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Potential hydrogen developments in the Arab region

Summary

The present document provides an overview of the role of hydrogen in diversifying the energy mix. The development of low-carbon hydrogen, whether blue or green, in the Arab region economies would be an important part of efforts to address the environmental and economic vulnerability the region is exposed to and reduce reliance on fossil fuels, both as a source of revenue from exports and in energy consumption.

In this context, the Economic and Social Commission for Western Asia (ESCWA), in partnership with the International Energy Agency (IEA), hosted a webinar on "Potential blue and green hydrogen developments in the Arab countries" on 14 December 2021, to discuss interlinkages between hydrogen and the Sustainable Development Goals (SDG) and ways to enable energy transition. ESCWA also released a report titled "Potential blue and green hydrogen developments in the Arab region" in May 2022, which focused on existing and planned hydrogen developments in the Arab region, and explored key challenges and opportunities for hydrogen production and use to support the region's energy transition within the context of the 2030 Agenda for Sustainable Development. The report also considered recent decisions by several countries to implement the net-zero emission targets by 2050 and discussed the implications of sustainable hydrogen production. The Committee on Energy is invited to examine the content of the present document, which is based on the above-mentioned report, consider the proposed recommendations and make comments thereon.

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Contents

Introduction

1. Diversifying the energy mix is a key aspect of the energy transition. Beyond accelerating the uptake of renewable energy and electrifying relevant sectors, alternative energy carriers, including hydrogen and hydrogen derivatives, should be explored to ensure a just and sustainable energy transition.

2. In the long run, the transition to a hydrogen economy can also ensure that Arab countries are not overly dependent on a select few energy sources and are therefore less exposed to supply shocks, thus becoming crucially more resilient.

3. The Arab region's economy is highly dependent on fossil fuels as sources of energy and feedstock, employment and export revenues. This situation not only has direct, adverse implications on the climate but also seriously affects the region's economy. It is therefore vital that the region address its environmental and economic vulnerability, as the situation could worsen if energy transition measures are not urgently accelerated.

4. The development and introduction of low-carbon hydrogen, whether blue or green, in the Arab region would play an important role as part of a toolbox of clean energy solutions and would leverage the region's natural gas resources and expansive renewable energy potential.

I. Hydrogen production, transport and storage

A. Production

5. Currently, all hydrogen consumed worldwide is produced using technological processes. For the most part, hydrogen is produced using natural gas as a primary source and used primarily in oil refining and ammonia production. In addition to the dedicated hydrogen production technologies to produce pure hydrogen, hydrogen can also be obtained as a by-product from other processes, along with other gases.

6. Steam methane reforming (SMR) is presently the dominant hydrogen production technology. Hydrogen can also be produced through gasification, using coal or biomass as primary sources.

7. In contrast, electrolysis uses electricity to split water into hydrogen and oxygen, with the electricity ultimately coming from fossil fuels or renewable sources. Today, electrolysis using renewables accounts for far less than 1 per cent of the global production of pure hydrogen.[1]

8. Some of the above technologies, especially SMR, can be coupled with carbon capture and storage (CCS) or carbon capture, utilisation and storage (CCUS) facilities. In this case, the hydrogen produced is labelled "blue hydrogen". Hydrogen produced through electrolysis with electricity supplied fully from renewable sources of energy is called "green hydrogen" and is considered the most favourable option for decarbonisation measures in the long run.

B. Transport and storage

9. Presently, about 85 per cent of the hydrogen produced is consumed where it is produced or nearby. Trucks or pipelines transport the remaining 15 per cent.[2] Over the next 10 or 15 years, this could change as hydrogen is traded and shipped across regions and countries.

[1] International Renewable Energy Agency (IRENA), 2023. Hydrogen.

[2] International Energy Agency (IEA), 2019. The Future of Hydrogen: Seizing today's opportunities.

10. There are various options to transport hydrogen:

- Blending hydrogen with natural gas in gas transmission pipelines or through dedicated hydrogen pipelines.
- Shipping of liquid hydrogen as pure hydrogen.
- Shipping in ammonia form.
- Shipping in liquid organic hydrogen carriers (LOHCs).

