

Floating solar PV in the Pacific

A game changer



TA-6680 REG Preparing Floating Solar Plus Projects under the Pacific Renewable Energy Investment Facility

TA 6680 is funded under the Clean Energy Financing Partnership Facility, through the Asian Clean Energy Fund established by government of Japan, and the Clean Energy Fund with financing partners: the governments of Australia, Norway, Spain, Sweden, and the United Kingdom, and administered by the Asian Development Bank

TA-6680 REG overview

The Technical Assistance TA-6680 REG Preparing Floating Solar Plus Projects under the Pacific Renewable Energy Investment Facility takes place in the Pacific Island Countries (PICs), specifically in PIC-11.

The implementation of the project in the PIC- 11 countries was divided in 3 phases:

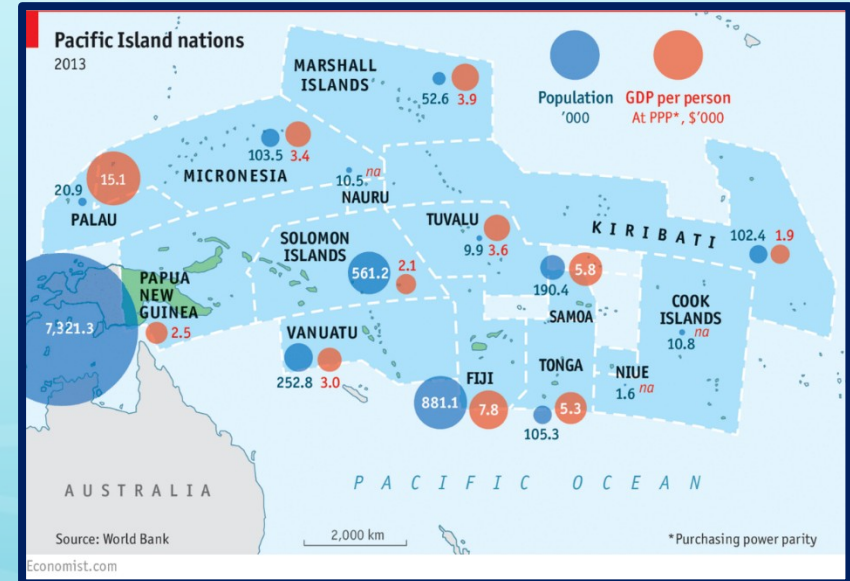
Phase 1:
Kiribati, Tonga and Tuvalu

Phase 2:
Federated States of Micronesia (FSM), Republic of the Marshall Islands (RMI)

Phase 3: Cook, Nauru, Vanuatu, Palau, Samoa and the Solomon Islands.

Total landmass of 46,000 km²
Population of 1.5 million

15% of the globe's surface
2,000 islands



Floating PV Technology

A floating solar PV system results from the combination of PV plant technology and floating technology. The technology is widely used in waterbodies inland, such as lakes, where several meteorological factors are in compliance with the FPV structural limits.

Several technical solutions of Floating Systems are presented below, from some reference suppliers:



HDPE type (Source: Ciel & Terre)



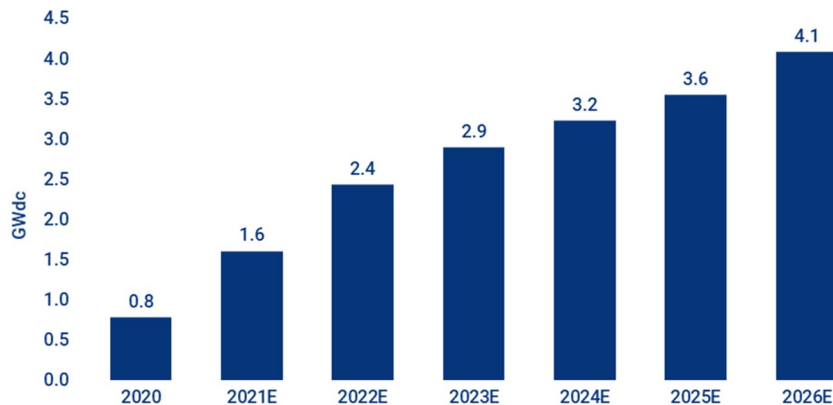
Solution provider for offshore PV systems- Offshore solutions metallic and plastic (source: Ocean Sun AS)

Off-shore FPV is still in its infancy and represents one of the main challenges for this technology.

