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Interconnecting energy grids and policies in the Med

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Facilitating policies - Med energy integration and market design integration

Where the possible common ground for a Med energy market governance stands

Trading energy with long term contracts is consistent with some regulatory features of non-EU energy markets, including single buyers and other centralized auctioning systems. Whatever the tool, it should allow competition.

Different shocks eventually brought to one outcome: a political drive within the EU to look for ways to deliver longer term price signals to ease investments in energy assets and to stabilize end user prices. This wave is interestingly coherent with some of the features of non-EU Med energy systems, including the use of institutional single buyers, which operate in Algeria (for bilateral contracts between producers and large consumers), Tunisia, Egypt. The single buyer model guarantees a decision role for the public sector in investments in power generation and, if managed accordingly, it can still allow competition, provided contestability and international transparency are secured in their energy procurement auctions.

This is why coordination on development of physical interconnections energy assets is probably more important than homogeneity in the energy market design throughout the area.

Developing framework agreements for bilateral energy exchange is also a good tool for integrating the Med energy industry. A positive example is the MoU to ease international trading of electricity signed in 2022 by Morocco (currently the only African market with a power interconnection to Europe), France, Portugal and Spain

under the Sustainable Electricity Trade Roadmap coordinated by the Moroccan agency for sustainable energy.

While competitive centralized auctions are being increasingly introduced within the EU to foster development of renewables and storage capacity, in a similar way contestability of procurement procedures of single buyers operating in some of the Med countries is key to trigger competition between technologies and a quicker spread of successful innovations. Another positive example is the open season[1] currently active in Morocco to attract proposals and funds to set a hydrogen production and logistics industry in the country.

RES potential in the Med

North Africa and Middle East have huge potential for renewables.

Potential for RES development especially in North Africa and Middle East is huge. Current renewable power generation capacity in the Med region is about 90 GW for solar PV and 82 GW for wind, while the potential is estimated at more than 3 TW by a study within the Teramed initiative[2], meaning that current development of renewables falls way short of its full potential. Namely, North African countries still have an installed capacity short of 12 GW.

Why subsidies to renewables are getting less and less critical

Renewables used to need subsidies to kick off. This is no longer true for utility-scale current projects. Henceforth, the ability to subsidize the RES is not a critical factor anymore for their development. Policies to phaseout fossil fuels subsidies are.

If we look at how renewables (henceforth, sometimes: RES) took off in countries like Spain, Germany, Italy, we see how important feed in tariffs have been (or feed in premium tariffs or minimum quotas like green certificates in Italy). In Germany and Italy at the end of the first decade of this century we have seen subsidies to RES as high as 500 €/MWh for some photovoltaic, which contributed to a reputation for all

[1] https://www.masen.ma/en/green-hydrogen-moroccan-offer
[2] See for example, here https://resourcegovernance.org/articles/terameds-campaign-unlock-mediterraneans-renewable-energy-potential

RES of being very expensive, which still lingers today among the non-experts (and sometimes, unfortunately, among politicians).

The recent combination of huge investments in China in the value chain of RES and the local economy slump has driven further down the cost of appliances and, consequently, the average cost of energy from RES.

In fact, economics have largely changed since then. In recent times, utility scale renewables are among the cheapest electricity sources in terms of average cost, only beaten in some cases by the existing (already depreciated) conventional nuclear[3]. All three countries mentioned above have abruptly slashed subsidies to renewables. Indeed, the only public support generally expected for mature utility-scale renewables in Europe in the years to come are contract for differences to stabilize the revenue from the energy produced.

The policy implication for Med energy governance is that we should not expect different financial capacity to support renewables by different countries to be a major limiting factor for integration anymore. In fact, a larger role might be played by how quickly and homogenously the Med countries will manage to phase out fossil fuel subsidies, which appear to be a critical issue since typically the oil and gas producing countries use such subsidies (often in the form of policy-driven low fuel retail prices) as a way to deliver welfare benefits to the public.

Hence, a solid cooperation within the Med area to phaseout fossil fuel subsidies is key to get to a level playing field in energy exchanges.

