

# Feasibility Analysis of Smart Renewable Hubs in Non-Interconnected Island Power Systems: a Case Study for GRIDSOL

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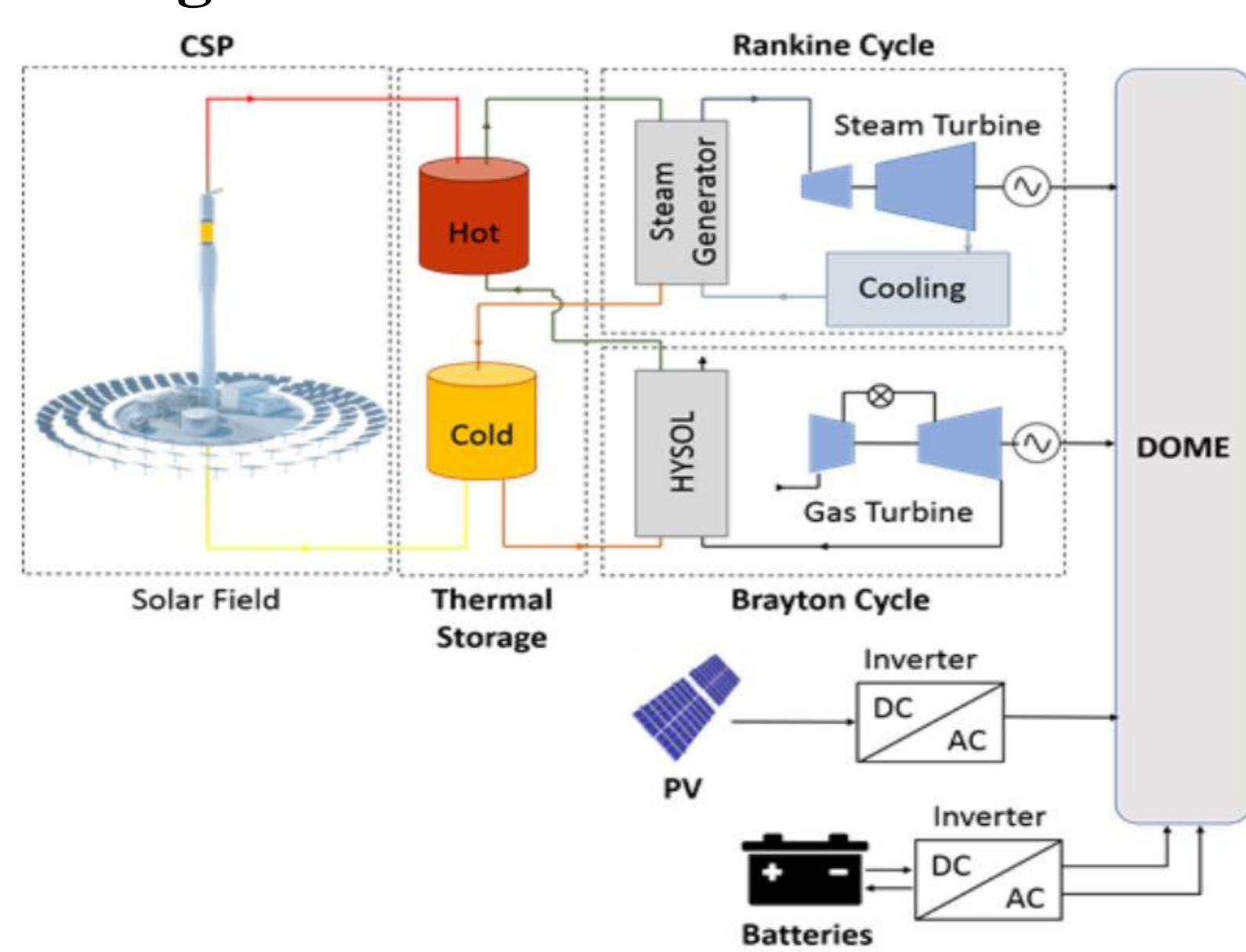
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## Introduction, Challenges and Smart Renewable Hubs

