



Fuel of the Future:

A Blueprint for a Mediterranean Market for
Emission - Free Hydrogen

MEDITERRANEAN PROGRAMME

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Summary

- States adjoining the Mediterranean Sea will engage in a supranational organisation developed on the basis of the current plans for a Mediterranean Green Hydrogen Partnership – MGHP.
- The MGHP will include hydrogen producing and consuming states around the Mediterranean; govern clean hydrogen production, certification, transportation and distribution; and ensure that sufficient affordable clean hydrogen is permanently available for all consumers.
- The organisation will boost the production, availability and consumption of clean hydrogen, making joint use of the abundant solar and wind energy resources of its geographical scope to produce clean electricity.
- The MGHP will make hydrogen the energy carrier of choice for European and African industry and heavy transport, allowing Europe to decarbonise its economy and Africa to build modern, emission-free industrial economies.
- The MGHP will adopt the supranational model of the European Coal and Steel Community both for its decision-making and for the implementation and oversight of its policies.
- The MGHP will pioneer the joint elaboration of rules and regulations applicable to the clean hydrogen market.
- This model can be extended globally, and the MGHP will be considered the forerunner in global supranational hydrogen governance for the benefit of all.

Introduction

The decarbonisation of the global economy is one of the fundamental challenges of the 21st century. Reducing greenhouse gas (GHG) emissions is critical for mitigating global warming and its effects on human societies and ecosystems, as acknowledged by the COP 21 Paris Agreement signed in 2015.

Hydrogen technologies provide a mature and competitive zero-emission solution for a growing number of applications. By providing a means to store energy produced using renewable sources., hydrogen can provide a buffer for the energy system as well as decarbonising heavy duty transport (by land, sea and air) along with energy-intensive industries like steel and cement production or oil refining.

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Recent years have seen the EU adopt inter alia the European Green Deal, the European Hydrogen Strategy and the Fit for 55 package. All these policies identify hydrogen as a key technology for achieving decarbonisation, but also European energy security as part of the RePowerEU plan¹.

In parallel, many countries in Africa have recognized the role hydrogen can play in decarbonizing the global economy through the adoption of various hydrogen policies and initiatives, R&D roadmaps and market development strategies. First and foremost, hydrogen could be used for the continent's own decarbonisation, but Africa could also become a global hydrogen production hub serving many clients across the globe via pipelines or ships.

Due to their geographical proximity, historical ties, and alignment of interests, Africa and the EU should become strong partners in the hydrogen trade. Indeed, Africa and the EU should collaborate to support the deployment of hydrogen technologies domestically, as well as develop robust trading routes for hydrogen and its derivatives. In this way, they can mutually contribute to global decarbonisation efforts, as well as creating jobs and growth on both continents for years to come.

The Mediterranean Green Hydrogen Partnership (MGHP) can provide stepping stones to the future structuring and governance of the global hydrogen market.

The deployment of the hydrogen ecosystem on both continents cannot be achieved without strong commitments from private African and EU stakeholders. Consequently, this African-European Hydrogen pact seeks to outline concrete commitments made by African and EU stakeholders to domestic and cross border hydrogen project development.

The Mediterranean Green Hydrogen Partnership (MGHP) can provide stepping stones to the future structuring and governance of the global hydrogen market. The MGHP should therefore be designed in a manner that is both relevant to members on both the African and European sides of the Mediterranean and potentially be an inspiration for other parts of the world. The key notion for the MGHP should be "supranationalism"--in its structure, its decision-making, and its policy implementation. This paper supports the view that an MGHP which functions supranationally will not only be capable of organising intercontinental hydrogen exchange, it will also form the embryo of a globally viable hydrogen agency governing the promotion, production and distribution of clean hydrogen.

¹ Non-binding target of 10 million tonnes of EU domestic hydrogen production and 10 million tonnes of imported renewable hydrogen by 2030 as part of the RePowerEU plan.

The Global Hydrogen Community is preparing for the future

Hydrogen will fuel the future. It will do so globally, as industrial processes are geared towards the consistent use of clean molecules, and transport discovers the benefits of running on water instead of fossil fuels. Global hydrogen demand will soar over the coming decades as national and supra-national strategies for the reduction of CO₂ emissions take effect. A global market for emission-free hydrogen is emerging and will need to be structured and governed.

