Regulatory and market screening analysis of offshore solar requirements in EU Mediterranean Countries

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Overview

Offshore Solar is a fast maturing industry with a large potential in the EU-Mediterranean[1]. The development of solar in the offshore environment enables large scale solar projects without using land space and thereby resolving conflicts over land use. In the North Sea region, large companies incl. Vattenfall, Copenhagen Infrastructure Partners, Shell, Eneco, RWE, and TotalEnergies have planned offshore solar farms integrated in offshore wind farms. In the EU-Mediterranean region, the energy output is expected to be easily +50% higher[2] as of more sunhours, lowering the costs of energy. Preliminary assessments indicate that by using only 0.2% of the Mediterreanean Sea area, 1000 GW of offshore solar can be integrated, resulting in potentially the largest renewable energy source for the region.

Typical offshore solar project applications include 'standalone' offshore solar farms, that are often located 1-5km offshore near large industrial hubs. As the offshore solar farm systems are (nearly) flat on the sea, they are not visible from shore, preventing them from causing conflicts for aesthetics. This enables the projects, unlike offshore wind, to be located in the proximity of 1-5km to the coast, and thereby reducing costs for expensive energy export infrastructure. Other projects are 'integrated' offshore solar farms, that are located within about <5% of the space of the wind farm and that are integrated on the same electrical power export infrastructure and cables as the wind farm. By complementing the wind farm with a solar energy profile, the infrastructure is better utilized (in particular in Spring and Summer) resulting in more power output for the same infrastructure investments, and thereby enabling better business cases for the offshore wind projects[3]. The offshore solar system of Oceans of Energy has operated for over 4-years in the North Sea region[4] while surpassing over 10-categorized storms and is applicable in standard systems of 200 MWp each (1000x1000m) for both the standalone and the integrated offshore solar projects in the Mediterranean. An offshore solar project of 1 GWp thereby requires about 5km2 of sea space.

The application of offshore solar fits very well with the Mediterrean region, however the market uptake has so far centered on the less suitable (as of lower yearly solar irradiation and more harsh wind- and wave metocean conditions) North Sea region. In addition to lessons learned from a technology perspective, the EU Mediterranean region can possibly learn from the North Sea region in terms of providing a regulatory environment in which first projects can be established. In the Netherlands permitting "Gebiedspaspoort" (area passports) frameworks exist that endorse multi-use of the sea space of offshore wind farms[5]This enables developers to locate sites for developing offshore solar projects and request permits in an organized and one-shop desk procedure. In Belgium, permitting frameworks have also been successfully used for the permitting of first offshore solar projects at sites within wind farms and that are used for sites within the offshore wind farms. This paper addresses current knowledge gaps of the regulatory & market status of offshore solar projects in the EU-Mediterranean countries Italy, Malta and Greece.

Methods

The researchers have first assessed country reports in terms of energy policies and the transition towards 0% emission economies for the countries Italy, Malta and Greece. Based on national policies, such as the Nationel

[1] https://www.solarpowereurope.org/press-releases/solar-power-europe-launches-landmark-floating-solar-report
[2] Meit et al., 2023 Offshore Solar in High Seas - Assessment of Resource Complementarity for a case study in Malta
[3] Golroodbari et al., 2020 (https://www.sciencedirect.com/science/article/pii/S0038092X20313219)
[4] https://oceansofenergy.blue/projects
[5] https://www.noordzeeloket.nl/beleid/interdepartementaal-directeuren-overleg-noordzee/idon-nieuwsbrief/nr-36/nieuwe-tools-ruimtelijke-zonering-zee/

Energy and Climate Plans, an assessment was made for the amount of final energy consumption can be replaced by the current renewable energy alternatives and their projected installed capacities by 2050. The remaining PJ of energy consumption that was not yet covered by the targeted renewable energy installations was measured and assessed how much installed capacity of offshore solar would be needed to reach the fully 100% renewable energy generated targets. It was further assessed what the impacts of the amount of GW offshore solar needed would be in terms of space at sea and the relative footprint of the offshore solar space needed in comparison with the targeted space for offshore wind projects. This enabled to quantify the countries' needs for offshore solar and the impacts on their sea space of establishing this amount of offshore solar.
Next, the researchers assessed regulatory literature to provide insights on the extent to which Italy, Malta and Greece are planning for implementing offshore solar projects and how these three countries are currently preparing their regulatory policies for the establishment of offshore solar projects[6]. The results of this literature study were presented and recommendations were provided including based on success stories from North Sea countries.

Results

The market analysis showed a large need for offshore solar. In the country of Italy-alone, about 500 GW of offshore solar would be needed to complement the renewable energy plans on land and with (floating) offshore wind to generate sufficient PetaJoules of renewable energy by 2050 to reach zero emissions[7]. For countries Greece and Malta a similar need for offshore solar exists, although their economies are less energy intensive in absolute terms and therefore the numbers are significantly lower[8]Considering that the renewable energy ambitions on land and with (floating) wind for 2050 require ambitious accelarations in renewable energy deployments and that likely more renewable energy needs to be generated as of weather intermittency than that is actually used, the amount and the need for offshore solar can in practice be considered even larger and the results may be considered conservative.

For the regulatory policy analysis it was found that all three countries have started with the development of offshore solar policies[9][10][11]. The existing policies provide a legal overview that enable the development of offshore renewable energy projects and site permitting procedures. A large extent is still focused on offshore wind, however, it seems as that it is feasible for first projects to establish regulatory acceptance in all three countries. All countries have even started, or have in preparation, incentive schemes to endorse offshore solar development. Furthermore, it seems that the permitting frameworks for establishing 'solar' energy projects are per MW more convenient for projects 'offshore', where a solar project can be 100-1000 times as large as of the available space and the limited stakeholders.

Conclusions

Offshore solar is a 1000 GW opportunity for the Mediterranean Sea region. This study conducted a regulatory and market screening analysis and found that as of the available space at sea, the good conditions offshore (in terms of sun hours and relatively calm metocean conditions), and the technology characteristics (in terms of negligible visibility from shore) there is a large interest in developing offshore solar industries in the EU-Mediterranean region. This can enable the countries to meet their renewable energy targets and become energy independent from external, non-EU countries. To establish this, the policies that are just recently being started to incentivize offshore solar need to be expanded, and policy makers, researchers, and industry need to engage with each other to steer this into a successful direction.

References

See footnotes

[6] https://www.solarpowereurope.org/press-releases/solar-power-europe-launches-landmark-floating-solar-report
[7] https://assoaero.org/wp-content/uploads/2025/03/EN-Position-Paper-AERO-HD.pdf
[8] Meit et al., 2023 Offshore Solar in High Seas - Assessment of Resource Complementarity for a case study in Malta
[9] https://www.independent.com.mt/articles/2024-01-31/local-news/Preliminary-Market-Consultation-for-offshore-photovoltaic-farms-launched-Energy-Minister-6736258225
[10] https://reglobal.org/floating-solar-in-europe-potential-growth-trends-and-opportunities/
[11] https://www.offshorewind.biz/2024/06/05/italy-to-award-contracts-for-difference-for-offshore-and-floating-wind-projects-eu-greenlights-eur-35-5-billion-renewables-subsidy-scheme/