Adequacy of Northern African and Middle Eastern electricity grids and role of standardized ancillary services for grid stability

Grid balancing and ancillary services are getting more and more important. So it is standardizing their products specification in the Med area by TSOs. Electricity grids are generally solid in the region, but further development of renewables might stress them.

[3] See, for example, here: https://www.iea.org/data-and-statistics/data-tools/levelised-cost-of-electricity-calculator

In a sector with larger unpredictable electricity sources, ancillary services markets are getting a larger share of the energy value also in terms of international trade.

Such standardization might be achieved either by integrating internationally the ancillary services markets - probably not an easy solution due to the complexity of such real time markets and the needs of deeply integrated grid monitoring - or by stronger cooperation between Transmission System Operators (henceforth: TSOs) in terms of framework policy for balancing products specification and mutual support.

Med-TSO, the network of Mediterranean power TSOs, twice a year assesses the adequacy of the Med power grids, and its report[4] issued in November 2024 only finds adequacy issues in the grids of Lebanon and, to a lesser extent, Jordan. The study considers the needs by the electricity systems to provide ancillary services as frequency containment reserve, which is a fundamental real-time support to grid stability by power plants. Such scenario depicted by Med-TSO, if positive in terms of current grid stability, should be seen in a perspective of a much larger deployment of renewables in the non-EU countries of the region which for a huge part still use gas fired power plants to make electricity and provide ancillary services, while the potential of renewables is still largely unmet. With such gap due to be hopefully overcome, the stability of Northern African and Middle Eastern grids might be challenged by a much larger extent. This needs to be foreseen and tackled in terms of investments.

Another element of attention in terms of grid adequacy is the lack of cooperation by the Algerian TSO, as reported by Med-TSO.

What interconnections - The (fading?) role of hydrogen

Repurposing gas grids

Repurposing to hydrogen the existing gas grids is probably going to be too expensive, while blending hydrogen with gas would prevent the availability of the hydrogen needed

[4] https://med-tso.org/wp-content/uploads/2024/11/Med-TSO-Adequacy-Studies-Winter-Outlook-2024.pdf

by the hard to abate sectors. The projected hydrogen corridors, sized over current gas flows, might never see enough hydrogen trade to take off economically.

The EU included the "SoutH2 corridor" in the Projects of Common Interest list under the revised TEN-E Regulation published in April 2024. The initiative aims at building a hydrogen corridor from Sicily to Germany, mainly for future imports from Northern Africa and for moving hydrogen from Southern Italy to central Europe.

The corridor will work largely on "repurposed" existing infrastructure, meaning that either the repurposed sections will be subtracted from natural gas transport, or hydrogen will be mixed with gas. The latter solution would most likely entail the impossibility to get pure hydrogen at destination unless devices to re-extract hydrogen from the mix prove cost effective[5]. As a consequence, hydrogen blending would not help meeting the hydrogen need of hard to abate industries like primary steel or cement.

Another critical point about mixing hydrogen with natural gas relates to the interdependence of the two: until high concentrations of hydrogen are not safe in the infrastructure, flow of hydrogen is only possible as long as the use of gas does not drop relevantly.

The part of hydrogen South corridor within the PCI list does not include so far any repurposing of the transmediterranean sections, not the one from Mazara del Vallo (Sicily) to Algeria via Tunisia, nor the newer "Greenstream" from Gela (Sicily) to Libya. Especially the first is a rather old infrastructure whose repurposing might be difficult or too expensive. Generally, repurposing underwater gas corridors might require laying down brand new hydrogen-ready pipelines whose cost might need adequate long term contracts for hydrogen transport capacity in order to afford the investment in a merchant configuration. On the other hand, paying them with regulated tariffs might hinder hydrogen competitiveness unless volumes take off quickly.

[5] Based on Snam's 2022-2032 development plan, membranes to do the job are still at an experimental stage.

Hydrogen as a vector and as a storage molecule

Hydrogen might be needed as an energy storage vector, but geologic storage of hydrogen is tricky and largely undeveloped. A Med strategy about how to solve the issue of seasonal energy storage is necessary before we can meaningfully identify the hydrogen assets we actually need.

