PIONEERS IN FLOATING SOLAR SYSTEMS SINCE 2008

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Our Mission

To **preserve the world** by using existing water bodies in our planet to generate renewable **solar energy** in a more efficient way, while at the same time **protecting** scarce **water** and precious **land**.

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Isigenere & Isifloating

- **Isigenere is an engineering and product development company** that created **Isifloating**, the pioneering floating solar system in the world since 2008.
- **Isifloating uses a unique and patented floating solar technology** which enables the covering of partial or entire water surface.
- Isifloating's high-quality plastic float device can be used to build floating solar power plants on top of **multiple water environments**: hydropower plants, irrigation reservoirs, natural lakes, water treatment facilities, quarry lakes, aquaculture farms, industrial water ponds and others.

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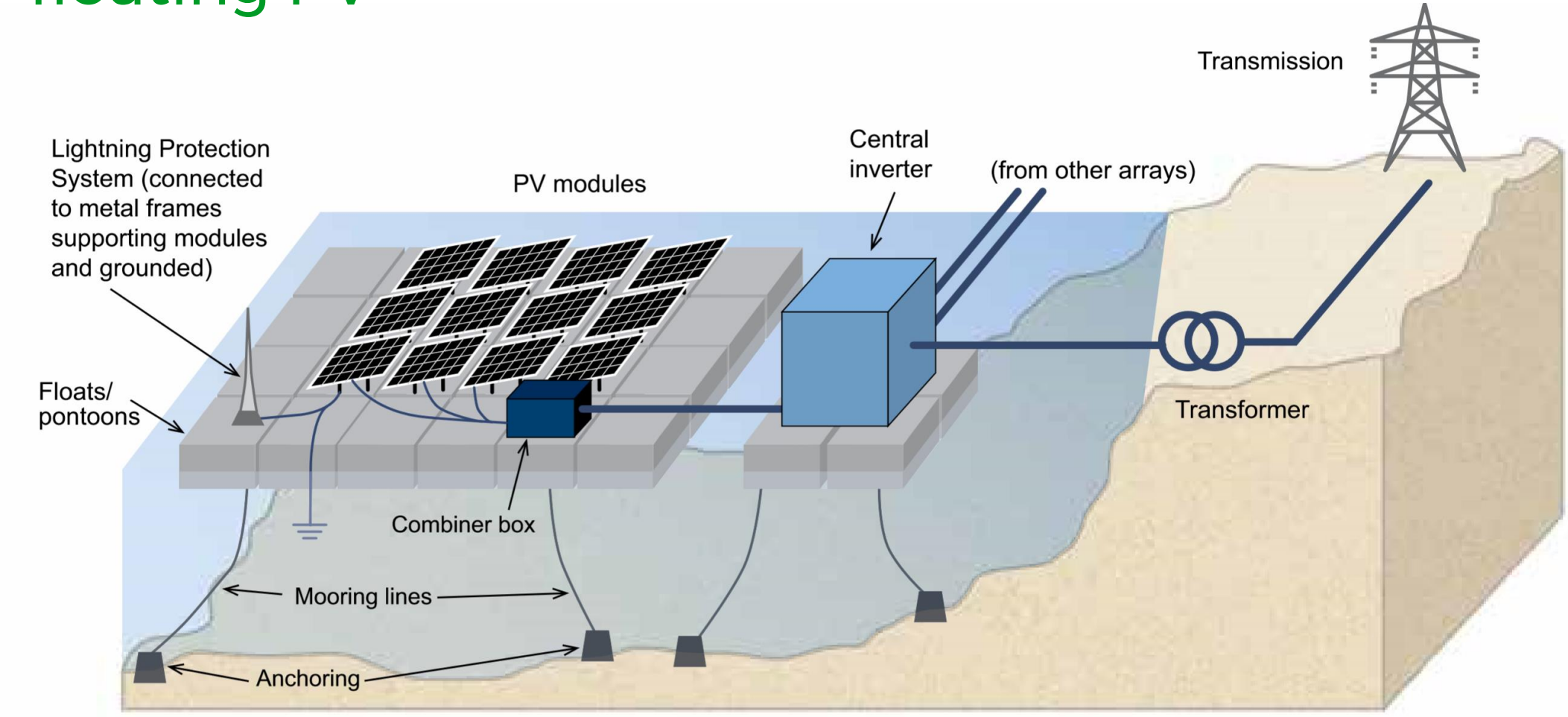
We are a Spanish team proud to belong to Spain´s photovoltaic energy engineering ecosystem

Schematic representation of a typical large-scale floating PV



Source: Solar Energy Research Institute of Singapore (SERIS) at the National University of Singapore (NUS).

