



Society of
FLOATING SOLUTIONS
(Singapore)



Centre for Offshore Research
& Engineering
College of Design and Engineering

Harvesting Sunshine: Exploring the Future with Floating Solar PV

Half-day symposium co-organized by the Society of Floating Solutions (Singapore) and the Center for Offshore Research and Engineering (CORE), NUS, with friendly support from the Asia Research Institute / ARI at NUS and the Singapore Institute of Technology / SIT

26 September 2024, Thursday (9am to 1.30pm)

Venue: National University of Singapore / NUS, Room EA-06-03 (EA building, 6th floor), 1 Engineering Drive 2, Singapore 117576

Please see the **map:** <https://maps.app.goo.gl/KpUdWsPmAXhAzF7p9>

Ticket purchase and registration: <https://www.eventbrite.sg/e/harvesting-sunshine-exploring-the-future-with-floating-solar-pv-registration-1002902858447?aff=oddtcreator>

The event is qualified for PDU (tbc, application submitted)

SYMPOSIUM OVERVIEW:

09:00	Welcome Remarks / Floating Solar PV Systems and Singapore's Energy Transitions Dr. Stefan Huebner SFSS and ARI, NUS
09:30	Development Review of an Open Water Floating Photovoltaic Platform Wang Wenping CIMC Raffles Offshore Limited
10:00	Coffee and Networking Break
10:30	The Floating Solar PV Market and Future Trends in Technology Dr. Oktoviano Gandhi SERIS, NUS
11:00	The Floating Solar PV Systems Boom: Benefits, Environmental and Social Impacts, and Design Considerations Riccardo Barbiellini Bureau Veritas
11:30	Buffett and Networking Lunch
12:30	Group Discussion and Q/A Session Moderated by Dr. Tay Zhi Yung Singapore Institute of Technology
13:30	End



Dr. Stefan Huebner



Wang Wenping



Dr. Oktoviano Gandhi



Riccardo Barbiellini



Dr. Tay Zhi Yung



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The event is open to the public and all are welcome!

The coffee break and a light buffet lunch are included in the ticket price.

Tickets can be purchased on **Eventbrite**: <https://www.eventbrite.sg/e/harvesting-sunshine-exploring-the-future-with-floating-solar-pv-registration-1002902858447?aff=oddtcreator>

Ticket prices:

SFSS member ticket: **SGD 0** (but registration is still necessary)

Public (non-member) ticket: **SGD 15**

Ticket sale at the venue, if available (SFSS members and public): **SGD 20**

Information on SFSS membership (regular membership: SGD 100 until the end of 2025 or SGD 270 until the end of 2027; student membership without voting rights: SGD 0) can be found at: <https://floatingsolutions.org/membership/>

SFSS members will lose their free tickets if they do not arrive for registration at least 15 min ahead of the event.

Further questions (event): SFSS President and SRF at ARI, NUS, Dr. Stefan Huebner at arihust@nus.edu.sg or president@floatingsolutions.org

Further questions (registration and tickets): SFSS Secretary Charles Lim at admin@floatingsolutions.org



Bedok Reservoir Floating Solar PV system, 2021

SYMPOSIUM DETAILS:

Harvesting Sunshine: Exploring the Future with Floating Solar PV

Floating solar photovoltaic (PV) systems have been experiencing a global boom since the 2010s. The largest project currently under construction globally is located in a reservoir on the Indonesian island of Batam and is intended to supply Singapore. Multiple large floating solar

