

Risks of the New Hydrogen Geopolitics in the Euro-Mediterranean Region

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The Role of Green Hydrogen in the Southwestern Mediterranean Basin

The year 2022 will be remembered as the year of the start of the war in Ukraine. In addition to the human and moral tragedy it entails, this war has had significant consequences in the energy sphere. The firm will of the United States and the European Union (at least on its western side) to replace Russian fossil energy supplies at any price¹ seems to be leading to ambivalent action located somewhere in a (non-equilateral) triangle whose angles are determined by a return to energy nationalism for EU Member States, the US positioning itself as a strategic gas supplier to Europe, and a boost to renewable forms of energy with low carbon emissions.

Among the latter, the one that has gained most momentum in international forums in the last two years is hydrogen. It is enough to look at the reports and publications of the main international energy agencies, such as the International Renewable Energy Agency (IRENA)² or the International Energy Agency (IEA),³ to gauge the role that hydrogen is expected to play in the future world energy scene.

On paper, in this – as yet hypothetical – scenario, some South-shore Mediterranean countries seem set to play an important role. For example, the new *EU External Energy Engagement in a Changing World* aims to establish a Mediterranean Green Hydrogen Partnership between the EU and the southern Mediterranean countries (European Commission, 2022b:6). The current realization of these projects is summarized in Table 5, showing 24 of the projects registered in the IEA database (2021), which includes all the hydrogen projects commissioned in the world since the year 2000. In general, of the total number of projects listed, a scant 5% appear to be under construction; and, if we refer in particular to the Southern Mediterranean, only one of them (column 4) appears to be in the implementation phase. Moreover, projects appear in only three countries, if we include Mauritania as part of the geographical area, namely the latter country, Egypt and Morocco. Furthermore, according to IRENA (2023:28-29), in other countries, there is currently only one MoU between Sonatrach and ENI in Algeria, and one MoU between Tunisia and Germany for developing infrastructures to produce and export hydrogen.

In order to properly interpret the contents of Table 5 – and the consequences that could be inferred from it for the Euro-Mediterranean region – it is useful to recall some basic aspects about hydrogen as an energy vector.

¹ As indicated in the REPowerEU Plan goals, “REPowerEU is about rapidly reducing our dependence on Russian fossil fuels [...]” European Commission (2022: 1).

² See the website (www.irena.org/Energy-Transition/Technology/Hydrogen) [consulted 2 May 2023].

³ See the website (www.iea.org/reports/the-future-of-hydrogen) [consulted 2 May 2023].

