

Centrale-Énergies

Centrale Métiers de la Mer



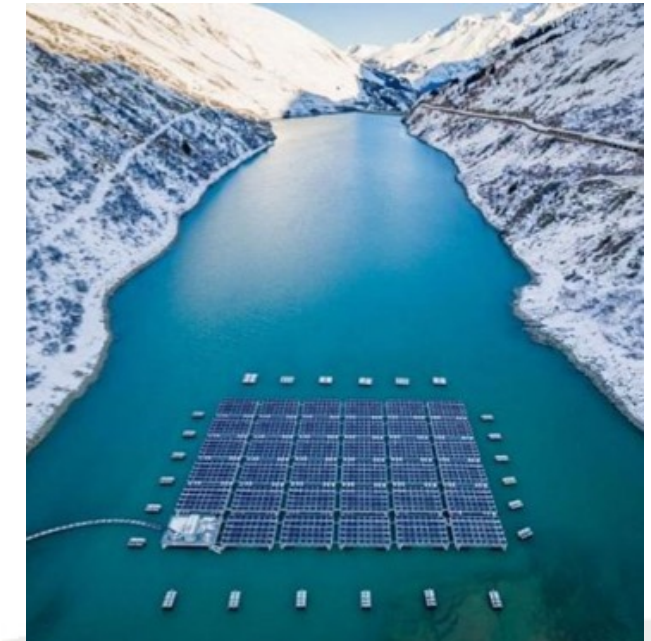
Le solaire flottant

Une croissance “exponentielle”

