A Hidroeletricidade em Portugal – Desafios | 07 de outubro

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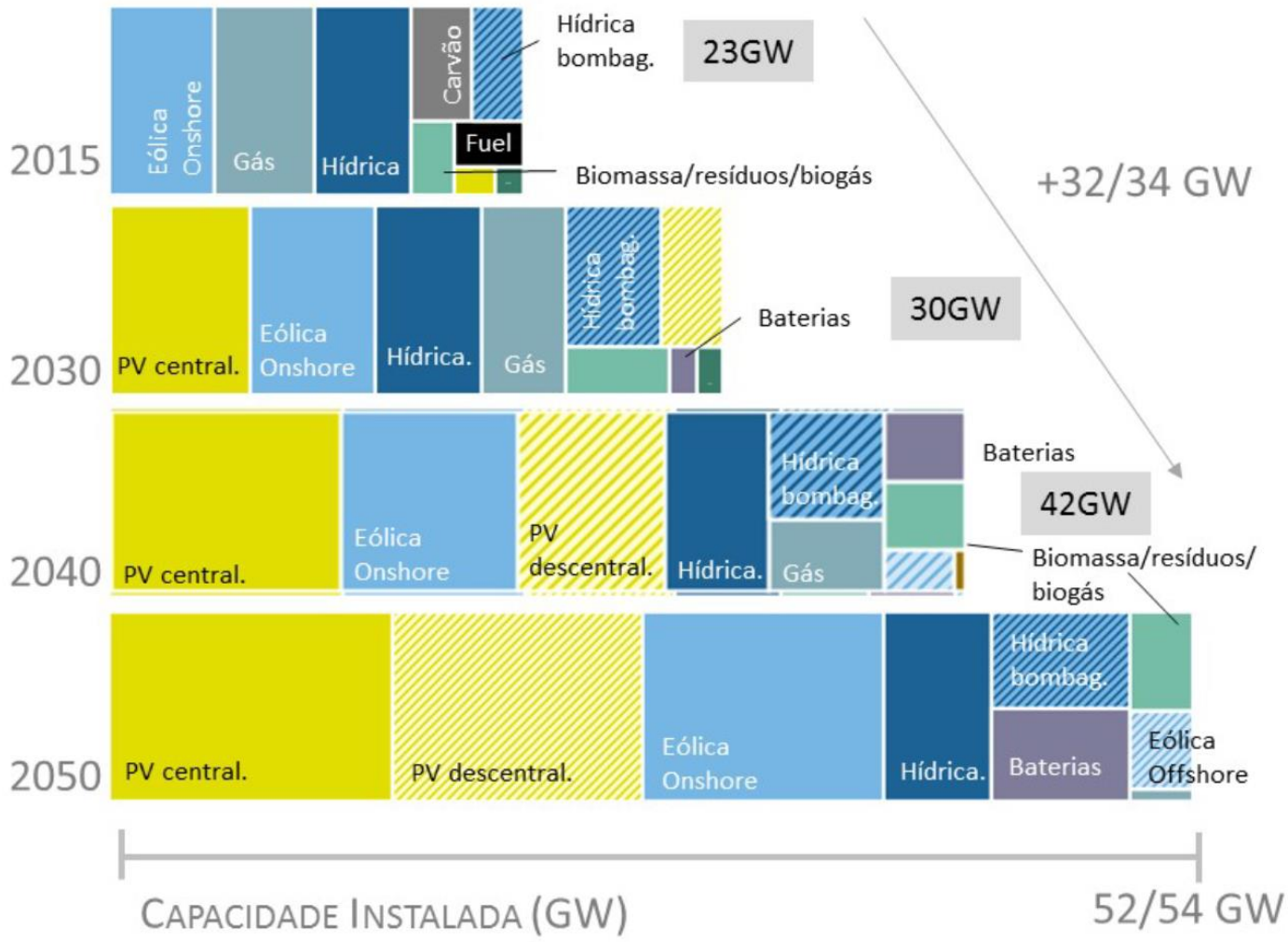
Um projeto inovador e o potencial dos projetos híbridos de *floatingsolar*

- RES Objectives
- Hibridization
- Pilot Project
- Future Projects
- Sum up

Portugal Targets In 2030 **80%** Of electrical consumption must be from RES

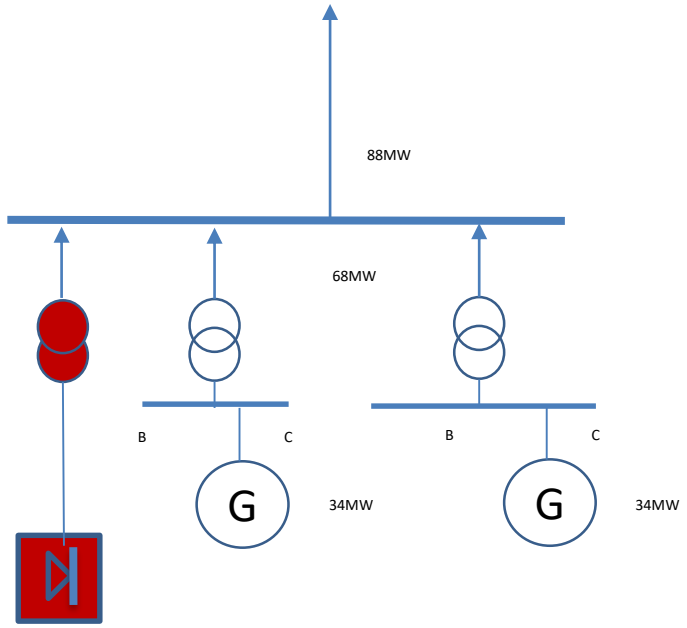


Hybrid Solar – Hydro:
Why does it makes sense?

Solar energy is complementary to hydro energy

…because infrastructures may be shared

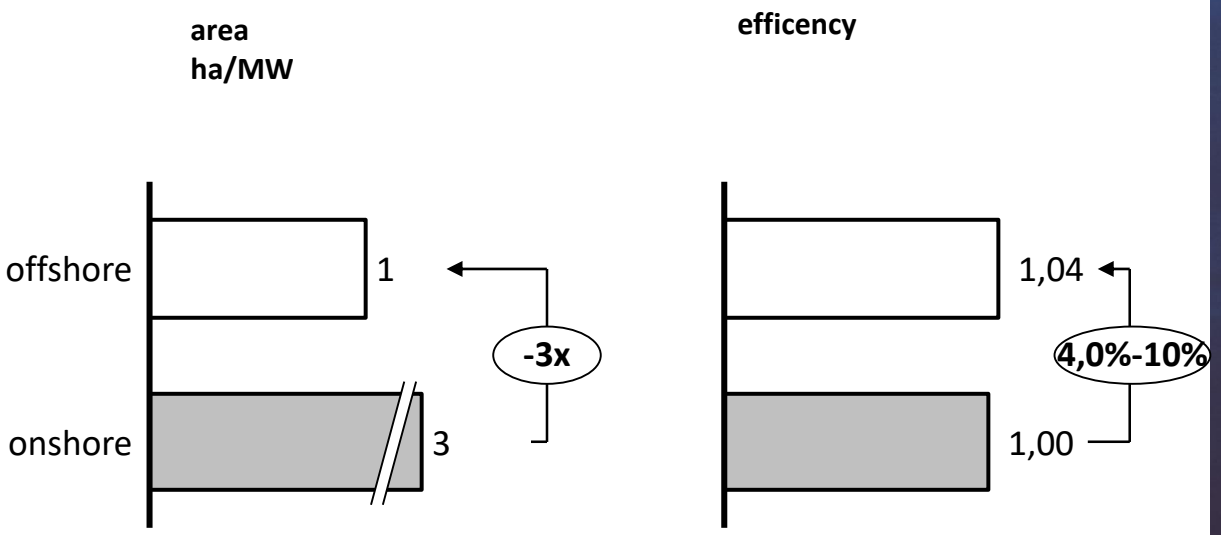
Avoiding further investments and environment impact in new transport lines, substation and auxiliaries…



…existing water surface is shared

- The Alto Rabagão reservoir is 50 years old
- Occupies about 2.200 ha

Why it makes sense in water?



OFFSHORE
Less area
Land for agriculture and forests is not used

ONSHORE
Greater surface per Wp
Competes with soils for other uses.
Terrain preparation, land fills, etc..