An electricity system mainly run on renewables requires plenty of storage capacity. Electricity markets with reasonably volatile markets are able to implicitly promote storage when it comes to intraday storage capacity through batteries, whose costs are rapidly decreasing. More problematic will be providing seasonal storage capacity, which in the fossil era is largely met by gas geologic storage.

Electing the decarbonized tool for seasonal storage is a critical energy policy issue in the Med as elsewhere. Hydrogen is a candidate for that. However, hydrogen geologic storage capacity in salt caverns is still extremely limited[6], while only a few pilot projects use reservoirs in porous formations. Uncertainties in terms of physical, chemical and biological interaction of hydrogen with surrounding materials make selecting and developing a site complicated and costly.

Still, we do need considerable hydrogen storage capacity if we want to use it as a vector of long term storage. If hydrogen storage happened to fail developing with reasonable pace and extent, an alternative solution might be using methane from green hydrogen instead. This would allow to keep relying on the existing gas facilities for transport and storage, while it would require adding adequate methanation capacity to the electrolyzers for hydrogen production, which in turn would need a solid infrastructure for separating, storing and transporting the CO2 necessary to get methane from hydrogen. Again, not the easiest task.

[6] On geologic hydrogen storage see Towards underground hydrogen storage: A review of barriers by R. Tarkowski, B. Uliasz-Misiak available here: https://www.sciencedirect.com/science/article/pii/S1364032122003574.

Power or molecules?

Power interconnections are an alternative to new hydrogen pipelines and can reduce the need for seasonal storage too.

Competition (or dilemma) between green hydrogen and green methane is not the only one when it comes to long distance energy interconnections and demand/supply balancing within the Med. Power interconnections can also provide balancing for all time spans. This is because a more interconnected grid is able to take profit from the reduced volatility of a larger portfolio of demand and supply assets. Statistically, the more interconnected the grid, the easier is to balance it because it is more likely to find the complement resource to a volatile one. This also applies at a seasonal level when an interconnection bridges countries with different peak seasons for consumption or production. What in a standalone scenario would require significant amounts of seasonal storage (difficult to provide, as we have seen), in an interconnected one might be mostly solved by complementary seasonal demand curves. Imagine, for example, how connecting the two sides of the Mediterranean Sea might allow to help Northern Africa and Middle East to provide power in winter to Europe for heating, while in summer air conditioning devices in South and East Med would get support from Europe during the local peak season.

We do need the institutions of the Med to coordinate in terms of a medium-long term vision of what the most realistic assets to provide security to an increasingly integrated and decarbonized energy industry are. Based on the observations just brought here, over reliance on hydrogen and carbon capture and storage of CO2 might prove risky and might delay the transition while reducing energy affordability.

Who comes first in the transmed interconnection race

With the making of the power interconnection between Italy and Tunisia, a substantial share of demand for cross-Mediterranean grid security and energy trade might be met, so reducing the need of hydrogen interconnectors.

If several physical integration options are available, the ones coming sooner might outplace the competitors. Most likely, the next transmediterranean energy interconnection will be the direct current electricity power line from Sicily to Tunisia.

It will have a capacity of 600 MW, extending for around 220 kilometres most of which is submarine cable with a maximum depth of 800 meters. The project has been included in the list of Projects of EU Common Interest (PCI). In August 2023 Terna (Italian TSO) and Steg (Tunisian TSO) signed the grant agreement with the European Commission which expedites the financing of €307 million. It is the first time, Terna notes, that funds for European connection facilities are allocated to an infrastructure project developed by a Member State and a Third Country.

With this infrastructure apparently on a solid course to be realized, it is reasonable to expect that long-distance energy transmission between the two sides of the Mediterranean will happen in form of electricity. Which would not mean that we will not need hydrogen to feed the hard to abate sectors or to contribute to storage and grid stabilization. This function might be met by storing in salt cavern a reasonable amount of hydrogen to be retransformed in power through gas-derived thermal plants, at least as long as they show lower costs than fuel cells.

In the era of mass electrification of energy consumption, electricity is probably readiest solution also for long-distance interconnection.

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