Renewable Technology

Floating photovoltaic (FPV) systems is a new but fast-growing segment globally in the renewable energy industry. They open new opportunities for scaling up solar generating capacity, especially in countries like Singapore, with high population density, abundant solar resource potential and competing uses for available land. FPV systems also increase energy yield due to lower module temperature as a result of higher wind speed on water and evaporative cooling effect, while being less prone to shading due to open and flat environments in water bodies.

About TR 100:2022

Technical Reference* (TR) 100:2022 Floating Photovoltaic Power Plants - Design Guidelines and Recommendations provides a set of technical guidelines for the design, documentation, testing, commissioning, inspection and maintenance of FPV systems. The TR aims to enable developers, engineers and regulators to deploy FPV systems on water bodies in a safe and effective manner.

As the national standards body, Enterprise Singapore oversees the Singapore Standardisation Programme through an industry-led Singapore Standards Council (SSC). The TR was developed by the Working Group (WG) on Solar PV Energy Systems, under the purview of the Electrical and Electronic Standards Committee. The WG comprised experts from government agencies, industry associations, energy solution providers and solar developers.

Prior to the publication of TR 100, there was no national or international standard for FPV systems design, maintenance, and testing. Given the enormous potential and fast-paced deployment of FPV systems, it is critical to put in place quality and safety standards at an early stage. The development of a standard on FPV systems would also support industry growth by providing guidelines for well-performing floating solar systems, while synergising and optimising the use of land resources.

TR 100 was developed to:

- introduce clarity to the safety and technical performance aspects of FPV deployment;
- lay the foundation for enhancing the design of future FPV systems; and
- facilitate the future development of a Singapore Standard on FPV systems.

Incorporating Industry Insights in the Development of TR 100

There are many challenges that have been reported from the design, implementation and operation of FPV systems. These range from electrical installation, proper mooring and anchoring, suitable cable and connector selection, cable routing and management, location of inverters and transformers, to maintenance issues such as cleaning of bird droppings. Through the contributions from the various stakeholders from the WG, these issues have been addressed in the development of the TR.

While building the 60 MWp Sembcorp Tengeh Floating Solar Farm (TFSF) in Singapore, Sembcorp Solar Singapore (Sembcorp) overcame several challenges in designing and operating one of the world's largest inland floating PV systems at Tengeh Reservoir, which generates sufficient electricity to power about 16,000 four-room Housing Board flats annually. As a member of the WG and one of the industry stakeholders, Sembcorp provided valuable insights which were incorporated into the standard. At the same time, Sembcorp benefited from building new competencies for future growth through establishing the TR.

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*A Technical Reference (TR) is a pre-Singapore Standard that is developed with the aim of meeting an urgent industry need.

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Benefits of Adopting TR 100

Implementing TR 100 has enabled energy solutions providers, energy retailers and solar developers to glean several benefits. Here are some of the views from Sembcorp:

Enhancing Safety, Quality and Competitiveness

Dr Franco Lim, Manager of Asset Performance & Optimisation, Operations Performance Management at Sembcorp Solar Singapore, shared that codifying the safety and quality aspects of FPV systems into a standard based on the domain knowledge gained and technical capabilities acquired from developing the TFSF, will equip Sembcorp to develop more floating solar projects in the ASEAN region. These also present opportunities to export their expertise overseas and cross-train employees in renewable energy sectors across solar, wind and energy storage systems.

Boosting Compliance, Productivity and Innovation

TR 100 provides the criteria to make FPV construction compliance simpler, while helping to streamline the system design process to enhance reliability and effectiveness. For instance, Sembcorp developed a custom-built jig that increased the rate of solar panel assembly at the TFSF by 50% during installation, and deployed drones for operations and maintenance that led to a 30% reduction in manual inspection costs.

Promoting Sustainability

Implementing the standard paves the way for greater sustainability among companies in the FPV sector. Dr Lim noted that TR 100 provides customers and investors with assurance that a rigorous approach should be implemented to minimise the environmental impact when installing floating solar systems. Sembcorp implemented a comprehensive environmental management and mitigation plan – established by an independent third-party company – to safeguard water quality and maintain biodiversity during construction and also after the floating solar farm was completed. This included using certified food-grade quality and recyclable high-density poly-ethylene plastic (HDPE) floats and leaving sufficient gaps between solar panels to enhance airflow and allow ample sunlight for aquatic life.

Elevating TR 100:2022 at the International Electrotechnical Commission (IEC)

To advance standards development for FPV systems at the international level, Singapore's TR 100:2022 has been accepted by the IEC in February 2023 to be referenced as the base document for the development of a new IEC standard on FPV systems. This new international standard, IEC TS 63496, is projected to be published in October 2024.

Elevating this standard to an international level would foster industry growth in this sector and promote safety and sustainability, while accelerating greater adoption across global markets.