Jean-Michel DUMAY

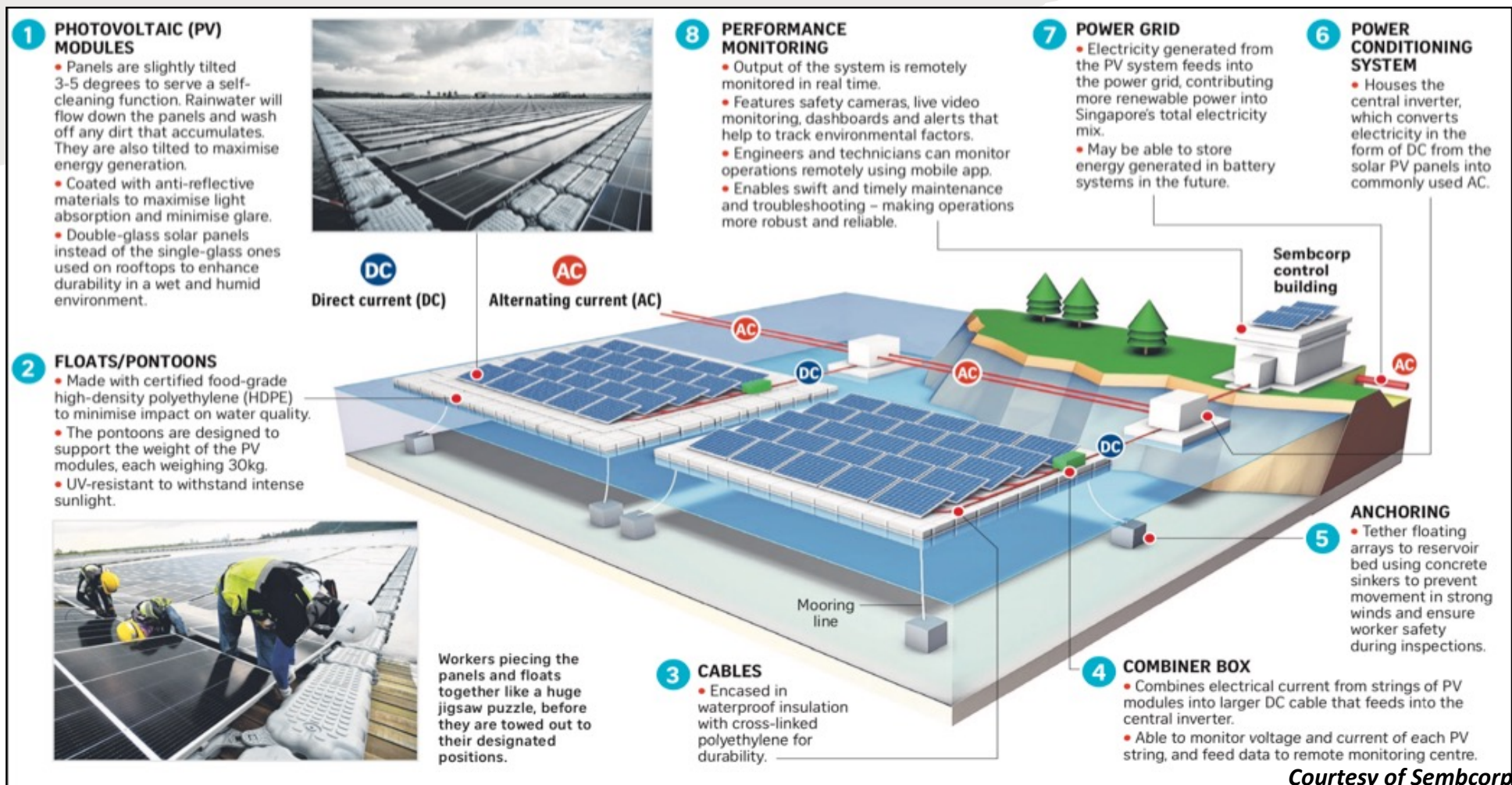


“Where there
is water,
there is
potential for
FPV”



conférence JMD du 16/11/22

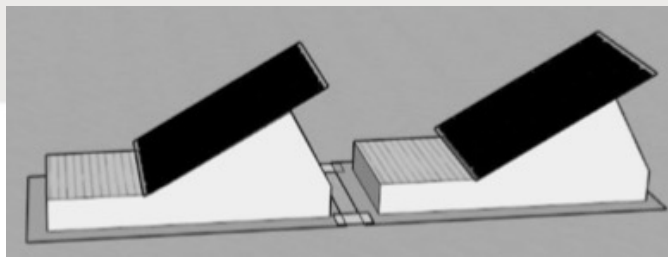
How FPV works?



Courtesy of Sembcorp

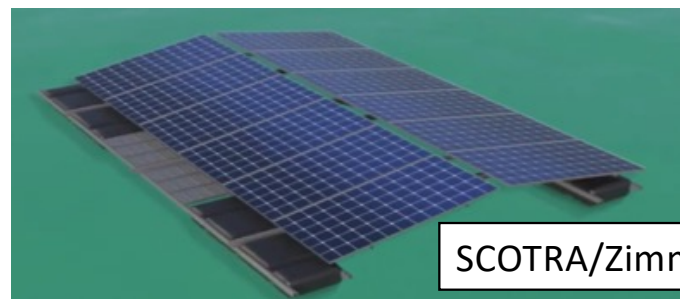
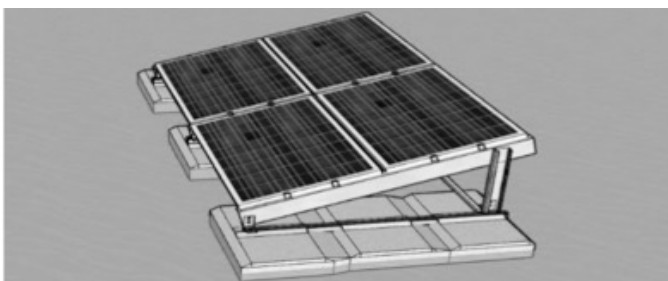
Technology review : 3 concepts