TABLE 6 Hydrogen Projects Commissioned in Morocco, Egypt and Mauritania

Project name	Country	Date online	Status	Technology*	Type of electricity (for electrolysis projects)	Product	Ammonia	Methanol	Iron & Steel	Other Industries	Mobility
Egypt Ministry of Electricity and Renewable Energy	EGY		Feasibility study	Other Electrolysis	Dedicated renewable	H2					
KIMA – Aswan Electrolyser	EGY	2000	Decommissioned	ALK	Dedicated renewable	Ammonia	1				
Cairo Green Hydrogen	EGY		Concept	Other Electrolysis	Dedicated renewable	H2					
EBIC – Ammonia plant	EGY	2024	Feasibility study	PEM	Dedicated renewable	Ammonia	1				
EEHC - Siemens MoU	EGY		Concept	Other Electrolysis	Dedicated renewable	H2					
Ain Sokhnaplant, Suez Canal Economic Zone (SCZone), phase 1	EGY	2026	Feasibility study	Other Electrolysis	Other/Unknown	Ammonia	1				1
Ain Sokhnaplant, Suez Canal Economic Zone (SCZone), phase 2	EGY		Concept	Other Electrolysis	Other/Unknown	Ammonia	1				1
Ain Sokhna ammonia project	EGY	2025	Feasibility study	Other Electrolysis	Other/Unknown	Ammonia	1				
Masdar Hassan Allam green hydrogen, phase 1	EGY	2026	Feasibility study	Other Electrolysis	Other/Unknown	MeOH		1			1
Masdar Hassan Allam green hydrogen, phase 2	EGY	2030	Concept	Other Electrolysis	Other/Unknown	Ammonia	1			1	
Total Eren, Enara green ammonia, phase 1	EGY		Concept	Other Electrolysis	Other/Unknown	Ammonia	1				
Total Eren, Enara green ammonia, phase 2	EGY	2030	Concept	Other Electrolysis	Other/Unknown	Ammonia	1				
Scatec Green Ammonia	EGY	2025	Concept	Other Electrolysis	Other/Unknown	Ammonia	1				
ReNew Power - Egypt MoU, Hydrogen, phase 1	EGY	2025	Concept	Other Electrolysis	Dedicated renewable	H2					
ReNew Power - Egypt MoU, Hydrogen, phase 2	EGY	2029	Concept	Other Electrolysis	Dedicated renewable	H2					
ReNew Power - Egypt MoU, Ammonia phase 1	EGY	2025	Concept	Other Electrolysis	Dedicated renewable	Ammonia	1				
ReNew Power - Egypt MoU, Ammonia phase 2	EGY	2029	Concept	Other Electrolysis	Dedicated renewable	Ammonia	1				
Saipem and Alboran Hydrogen (1 plant)	MOR		Concept	Other Electrolysis	Other/Unknown	H2					
OCP Group demo project	MOR	2022	Under construction	Other Electrolysis	Dedicated renewable	Ammonia	1				
HEVO-Morocco	MOR	2026	Feasibility study	PEM	Dedicated renewable	Ammonia	1				
Massen - kW	MOR	2025	Feasibility study	Other Electrolysis	Dedicated renewable	H2					
Amun	MOR		Concept	Other Electrolysis	Dedicated renewable	H2	1				
Project Nour	MRT		Feasibility study	Other Electrolysis	Dedicated renewable	H2					
Aman - Green Hydrogen Project	MRT	2030	Feasibility study	Other Electrolysis	Dedicated renewable	H2	1		1		

*ALK: Alkaline electrolysis; PEM: Proton exchange membrane electrolysis
Source: IEA (2021), Hydrogen Projects Database (www.iea.org/eports/hydrogen-projects-database).

Green Hydrogen?

The first and fundamental aspect is that hydrogen gas, as we refer to it when talking about the energy transition, is not a primary source of energy. The hydrogen we use is a chemical compound obtained from one of two possible processes: the decomposition of water (H₂O) into oxygen and hydrogen by means of electrolysis; or that obtained by subjecting methane (CH₄) of fossil or organic origin to a chemical reaction separating the carbon from the hydrogen. Therefore, the first characteristic of “hydrogen” is that it is more like electricity or a fuel such as oil or coal. It is something that can be produced anywhere and not a source of primary energy exclusively located in certain territories of the world. To produce hydrogen by electrolysis requires (fresh or salt) water and electricity; to generate it from methane requires coal, oil or gas (or biogas). Hence, electrolysis from renewable energy (green hydrogen in Table 6) can be carried out almost anywhere in the world (at different scales), while electrolysis whose electricity has a fossil or nuclear origin, or the hydrogen resulting from chemical separation (blue, grey, black or brown, turquoise, purple, pink or red hydrogen) would simply be another piece of the existing fossil⁴ or nuclear chain (except in the case of biogas). It therefore follows from the explanation and Table 6 that “green hydrogen” refers only to hydrogen produced by electrolysis (the case of biogas would be debatable) from electricity generated by renewable energy sources.