Many countries in Europe, Africa, Asia and America are contemplating becoming champions of hydrogen production. From Namibia to Egypt, from Mauritania to Saudi Arabia, from Oman to Algeria, in Chile, Argentina, Brazil, South Africa and Australia, not to mention China and India, hydrogen is perceived not only as the fuel of the future, but also the cornerstone of a sustainable industrial and economic development for the producing countries themselves. In Europe, future producers and consumers are associated with the hydrogen strategies of the European Union, which are built on significant own production as well as imports on a significant scale.

Hydrogen can become the world's principal source of energy. It has the capacity to stabilise electricity networks by storing energy the electrical grid cannot, it can power steel production, chemical processes, ships, aeroplanes, trains and trucks. Given this enormous strategic potential, and the need to ensure a functioning hydrogen market for the benefit of all, the infrastructure, trade and development of hydrogen should be administered like coal and steel were in Europe after World War Two. A global association of hydrogen-producing and hydrogen-consuming states must be formed, whose supra-national governance reflects the model of the European Coal and Steel Community.

The logic of a global governing organisation for clean hydrogen is inspired by the need to ensure optimal development conditions along with an even roll-out of hydrogen technologies across the world. It is informed by the lessons learnt from bilateral and multilateral dependences, and aims to overcome both. And it is conceptualised on the understanding that a resource for the world needs to be produced freely and jointly administered, and that this governance requires its own criteria, infrastructure and mechanisms which are enforceable, and not subject to injunctions or force emanating from individual state and non-state actors. The shortcomings of organisations such as OPEC must be taken into account, along with the confrontational attitudes that have led to energy crises in the past. The overarching goal of global hydrogen governance is long-term abundance availability under optimal conditions for price building and distribution world-wide.

Oil is the fuel of the past. It has not only polluted the atmosphere, it has also polluted international relations as a (re)source of conflict and war. Hydrogen is not a pollutant, and it will foster international relations and understanding. The resource of the future must be a resource of peace.

The Hydrogen Economy needs global governance

The hydrogen governance envisioned in this paper is designed to ensure constant availability, traceability, price transparency and infrastructural performance. It is also aimed at allowing producers and users of hydrogen worldwide to plan their activities over longer periods of time and to benefit from price and delivery security. The erratic performance of oil and gas markets at the present time and in the past must not be a feature of the hydrogen market. A loss of confidence in hydrogen and the safety of hydrogen producers and consumers would be

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The erratic performance of oil and gas markets at the present time and in the past must not be a feature of the hydrogen market. A loss of confidence in hydrogen and the safety of hydrogen producers and consumers would be seriously detrimental to the global roll-out of hydrogen and the massive global reduction in CO2 emissions this would achieve.

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Hydrogen governance must cover every aspect of its production, trading and delivery. This includes certification, market organisation and developing/maintaining the requisite infrastructure, as well as price building and--during a period of transition in which demand for clean hydrogen will continue to exceed supply--the management of a system of contracts for difference (CfD) designed to ensure equality and equal treatment for market actors.

The global organisation charged with governing the world's hydrogen supply will have to apply itself to every aspect of hydrogen and its production. Naturally, since hydrogen is part of the transition to emission-free energy, the market to be organized will be a market for zero-emission and low-emission hydrogen. However, 'gray' and 'blue' hydrogen should still be included in the organisation's remit in the form of a department which will be wound up within a clear and fixed timeframe. It is therefore imperative that a formal understanding is in place concerning the phasing out of high emission hydrogen and both the conditions under which, and timeframe within, this will be achieved.

EU and North Africa as frontrunners for a global governance

Since the geographical ambition of joint hydrogen governance has to be global, its launching pad could be a regional association of countries which puts supranational hydrogen governance to the test. This can be the Mediterranean Green Hydrogen Partnership, which covers the European Union and other European states, African partner states on the other side of the Mediterranean, plus those Levantine states which express an interest in joining the supranational partnership.

The European Union, together with North Africa and other neighbouring countries, has a unique opportunity to create a green hydrogen system. Europe including Ukraine has good renewable energy concepts and potential, while North Africa has outstanding and abundant resources for the generation of clean electricity. Europe can reuse its gas infrastructure with interconnections to North Africa and other countries to transport and store hydrogen, while it is also a global leader in clean hydrogen production in general, and electrolyser manufacturing in particular.