Floating PV quick facts

- Started in Europe before 2010, but currently more than 70% of the market is in Asia
- Most FPV installation are in Japan
- Largest installations are in China
- India will join the top FPV countries with the projects under construction
- Netherlands leads in Europe in terms of installations
- Portugal has conducted the first dedicated FPV auction in 7 reservoirs and booked a negative tariff for a 70 MW project in Alqueva.

Annual global floating solar installations



Source: Wood Mackenzie Global Solar Markets Service

Floating PV recent developments in Asia



Project Name: Sembcorp
Tengah Floating Solar Farm

Location: Tengah Reservoir,
Singapore

Developer: Sembcorp
Industries

Size: 60 MWp

Start date: August 2020

Commission Date: July 2021



Floating PV recent developments in Asia



Project Name: Hapcheon
floating solar power plant

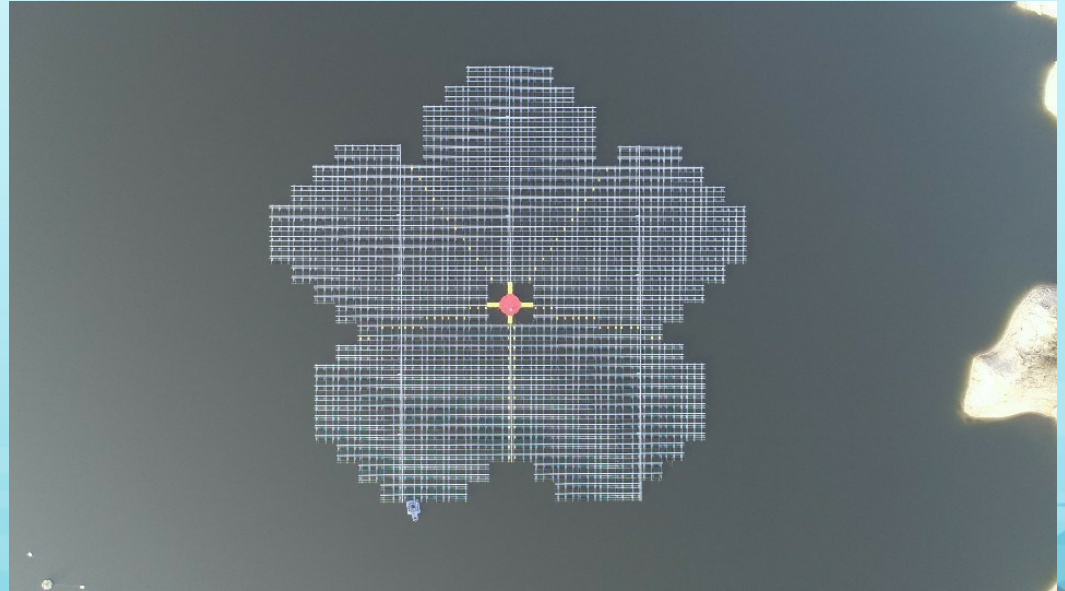
Location: Hapcheon Dam in
South Gyeongsang province,
South Korea

Developer: Scotra (floater
manufacturer)

Start date: 2020

Commission Date: December
2021

Size: 41 MW



Floating PV recent developments in Asia



Project Name: Sirindhorn Dam
Floating Solar Power Plant

Location: Ubon Ratchathani
Province, Thailand

Developer: Electricity
Generating Authority of
Thailand (EGAT)

Start date: 2020

Commission Date: October
2021

Size: 45 MW



Floating PV recent developments in Asia



Project Name: Huaneng
Power International's 320MW
floating solar Plant

Location: Dezhou reservoir

Developer: Huaneng Power
International

Start date: 2020

Commission Date: December
2021

Size: 320 MW (includes 8
MWh of BESS)



Near shore FPV solutions



Source: Energyfacts.eu

5MWp FPV plant, straits of Johor, Singapore, March 2021

Installed between peninsular Malaysia and Singapore, by Sunseap group Ltd, of Singapore.



Source: PV-tech

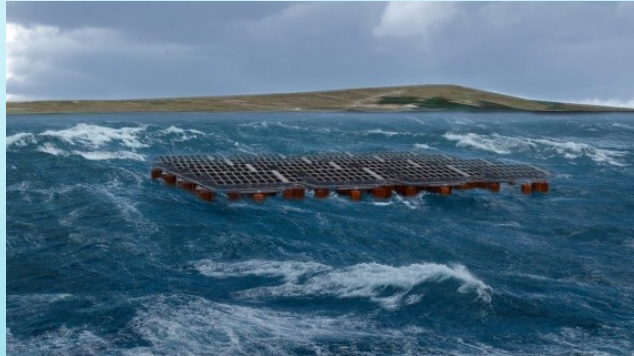
4MW FPV plant, Mahe, Seychelles, 2020

Installed on a salt water lagoon, Providence by Quadran Seychelles Ltd, a local entity of Quadran International, part of Lucia Group.