TABLE 6	The Colours of Hydrogen
Hydrogen Colour Code	Hydrogen Sources and Production Processes
Green	Electrolysis using renewable sources
Blue	Fossil fuels with carbon capture and storage (methane or electrolysis)
Grey	Fossil fuels (steam methane reforming or electrolysis)
Black or Brown	Coal (gasification or electrolysis)
Turquoise	Methane pyrolysis
Purple / Pink / Red	Nuclear Energy
White	Naturally-occurring hydrogen

Source: own creation.

⁴ According to IRENA (2022), in 2021 only 3% of the total energy demand was covered by hydrogen. The origin of the hydrogen was as follows: almost 47% came from natural gas; 27% from coal; 22% from oil; and only 4% from electrolysis. The source of the latter's electricity could be renewable or non-renewable.

⁵ There are other classification systems, such as that of the IEA (2022), where the end products would be CH₄ (synthetic methane); H₂ (hydrogen in its molecular form); LOHC (Liquid Organic Hydrogen Carrier, i.e. liquid hydrogen for transport); methanol; ammonia; and syngas (i.e. synthetic fuels).

In the case of the southwestern Mediterranean, as shown in Table 5 (Column 5), most of the planned projects are identified as “green,” although in other cases, especially in Egypt, they may well refer to so-called “grey hydrogen” (that produced from fossil sources) or “blue hydrogen” (also produced from fossil fuels, but with carbon capture and storage techniques). In fact, although no project has yet been commissioned in Algeria's case, and although the MoU signed between Sonatrach and ENI mentions “green hydrogen,” it seems that Algeria will likely opt for “blue hydrogen” (Mousjid & Hajbi, 2023).

The first characteristic of “hydrogen” is that it is something that can be produced anywhere and not a source of primary energy exclusively located in certain territories of the world

In the latter case, it should be considered that the use of gas to produce hydrogen would be to the detriment of that currently exported or employed for domestic use. This end-use competition factor could also pose problems for initiatives such as the now-cancelled Aswan Project (second row of Table 5), where hydroelectric electricity for electrolysis would compete with electricity for “ordinary” use.

Hydrogen Production: For What Purpose?

The second aspect that emerges from the list in Table 5 is the product expected of these projects (column eight), grouped around the generic “hydrogen.” As Chart 8 shows, three products⁵ are possible: the hydrogen obtained without further processing, i.e. hydrogen in its molecular form; ammonia, the result of a chemical synthesis process; and synthetic fuels (Table 5, ninth row). The uses of these products, on the other hand, are manifold. In our case of analysis, only