11. Pipelines are the cheapest mode of hydrogen transportation across medium- to long-term distances. For longer-distance shipments of large volumes of hydrogen between countries, conversion into ammonia or liquid organic forms is preferred. However, the costs of conversion to liquid forms and then reconversion to gas increase the total costs, with a meaningful hit to energy efficiency.

12. The storage of hydrogen will depend mainly on the volumes to be stored; the storage duration; movements in and out of storage and geological conditions. For small volumes over short periods, storage in pressurised tanks is usually the preferred option. For large-scale volumes over longer periods, storage in geological formations is a better option. Aquifers have also been considered as a potential storage option, but their suitability remains to be fully investigated as no pure hydrogen storage has taken place yet. In fact, the commercial viability of hydrogen storage in both depleted hydrocarbon reservoirs and aquifers remains to be proven.

C. Relevant aspects for the Arab region

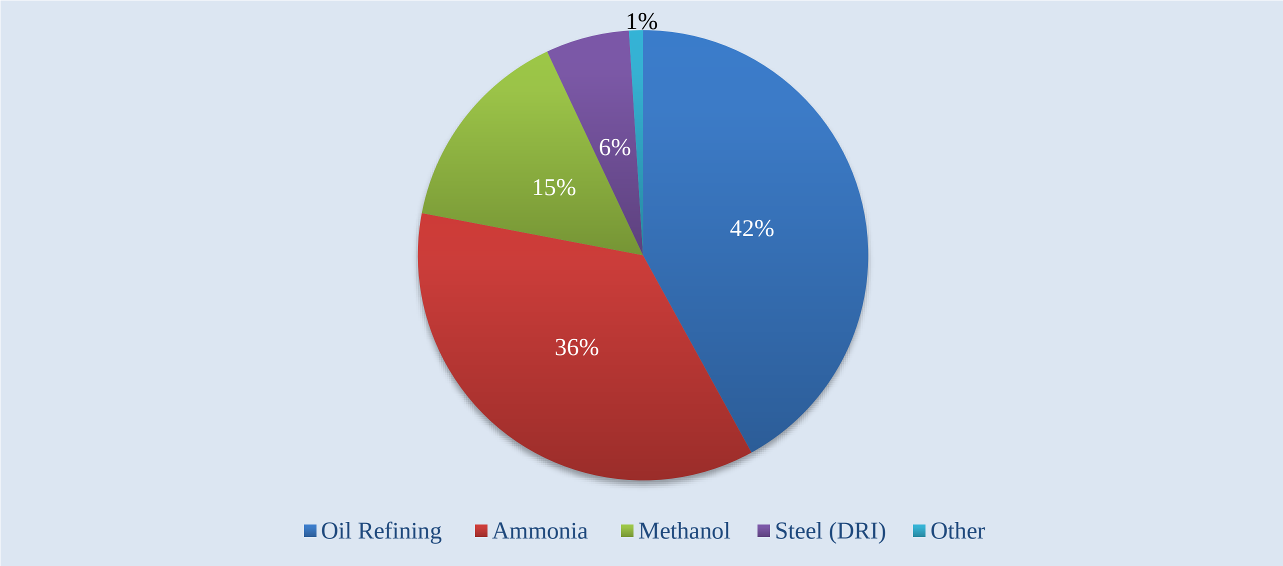
13. The production, transportation and storage of hydrogen will differ from country to country in terms of technologies and primary sources used for hydrogen production. Different Arab states may follow different pathways to introduce hydrogen into their respective economies. The choice of technology is driven by costs and non-cost factors. With the increasing concerns about achieving our climate targets by mid-century and the SDG 7 targets by 2030, especially in the transport sector where the Arab region remains the most energy-intensive among all regions, the choice of technology will be highly influenced by these drivers and related policies, laws and regulations.

II. Existing and potential hydrogen uses

A. Current structure of hydrogen uses

14. At present, hydrogen is mainly used in the hydrocarbon and petrochemical industries (including ammonia production for fertilisers). Hydrogen is also used in the steel industry, especially in the direct reduced iron (DRI) process. In 2020, oil refining and ammonia production accounted for over 80 per cent of all hydrogen used globally. These industries have been developed and continue to be developed in Arab hydrocarbon-producing countries.