Offshore floating PV plants



Pilot for offshore floating solar power in Canarian waters (Spain) within the framework of the EU BOOST (Bringing Offshore Ocean Sun to the global market)



Concept for Pilot projected for a FPV plant in Froya (Norway) by Equinor

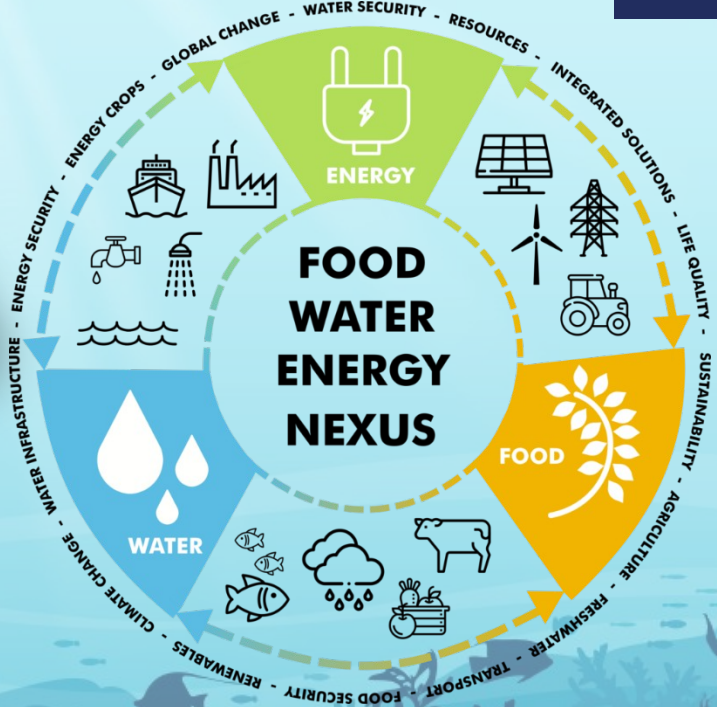
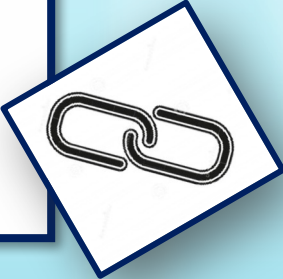
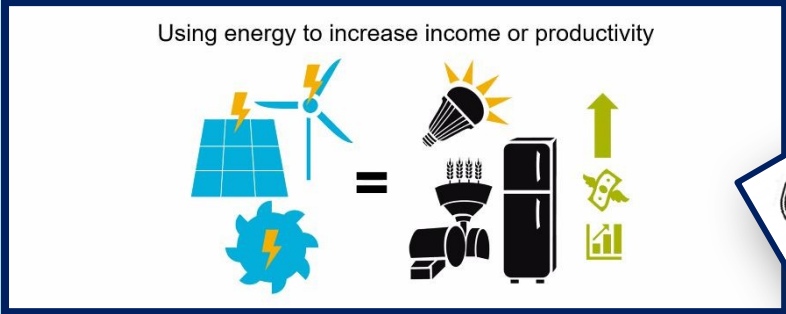


Hybrid Off-shore pilot project FPV+Wind funded by European Union - SCORE

Note: Although there are some examples of FPV structures with more resistance, the tolerance of FPV for Off-shore environment is still very limited.

Productive uses of energy

What is a productive use of energy?



“Agricultural, commercial and industrial activities involving energy services as a direct/indirect input to the production of goods or provision of services with increase in income or productivity” (GIZ)

Floating PV and PUE

Energy-Food Nexus

Aquaculture

Aquaculture may be developed co-located with Floating PV, with guidelines for each marine environment.



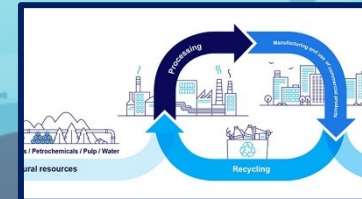
Vertical farming and Aquaponics

Commercially viable and cost competitive solutions



Energy-Circular Economy Nexus

- FPV and circular economy integration;
- Potential use and scalability of recycled materials in the FPV;
- Studies and projects on FPV integration within the value chain of specific contexts such as remote island settings



