seanergy
26>28 June, 2024
Nantes, Pays de la Loire • France

Poster n°29

DMEC
DUTCH MARINE ENERGY CENTRE

EU-SCORES
European Scalable Offshore Renewable Energy Sources

Turning floating wind parks into hybrid energy systems

A use-case in the French Mediterranean

M. MIHAJLOVIC, S. STARK, V. BONNIN
Dutch Marine Energy Centre (DMEC)

CONTEXT

- Especially in the mediterranean offshore solar offers a great resource to utilize space in between planned (floating) wind farms
- Offshore solar concepts are rapidly increasing in maturity, with first multi-MW demonstrators planned in the Dutch North Sea in 2027
- To assess the feasibility and benefits of multi-source energy parks in France we assessed a planned French floating wind site for:
  1. Increase of **energy density** in multi-source energy parks.
  2. Improved **capacity factor** of the export infrastructure.
  3. Impact of different **battery strategies** and battery **size** to further improve the power profile, energy exported and smoothness.

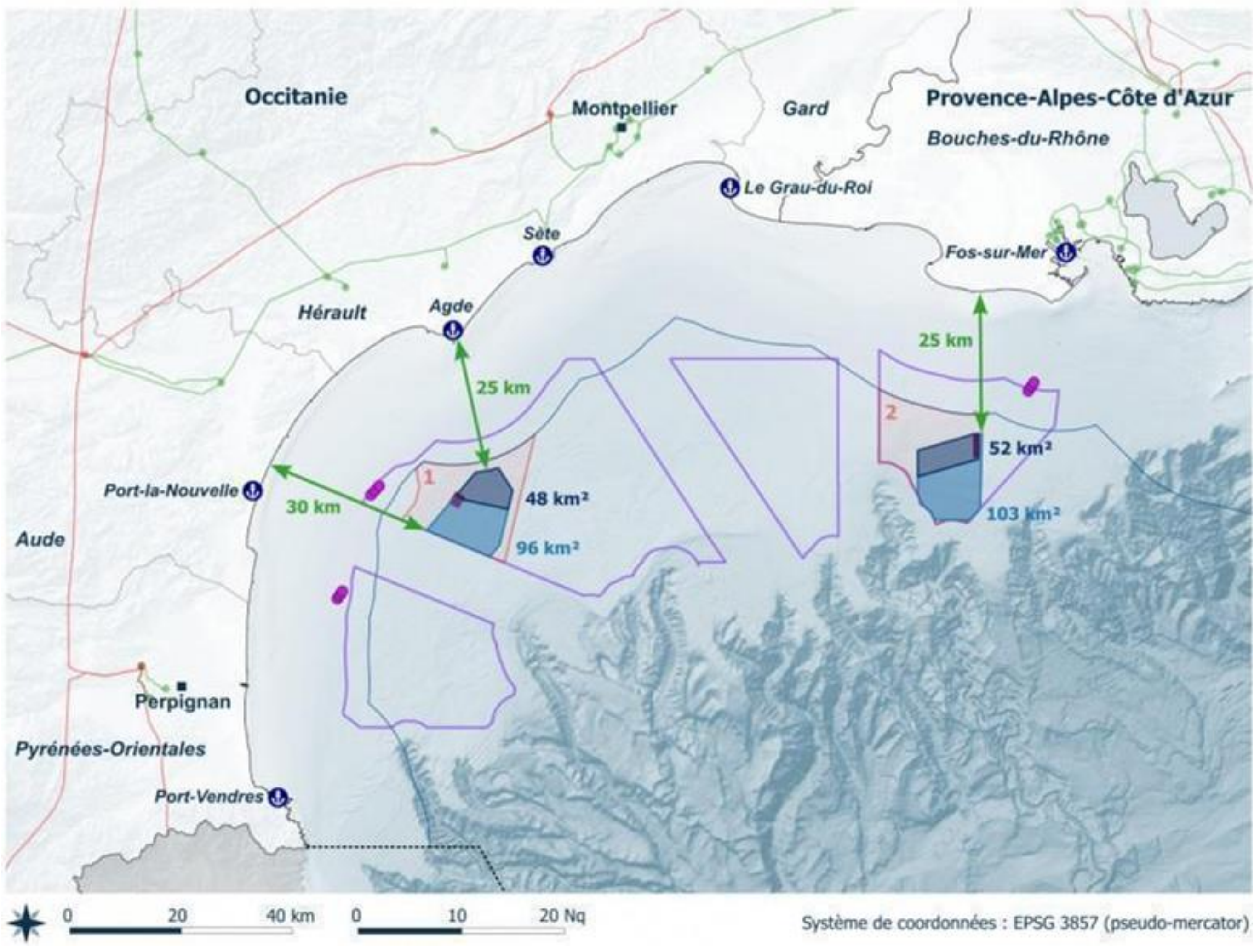


Figure 1 – French allocated offshore floating wind sites in the mediterranean sea (Total capacity of 1.5 GW)