Figure 1. Shares of global hydrogen main uses by sector, 2021



Source: IEA, 2019.

B. Potential sectors for hydrogen use, whether blue or green

15. Except for very few blue hydrogen projects in the Gulf Cooperation Council (GCC) area, all of the hydrogen consumed in the Arab region is grey hydrogen produced from fossil fuel sources without CCS or CCUS. As part of a sustainable energy transition and the achievement of the SDGs, the abatement of the carbon footprints of these sectors or industries is a challenging objective that needs to be addressed.

16. International regulations for a continuous lowering of the sulphur content in transport fuels will require an increase in hydrogen volumes for de-sulphurisation units, which could be addressed using blue or green hydrogen. However, this is a challenging proposition since these low-carbon forms of hydrogen are much more expensive than the grey hydrogen supplies currently used.

17. Large gas-based chemical plants, such as ammonia and methanol plants, located mainly in gas producing countries (e.g., Algeria, Egypt, Saudi Arabia and the United Arab Emirates), use exclusively hydrogen from grey hydrogen sources. The carbon footprint of the hydrogen production segment is a potential barrier for international ammonia and methanol trade, especially for exports to Europe and some parts of Asia.

18. All steel plants in the Arab region use fossil fuels and produce grey hydrogen, except in one country. In the United Arab Emirates, the hydrogen used in the Emirates Steel DRI plant is produced from natural gas. It is however categorised as blue hydrogen since the CO2 produced as part of the process is captured through the ADNOC Al Reyadah CCUS facility and transported to oil wells where it is used for enhanced oil recovery (EOR).

III. Hydrogen and interlinkages with the Sustainable Development Goals

A. Interlinkages with the Sustainable Development Goals

19. The United Nations SDGs provide a framework to identify and categorise the different sustainable development advantages of low-carbon hydrogen through its linkages with these SDGs, as outlined in the following table.

Low-carbon hydrogen and SDG linkages

Low-carbon hydrogen impact	Sustainable Development Goal
The introduction of clean sources of hydrogen, especially in hard-to-abate sectors of the economy, has a clear positive impact on the health and well-being of communities.	SDG 3: Good Health and Well-being
In some regions of the world that are severely affected by water scarcity problems, the use of fresh water to produce green hydrogen could be a critical issue. However, the development of commercially viable and sustainable sources of additional seawater desalination capacities for hydrogen production could also provide water supplies for local communities.	SDG 6: Clean Water and Sanitation
The long-term production and use of low-carbon hydrogen will provide a new source of storage for clean energy. The challenge will be to scale up low-carbon hydrogen production capacity over time and create viable markets to make it widely affordable.	SDG 7: Affordable and Clean Energy
The development of a multibillion-dollar low-carbon industry in potential low-carbon hydrogen producing and consuming countries will in the long term provide economic growth and employment opportunities.	SDG 8: Decent Work and Economic Growth
The development of low-carbon hydrogen is already promoting innovation along the low-carbon hydrogen chain and in the long term, a resilient low-carbon hydrogen infrastructure is likely to be developed, at least in the leading hydrogen producing and consuming centres.	SDG 9: Industry, Innovation and Infrastructure
The long-term large-scale use of low-carbon hydrogen in the mobility or transport sector would contribute to the reduction of road traffic pollution and help improve local environments in cities and communities. However, low-carbon hydrogen use would be mainly for long-distance heavy load transport.	SDG 11: Sustainable Cities and Communities
Low-carbon hydrogen is part of a mix of clean solutions and measures to address the issue of climate change mitigation, especially in hard-to-abate sectors. However, when considering the option of renewable energy use for green hydrogen production, there is a need to find an acceptable balance between clean electrification and low-carbon hydrogen production.	SDG 13: Climate Action

Source: Potential blue and green hydrogen developments in the Arab region, p. 25.

B. Low-carbon hydrogen and nationally determined contributions

20. Low-carbon hydrogen development for domestic and export markets has not been included by Arab states in their nationally determined contributions (NDCs). But Saudi Arabia and the United Arab Emirates have highlighted clean hydrogen in their latest NDC, and some Arab countries have also referred to CCS technology in their existing NDCs. This could be an indication that CCS could be used to produce blue hydrogen, specifically in natural gas producing countries. CCS technology is likely to include uses other than the production of low-carbon hydrogen, or it could only be part of a list of “long-term decarbonisation ambitions”.