Pure
floats



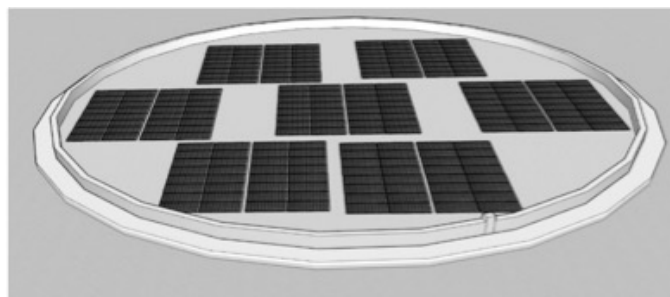
Sungrow/Ciel & Terre

Modular
raft



SCOTRA/Zimmerman

Membrane
floats

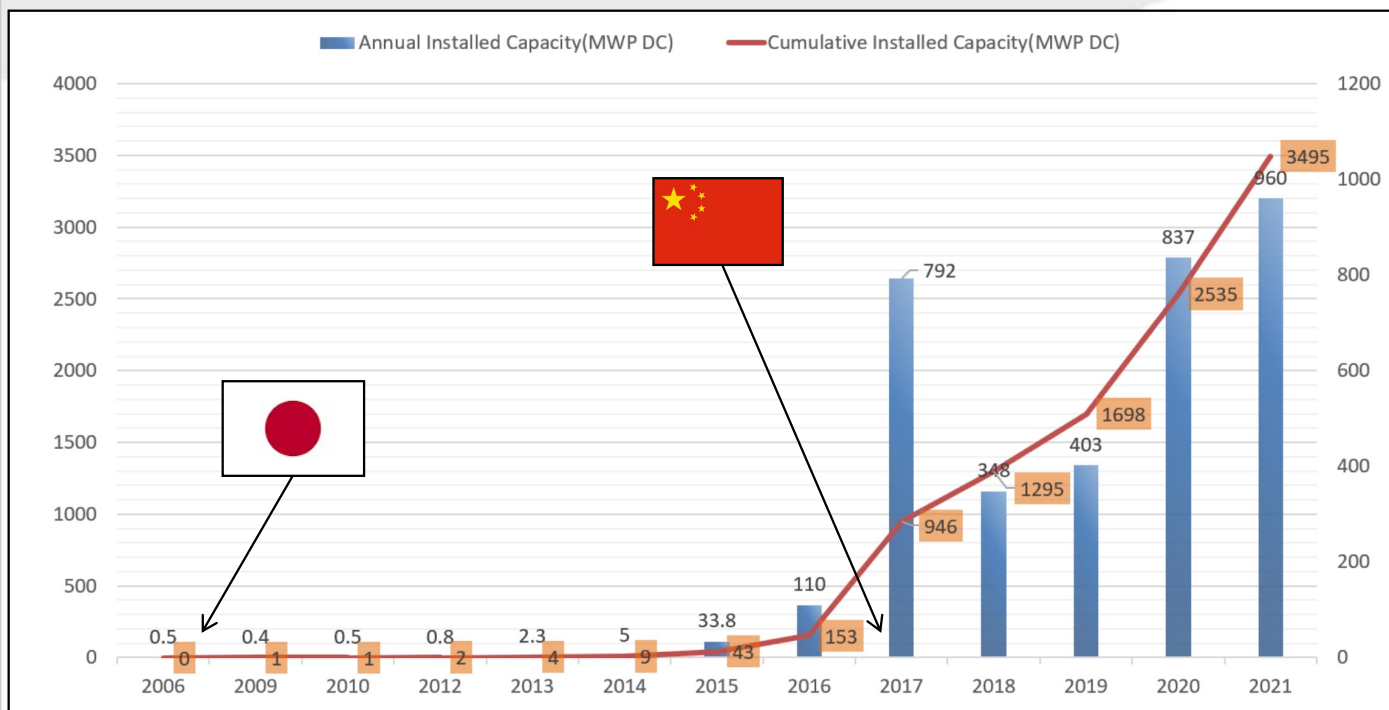


Ocean Sun/Solar Duck