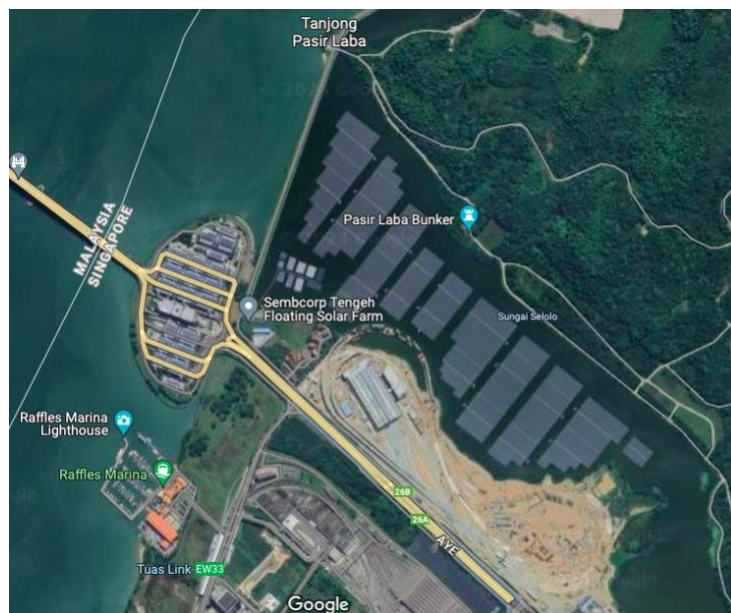


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PV systems have been set up in Singaporean reservoirs and coastal waters. This form of renewable energy generation has gained momentum in many Asian countries, as it promises reductions in greenhouse gas emissions, utilizes Asia's sunshine potential, does not compete with other land-based industries for space, and seems to have gained more social and political acceptance than many other forms of energy generation. Floating solar PV systems also appear compatible with governmental considerations of an energy economy focused more strongly on electrification and the use of new fuels like ammonia and hydrogen. Our symposium will examine key findings in the design and engineering of floating solar PV systems in inland waters, along coastlines, or offshore, and explore the technical, social, economic, and environmental dimensions of their deployment. Depending on location, mooring systems, cooling systems, cleaning systems, construction and maintenance costs, disaster safety, local power generation potentials, environmental impacts, interactions with wildlife, synergies with other industries or spatial competition with them, integration into changing energy economies and supply chains, energy security concerns, and aesthetic considerations have given rise to a multitude of questions that this symposium will address.



Sembcorp Tengkeh Floating Solar Farm

SPEAKER ABSTRACTS AND BIO TEXTS:

Dr. Stefan Huebner | Society of Floating Solutions Singapore / SFSS and Asia Research Institute / ARI, NUS

ABSTRACT: Floating Solar PV Systems and Singapore's Energy Transitions

This presentation integrates floating solar PV systems into Singapore's past and present energy transitions. It explores how fossil fuel-related lock-in effects, potential synergies with other industries, and the use of aquatic space for energy generation continue to shape the city-state's and the region's energy economies. Singapore has experienced multiple important energy transitions since the nineteenth century. These energy transitions had close connections to



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aquatic bodies, including transportation, cooling water intake, resource extraction (offshore oil and gas), and the use of energy infrastructures like submerged pipelines, single buoy moorings, or floating LNG terminals. The multiple economic synergies that characterized previous fossil fuel-powered transitions today create lock-in effects for Singapore's planned transition to renewable energy sources and fuels in the form of ammonia and hydrogen. However, floating solar PV systems appear as a promising solution to Singapore's and Southeast Asia's electricity demand. The project in Batam, constructed to supply Singapore, is one example of new forms of energy imports, utilizing new aquatic space with related advantages and problems, and creating new synergies between industries.

Dr. Stefan Huebner is the president of the Society of Floating Solutions (Singapore). He is also a Senior Research Fellow at the National University of Singapore's Asia Research Institute. He is working on the history, present, and future of ocean industrialization and new forms of urbanization. His monograph on the topic is expected to be published in 2025, and he has written multiple articles on the topic. He is currently conducting research on a project on the carbonization and decarbonization of Asia. During the spring semester 2019, he served as a U.S. SSRC Transregional Research Fellow at Harvard University, where he was previously a Fulbright scholar during the spring semester of 2018. Earlier, he was a History and Public Policy Fellow at the Woodrow Wilson International Center for Scholars in Washington, DC.

Wang Wenping | CIMC Raffles Offshore Limited

ABSTRACT: Development Review of an Open Water Floating Photovoltaic Platform

Building a safe, reliable, green photovoltaic (PV) power generation plant has become a key national development direction in China's new energy industry. Nowadays, the available land for deploying PV is becoming scarce. Additionally, national restrictions on deploying PV in lakes, reservoirs, and other freshwater areas have been announced to ensure further environmental protection. Therefore, deploying floating PV platforms on seashore open water is emerging as a national-level urgent need. A four-body interconnected platform (400kW) has been installed 4km away from the coastline of Yantai, China, for concept proof and data collection purposes. A bamboo-based composite material floating platform is also installed nearby for material testing. Together with a bottom-seating steel platform carrying various kinds of testing equipment, the first Offshore PV Demonstration Base dedicated to PV testing under sea environment has been established by CIMC Raffles in China. This talk is a project development review of our semisubmersible-type floating platforms. It highlights our novel weight optimization concepts in various aspects. Special emphasis is placed on a fully coupled time-domain hydro-structure-mooring multi-body analysis workflow, including composite material modeling, which has been used to provide an accurate global strength analysis. In addition, a bamboo-based composite material platform, a totally lightweight and low-carbon platform, is briefly introduced. Our illustrated experience covers design, fabrication, installation, and operation with field monitoring. This project review provides the audience with a project reference for assessing any seashore floating PV platform. Our continuous research into developing a lightweight and low-carbon floating platform is a recommended option for the future.