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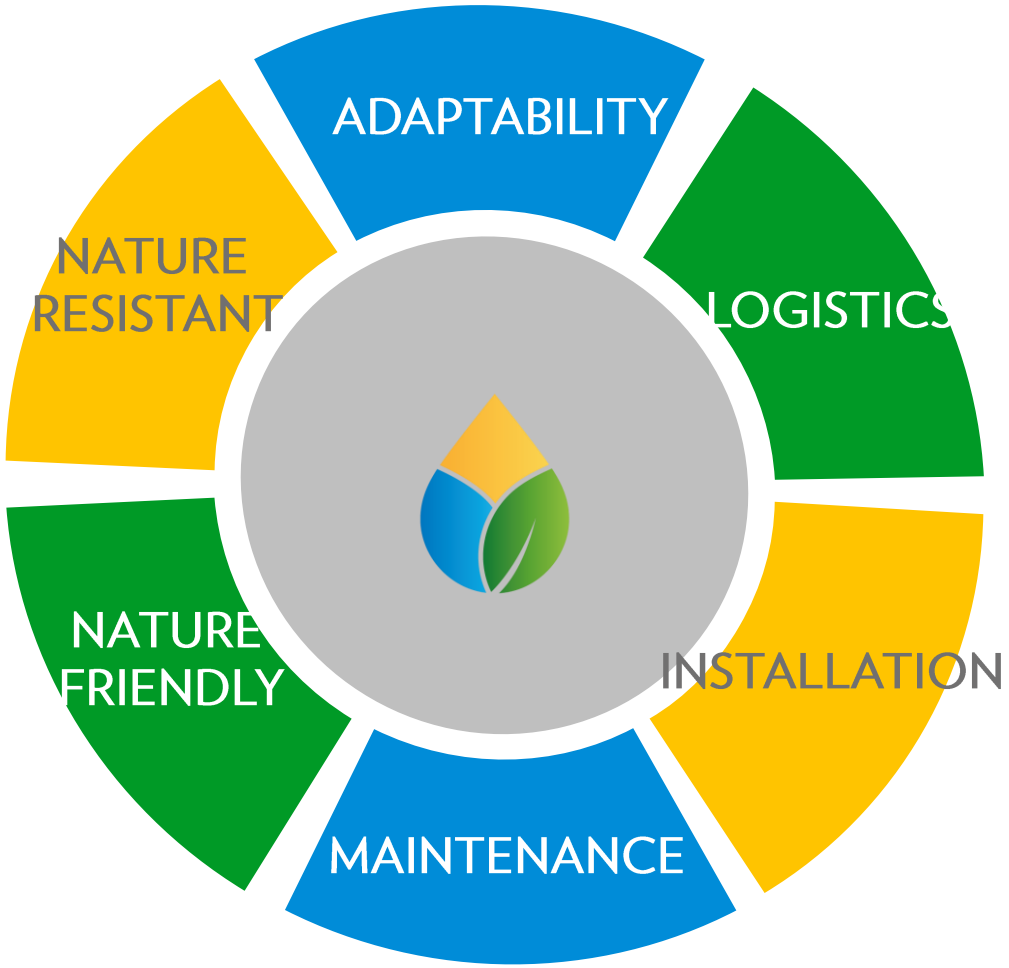
Key challenges to solve in a floating solar system



- ADAPTABILITY: adaptation to the concave profile of the water surface as **water levels go up or down** through the year
- LOGISTICS: Any project takes thousands of floats. **Don't pay for air being transported** or devote significant space to stock material
- INSTALLATION: No need of specialized and expensive technical teams. Setting up your project **should take weeks, not months**.
- MAINTENANCE: **easy and safe access** for O&M crews. **Components should be resistant** and exhibit partial flexible behavior.
- NATURE FRIENDLY: The system must integrate and **preserve nature** in places where wildlife exists
- NATURE RESISTANT: Installation should **stand mother nature**. Combination of **sun, wind, waves**, snow, animals, saline water, algae and fungus are elements the technology **must cope with for 25+ years.**