According to DNV

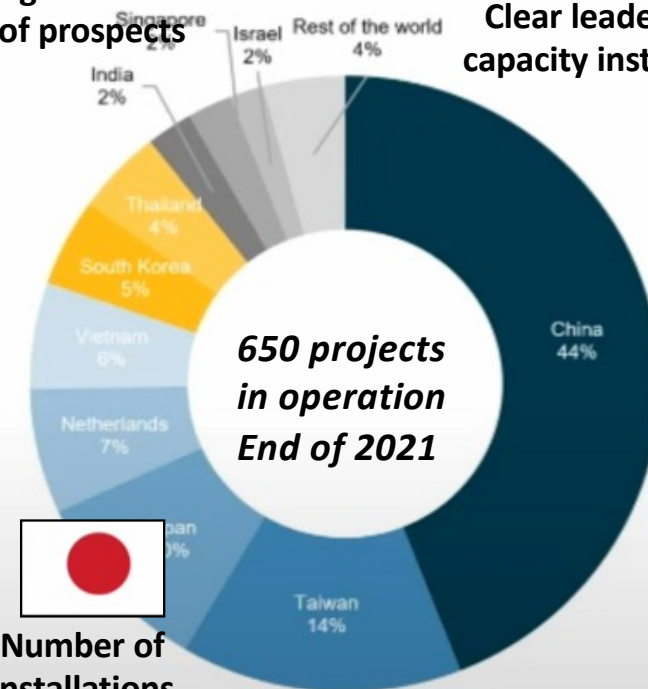
Exponential market growth



**Largest number
of prospects**

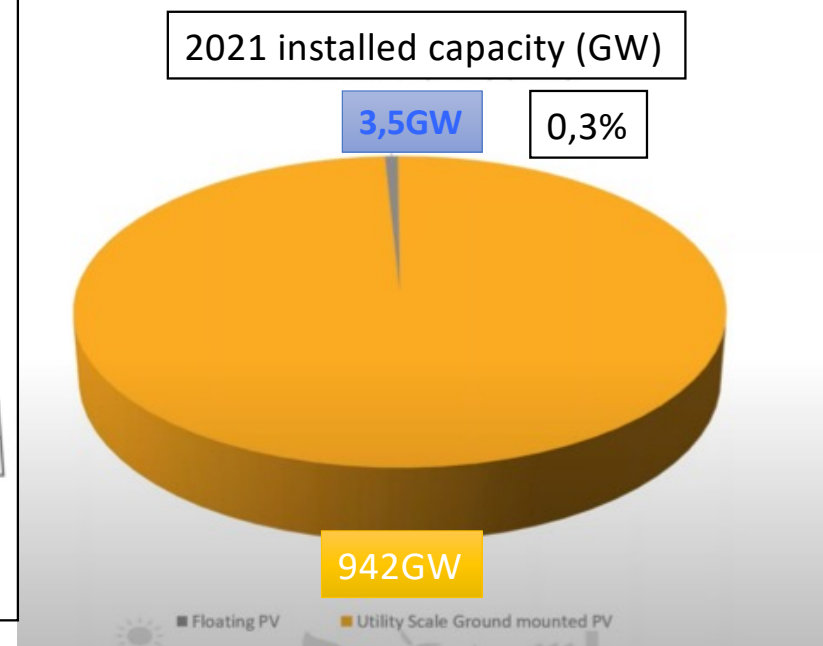
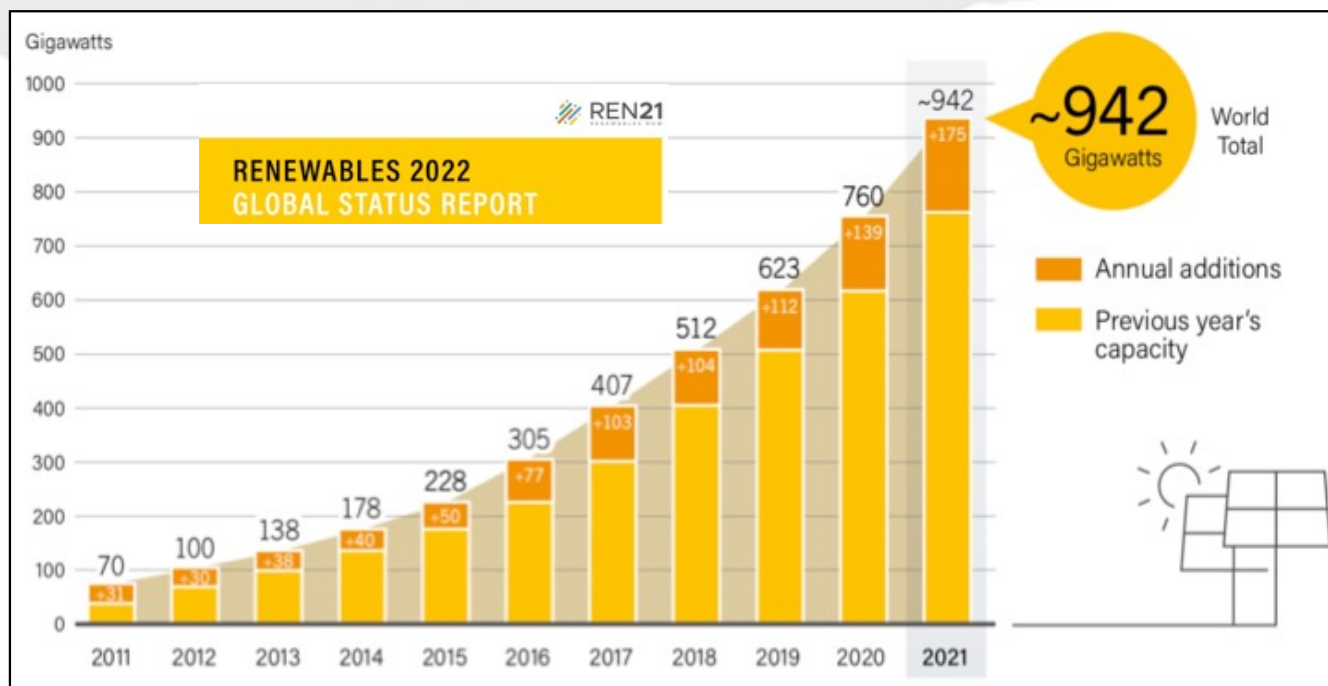