21. Egypt, Mauritania, Morocco, Oman, Saudi Arabia and the United Arab Emirates are all developing green hydrogen projects. In this context, Egypt signed a series of agreements to develop clean hydrogen during the Climate Change Conference (COP 27). These agreements were signed in conjunction with a strategic declaration for the development of low-carbon hydrogen, supported by the Sovereign Fund of Egypt and the European Bank for Reconstruction and Development (EBRD). These agreements represent a continuation of the memorandum of understanding signed by Egypt in the past few months, including an $8 billion green hydrogen plant in the Suez Canal Economic Zone and the $3.5 billion Saudi alfanar project to produce green ammonia.

22. Morocco plans to become a supplier of green hydrogen or green hydrogen-based ammonia to Europe. In June 2020, Morocco signed a partnership agreement with Germany involving two green hydrogen projects. Morocco, along with Egypt and Mauritania, was among the six countries that officially launched the Africa Green Hydrogen Alliance (AGHA) with the aim of intensifying cooperation to develop green hydrogen projects on the African continent.

23. Saudi Arabia in particular, is developing an $8.5 billion green hydrogen plant in the city of Neom, aiming to produce 219,000 tons of hydrogen per year for export as ammonia. More broadly, Mauritania recently signed a memorandum of understanding with partners in Germany, the United Arab Emirates and Egypt to develop a 10 GW green hydrogen project with an annual capacity of up to 8 million tons of green hydrogen and its derivatives, with the first phase to be completed by 2028. Oman also recently signed six agreements with green hydrogen project developers to produce green hydrogen in the Sultanate worth over $20 billion. These projects have a production capacity of 15 GW of renewable energy.[3]

IV. Renewable and non-renewable energy potential in the Arab region

A. Renewable energy potential

24. The Arab region’s existing and future renewable energy capacities, as well as its endowment of natural gas resources, is important to the development of blue and green hydrogen capacities.

25. There has been a significant increase in the Arab region’s installed renewable energy capacity (excluding hydroelectricity), from 1 GW in 2010 to over 22 GW in 2021,[4] and some countries have announced ambitious renewable energy targets. But, the share of renewable energy in the energy mix is unlikely to exceed 30 per cent by 2030 in most Arab countries.

26. Therefore, over the next fifteen years, fossil fuels, especially natural gas, are expected to continue to play a dominant role in the Arab region’s total electricity generation capacity. To introduce new low-carbon hydrogen capacities in their economies for domestic and/or export purposes, policymakers would have to take some fundamental energy policy decisions.

[3] The New Arab, March 2023.

[4] IRENA. Renewable Capacity Statistics 2022.