METHOD

- Hourly time series of power profiles and curtailment (export capacity)
- Assessment of low production hours (<150MW exported) and smoothness (coefficient of variance)
- Applying battery strategies and different sizes to optimise power

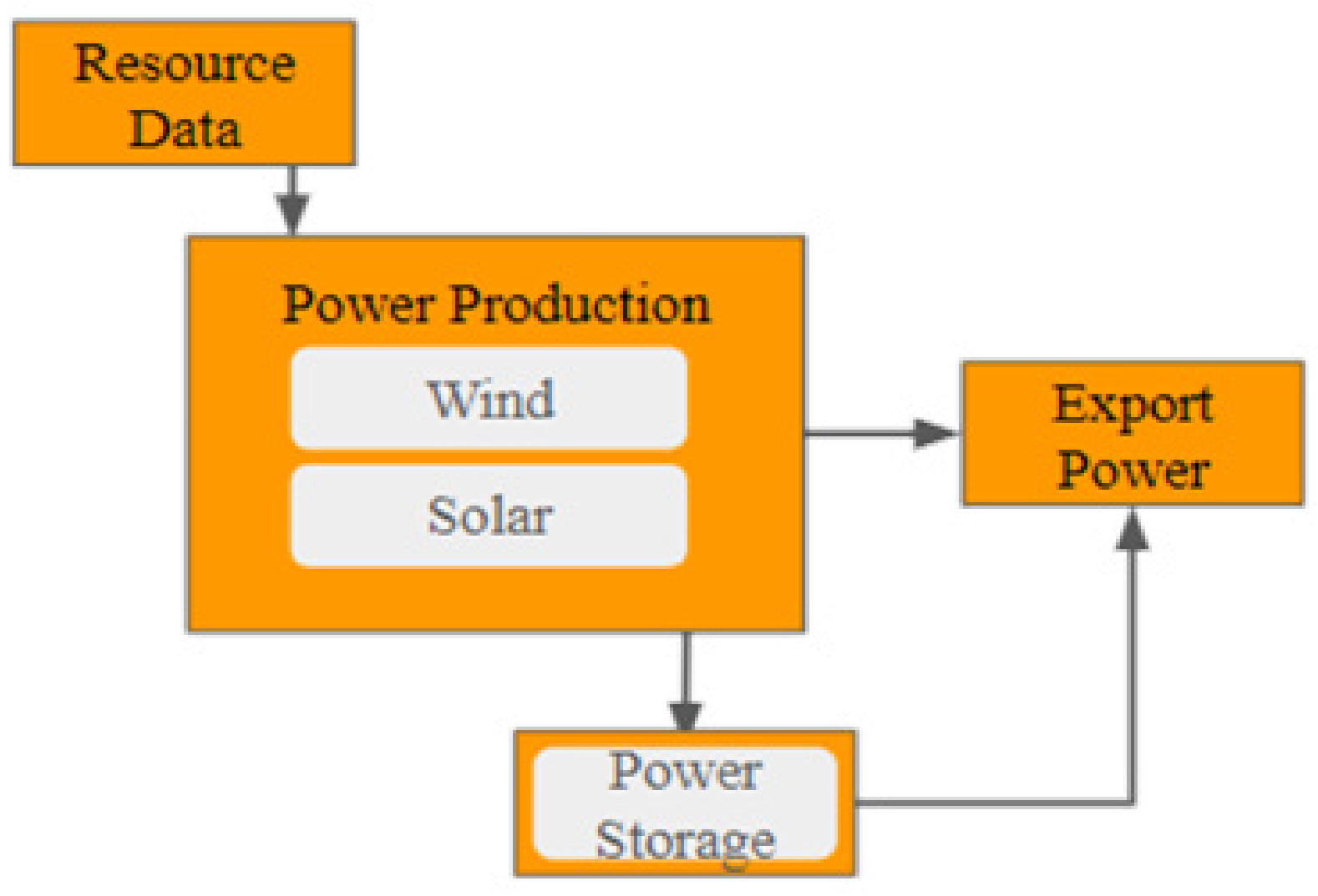


Figure 2 – Model structure

	Specification	Capacity
Wind	IEA 15 MW	750 MW
Solar	South, 31 deg	750 MW
Export	–	750 MW
Storage	81% eff – 1C	*variable*