Cooling effect
Greater efficiency

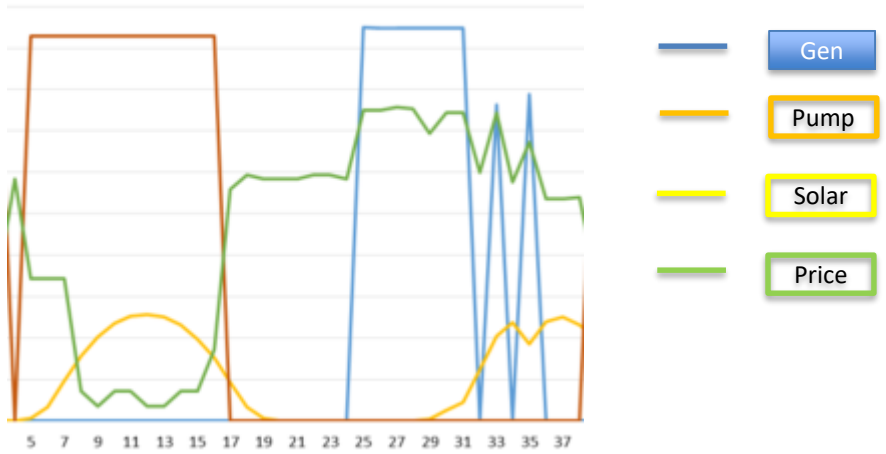
Less area/Wp

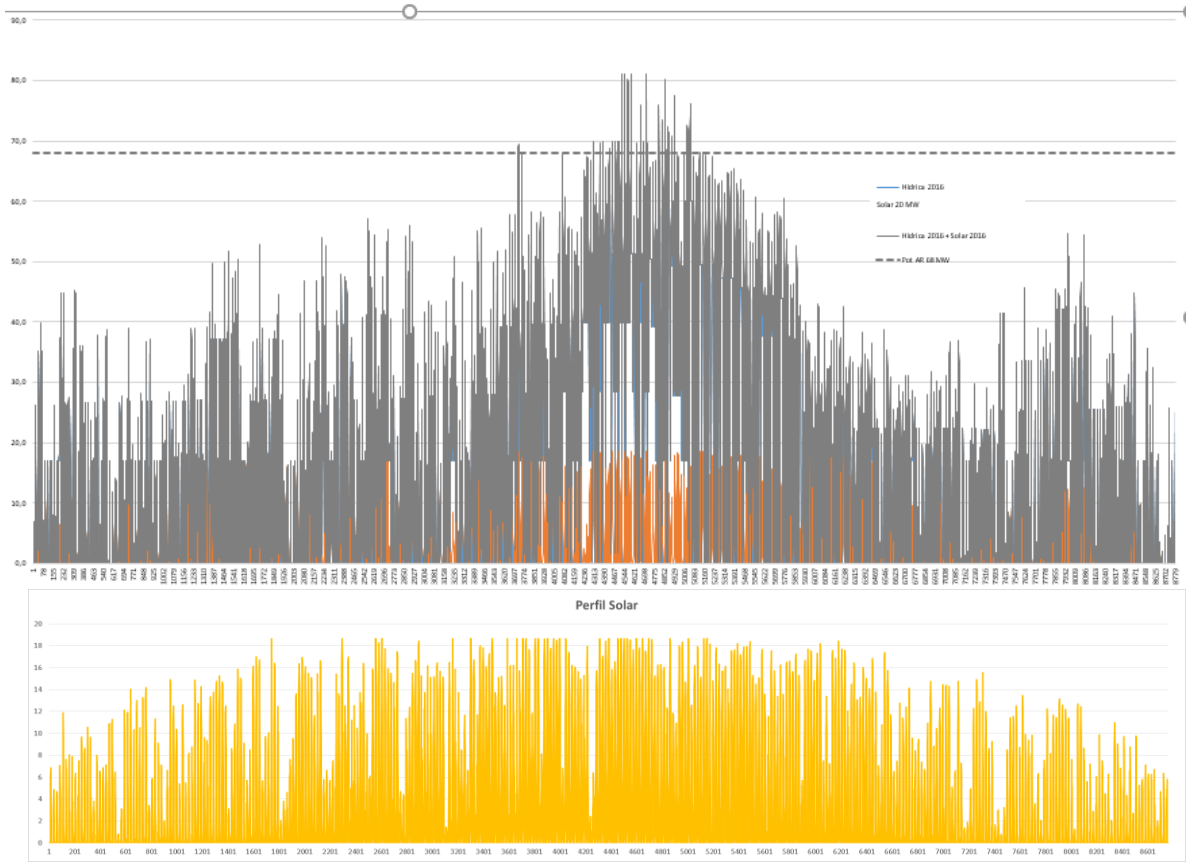
…however in hydro plants with seasonal storage, sun and water have same generation profile (Portugal case in 2020).

In actual market conditions hydro (seasonal storage dams) and Solar compete .

2040

However in 2040 it is expected prices profile to change dramatically: Solar and Hydro will be complementary.

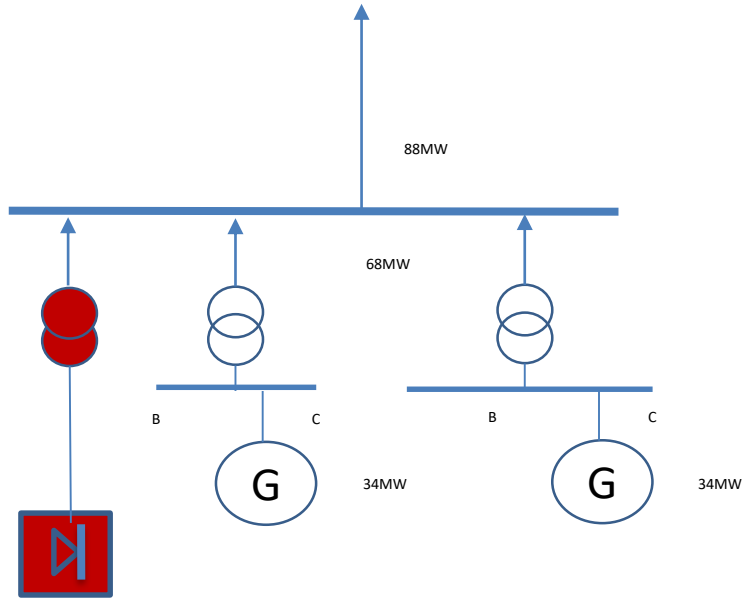




…requiring local dispatch -VPP and portfolio aggregation

Photovoltaic and hydro energy have to be dispatched locally in the connection point ensuring the optimization of the capacity of transport lines.

Combining solar with hydro locally diminish penalties of market deviations in solar energy forecast.



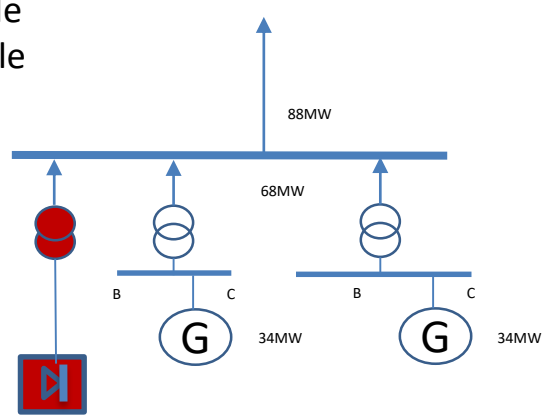
Case Study
Hybrid Solar – Hydro
An example of economic evaluation in balancing area

Rabagão max transmission line capacity = 88 MW
Rabagão transmission line spare capacity = 20 MW
Rabagão Hydro: 2x 34 MW pump turbines

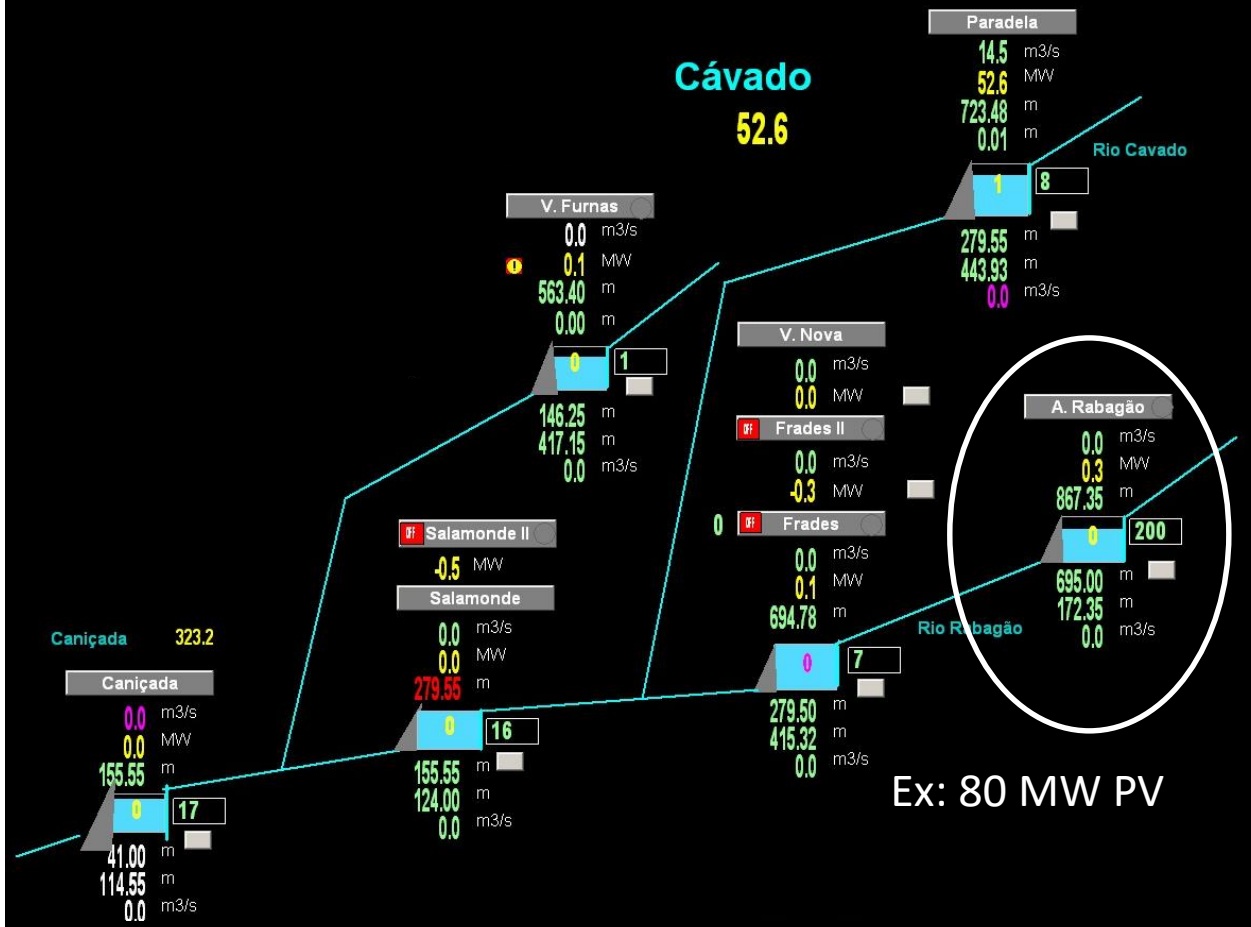
Case Study: 80 MW Solar PV hybrid in Rabagão (AR) hydro