Wang Wenping currently works as a principal engineer at CIMC Raffles Offshore Limited in Yantai, China, in charge of basic design review and new energy research, such as floating solar,



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floating wind turbines, etc. He came to Singapore as a research scholar in NUS' Civil Engineering Department in 1995. After graduating with a Master of Engineering, he has been working for several EPC companies, like JSPL and Keppel. He has a total of 20+ years of marine and offshore basic design professional experience in Singapore. He once led a structural group for the complete semisubmersible and drillship hull and topside structural design at Keppel. He also has hands-on experience with TLP (Houston), FPSO (China), container ships, etc., for basic design. He is a technical specialist, familiar with various FEM tools for analysis of various kinds of floating structures, especially for coupled hydro-structure simulations.

Dr. Oktoviano Gandhi | Solar Energy Research Institute Singapore / SERIS, NUS

ABSTRACT: The Floating Solar PV Market and Future Trends in Technology

This talk will provide a comprehensive overview of the Floating Photovoltaic (FPV) market, examining its current landscape and global potential for clean energy generation. It will also address the need for international standards to ensure safety and reliability while exploring future trends in FPV technology, particularly focusing on hybridized operation.

Dr. Oktoviano Gandhi serves as a Senior Research Fellow at the Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore (NUS), where he currently works on floating PV projects in collaboration with industry partners and public institutions. Dr. Oktoviano obtained a Master of Physics from the University of Oxford, United Kingdom, in 2015. He subsequently obtained his Ph.D. in Solar Energy from NUS, Singapore, in 2019 and became the Valedictorian. His research spans solar cell design, energy storage, power system operations, and energy policy, resulting in more than 40 international publications and two books with over 1,900 citations.

Riccardo Barbiellini | Bureau Veritas Marine & Offshore

ABSTRACT: The Floating Solar PV Systems Boom: Benefits, Environmental and Social Impacts, and Design Considerations

Floating solar photovoltaic (PV) systems offer an innovative approach to renewable energy generation, leveraging water bodies to produce clean electricity without occupying valuable land. With significant potential in the Asia-Pacific region, these floating solar farms are gaining traction, as exemplified by Singapore's ambitious actions. Bureau Veritas provides comprehensive support for floating PV projects, from technical advisory and certification to operational guidance, ensuring the safety, reliability, and sustainability of these innovative systems. This presentation provides an overview of the key technical aspects of floating solar technology, including the benefits, design considerations, environmental and social impacts, and operational best practices.

Riccardo Barbiellini is the Data and Digitalisation Manager for Bureau Veritas Marine and Offshore based in Singapore. In his role he formulates partnerships and provides guidance to clients with a bespoke end-to-end service supporting them on their digitalization journey. He is a leader focusing on new digital technologies and innovation, helping clients be safer, more efficient, environmentally friendly, and informed. Riccardo also extends his expertise in the



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areas of marine renewables, battery, and hybridization as well to support Bureau Veritas' clients in their efforts to embrace more sustainable and technologically advanced marine solutions. Riccardo has had a diverse career, with over ten years as an electrical engineer in the Royal Australian Air Force and ten years in the energy and utilities sector, leading programs for construction, asset strategy, new technology, and innovation. Riccardo has successfully led adoption programs for IoT networks, electric vehicle trials, and satellite hyperspectral imagery gathering. He holds a Master of Business Administration from Deakin University, a Master of Science in Military Electronic Systems Engineering from Cranfield University, and a Bachelor of Electrical Engineering with honors from the University of New South Wales.

MODERATOR:

Dr. Zhi Yung Tay is a council member of SFSS and serves as an Associate Professor at the Singapore Institute of Technology (SIT), specializing in offshore engineering and floating structures designs, as well as hydrodynamics and hydroelastic. Previously, from 2014 to 2016, he held a prestigious position as a Postdoctoral Research Associate at the Institute of Energy Systems (IES), University of Edinburgh. During this tenure, Dr. Tay spearheaded the hydrodynamic modeling efforts within the EPSRC EcoWatt2050 Project, showcasing his expertise and leadership skills. Prior to his role at IES, Dr. Tay garnered extensive industry experience, notably as a Senior Research Engineer at the Keppel Offshore and Marine Technology Centre. Additionally, he served as a Research Fellow at the esteemed National University of Singapore (NUS). Dr. Tay's academic journey culminated in the attainment of his Ph.D. from NUS, with a specialization in the hydroelastic response of very large floating structures. Dr. Tay's research endeavors focus on hydroelastic and hydrodynamic analysis, with particular interests in offshore engineering, coastal protection and flood management, marine engineering, marine digitalization and AI, renewable energy, ocean space utilization, and the dynamics of very large floating structures.

This event is co-organized by the Society of Floating Solutions (Singapore) / SFSS and the Center for Offshore Research and Engineering / CORE at NUS, with friendly support from the Asia Research Institute / ARI at NUS and the Singapore Institute of Technology (SIT).