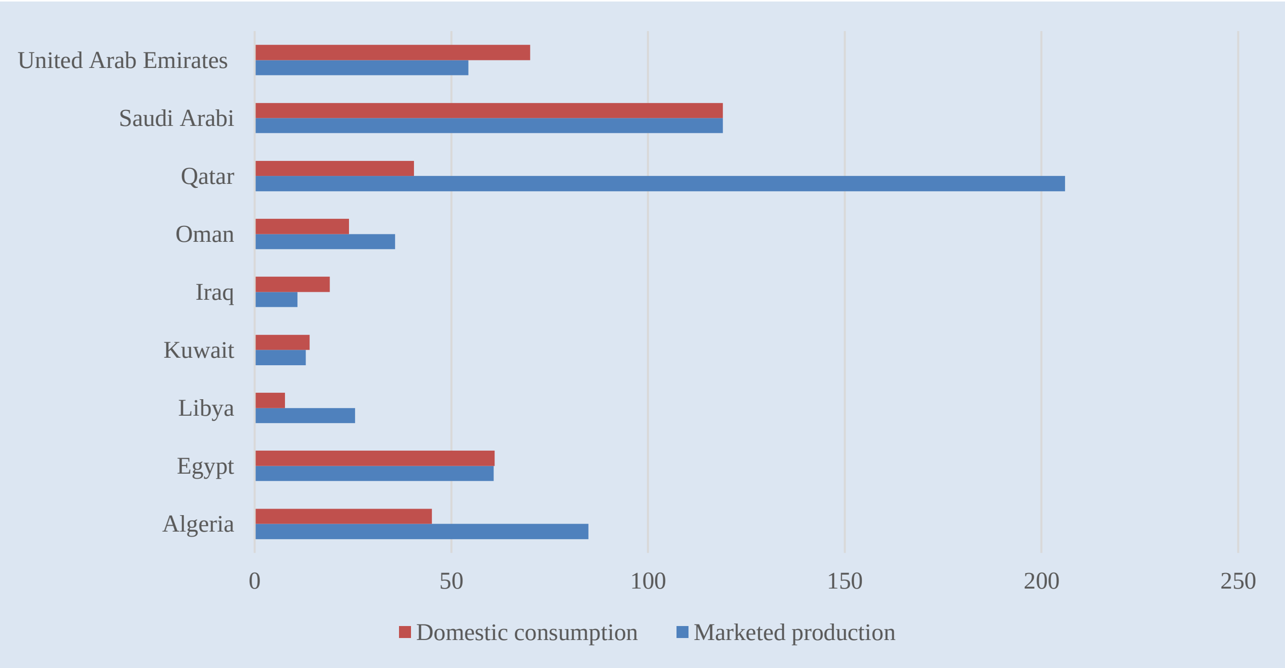
27. This includes the critical question of whether Arab economies should dedicate a part (or rather a large part) of their future renewable energy capacity to produce green hydrogen or focus in the near term on the production of blue hydrogen using natural gas with CCS as a transition fuel, wherever resources and geological conditions allow.

28. An overview of planned renewable capacities shows that a few countries (Egypt, Morocco, Oman, Saudi Arabia and the United Arab Emirates) could emerge as potential sources of green hydrogen production capacities. However, this depends on the prioritisation (or not) of further renewable electrification of their power sector.

B. Natural gas endowment

29. Natural gas is essential for the production of blue hydrogen, but not every Arab country has access to natural gas supplies. Where natural gas is available, it is likely to be prioritised for generation of electricity. Nevertheless, there is a very small group of Arab countries that are surplus gas countries where gas is exported through cross-border gas pipelines and/or by liquefied natural gas (LNG) tankers and where natural gas could also be used to produce blue hydrogen for export after meeting domestic market needs.

Figure 2. Arab region – Natural gas production and consumption in 2021 (Billion cubic meters)



Source: Gas Exporting Countries Forum (GECF), 2022.

30. Figure 2 shows the fragile natural gas balance of several Arab countries, where a high percentage of current gas production is consumed domestically or is simply insufficient to meet domestic needs. Apart from Qatar, which will continue to be a major net gas exporter regionally and globally, natural gas produced in most Arab countries is likely to be allocated to meet rising domestic demand for gas in the power sector and industry.

31. Large natural gas reserve holders such as Qatar, Saudi Arabia and the United Arab Emirates have the renewable and non-renewable energy potential to develop both blue and green hydrogen, as presented in the ensuing section.

V. Existing and planned hydrogen developments in the Arab region

32. The production of blue and green hydrogen and the development of a circular carbon economy as alternatives to help meet the long-term target of carbon neutrality are being adopted in a very limited number of Arab countries. It should be noted that most of the countries in the Arab region are still facing challenges in the planning and implementation of realistic sustainable renewable energy programmes. Integrating adequate levels of renewable electricity generation remains an objective that has yet to be achieved in this region.

33. Low-carbon hydrogen exports provide opportunities for potential new producers in the Arab region and could in the long term offer Arab hydrocarbon producers diversification opportunities and incentives for an accelerated energy transition.

34. Many Arab countries have been considered as potential sources of low-carbon hydrogen production because of their significant solar and wind energy potential and the availability of large plots of land to develop renewable energy projects.

35. New low-carbon hydrogen export opportunities are beginning to emerge in the Arab region, partly due to the scarcity of local low-carbon hydrogen supplies in Europe that will not be sufficient to meet the projected long-term demand for hydrogen.