Impact in River Basin Portfolio:

- 40 years historic
- Hourly market prices profile
- PV hourly generation profile

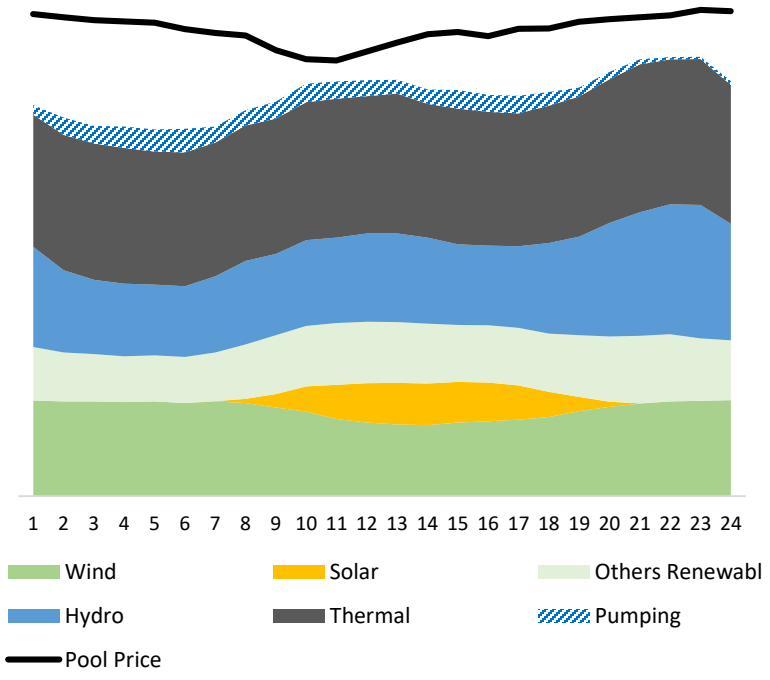


1,4 GW

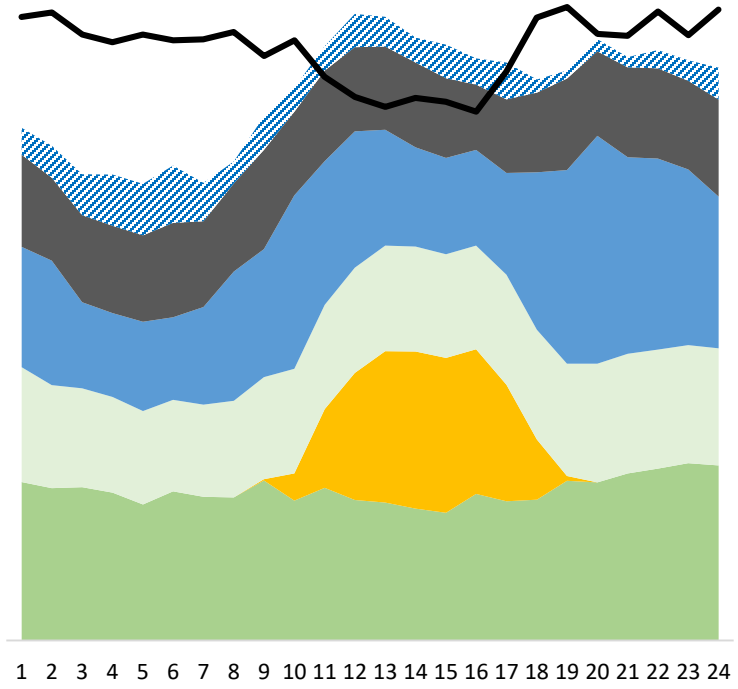


80% RES by 2030 will radically change pool price and electrical system mix

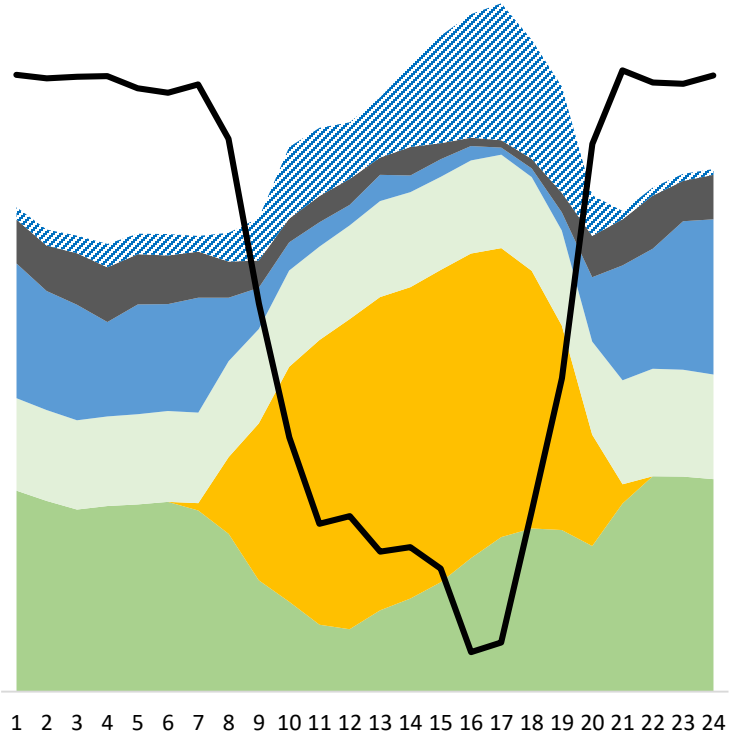
[2020]