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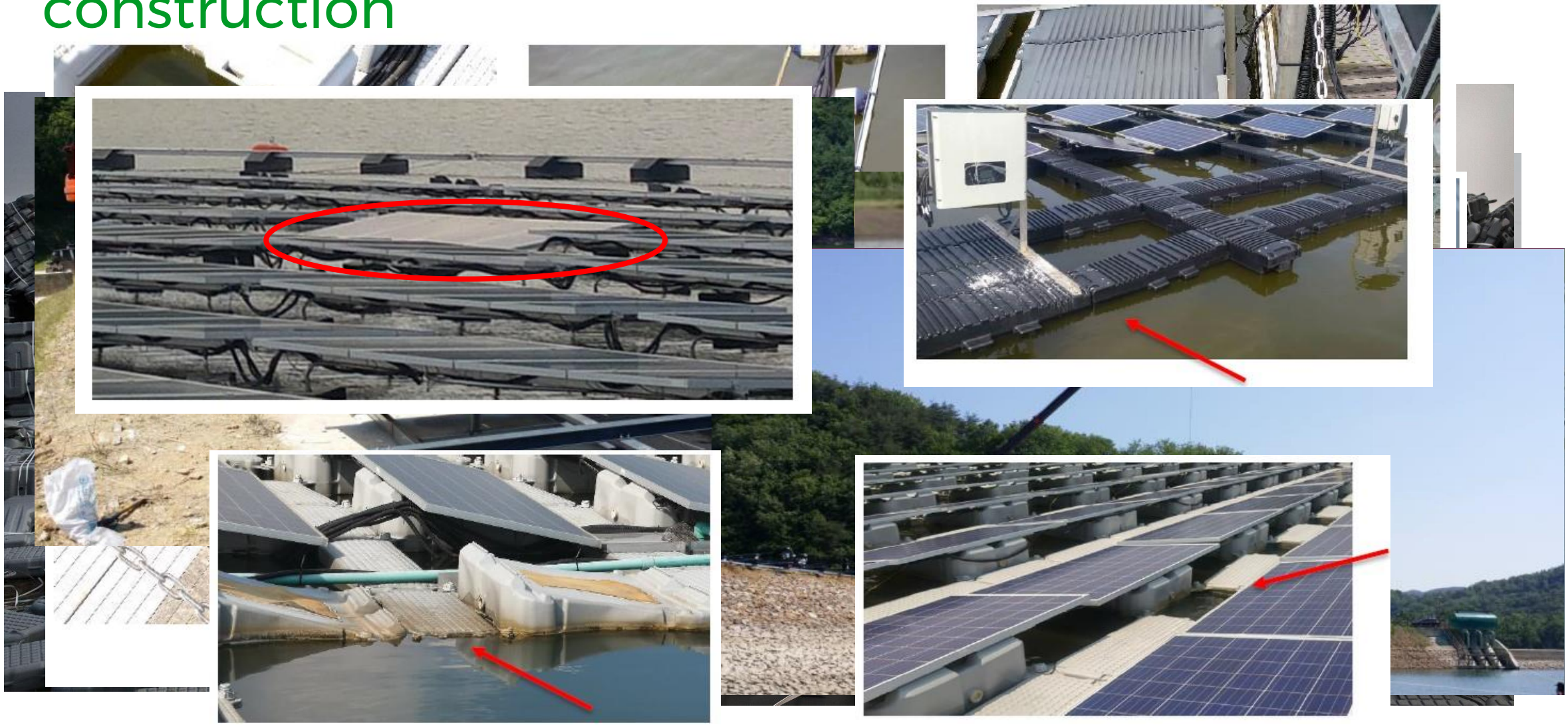
It is very important to invest in design and construction



