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Mapping wind energy potential to support spatial planning for offshore wind farms in Italy

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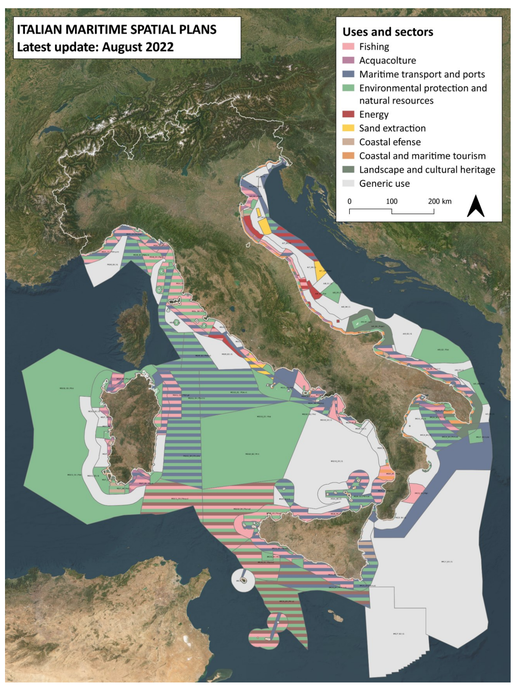
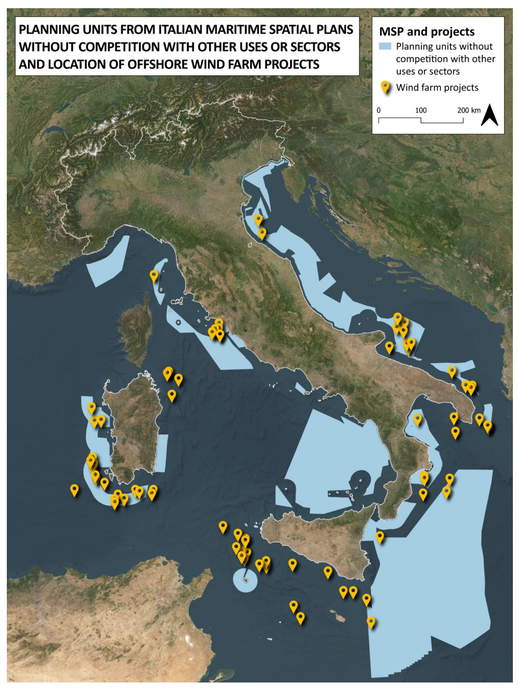
Introduction

In alignment with the most recent European guidelines for decarbonisation, Italy has dramatically increased the Renewable Energy Sources targets for electricity, providing around 75 GW of new RES power plants by 2030. The scenario developed within the National Energy and Climate Plan (NECP) relies substantially on the incremental contribution of wind and photovoltaics. Much expectation is placed on offshore wind power, not only by industrial and energy operators, but also by Central and Regional Governments, which see in this solution a concrete possibility of achieving the 2030 RES targets whilst limiting land exploitation caused by the deployment of onshore plants. The high depths of the Mediterranean Sea, however, imply the use of floating plants in most territorial marine areas. In spite of the high costs and unreadiness of this technological solution, 80 projects with a total capacity of more than 60 GW have been submitted for the permitting process in the last couple of years. The evaluation of the projects is proceeding slowly also due to the lack of an approved Maritime Spatial Planning (MSP), a tool to help decision-makers lead a balanced offshore wind development, consistent with other uses of the sea. In this work through a GIS-based approach, we present a preliminary assessment of the localization of the submitted projects considering either the exploitable wind resource or possible conflicting uses derived from the MSP mapping.