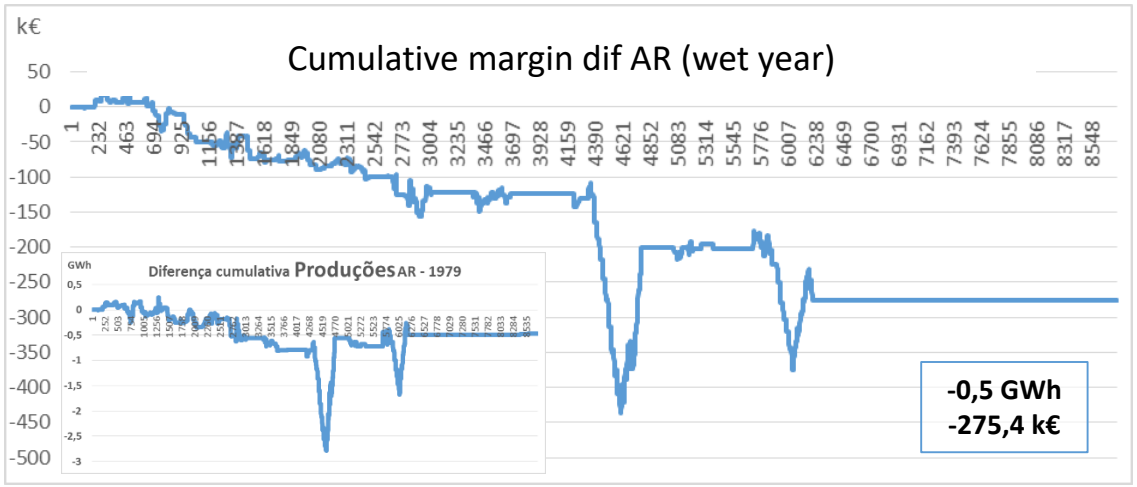
[2040]
January

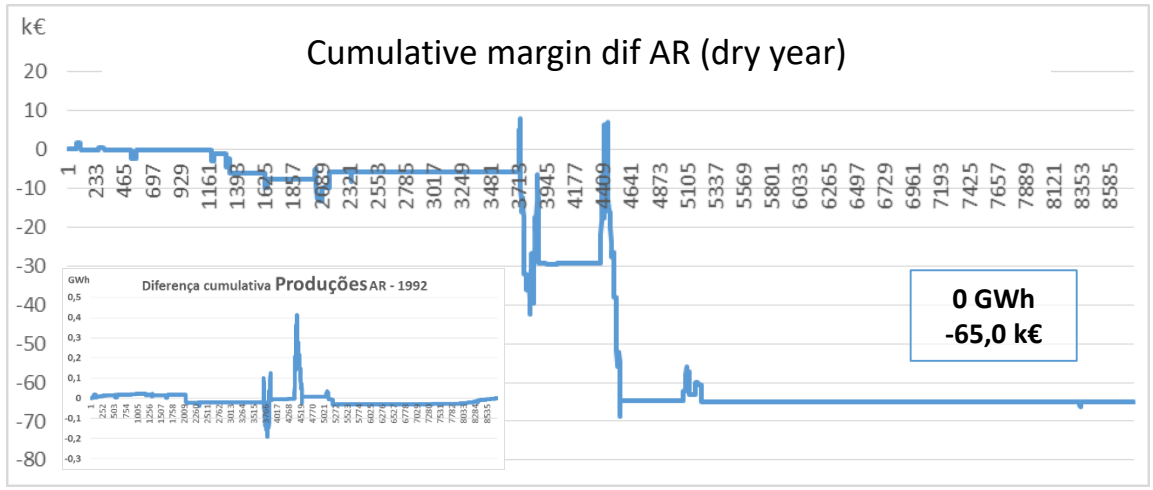


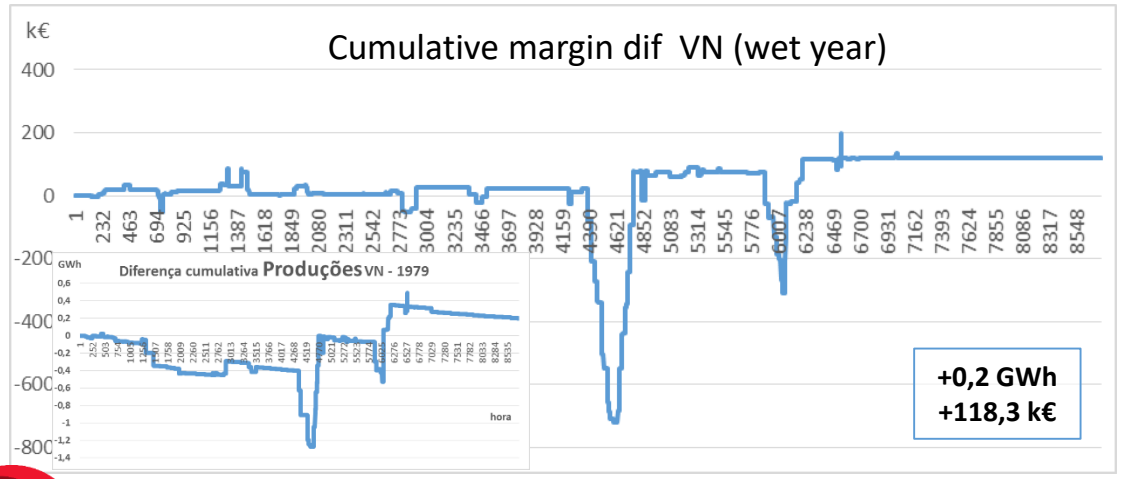
[2040]
July

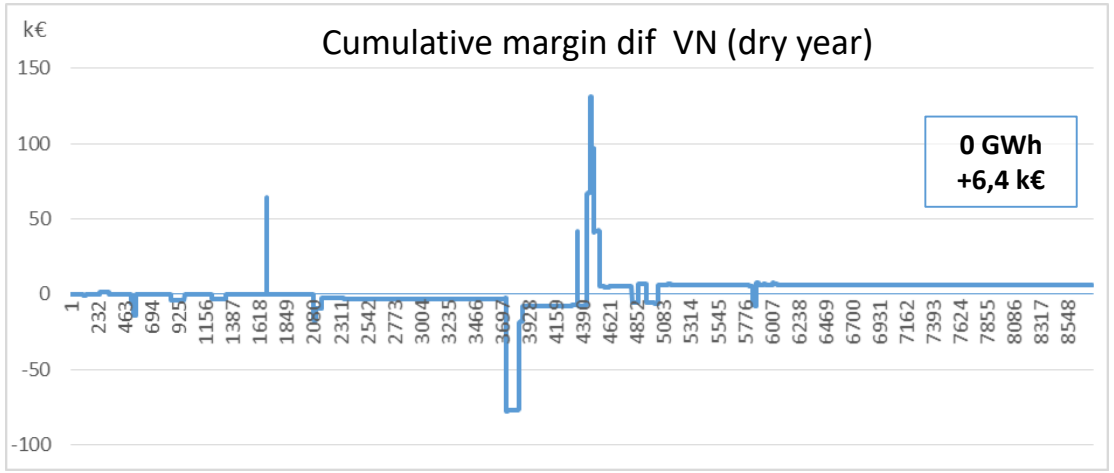


Hybrid Solar – Hydro: economic evaluation in river basing portfolio – worst case scenario – 80 MW – full line capacity 2020