If the European Union, in close cooperation with neighbouring nations, wants to build on these unique assets and create a world-leading industry for renewable hydrogen production, the time to act is now. Dedicated and integrated multi-GW green hydrogen production plants can unlock the vast renewable energy potential, but it is crucial that new, unique and long-term mutual co-operation mechanisms are designed and implemented between the EU and North Africa on the political, societal and economic level.

The unique opportunity for the EU and North Africa to develop a green hydrogen economy will contribute to economic growth, create jobs, and bring into being a sustainable, affordable and fair energy system. Building on this position, Europe and its neighbours can become world market leaders for green hydrogen production technologies.

The Power of the Desert

A fraction (8-10%) of the area of the Sahara Desert could generate energy to meet worldwide demand in its entirety (van Wijk, van der Roest, & Boere, Solar Power to the People, 2017).

The Sahara Desert is the world's sunniest area year-round. It is a large area (at 9.4 million square km, it is more than twice the size of the European Union) that enjoys an average of 3 600 hours of sunshine yearly, with some areas receiving 4,000 hours (Varadi, Wouters, & Hoffmann, 2018). This translates into solar insolation levels of 2,500-3,000 kWh per square meter per year. A fraction (8-10%) of the area of the Sahara Desert could generate energy to meet worldwide demand in its entirety (van Wijk, van der Roest, & Boere, Solar Power to the People, 2017).

It should be noted that the Sahara Desert is also one of the windiest areas on the planet, especially on the west coast. Average annual wind speeds at ground level exceed 5 m/s across most of the desert and reach 8-9 m/s in western coastal regions. Wind speeds increase with height above the ground, and the Saharan winds are quite steady throughout the year. In addition, Egypt's Zaafarana region is comparable to Morocco's Atlantic coast, with high and steady wind speeds (van Wijk A. , Wouters, Rachidi, & Ikken, 2019). There are also areas in Morocco, Algeria, Tunisia, Libya and Egypt, where wind speeds are comparable to offshore conditions in the Mediterranean, the Baltic, and some parts of the North Sea.

North Africa isn't alone in enjoying good and abundant solar and wind resources; the Middle East does, too: Turkey, Oman, Saudi Arabia, Jordan, the UAE and other countries in the region also have the potential to become major green hydrogen exporting countries. That is why they should be included, as the next step, in any form of supranational cooperation.² The excellent connectivity between North Africa and Europe via existing gas pipelines (e.g. between Morocco and Spain, Algeria and Spain, Algeria and Italy, Tunisia and Italy, Egypt/Libya and Italy), which will be further improved by upcoming connections (the construction of the EastMed pipeline between Egypt/Israel and Greece/Cyprus is underway) mean that the first step must take place around and across the Mediterranean.

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Making Clean Hydrogen in the Mediterranean Green Hydrogen Partnership (MGHP)

The process whereby clean hydrogen is produced is the first global regulatory challenge. Currently, the approach taken to the production of clean hydrogen varies greatly across the world. Comparing the initial position of the European Commission, which sought to confine hydrogen to being a side product of clean electricity, with the incentives provided for its production by the Inflation Reduction Act in the United States, the logic could not be more different. Add to these divergent regulatory ambitions the different stances taken by India and China, Australia and Chile, Saudi Arabia and Namibia, and it is clear that clean hydrogen is no more or less than what a given regulator wants it to be. This lack of a global definition is evidently detrimental to the emergence of a global market for clean liquid hydrogen and would, if unaddressed, inevitably lead to distortions in market access and competition rules. If hydrogen is to become a globally tradable commodity capable of transforming industries and societies, such distortions must be avoided. The appropriate way to do so lies in establishing global rules governing the production and certification of clean hydrogen. Naturally, these rules must be applicable to all production processes which seek to result in a clean gas. Given the understanding that the joint potential of the MGHP between the Atlantic and the Red Sea alone clearly makes this area the global leader in green hydrogen production,

² Ad van Wijk / Jorgo Chatzimarkakis (2020): A 2x40 GW Green Hydrogen initiative, https://dii-desertenergy.org/wp-content/uploads/2020/04/2020-04-01_Dii_Hydrogen_Studie2020_v13_SP.pdf

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such regulations would originate from the MGHP, working in co-ordination with other major hydrogen producers.