**Clear leader in
capacity installed**



**Number of
installations**

Floating Solar vs Ground mounted



Where Sun Meets Water

BENEFITS AND CHALLENGES OF FLOATING SOLAR

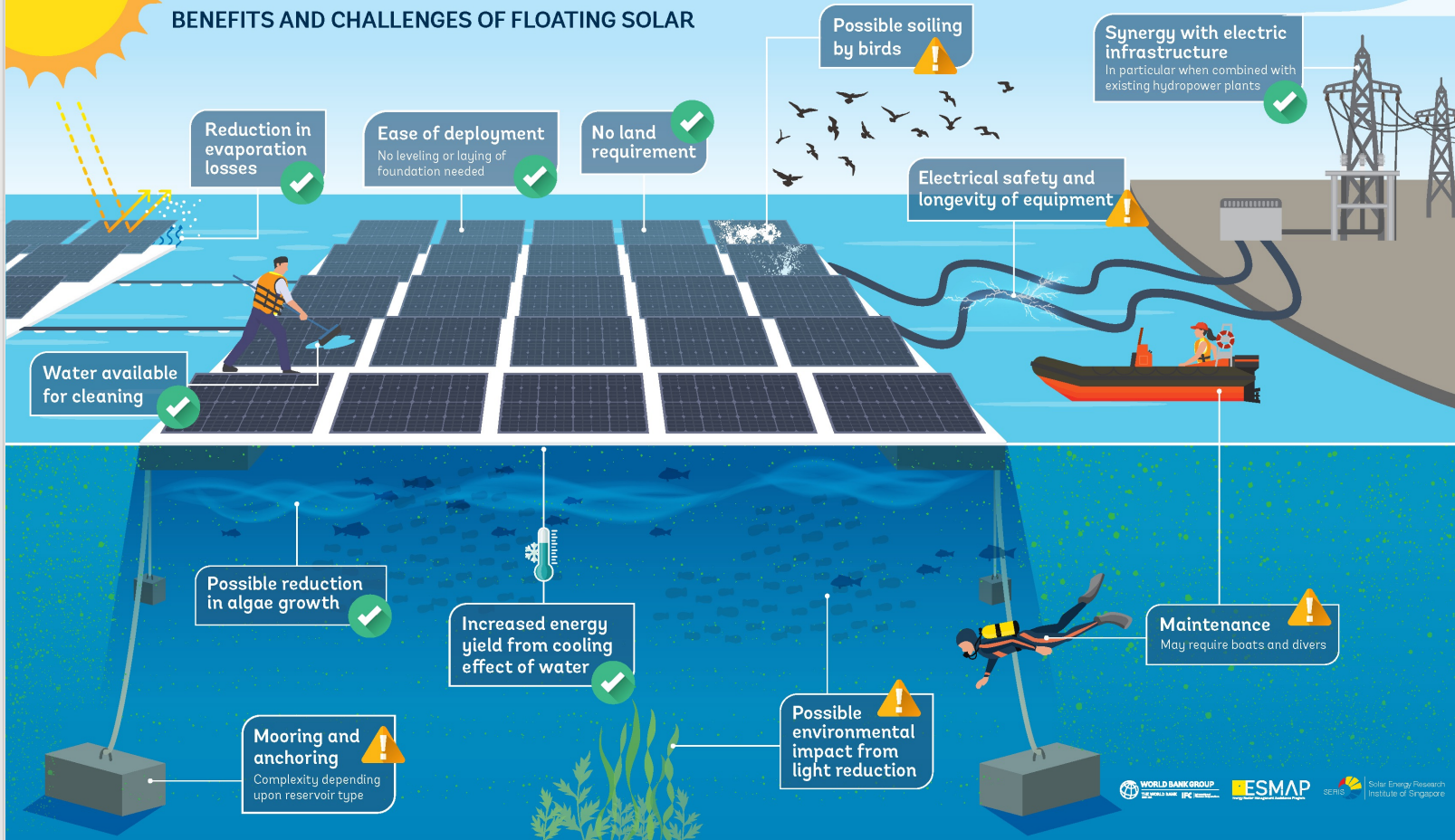


Image credit: World Bank Group, ESMAP and SERIS.

BENEFITS

- No land requirement
- Cooling effect
- Reduce evaporation
- Easy to deploy
- Net Zero Carbon
- Autonomy

CHALLENGES

- Mooring/electrical
- Intermittence
- Oper. & Maintenance
- Environment
- Other users (Tourism, Fishermen...)