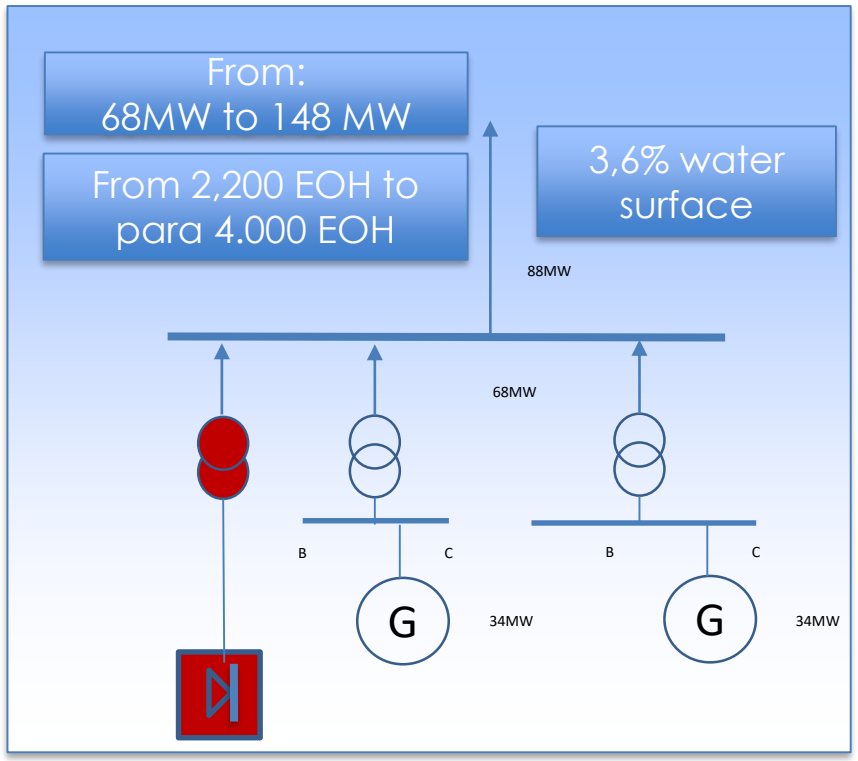








Case study:
80 MW solar in 68 MW Hydro

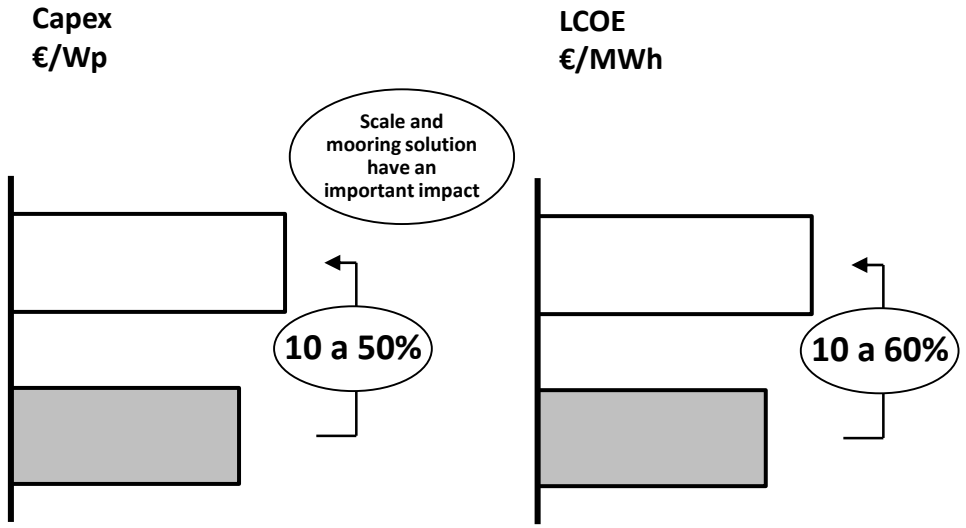


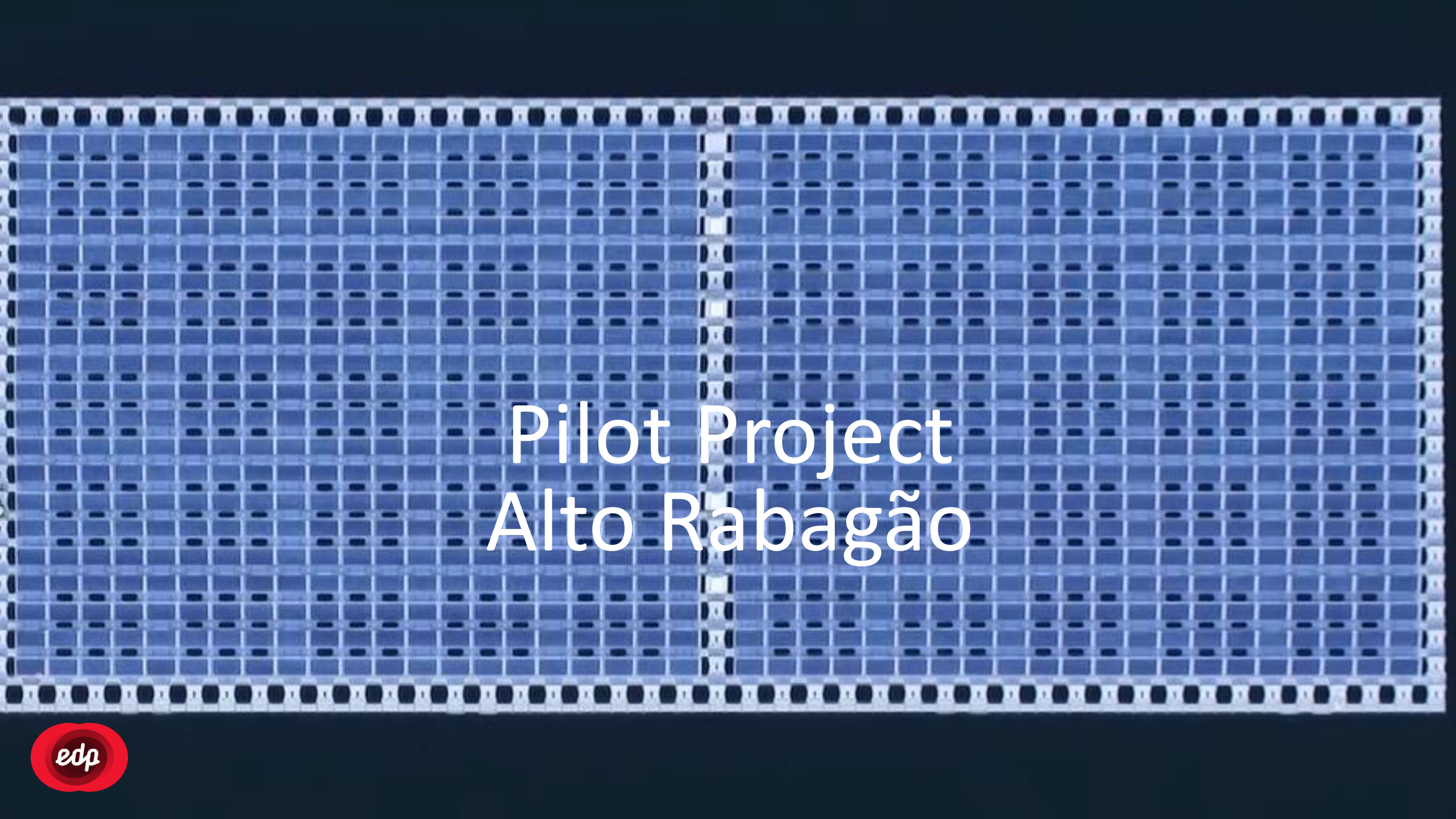
Hybridization Solar – Hydro duplicates energy output in same connection point
Some margin in Hydro is lost, depending of dry or wet year

Scale has an important impact in cost/Wp

A 20MW plant target cost must be 0,6€ /Wp

AR pilot project not economically viable w. tax credits R&D




Pilot Project
Alto Rabagão

Technical data

Installed Power = **220 kWp**

Net Power @ 15kV = **192 kW**

Panels = **840 x 260 W** (REC)

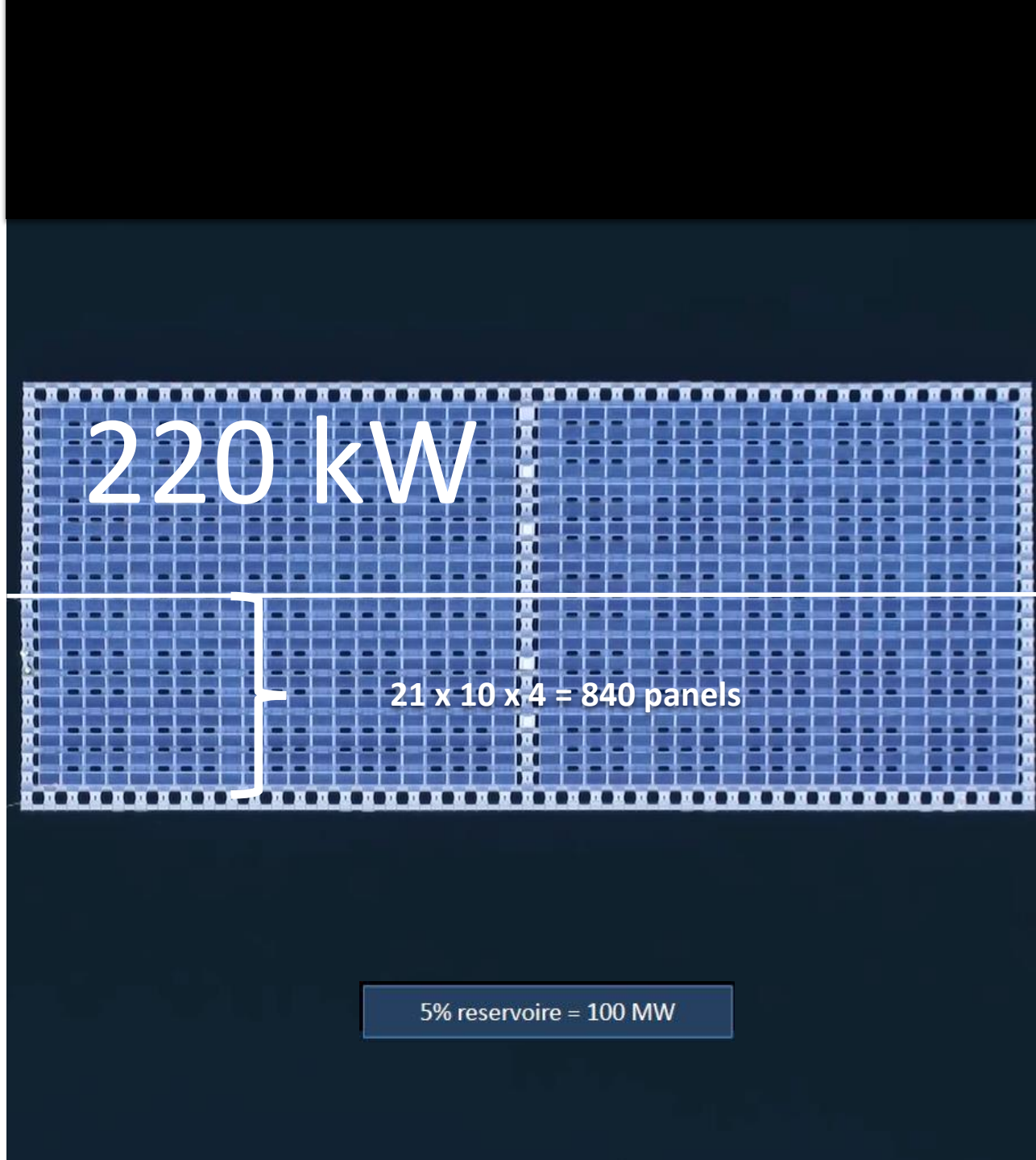
Inverters = **4 x 50 KW** (ABB)

Generation aprox.: **300 MWh/year** (equiv. 100 house holds)