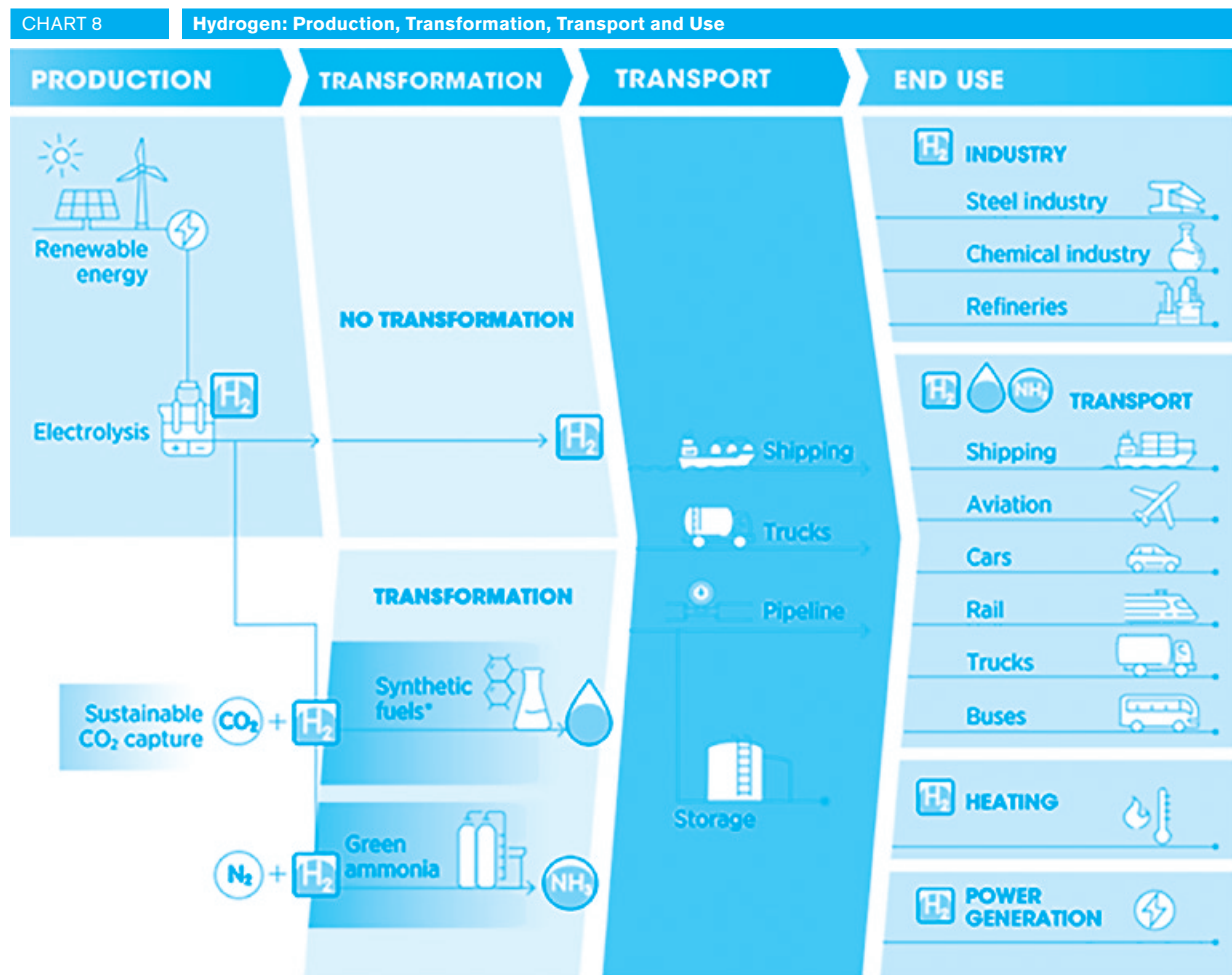
five possible uses for “hydrogen” products are considered (columns nine to thirteen), but there are others, such as electricity generation, heating, etc.

Despite this great diversity, which shows that hydrogen would be a versatile energy vector in terms of end uses, in general, the majority of projects will be aimed at producing ammonia.

In the world today, the main product of ammonia is nitrogenous fertilizers (70% of its production is used for this purpose) and it is produced using fossil energy (in 70% of cases its source is gas and in 30%, coal⁶). However, when we look to the future, forecasts point to ammonia production of a different colour: blue and green.

In the imagined geopolitics of hydrogen, the southwestern Mediterranean – Egypt being the frontier – is

designated as a hydrogen exporter and especially as a region from which ammonia will be exported to Europe. Corresponding to this line of thought are, for example, the definition of a “hydrogen import corridor” provided by the European Union (European Commission, 2023:5); the scenarios that IRENA (2023: 69) puts forward for North Africa, in which green hydrogen production is foreseen only for export; and the MoU that was signed between Tunisia and Germany for the export of green hydrogen. The aspirations of Morocco, Algeria and Tunisia to become key players in the green hydrogen export chain to Europe also correspond to this approach (Mousjid and Hajbi, 2023), as do the interests of many of the foreign companies that plan to invest in projects of this type in North Africa.