Operating in complex environmentally & socially sensitive areas



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Market segmentation

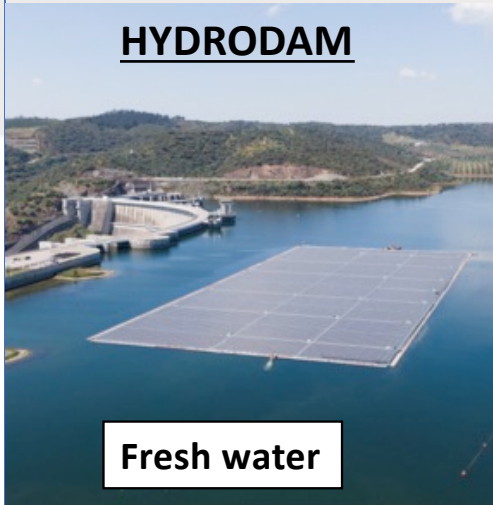
INLAND WATERBODIES



Fresh water

- Huaneng Power International Shandong (China)
320MW
2021
- Akuo Quarry Piolenc (France)
25MW
2019-2022

HYDRODAM



Fresh water

- EGAT Sirindhorn Dam (Thailand)
45MW
2021
- EDF Lazer (France)
20MW
2022

NEARSHORE Lagoon, intertidal..