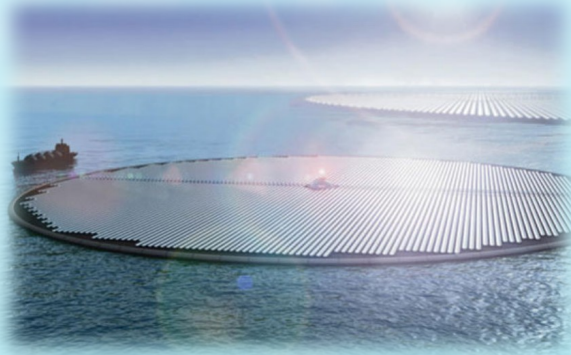
Floating PV and PUE

ADB

Energy-Water Nexus

Desalination

Large scale projects for the integration of both technologies should be further developed. Specific large-scale commercially-viable FPV designs that could filter the rainwater and provide a clear safety water supply should also be further developed.

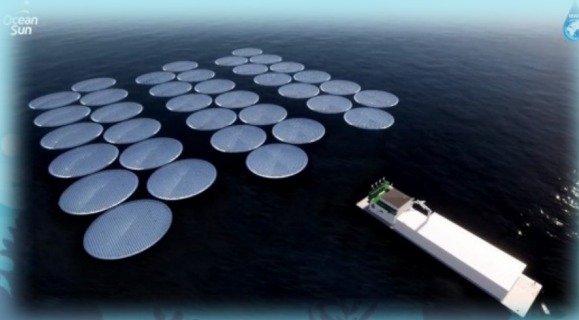


Hydrogen +FPV research project: A solar PV-powered electrolysis device which can operate as a stand-alone platform that floats on open water.

Energy-Transportation Nexus

Energy-Mobility Nexus

- Development, technological improvement and commercial use of electrical transportation system such as e-ferrys, e-bikes, e-vehicles.
- Designing FPV with integrated floating charging stations at a large-scale and commercially viable for the charging of e-boats and hybrid vessels;
- Development of low-cost e-boats for O&M of the FPV plants



Ocean sun's Floating PV technology for desalination plant



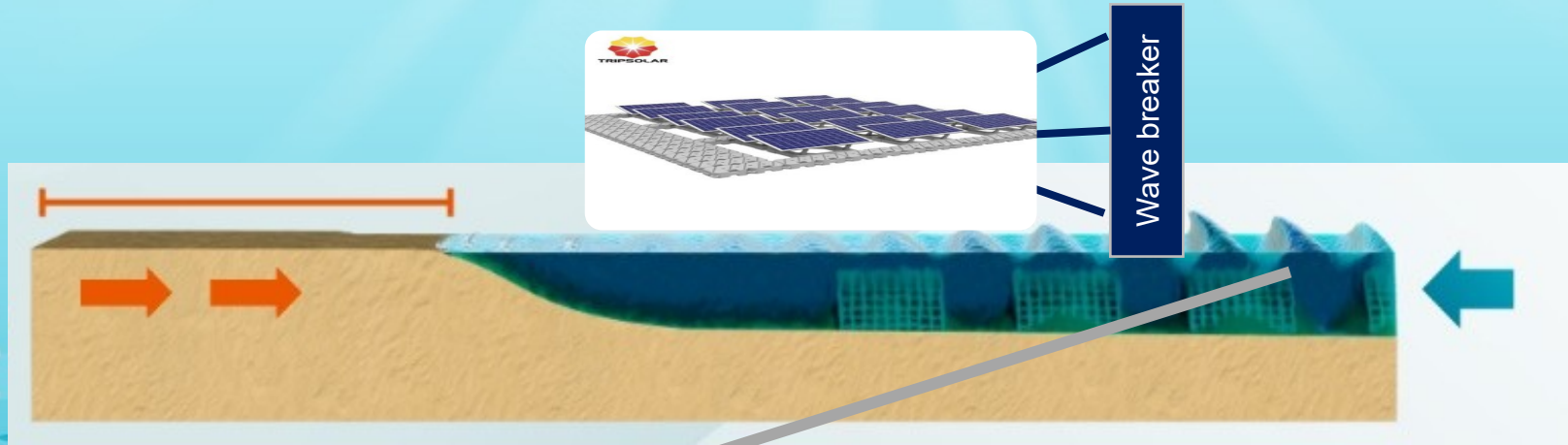
E-boat X Shore Eelex 8000

OCA
GLOBAL

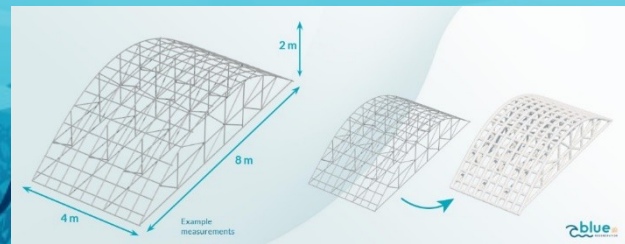
Near shore FPV and coastal protection solution for the Pacific islands