* The term synthetic fuels refers here to a range of hydrogen-based fuels produced through chemicals processes with a carbon source (CO and CO₂, captured from emission streams, biogenic sources or directly from the air). They include methanol, jet fuels, methane and other hydrocarbons. The main advantage of these fuels is that they can be used to replace their fossil fuel-based counterparts and in many cases be used as direct replacements – that is, as drop-in fuels. Synthetic fuels produce carbon emissions when combusted, but if their production process consumes the same amount of CO₂, in principle it allows them to have net-zero carbon emissions.

Source: IRENA.

⁶ Source: IEA (2021b).

In other words, the new hydrogen geopolitics are designed to maintain certain territories in the world as places from which energy is exported to others, where it will be used. Within this framework, some southern Mediterranean countries are considered to be suitable places for the production of ammonia, which will be exported for use in the “consumer countries” once it has been processed (Chart 8).

Considerations on the Geopolitics of Hydrogen

The hydrogen geo-energy project requires some additional considerations. The most relevant is to realize that when the European Union raises the possibility of a Mediterranean green hydrogen corridor, for instance, two choices have already been tacitly made: one geopolitical and the other regarding the type of energy model we are opting for.

Insofar as green hydrogen is a product that can be “manufactured” from universally distributed renewable sources and not a primary energy source, located – only – in certain parts of the world, to a greater or lesser extent, choosing to generate it in one part of the world and not in another is the result of a decision. Hence, to single out certain territories in the southern Mediterranean as future “exporters” of green hydrogen is to choose to relocate hydrogen production there. This choice also explains the growing competition between Morocco, Algeria, Tunisia, Mauritania and Egypt to make their territories the sites for the production and export of “green” hydrogen (or ammonia) to EU countries.

Furthermore, although it is true that hydrogen is an energy vector useful for storing renewable energy, the option of “delocalization” also implies a certain conception of what the future of energy relations based on hydrogen will look like.

In the aforementioned reports, especially that of IRENA, solar or wind energy is conceived as a source for producing hydrogen or ammonia, with the aim of

transporting it, at a high economic cost and with losses of useful energy along the way,⁷ to another part of the world (where hydrogen could also be generated) where it would finally be used. Thus, the intention is to replicate the current energy model, replacing oil or gas with hydrogen/ammonia to create a new type of “energy exporting countries.”

The new hydrogen geopolitics are designed to maintain certain territories in the world as places from which energy is exported to others, where it will be used

Conceptually, this option is the complete opposite of what was originally proposed, such as the German initiative within the framework of the *Energiewende*, which saw hydrogen generation as an instrument that would help to carry out the energy transition, as it would make it possible to store – on site – surplus wind or solar energy, which would be used on the spot when needed.⁸

For all these reasons, the current scenario points towards a replica of the international energy relations that exist today, in which the countries of North Africa, instead of – or in addition to – being exporters of oil and gas, would become exporters of hydrogen.

Risks of the New Hydrogen Policy for the Euro-Mediterranean Region

This division between hydrogen exporters and importers, if implemented, could end up having some undesirable results, at least in terms of improving coexistence between southern Mediterranean countries, of moving towards a process of greater energy integration in the Euro-Mediterranean space, and of progressing on the path towards the energy transition.

⁷ On paper, hydrogen can be transported in three ways: a) via pipeline, at a much higher pressure than natural gas (600 or 700 bar), which implies a loss of useful energy to maintain pressure; b) by liquefying hydrogen at extremely low temperatures (-253 °C), which have to be maintained during transport and whose conversion implies losses of between 30 and 40% of useful energy; and c) ammonia, which in relative terms appears more efficient, but which, along the chain from electricity generation for electrolysis to its final use, is energetically costly (at best, the energy yield would be 37%). American Chemical Society (2021: 4391).

⁸ An example of this would be the South Lower Saxony Hydrogen Alliance, www.suedniedersachsenstiftung.de/projekte/wasserstoff-allianz/ [consulted 12 May 2023].