Maritime Spatial Planning (MSP)



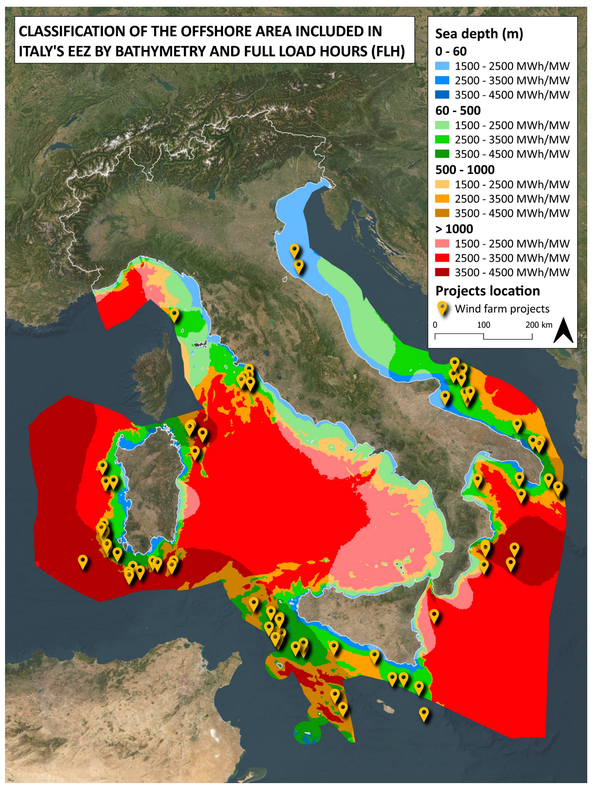


A draft version of MSP[1], currently still in approval process, was released in 2022. The Plan divides the marine space into Planning Units categorized with one or more types of use (priority, reserved, limited or generic) in relation to various activities (such as energy, fishing, transport, environmental protection etc.). For our purpose, we selected as suitable areas only those Planning Units where energy exploitation is cited as a permitted activity, encompassing both priority and generic uses.

Subsequently, the offshore wind plants currently in the permitting pipeline[2] (updated as of September 2023) were analysed in relation to the selected Planning Units. Among the 80 projects, 39 (36.2 GW) are situated in Planning Units where energy use is not mentioned, and the priority uses appear to be incompatible with the presence of offshore wind plants.

MSP use	N° projects	Power (GW)
Energy use	7	3.0
Generic use	34	24.1
Other uses	39	36.2
Total	**80**	**63.4**