	Strategy	Charge	Discharge
1	Export	P > 100%	P < 100%
2	Baseload	P > 20%	P < 20%
3	Smoothness	P > 80%	P < 20%
4	Hybrid	P > 100%	P < 20%

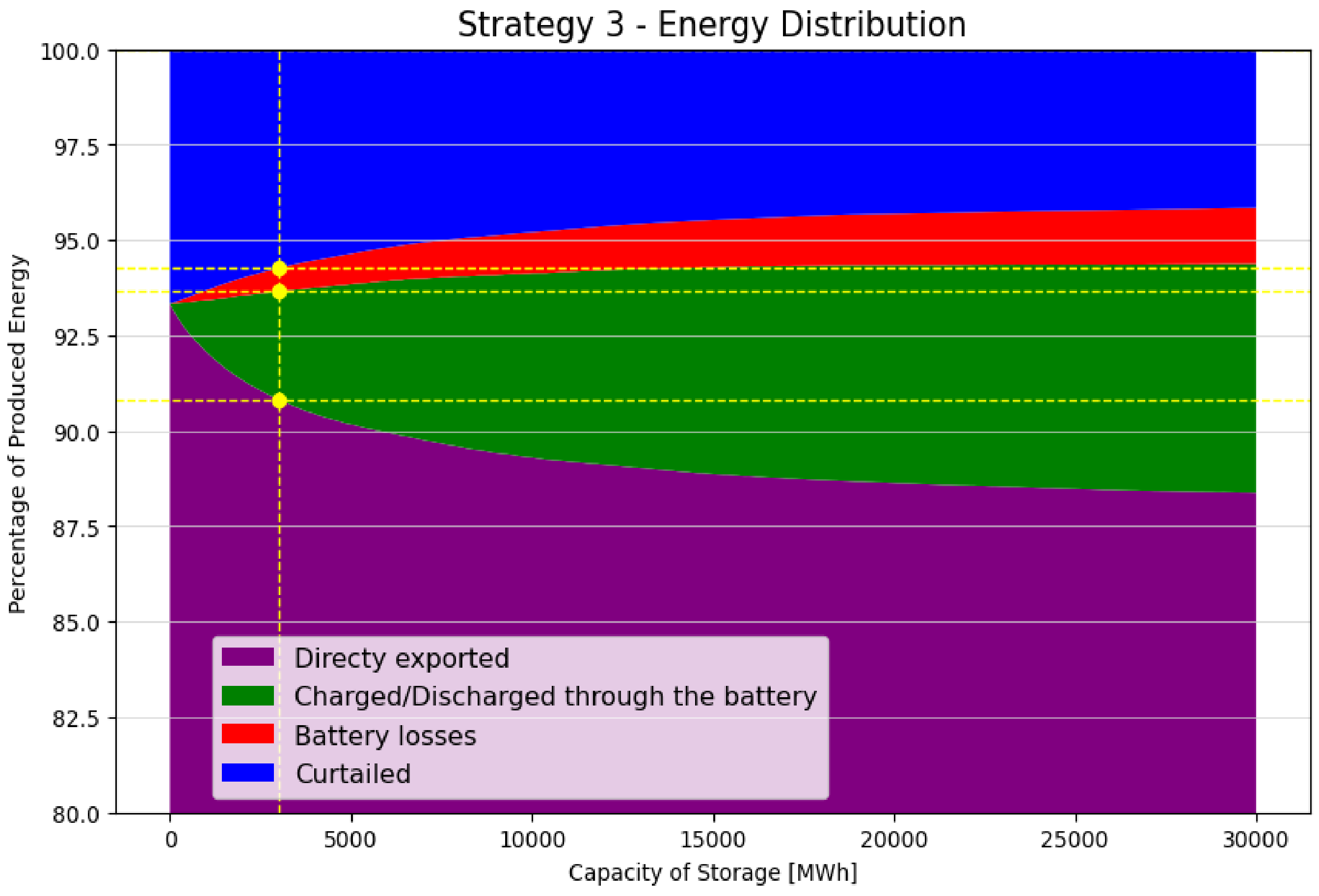
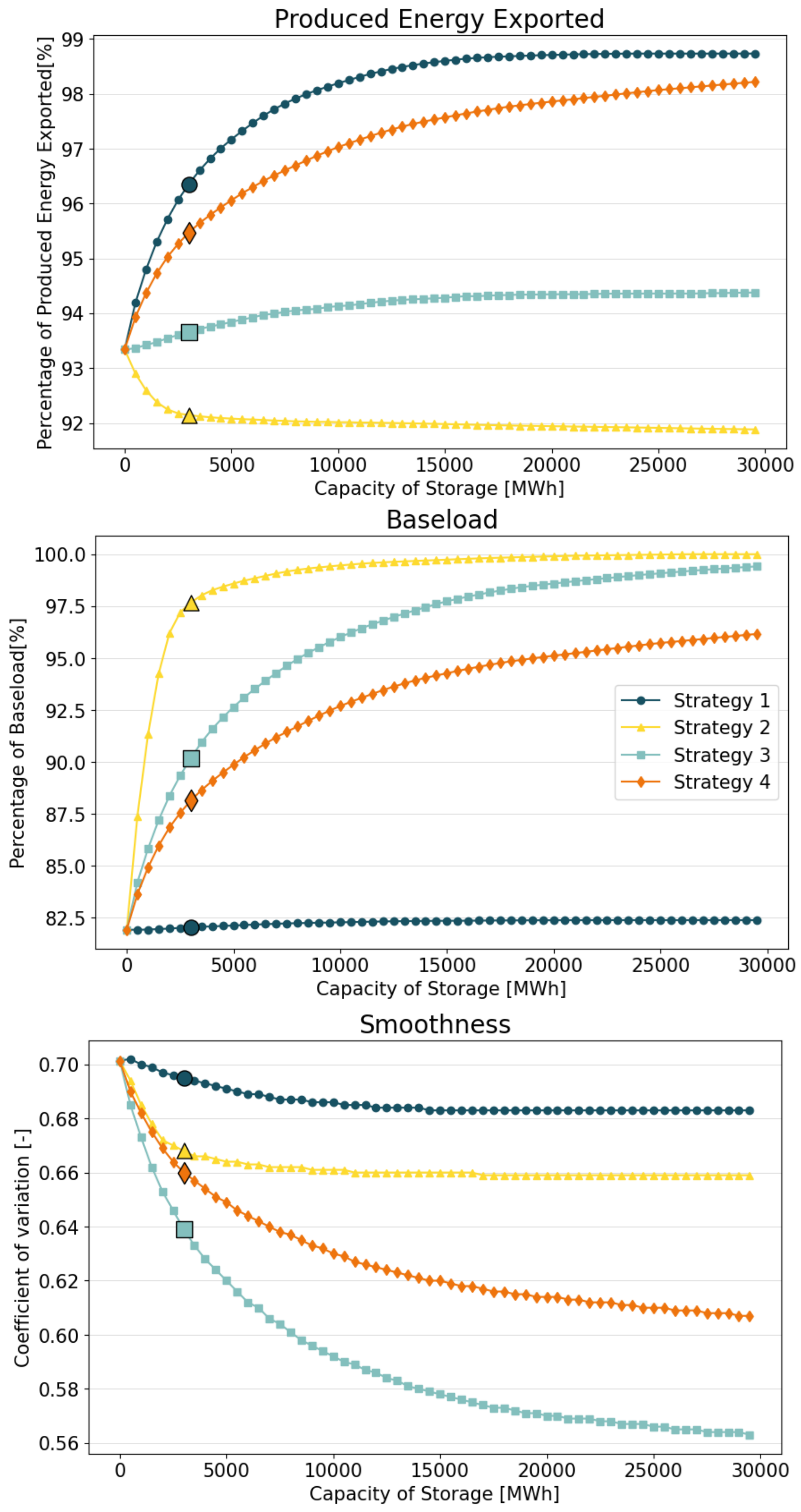


Figure 3 – Share of total power over export (purple, green) and losses to assess impact of different battery sizes. Example plot for strategy 3

Figure 4 – Top: Percentage of total produced electricity exported for different battery sizes (equivalent to figure 3 purple+ green).
Middle: Improvement of percentage baseload (150 MW) power delivered over battery sizes
Bottom: Improvement of the coefficient of variances expressing the width of the distribution of the power profile.



+ Wind and solar are **highly complementary**: In a combined wind-solar park with 100% overplanting energy production is increased by **31%** (>7% of energy curtailed)
+ Simple storage control strategies can already improve **energy security**, **baseload** capability and **smoothness** by 80%, 100% and 20% respectively.

→ Strong changes in power output can be seen for battery sizes of up to 3000 MWh. Warranting detailed studies of that range.
→ For techno-economics optimisation a detailed review of specific battery sizes and strategies against the resulting charge profile of the battery can inform sizing, c-factor and number of cycles.

This project has received funding from the European Union's Horizon 2020 research & innovation programme under grant agreement number 101036457