The project to transform North Africa into a site for the production and export of green hydrogen could result in increasing regional conflicts, as a consequence of growing competition between Southern Mediterranean countries to attract investment and position themselves as the “prime” exporter. It may appear paradoxical, as it would seem that the fact that hydrogen can be generated anywhere should put an end to energy-related differences between countries, but the option of creating exporters – of deciding in which country the ammonia generation and export infrastructure will be installed – may lead to even greater rivalry between the countries of the region.

The type of plans and agreements proposed may also lead, if possible, to a greater bilateralization of energy relations in the Euro-Mediterranean area, since both the business projects referred to in Table 5 and the MoUs mentioned above tend to favour the national rather than the European level: ENI (Italy) with Algeria; Germany with Tunisia... Moreover, the growing bilateralization – which projects, such as the Barcelona-Marseille hydrogen pipeline, will not alleviate – is accompanied – although not only in the energy field – by the possible entry of energy actors from outside the region,⁹ making it difficult to imagine the geography of the future Euro-Mediterranean hydrogen geo-energy space.

The intention is to replicate the current energy model, replacing oil or gas with hydrogen/ammonia to create a new type of “energy exporting country”

Finally, the consequence of prestigious international energy organizations, such as the IEA or IRENA, or the European Union itself, announcing and disseminating the idea that in the near future there will be a new geopolitics of hydrogen in which the countries of the southern Mediterranean will be its exporters,

while the industrialized European economies will be its importers, may end up blocking or postponing the energy transition and compromising the environmental sustainability of the entire region.

The type of plans and agreements proposed may lead to a greater bilateralization of energy relations in the Euro-Mediterranean area

Today, these announcements are already mobilizing huge resources (financial, technical, human, etc.) to create large infrastructures for the generation, export, import and processing of green hydrogen, which only secondarily seem to be thought of as an option to assuage the dearth and low quality of energy supply in the countries of North Africa. However, these resources could be used to invest on a smaller scale in already mature technologies in national energy development projects which, although more modest, could contribute to alleviating some of the current problems facing North Africa: conflicts between neighbouring hydrocarbon exporters and importers; the drop in income from gas exports; or simply the existence of large areas with low levels of electrification...

On the other hand, doubts about the economic profitability and energy efficiency of green hydrogen export projects could end up granting an even greater role to the conglomerates of the fossil energy industry (states and companies) already operating in the region, since if investments in the aforementioned projects were to go ahead, the “need” to make green hydrogen exports profitable would be even greater, the “need” to make profitable and amortize what has already been invested in hydrogen export and import infrastructures could end up normalizing, as a “second best,” the production of grey (or blue) hydrogen in Algeria, Egypt or Libya, which, compared to the current situation, would only imply adding another link to the existing fossil chain.

⁹ For instance, the announcement made in April 2023 that an agreement has been signed between Morocco and the Chinese company Energy China International Construction Group, which in turn has signed an MoU with a Saudi conglomerate, Ajlan Bros, and the Moroccan holding company Gaia Energy, to realize a green hydrogen project. See www.moroccoworldnews.com/2023/04/355105/morocco-partners-with-chinese-contractor-on-green-hydrogen-project [consulted 15 May 2023].

The choice of large hydrogen export and import infrastructures may end up forever condemning the attempt to achieve an environmentally sustainable energy transition

In short, Europe's desire to substitute energy supplies from Russia coincides with the rise of reports and projects that augur a new hydrogen geopolitics in which the southern Mediterranean seems destined to become an exporter of green hydrogen to the EU. The content, efficiency and profitability of these projects are unclear today, but the way in which they are designed and announced seems to wish to maintain the historical pattern of Euro-Mediterranean energy relations.

The geographical non-determinism of hydrogen generation may cause rivalries between countries, leading to greater regional conflict; while the type of projects announced, if implemented, will further fragment the Mediterranean energy area. Finally, the choice of large hydrogen export and import infrastructures may end up forever condemning the attempt to achieve an environmentally sustainable energy transition.

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