Salty water

- Chenya Energy Changbin (Taiwan)
181MW
2020
- Qair Mahé (Seychelles)
5MW
2023

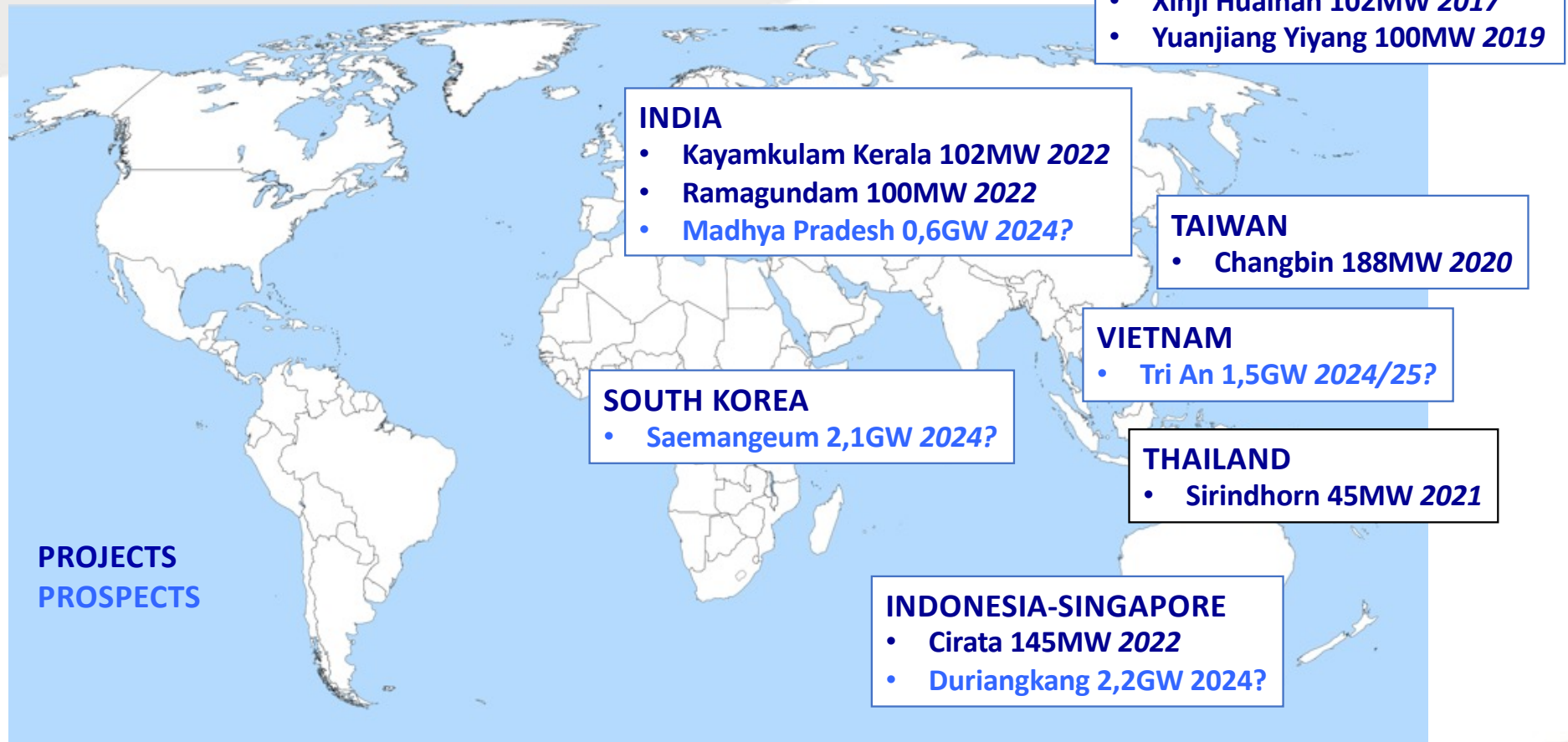
OFFSHORE



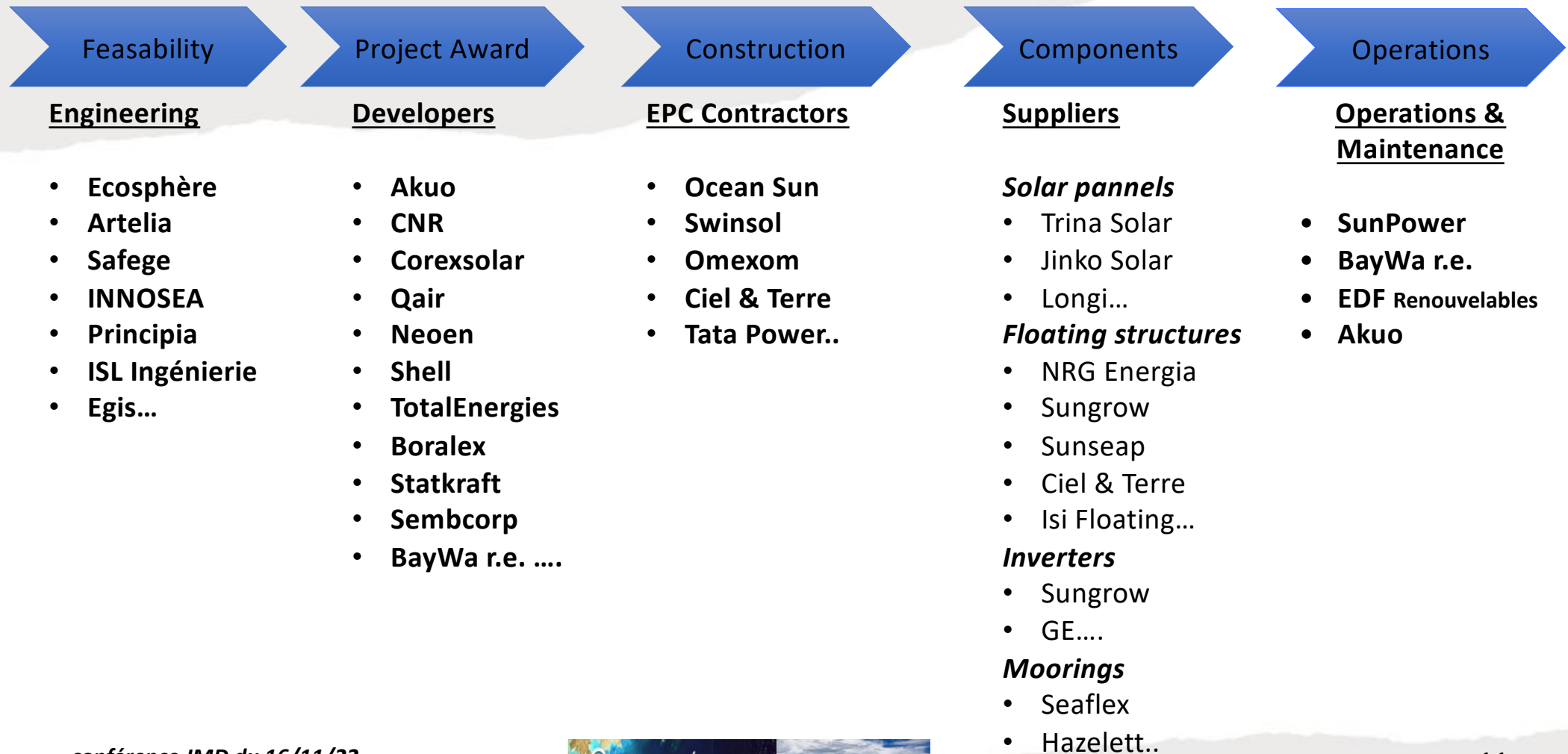
Salty water

- Equinor – Moss Maritime
To test a pilot of 1MW
Offshore Norway in 2022
- Solar Duck
BOC project
Cooperation with RWE
- SPIC – Ocean Sun 0,5MW
combined with OWF