The MGHP would establish a nomenclature of hydrogen production processes, which would be subject to review at regular intervals in order to integrate the full breadth of technological developments. Indicatively, at the outset, such a system of definitions would have to encompass:

- Electrolysis with electricity generated by wind and solar power.
- Electrolysis with electricity generated by nuclear power.
- Pyrolysis.
- Processes involving radiolysis, water splitting techniques, and other alternative production processes.

To organise the distribution and allocation of clean electricity, a dynamic minimum volume geared exclusively towards hydrogen production will have to be defined and applied across the MGHP.

It will be imperative to ensure that dedicated hydrogen production using renewably produced electricity is possible without constraints regarding the alternative utilisation of the same electricity. Given the enormous quantities of hydrogen that will be required globally, hydrogen production must emerge as the primary priority for the production of clean electricity. Dedicated facilities must be encouraged, not hampered or prevented.

To organise the distribution and allocation of clean electricity, a dynamic minimum volume geared exclusively towards hydrogen production will have to be defined and applied across the MGHP. This minimum volume would be safeguarded at all times and not be available for grid allocations. It is essential that the hydrogen industry be able to plan production ramp-up and additional development on the basis of set electricity quotas which will not be debated.

While hydrogen can be produced anywhere, ensuring a constant supply in significant quantities will require the existence of a number of large-scale production sites. These must not be concentrated geographically in any one global region, nor must they operate in functional competition with one another. The design of a global hydrogen production and distribution network which allows for redundancies and the replacement of capacities at any given time will be a key regulatory challenge.

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The MGHP is to be officially launched at the COP 28 in the UAE at the end of 2023. It was first referenced in the context of the RePower EU strategy for reducing the bloc's dependence on Russian gas, which was published in March 2022.

Trading hydrogen in the MGHP

The market for clean hydrogen is currently being developed from scratch. This allows for significant freedom in both design and dynamics, and for production capacities to be interconnected before national entrenchments make this harder to achieve.

At present, only minuscule quantities of clean hydrogen are traded. The months and years to come will see a market ramp-up in the course of which production quantities are increased, transport capacities diversified and industrial demand significantly enhanced. This ramping-up of the global clean hydrogen market will be the most opportune moment for the elaboration of a global organisation to take charge of defining market mechanisms, price building and control, trading spots and platforms, and support mechanisms; public institutions and their funding potential should be employed during this phase. The most relevant feature of the market ramp-up will be the evolution of the price of clean hydrogen, which will need to move

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from heavily subsidised in the initial stages to freely formed and affordable at a later stage which has still to be defined.

Hydrogen should be freely tradable once it reaches the market. It will need trading centres – quite conceivably a number of them – which will determine supply in the light of demand, set prices, and allow for industrial planning. The production capacities must provide sufficient supply, and supply must be foreseeable: supply must always be matched to demand. The market structure and operation must be designed not to keep the resource rare and the price high, but to make hydrogen available in abundance at a price which balances consumer interests, industrial production costs, and returns on infrastructure investment. In this way, production planning can be guaranteed, investments scheduled, and infrastructures constructed and maintained.

The market ramp-up will largely be characterised by price interventions in the form of contracts for difference (CfD). These contracts should be subject to a uniform rationale and their goals and effects harmonised on the basis of the best practises that exist when the MGHP comes into being. The CfD will remain in use until the supply of clean hydrogen meets demand for the first time, and it becomes possible to plan for the scaling up of both, with hydrogen production infrastructures expanding as hydrogen demand from industry and society-at-large increases.

Transporting and Delivering Clean Hydrogen

The transportation of clean hydrogen will depend on the existence of a distribution infrastructure modelled on the gas networks of today. Pipelines will form the backbone of this infrastructure, both for longer distances – including intercontinental connectivity – and for the supply of regional and local distribution points. These pipelines will need to be constructed and their construction funded, which will constitute a primary objective for the MGHP.