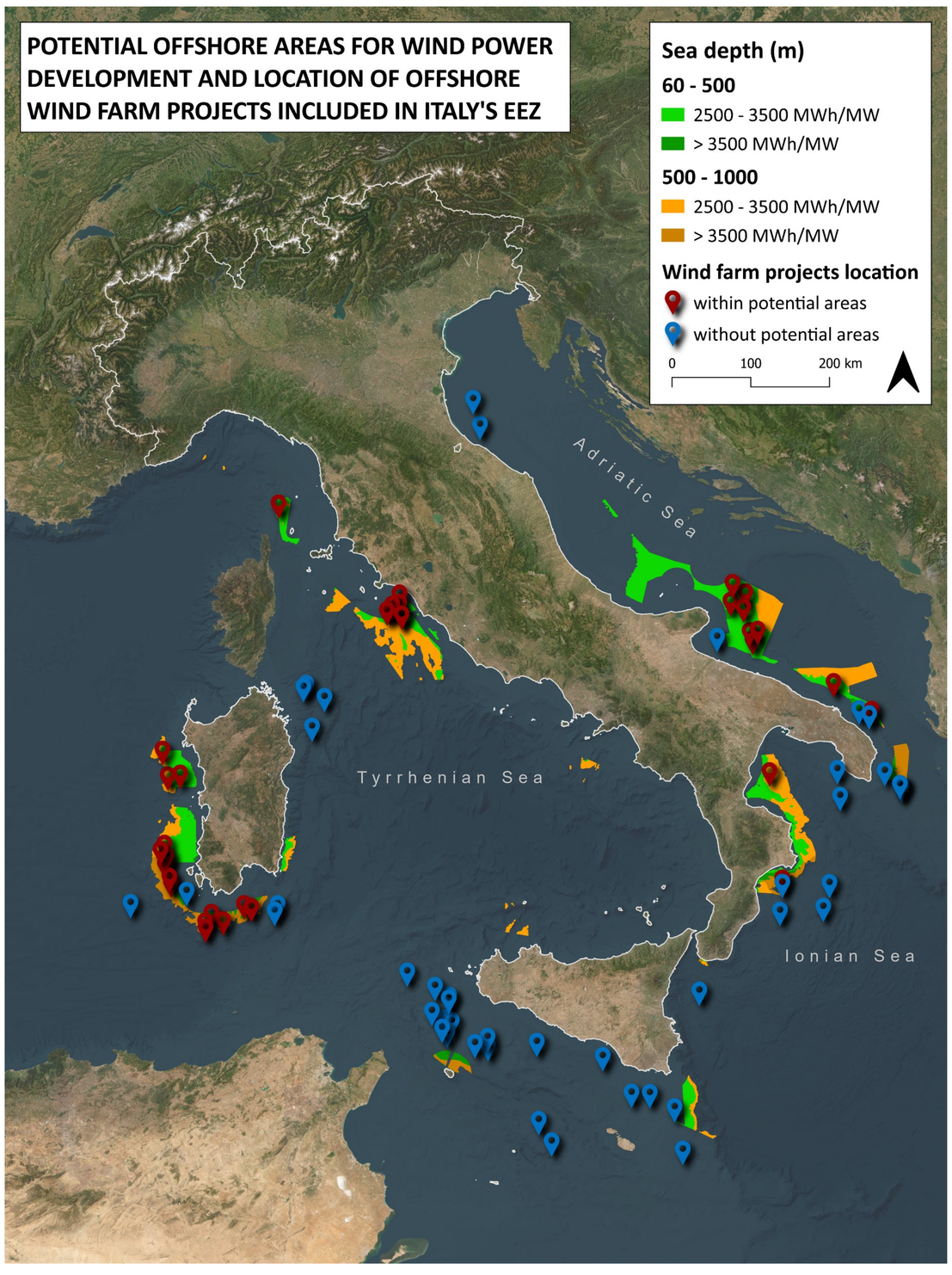
Offshore wind potential and MSP



An overall assessment of the offshore wind energy potential[3] within the Italian Exclusive Economic Zone (EEZ)[4], was carried out taking into account wind resource[5], bathymetry[6] and distance from shoreline, as follow:

- Full Load Hours (FLH) at 150 m a.s.l. > 2500 MWh/MW
- Depth < 1000 meters
- Distance from shore < 100 km

By integrating these criteria with MSP, it is possible to estimate how many wind farm projects are currently potentially suitable and, in general, the energy potential of Italian seas exploitable in short and medium-term period.



Results and Conclusions

- Nearly all the wind farm projects are located in areas with a good wind resource (> 2500 MWh/MW). The only 2 projects with FLH < 2500 MWh/MW provide fixed foundations (northern Adriatic Sea), then a lower capital cost.
- 11 projects are located in areas resulting not suitable in short and medium-term period due to sea depth and 3 projects due to distance from shore.
- 39 projects are located in areas resulting not suitable due to the MSP classification.
- Altogether 35 projects, for approximately 23.7 GW of power capacity, are located in areas considered suitable for all the criteria.

Offshore areas	N° projects	Power (GW)
Potentially suitable	35	23.7
Not potentially suitable	45	39.7
Total	**80**	**63.4**

Although there could be mutual exclusions due to possible overlaps between neighbouring projects, the total eligible capacity could give a significant contribute to achieving the 75 GW RES-E target.

1. https://www.sid.mit.gov.it/mappa
2. https://va.mite.gov.it/it-IT/Procedure/ProcedureInCorso
3. F. Lanni, D. Airoldi, I. Galbiati, R. Naldi, G. Pirovano and L. Serri, "Feasibility of HVDC Connection for Offshore Wind Farms in Italy" 2023 AEIT HVDC International Conference, Rome, Italy, 2023, doi: 10.1109/AEITHVDC58550.2023.10179080
4. https://www.marineregions.org/eez.php
5. https://atlanteeolico.rse-web.it/
6. https://emodnet.ec.europa.eu/en/bathymetry

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RSE Ricerca Sistema Energetico — we move research

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