Projects & Prospects **booming** across the globe



Supply Chain : a fragmented market

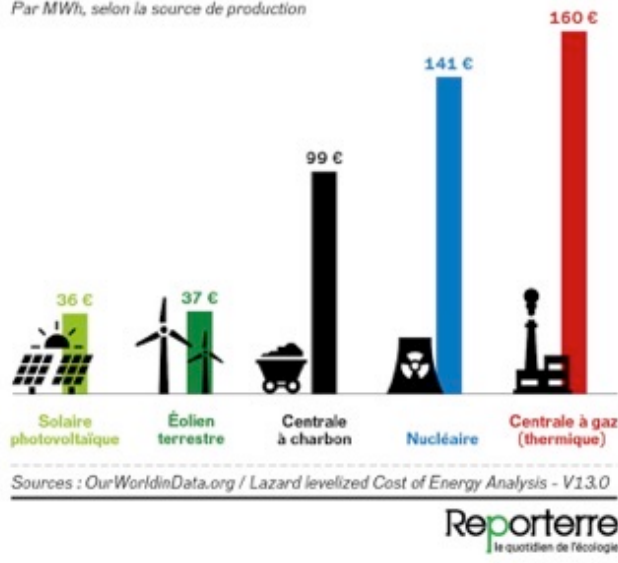


LCOE (Levelized Cost Of Energy)

$$LCOE = \frac{\sum_{t=1}^n \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^n \frac{E_t}{(1+r)^t}}$$

Onshore PV : the cheapest energy

Par MWh, selon la source de production



Offshore FPV : highly dependent on project's specifics : CAPEX, OPEX, irradiation...

CAPEX 1MW=1M€

- Larger projects
- Small waves
- Low salinity
- Less windy
- Lower variation in water level
- Anchoring available on banks
- Can utilize nearby infrastructure
- Favorable logistics
- Smaller projects
- Large Waves (limit 1.5m*)
- Saline/corrosive environment
- Prone to extreme weather events
- High variation in water level
- Underwater anchoring required (Deeper = \$\$\$)
- Must construct own Substation/ transmission infrastructure

Image credit: World Bank Group, ESMAP and SERIS

LCOE (Levelized Cost Of Energy) for Floating PV est. at 40 to 60€/MWh

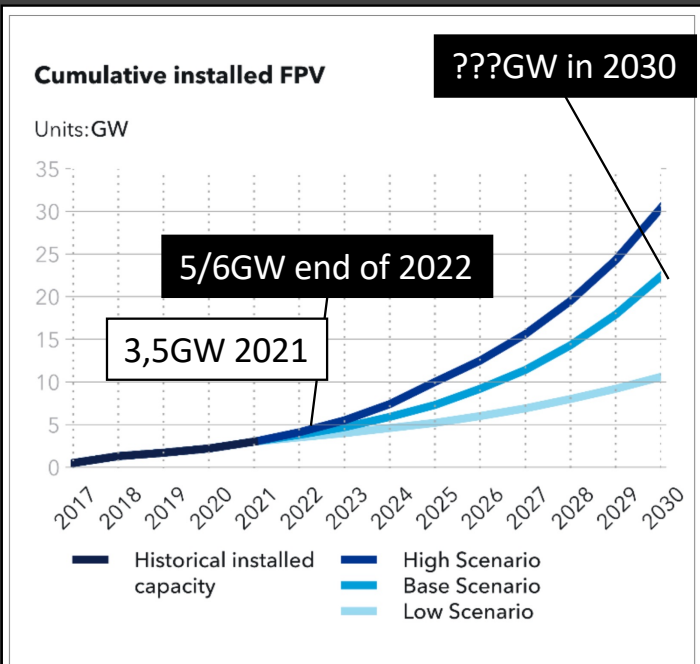


Figure 3 - Historic growth and growth forecast based on DNV owned calculations and studies [5-7, own study]

“Il a fallu attendre 70 ans pour atteindre le premier térawattheure de PV solaire terrestre installé dans le monde. Il n’en faudra probablement que 3 ou 4 pour le deuxième”

Pierre VERLINDEN Directeur Scientifique chez Trina Solar
Milan Sep 30 2022

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Exponential growth

Limitless potential of floating solar photovoltaic

- Growth opportunities for countries with significant hydropower
- Nearshore FPV development in island with protected area such lagoon, bay.....
- Offshore remains the domain of research & prototype test

Asia is set to dominate this growth with India & China leading

Vision for Floating PV in 2030 ?

Limitless potential for innovation

- Digitalization/standardization/recycling
- Remote monitoring & control
- Step change in technology (Modules, Floaters, solar tracking...)
- Combined activity : aquaculture, offshore wind...