Beach, reef regeneration & shore and floating PV protection for the PIC-11: projects coming up in 2023 in Kiribati and Tuvalu



Concept of Biorock sunken structure for wave attenuation and reef growth

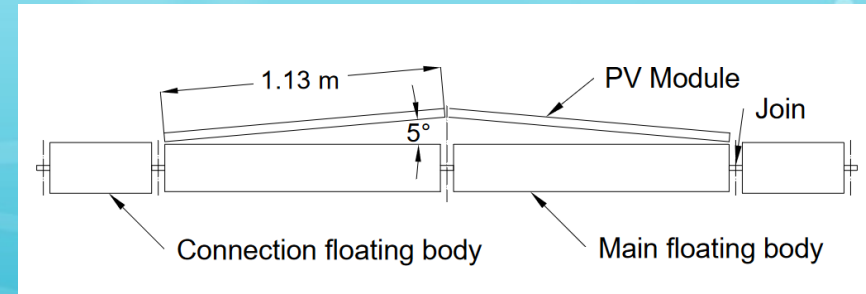
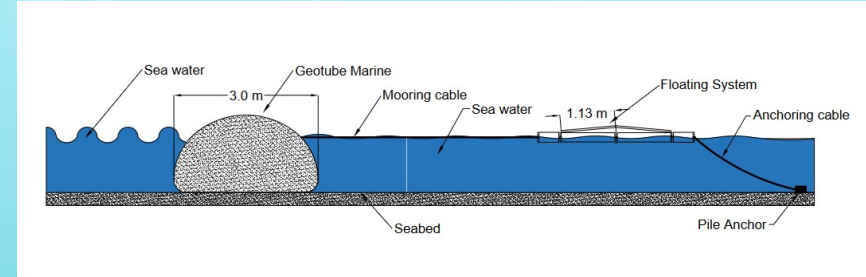
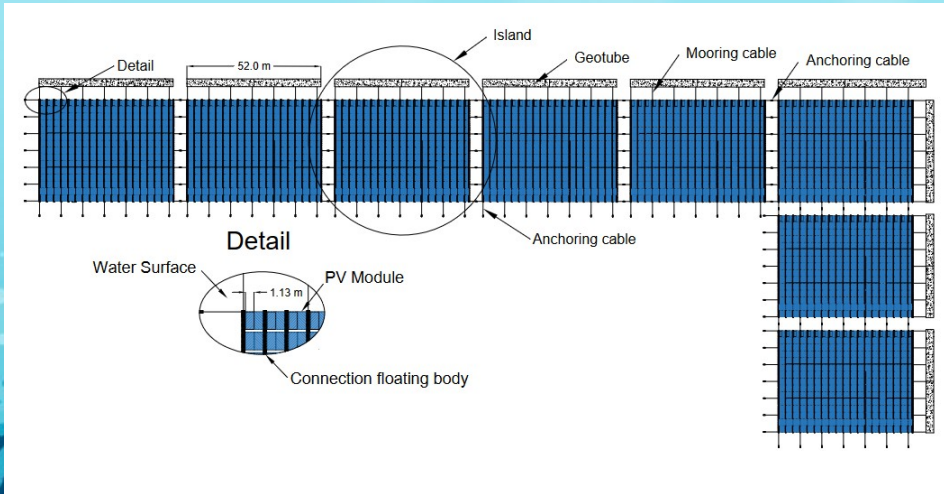


Kiribati – Betio Marine Training FPV plant

Scheduled for implementation in 2023



- Smaller islands
- Geometrical shapes
- Reduced drag and lift
- Protection by wave breaker
- Partially filled floaters



Floating PV

Game changer in the Pacific



- Land is scarce and valuable plus it is disappearing: FPV does not need land and can even provide coastal protection
- Can be located next to the load at utility scale with scale and cost benefits versus rooftop PV
- Can accelerate the solar PV penetration in the electricity generation
- Addresses climate vulnerabilities, achieves resilience
- Improve marine conditions at the FPV site
- Positions PIC-11 at the forefront of Renewable Energy Green Economy
- Delivers benefits of energy/water/food/transport nexus
- Enables flourishing local socio-economic growth, employment and well-being
- Low to no environmental and social impact



Thank you!

TA-6680 deputy team leader
Agostinho Miguel Garcia