36. In its hydrogen strategy, the European Union identifies particularly North Africa and its geographical proximity and the fact that it could potentially provide cost-competitive renewable hydrogen supplies. The Middle East is another potential source of low-carbon hydrogen supply to Europe and some Asian countries.

37. It is important to raise the question of whether the potential sources of clean energy in the Arab region could produce enough low-carbon hydrogen to meet the projected import demand. States are likely to adopt different pathways to decarbonise their economies and move towards long-term carbon neutrality, but there are common features regarding the development and implementation of blue and green hydrogen projects.

38. Blue hydrogen projects are mainly initiated and led by the national oil and gas companies (NOCs) in hydrocarbon-producing countries, in partnership with international oil and gas companies (IOCs), local and international private sector companies and government agencies in energy importing countries. However, in the case of green hydrogen projects which are closely linked to renewable energy projects, utility companies tend to play a leading role in development and implementation.

39. Furthermore, low-carbon hydrogen projects tend to be concentrated in industrial clusters, parks, “valleys” or new hubs (e.g. Neom), where most of the low-carbon hydrogen produced is expected to be consumed domestically, or in port areas where it can be consumed locally and/or in the long term be exported as low-carbon hydrogen or green ammonia.

VI. Challenges and opportunities

A. Technical and commercial barriers

40. The main challenge is the fact that electrolysis technologies have not yet reached the commercial viability needed to realistically meet long-term net-zero emissions targets. The scaling up of these technologies and concomitant reduction in production costs will take time and require large financial resources.

41. Another technology-related factor that is presently considered a significant barrier is the energy inefficiency. According to the International Renewable Energy Agency (IRENA), between 30 and 35 per cent of the energy consumed in the process of producing green hydrogen through electrolysis is lost. Furthermore, the transformation to other forms, especially to transport the clean product, can lead to between 13 and 25 per cent energy losses.

42. CCS or CCUS enable the production of relatively less expensive blue hydrogen. Companies were reluctant to invest in these two processes and sought strong Governments' support. However, this technology remains expensive and has still not evolved at the scale required to meet net-zero emission targets. Moreover, the availability of suitable CO2 storage locations and acceptance of CCS and CCUS facilities are major challenges for such projects.

43. In view of the planned significant expansion of blue and green hydrogen and the potential developments in the Arab region with its enhanced capacity to produce low-carbon hydrogen for domestic uses and potentially for exports, the existing hydrogen pipeline infrastructure would be hard-pressed to cope with growing domestic and cross-border transport requirements.

44. The quantity of water required by green hydrogen plants could limit their use in certain regions of the world. This is an extremely important consideration in the Arab region, especially in inland areas with no access to potential sources of desalinated seawater. Furthermore, even if accessible, the desalination of seawater is an energy-intensive and costly process that would need to be assessed within a local or regional context.

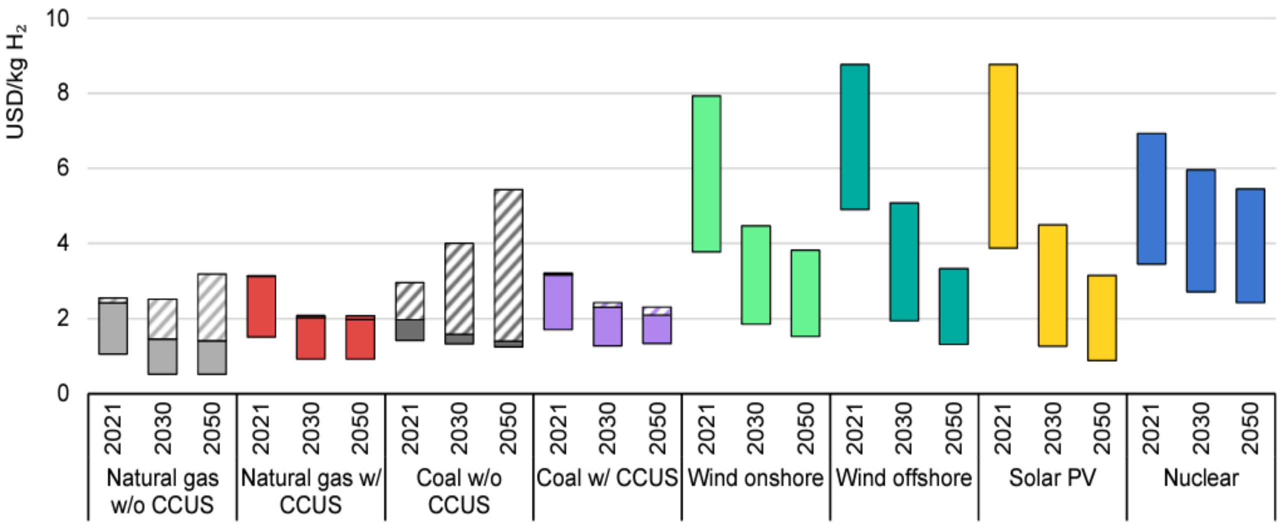
45. Developers and operators of low-carbon hydrogen production, transformation and transportation capacities would face some additional technical constraints in terms of skill availability and relevant manufacturing capacity for technology components.