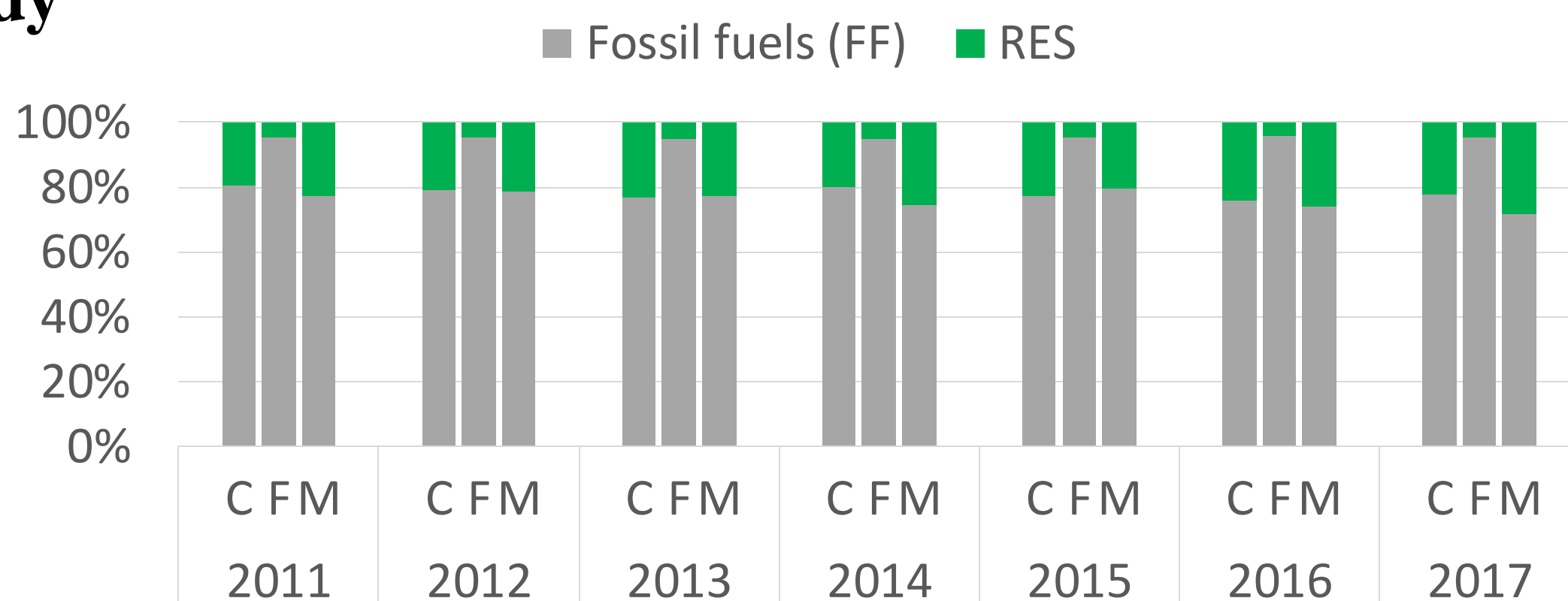
The European Union is working to decarbonize the energy systems. Solutions have been proposed targeting technologies advancement, energy markets transformation and enhanced schemes of policy support. Consistent efforts are directed to island cases as, being isolated systems characterized by aged fossil-fuel based technologies and with high electricity prices, they pose major challenges for the transformation of the European energy system. The GRIDSOL project proposes Smart Renewable Hubs (SRH) as a solution to provide secure and clean electricity, by combining renewables and storage technologies through an advanced control system.

## The GRIDSOL Design



The GRIDSOL design couples the fluctuating production from renewable-based technologies with thermal and electrical storage systems. The dynamic output manager of energy (DOME) manages the operation of the technologies, and acts as an interface between the hub and the local energy system. Capacity and type of components for the hubs can vary according to local geo- and ortho-conditions (e.g. solar DNI/GHI and wind profiles).