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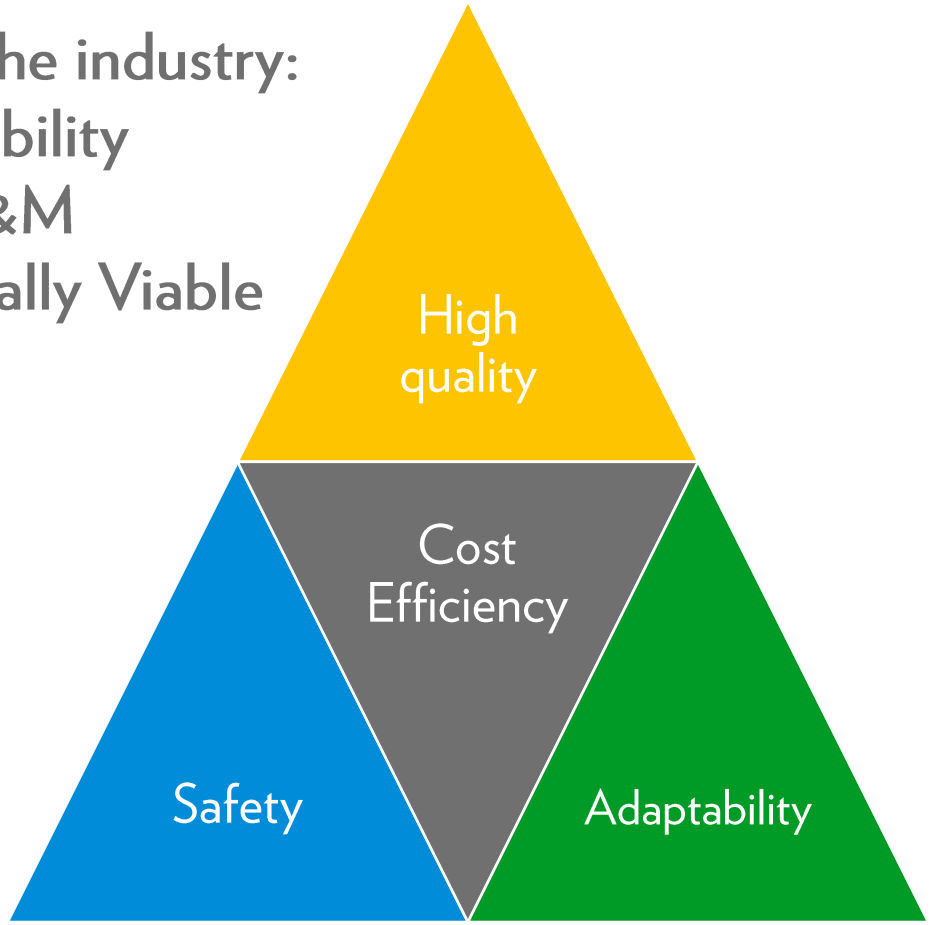
Own photos, SERIS, newspapers

What to design for?

Key needs in the industry:

- Durability
- O&M
- Economically Viable



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There is no a “one size fits all” solution

Type of water reservoir	Type 1	Type 2	Type 3
Characteristics	• Artificial Irrigation man made ponds • Depth < 10 mts • Water level changes < 10 mts • Winds < 100 km/h • Waves < 0,5 mts	• Small Lakes or hydroelectric dams • Depth between 10-30mts • Water level changes 10-20 • Winds between 100-150 km/h • Waves < 1,0 mts	• Large hydroelectric or large lakes • Depth > 30 mts • Water level changes > 20 mts • Winds above 150 km/h • Waves > 1,0 mts

Each project requires a customized design adapting to the specifics of the reservoir

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The design phase takes as inputs several key parameters of the complexity of the water body

Parameter

- Years of expected operation
- Size of the water body
- Depth
- Water level changes
- Wind
- Waves
- Snow
- Type of bottom and slope surface
- Water salinity
- Currents
- Climate
- …

Implications

- Quality of floating structure used (thickness, additives)
- % of the surface covered to minimize environmental impact
- Type of anchoring possible (On shore vs Bottom)
- Flexibility of the structure
- Buoyancy (Workers, Inverters, cables)
- Electrical equipment (Insulation, corrosion)
- Logistics (Floating structure mainly)
- Safety or workers in installation and O&M (Access to components)
- .....
- Balance of cost & risks

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There are some general “rules of thumb” of a good design to be taken into account

Structure

- Structure to withstand constant mechanical stress, fatigue of materials due to constant water movement, UV radiance, wind, weight loads and other factors during 25+ years
- Design for TCO (Total Cost of Ownership) – Direct cost + Transportation + Installation + Maintenance
- Minimum technical specs: Minimum thickness and higher where needed, float anchoring points resistant enough, UV and anticorrosion additives safe by standards
- Health and safety factors: minimize holes in structure where somebody can fall, minimum buoyancy, attach safety elements to the structure (railings, life vest)

Modules, inverters, cables

- High quality modules, 72 cell panels, framed, glass to glass vs weight, drainage design, Box IP67
- String inverter vs central inverter, plant availability, total cost of cables, distance to the shore, IP67
- Cabling system needs to be designed to be air ventilated, structured, ordered and its supporting structure to be designed accordingly so they are not submerged except the evacuation cables that should have maritime specs

Anchoring and mooring

- When possible try to increase the mix of on-shore anchoring vs bottom anchoring
- The higher the panel tilting, the higher the wind drag to be sustained and higher cost of anchoring
- Hydrodynamic study very relevant to understand wave and currents on the site
- Significant water changes of level might require use of elastic anchoring that provides dampening effect

Now moving to the construction phase...