B. Evolving economics

46. The economics of low-carbon hydrogen production remain very challenging and are directly linked to the technological constraints described above, among others. The main issue is the much higher cost of producing green hydrogen compared to blue hydrogen. It should be noted also that blue hydrogen production is not widely developed yet, but the transitional low-carbon blue hydrogen option could progress more quickly than the green hydrogen option. In the long term, the cost gap between blue and green hydrogen production is predicted to narrow significantly, if the scaling up of green hydrogen capacity takes place as expected.

47. In the meantime, the production of blue hydrogen using natural gas as a primary source through the SMR technology and with CCS/CCUS could provide a low-carbon hydrogen transition to a more cost-effective green hydrogen solution.

Figure 3. Levelized cost of hydrogen production by technology in 2021 and in net-zero emissions scenarios by 2021, 2030 and 2050



Source: IEA (2022). Global Hydrogen Review 2022.

48. In the case of North African gas-producing countries, blue hydrogen production using natural gas as a primary source could be more challenging. The increasingly constrained natural gas balances of producers such as Algeria and Egypt could limit blue hydrogen production growth prospects in this area. Nevertheless, North Africa offers much better opportunities in the production of green hydrogen using existing and potential renewable energy resources. Therefore, the near-term cost advantages of blue hydrogen production are likely to be leveraged mainly in the few Arab gas surplus countries of the GCC area.

49. At present, the cost of green hydrogen production is a major barrier to the development of scaled up green hydrogen capacity. The production cost of green hydrogen is driven by three main interacting elements: electrolyser investment cost; capacity factor (percentage use or operating hours) and the cost of electricity from renewable energy sources.

50. Arab countries, such as Jordan, Morocco, Saudi Arabia and the United Arab Emirates, with existing and potentially low and declining costs of electricity generated from renewable sources of energy (solar and wind), offer a key comparative advantage in the production of green hydrogen.

C. Financing constraints

51. Most Arab countries have faced challenges in securing external financing for hydrogen development projects. Therefore, they will have to rely on effective partnerships with international companies or institutions not only to develop and install the relevant technologies, but also to invest in the whole low-carbon hydrogen production chain.

52. The commercial viability of low-carbon hydrogen projects requires a significant scaling up of the hydrogen production capacity underpinned by secure long-term market demand with contractual purchase commitments like those that enabled the launch of the international trade of LNG, at least initially. Other mechanisms, like Contracts for Difference, could also ensure stability of revenue.

53. Commercial banks, among others, are likely to wait for low-carbon hydrogen projects to be de-risked before offering financing at the needed scale. Therefore, both public and private sector funding and financial incentives will be necessary.

D. Legal and regulatory framework

54. Addressing financing challenges will require an adequate legal and regulatory framework to support the scaling up of low-carbon hydrogen production capacities. This framework will need to reflect realistic strategies formulated at the country or regional level that will serve as the basis for the formulation of a legal and regulatory framework to support the development of low-carbon hydrogen in each country or region.

55. Arab hydrocarbon-producing countries have been producing and using grey hydrogen for the past several decades. However, there is no dedicated legal and regulatory framework focused on the development of low-carbon hydrogen production and use (domestically or for exports) in any Arab country, apart from technical regulations related to hydrogen use in the mobility sector.