## Case Study



The study analyzes different GRIDSOL configurations in EU islands uniquely characterized by energy market conditions, remuneration mechanisms, renewable sources availability and large share of fossil fuel for electricity production:

- **Locations:** Crete (C), Fuerteventura (F) and Madeira (M).
- **Configurations:**
  - **BioGRIDSOL:** a system including a biogas turbine, with a CSP plant forced into the mix;
  - **GRIDSOL:** a system including a natural gas turbine, with a CSP plant forced into the mix;
  - **SRH:** a system with no specific technology forced into the mix, but with at least two generators and one storage system.

Location	Support Type	Plant Type	Fixed Costs [€/MW]	Variable Costs [€/MWh]	Power Remuneration [€/MWh]
Crete	Law 4414/2016	RES Cogeneration	X	X	X
Fuerteventura	Régimen Retributivo Adicional Régimen Retributivo Especifico	RES Conventional	R <sub>inv</sub> X	R <sub>o</sub> , I <sub>inv</sub> X	X
Madeira	Special Production Regime	RES Cogeneration	X	X	X

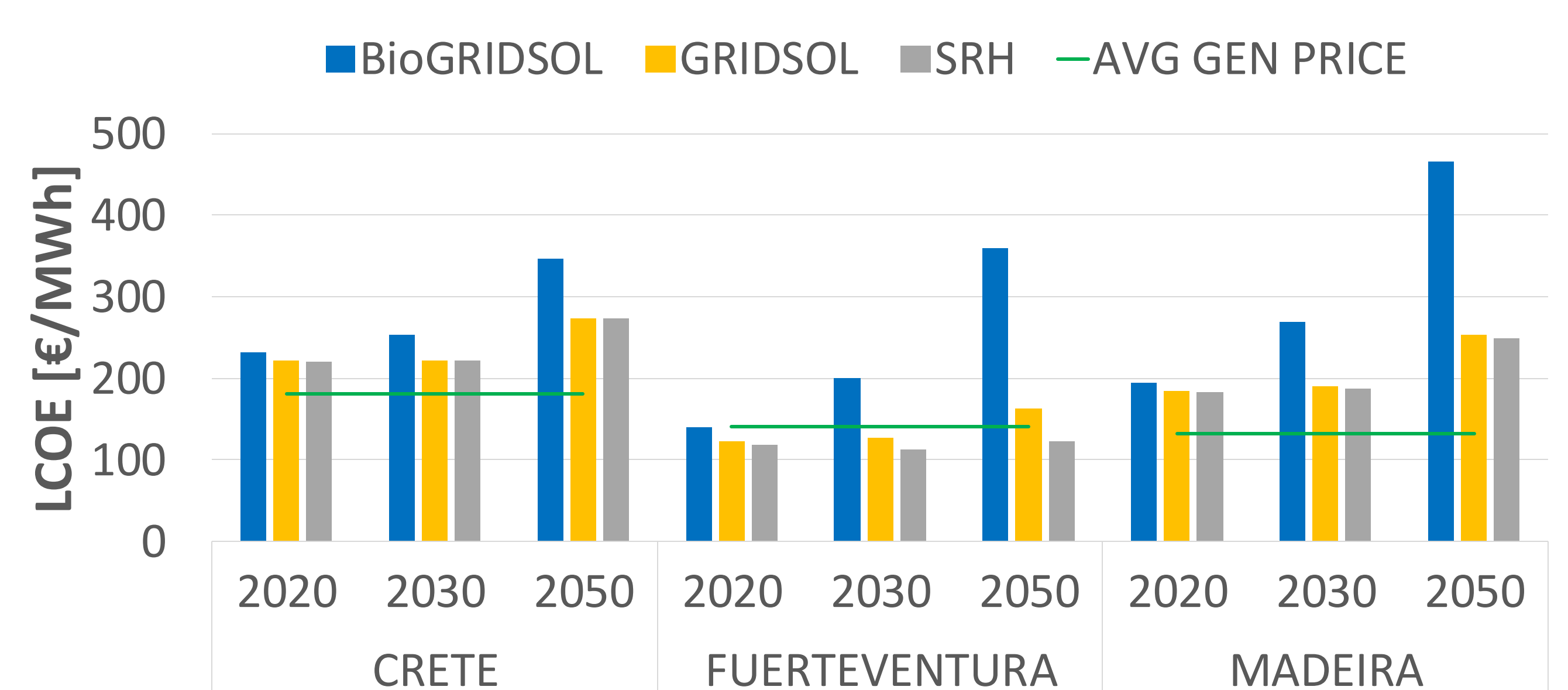
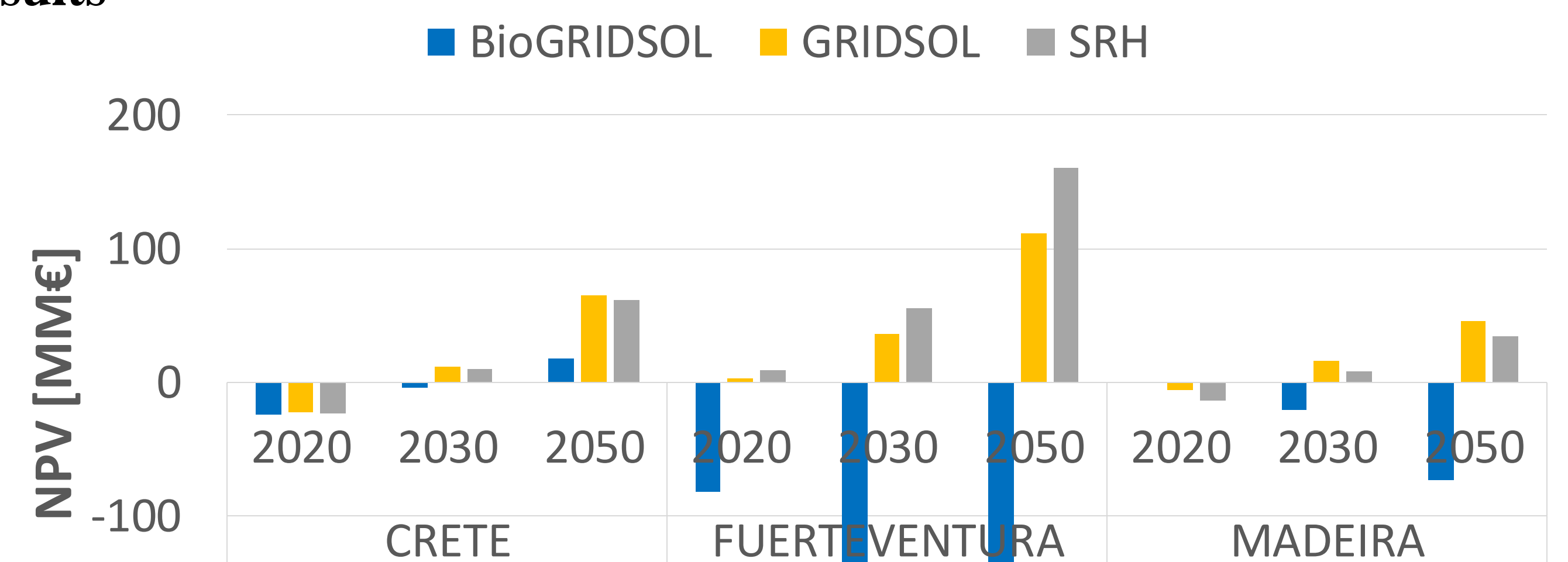
## Conclusions

- **NPV and IRR** indicate attractive investments in 2030 and 2050 for (almost) all configurations and locations.
- BioGRIDSOL configuration is largely influenced by biogas prices (attractive when biogas is supported).
- **LCOEs** are still above the average generation cost of energy production in the islands.
- The sensitivity analysis reveals that potential declines in CSP and PV CAPEX can increase the competitiveness (other parameters account less).
- A larger focus on R&D, technology development and cost reduction can foster the competitiveness of GRIDSOL solutions, and reduce CO<sub>2</sub> emissions in islands systems.