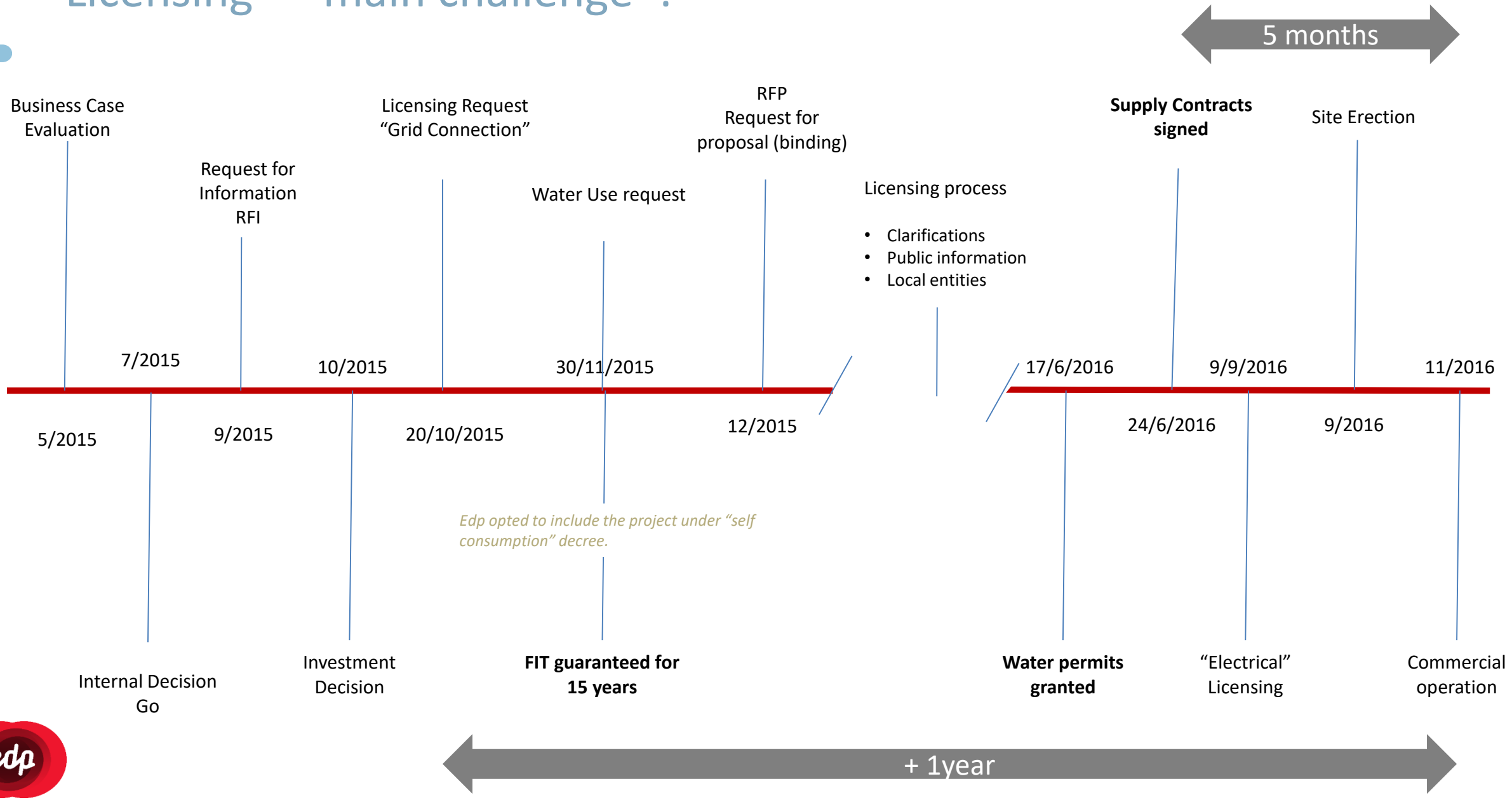
Size: 32x77 m = **2.500 m2**

FIT = **95 €/MWh** (15 years)

Main Contractor: **Ciel & Terre** (France)



Licensing – “main challenge”?



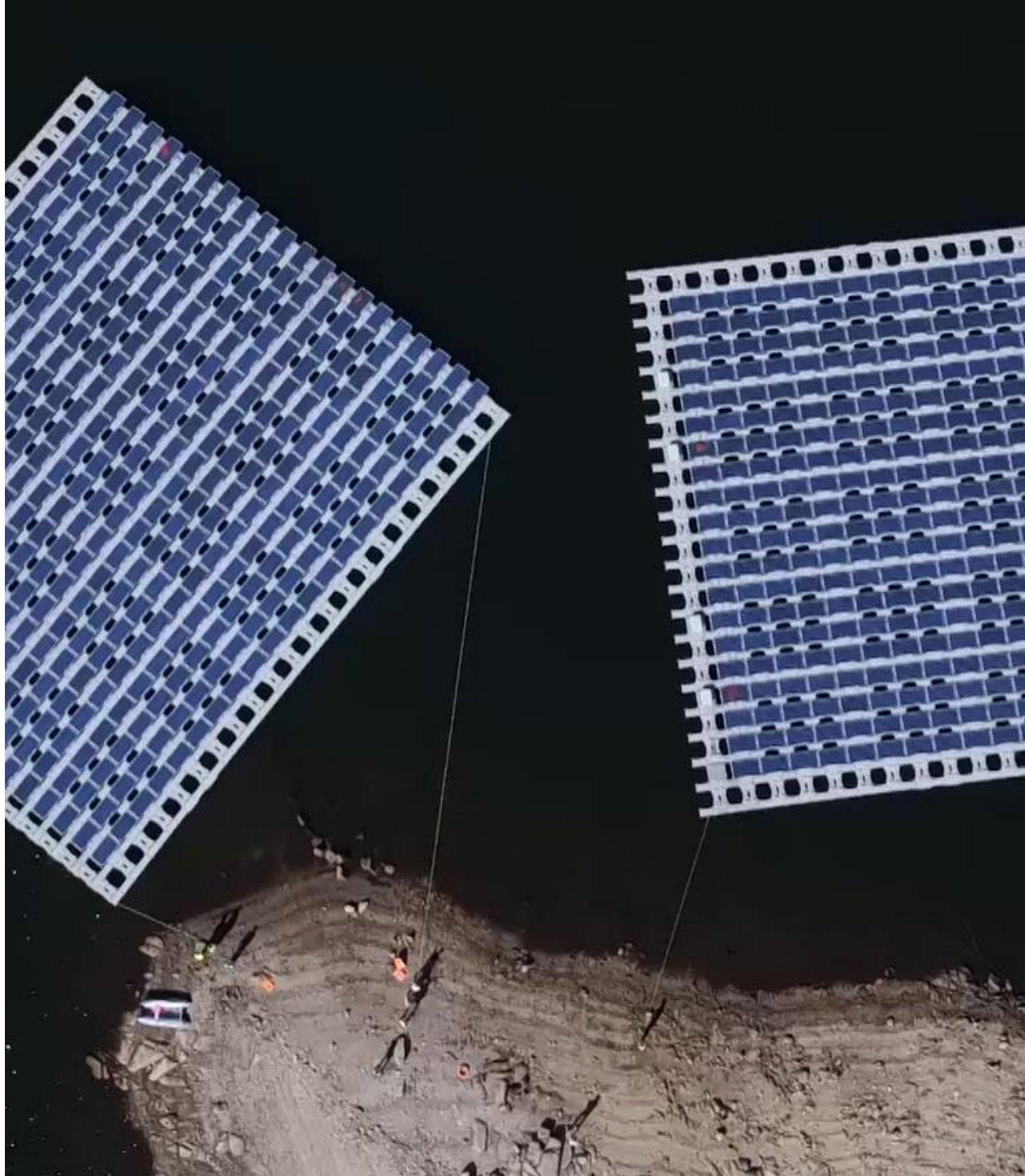
Mooring system

Demanding site conditions:

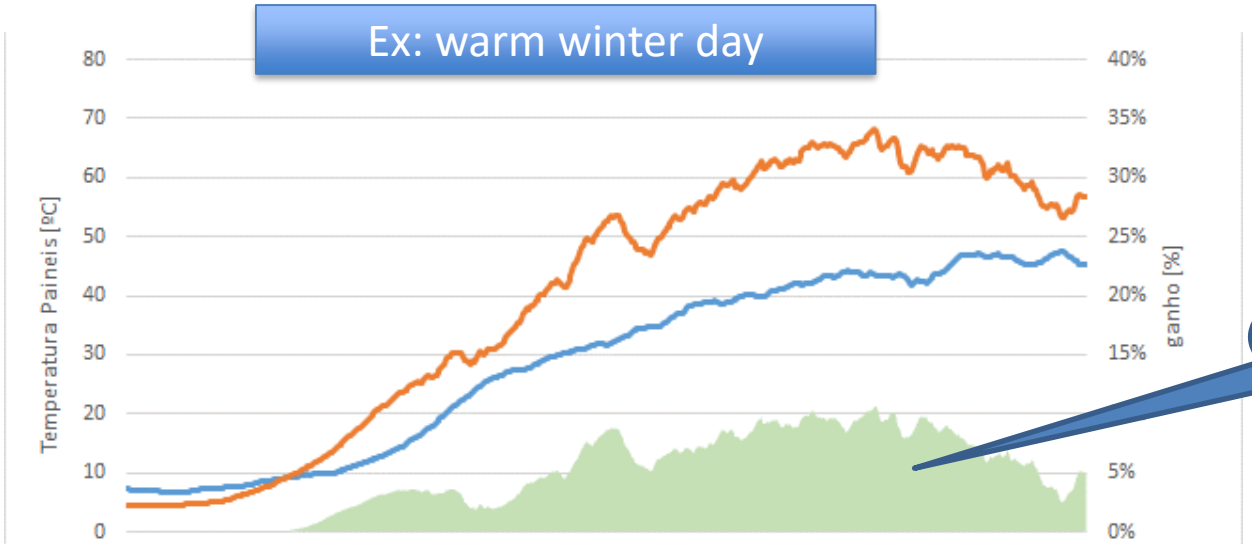
- 1 m waves;
- 60 m water depth
- 30 m level variation
- Granitic river bed
- Increased cost/Wp