56. The pathway for some regions or countries could be a gradual transition from a blue to a green hydrogen economy to allow for a scaling up of capacity and future cost reductions, while others could opt to leapfrog the transition phase and move directly into green hydrogen. There would also be countries that would continue to develop both blue and green hydrogen capacities concurrently. Therefore, the legal and regulatory frameworks would vary, reflecting the different pathways chosen by specific countries or groups of countries.

E. Opportunities for Arab countries

57. In gas-rich Arab countries, the production of blue hydrogen using natural gas as a primary source in the SMR process coupled with CCS or CCUS facilities could smooth out the transition to a lower-cost green hydrogen production phase by supporting a scaling up of low-carbon hydrogen capacity. However, these Arab hydrocarbon producing countries would need to take a more active role in mobilising investments in scaled-up CCUS and geological storage facilities.

58. Green hydrogen production could benefit from low-cost renewable electricity supplies and the availability of large land areas in some parts of the Arab region to develop or expand renewable energy capacity.

59. In addition, GCC countries with long-established seawater desalination industries and large production capacities could leverage this experience to mitigate any adverse water usage impacts when expanding these capacities to produce green hydrogen. Furthermore, the development of scaled-up desalination capacity could also provide local communities with additional water supplies.

60. North African gas producing countries (such as Algeria and Libya) have large cross-border natural gas pipeline infrastructure linking them to southern Europe. This infrastructure could potentially be used to export hydrogen.

61. Some key Arab hydrocarbon-producing countries have large industrial parks or clusters where low-carbon hydrogen projects could be located at lower costs than green field sites. Substantial shares of the hydrogen production could be consumed locally by industries in these parks.

62. Finally, the development of a low-carbon hydrogen industry could help achieve economic diversification away from hydrocarbons. However, to do so, the new low-carbon hydrogen industry will have to disconnect from the existing hydrocarbon industry.

VII. Recommendations

63. The following are select recommendations for Arab countries to accelerate the development of low-carbon hydrogen locally and globally:

- Accelerate domestic renewable energy projects to increase the share of renewable electricity in power systems to ensure adequate capacity for green hydrogen production.
- Explore flexibility measures including regional grid interconnection in order to effectively manage the inherent variability of solar and wind generation.
- Establish certification and standardisation schemes for green and blue hydrogen that are aligned with international standards.
- Reduce risk by formulating low-carbon hydrogen strategies that reflect each country’s carbon neutrality objectives and commitments, renewable and non-renewable energy endowments and financial strengths and/or access to funding sources. Governments can also reduce off-take risk by establishing local low-carbon hydrogen demand initiatives.
- Increase public funding in research, education and innovation as well as the infrastructure required to produce and transport low-carbon hydrogen, hydrogen derivatives and low-carbon industrial products.
- Provide strong innovation support to ensure projects reach the commercialisation stage and to incentivise market creation while collaborating with local universities and research centres and international research and development partnerships.

- Encourage involvement of all relevant public and private sector stakeholders in the initial strategy design process and obtain their buy-in. Strategies should be based on thorough multidisciplinary assessments, including social and environmental impact studies and cost/price-sensitive market evaluations.
- Leverage experience in the oil and gas sectors as well as international partnerships with oil and gas companies. Also leverage existing refining and shipping infrastructure to accelerate the transition to the production and export of sustainable fuel and industrial materials, thereby mitigating disruptions to local economies and jobs in the face of global decarbonisation strategies and incoming carbon border adjustment mechanisms.
- Study and thoroughly understand all the barriers that could arise in this potential new low-carbon fuel and materials trade with other countries and regions (e.g. carbon pricing, certificates or guarantees of origin) since most of the low-carbon hydrogen that would potentially be produced in the Arab region could initially be exported.
- Develop adequate legal and regulatory frameworks to incentivise low-carbon hydrogen investments by local and international investors.
- Focus on decarbonisation of hard-to-electrify sectors but avoid the financially demanding and high-risk cycle of subsidies.
- Promote Arab regional cooperation in the Arab market for electricity, renewable energy and hydrogen to take advantage of integration opportunities among the countries of the region.