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Financing infrastructure will be one of the most visible areas of MGHP intervention. The organisation will not only provide core funding itself, it will also concern itself with the creation of consortia and joint ventures designed to set up large facilities for production, storage and transportation. Through a system of guarantees on investment and returns, the MGHP will be able to leverage the funding required for the global hydrogen supply system, as well as the connection between facilities and their co-ordinated operation. The “Hydrogen Bank” announced by the European Commission will serve as a cornerstone of the future funding architecture.

Governing Institutions in the MGHP

The MGHP will not be a copy of any existing organisation. Since its essence is supra-national decision-making for the common good, it needs to be functional and efficient but also

democratic and participative, which will allow hydrogen producers and consumers to address the challenges of the hydrogen roll-out together.

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The basis of every supranational institution is the assembly of all its members. Membership of the MGHP is open to every Mediterranean country. Members should, however, be grouped into membership categories which reflect their position in the hydrogen economy. It is also clear that countries which play particularly significant roles in hydrogen production and consumption should benefit from representation which is incisively present in the organisation.

In a first phase, those countries that are already active in signing bilateral agreements on green hydrogen with the EU or EU Member States should be envisaged as supranational partners of the EU; these countries are currently Algeria, Egypt, Morocco and Tunisia (in alphabetical order). Turkey will also be an associate partner, having signed an association agreement with the EU back in 1963. Apart from these nations, there is obviously a spot for Libya, once the country is willing and able to take it up, as well as for countries immediately adjoining the Mediterranean space and organically linked to it, such as Mauritania and Saudi Arabia.

Based on the European Community for Coal and Steel (ECSC) model, a High Authority – whose precise name has still to be decided on at this stage – will be entrusted with running the MGHP on a daily basis and ensuring its interaction with the global community, states, industry and society-at-large. This Authority would be made up of representatives from all the official members of the MGHP; Associated Partners would have observer status.

The institutions of the MGHP will comprise a High Authority, a Common Assembly, a Council of Ministers, and a Court of Justice. A Consultative Committee could be established as a fifth institution to represent producers, workers, consumers and traders.

Mirroring the supranational approach implemented by the ECSC, the institutions of the MGHP could be designed as follows:

The institutions of the MGHP will comprise a High Authority, a Common Assembly, a Council of Ministers, and a Court of Justice. A Consultative Committee could be established as a fifth institution to represent producers, workers, consumers and traders.

- The High Authority could consist of members in office for a term of five years, appointed by the governments of the signatories. The President of the High Authority could be appointed from the members in office on a rotating basis, interchanging between representatives from the EU and Northern Africa or other Member States of the MGHP in a second phase on. The competence of the High Authority should ensure that the common market for clean hydrogen between the signatories functions smoothly.
- The Common Assembly could be composed of Members of Parliament from the signatory nations (including the EU, which will send MEPs).
- A Council of Ministers to be composed of representatives of the national governments should be convened every three months to ensure that the work of the High Authority is harmonised with that of the national governments.
- A Court of Justice could ensure the observation of MGHP law on the basis of the MGHP Treaty. The Court should be composed of 10 judges, appointed by common accord by the national governments for a six-year term and assisted by two Advocates General.
- The Consultative Committee could be divided equally between producers, workers, consumers and dealers in the hydrogen sector, though without national quotas safeguarding an equilibrium between MGHP member states.

Conclusion

The MGHP offers an excellent framework for making the EU and North Africa global frontrunners in green hydrogen cooperation.

The EU is preparing to make Europe the first climate-neutral continent by 2050. The tool to achieve this overarching goal is the European Green Deal, underpinned by the “Fit for 55” legislative framework in tandem with the Renewable Gases and Hydrogen Directive. The Russian invasion of Ukraine has helped accelerate the implementation of the EU strategy for energy resilience and the replacement of fossil energy carriers. An important part of this strategy is the Mediterranean Green Hydrogen Partnership or MGHP. As the EU and its North African partners are interlinked socio-economically, and since both sides have agreed on hydrogen strategies, the MGHP offers an excellent framework for making the EU and North Africa global frontrunners in green hydrogen cooperation, and for laying the foundations for a future global governance for hydrogen. A supranational approach would deepen the partnership between the EU and North Africa and its neighbours substantially. The timeframe between COP 27 in Egypt and COP 28 in Dubai should be sufficient for an official launch.