Platform assembly in 2 weeks

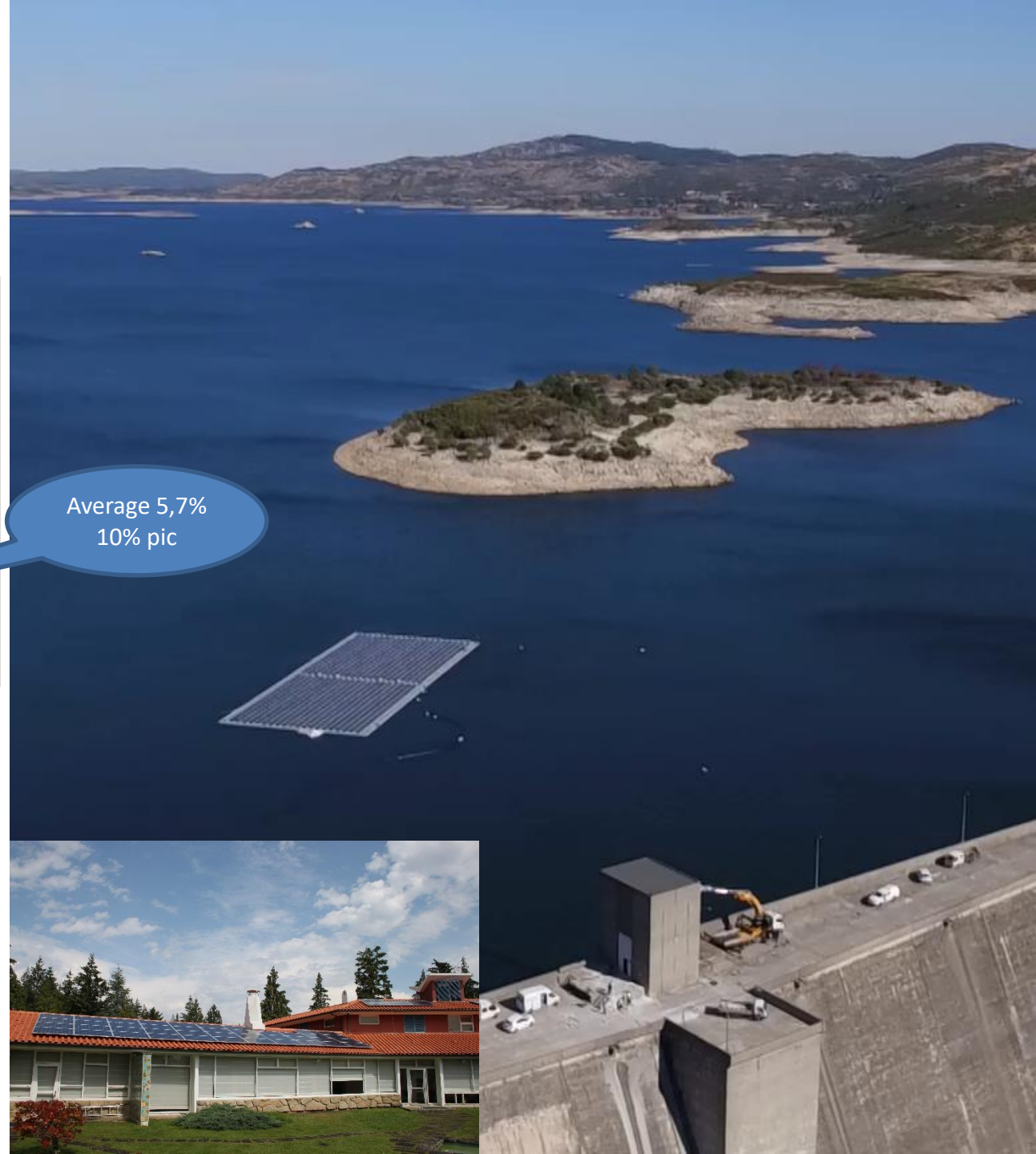
Easiness of assembly



…performance offshore vs onshore



- Efficiency gain since startup aprox. 5%
- However:
  - Atypical 2016 and 2017 winters with high irradiance and temperatures
  - 2018 production less than 2017



34 months operation

Aprox. 619 MWh total (2017 better then 2018)

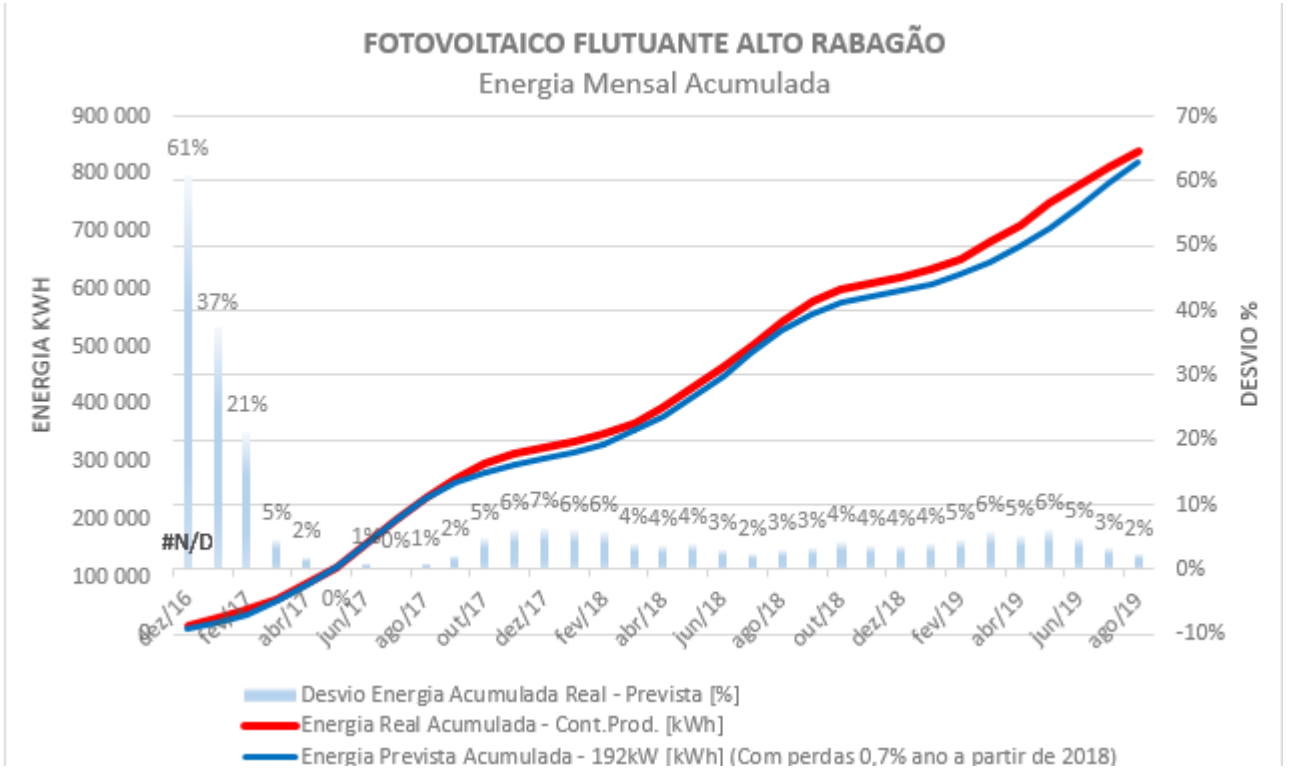
Generation to date: +4% than Business Case (peak +7%);