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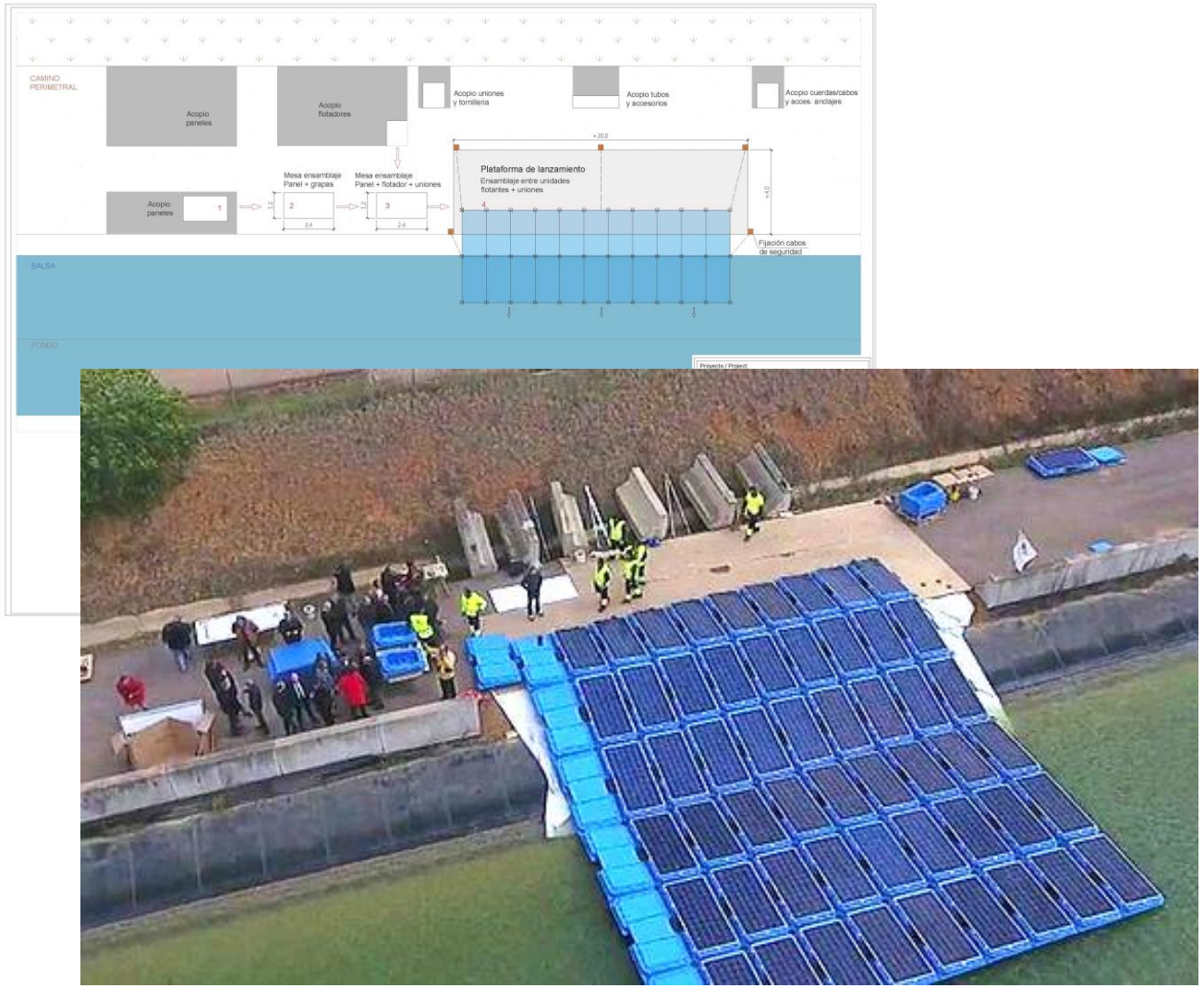
Taking about construction, some ideas to keep in mind

- Plan, plan and in addition, plan. Specially having always stock of all materials and movement of material
- Not all the materials take the same amount of stockage space
- Movement of materials to be minimized as possible. Team should be focused on building not moving
- Build a good launching platform that optimizes installation efficiency and minimizes efforts for workers



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