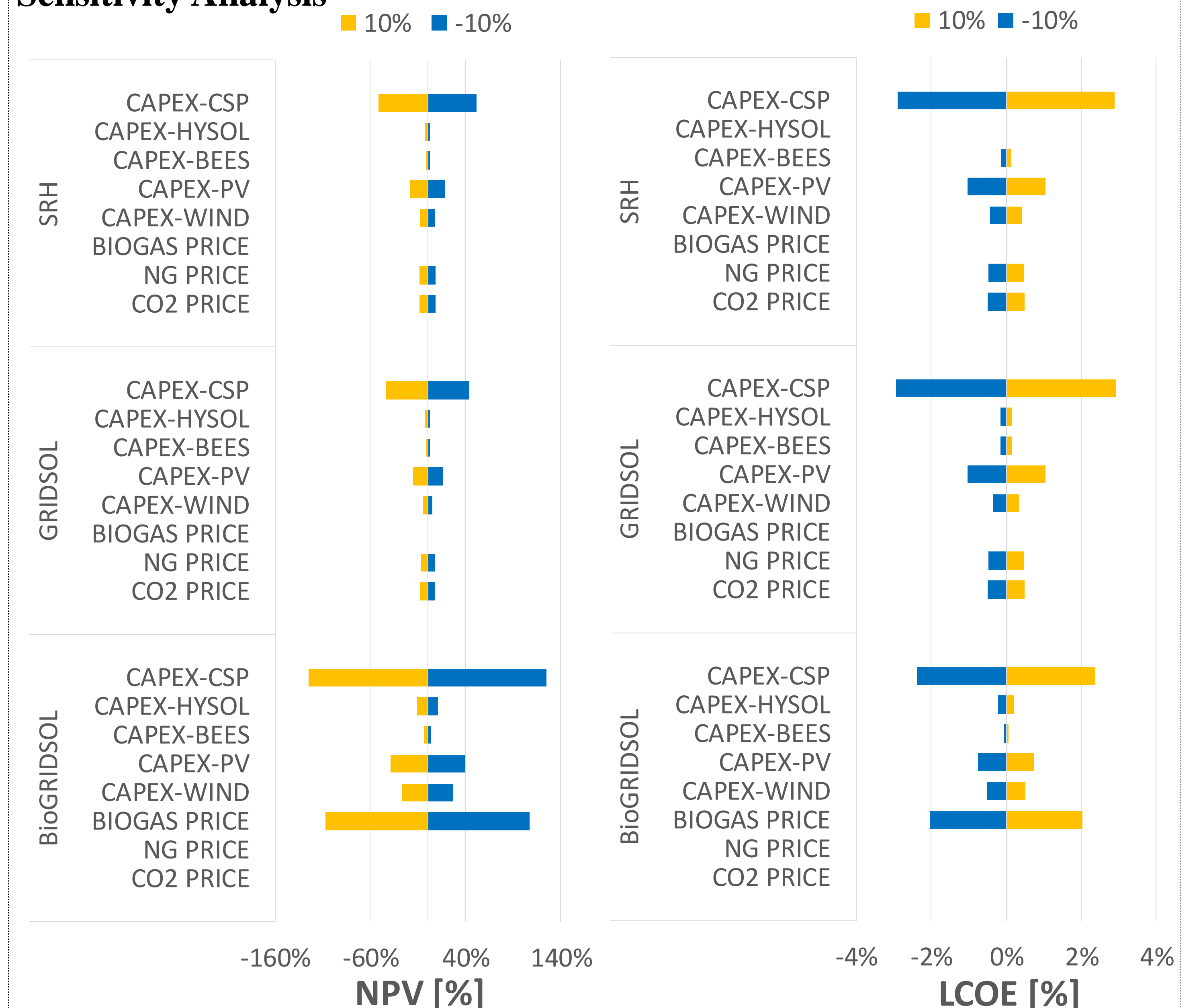
## Research Interest

Are investments in smart renewable hubs commercially attractive-given the market framework conditions, local resources and existing remuneration framework-in the non-interconnected energy systems of Crete, Fuerteventura and Madeira?

## Results



## Sensitivity Analysis



## Acknowledgements

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