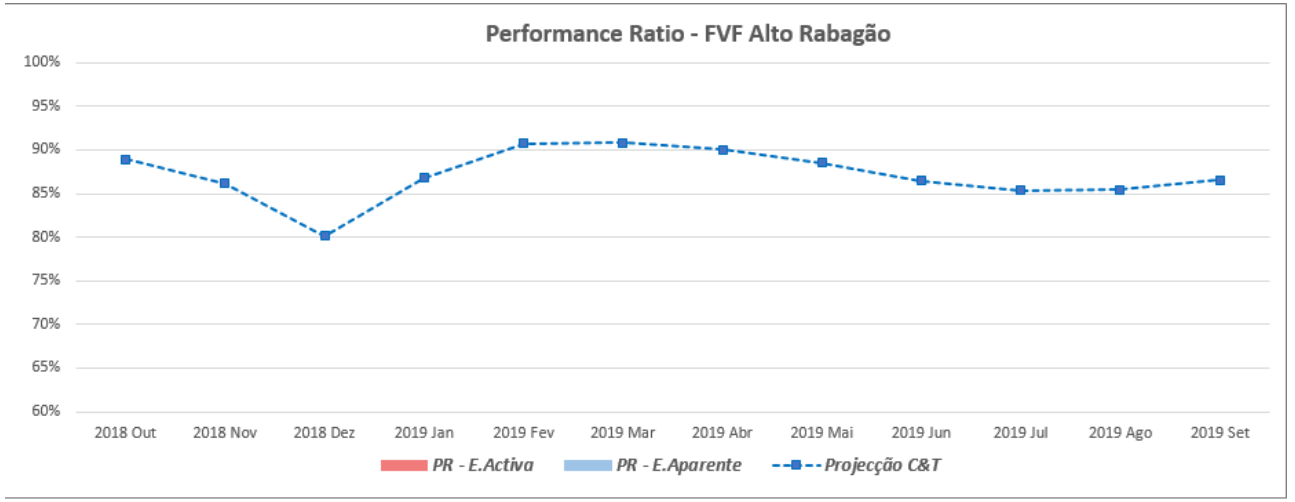
Several minor youth problems being solved (mainly due to water/platform movement);

Biggest generation 2017: 06th June – 1.615 kWh
2018: 16th June – 1.653 kWh

Cooperation with Academia & Startups (Dataglen)

- 3 academic thesis with portuguese Universities and Mooring studies (WaveEc)





Future & sum up

New projects under development

Large scale is needed;

Cost/Wp as to decrease ;

Floater transport costs;

Mooring optimization required;

Efficiency gain depends on country climate and has to compensate over investment;

Special regulation for hybrid plants is required;

VPP managing systems to be developed;

Licensing

Optimization of existing hydro projects.

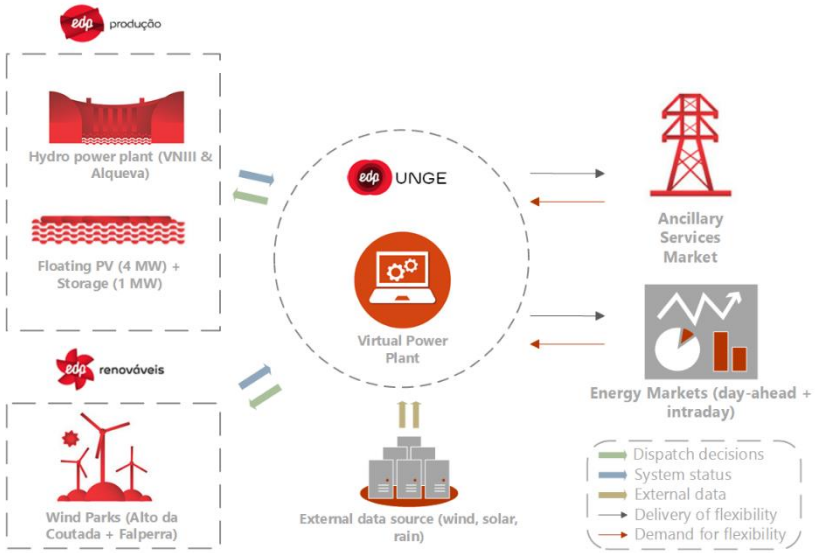
Future:

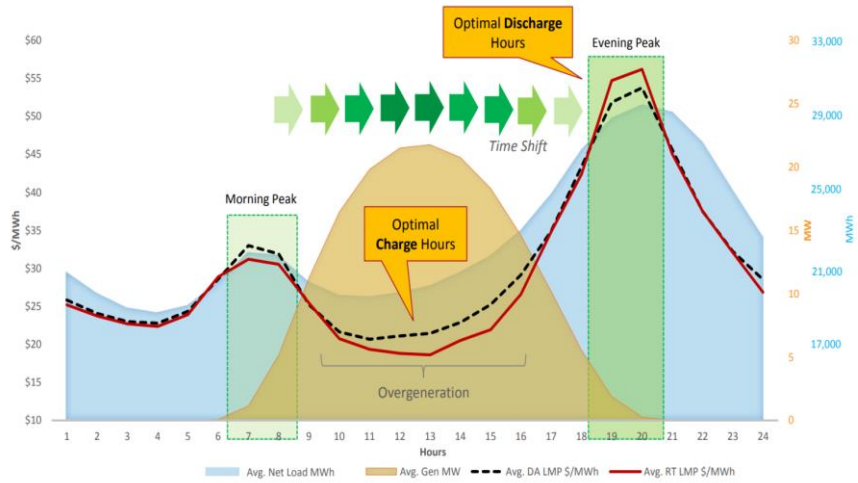
VPPs - Combining RES + Storage

Dispatchable and non Dispatachable Renewables with storage options

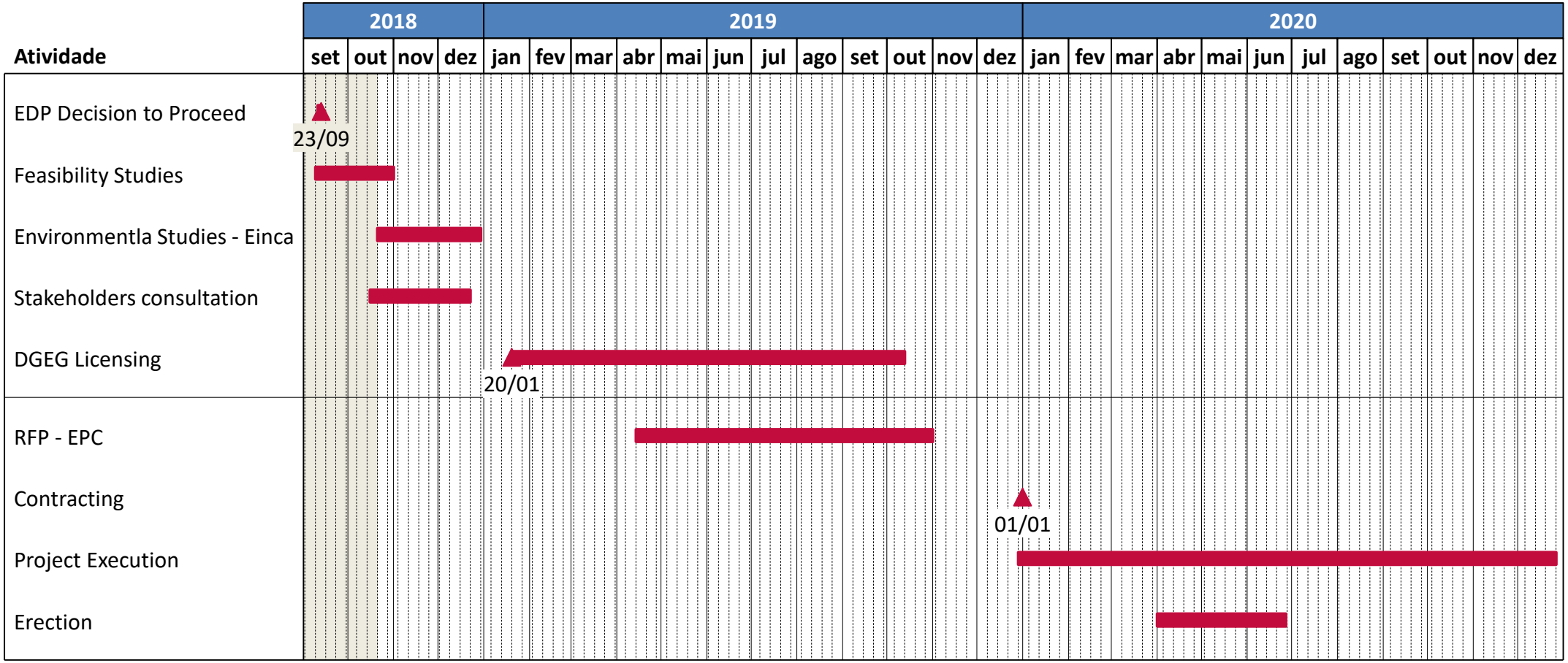

Alqueva 4MW Floating PV
+
1MW/1MWh Battery
(under licensing)
with
4 x 120 MW PSP Hydro

VPP – Solar + Wind + Hydro + Storage





Time Schedule



Sum up

- RES objectives can only be met by combining all solutions;
- Regulation must be proactive and opened to these solutions
- Market design must include new ancillary services required for high RES penetration;
- Floating Solar can only compete with floating solar.

EDP “Strategic Update” march 2019:
2030

- EDP´s RES generation > 90%
- 90% CO2 reduction (compared with 2005).