

Hydrogen Education as a Partnership Model? Potential and Challenges for Closer EU-Saudi Arabia Cooperation.

REVITALISING **MULTILATERAL** PERSPECTIVE AND POLICY SERIES
ANALYSIS

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Energy diversification has emerged as a key driver for Saudi Arabia's socioeconomic transformation. Traditionally, oil generates more than 70% of export revenues, but as global demand for fossil resources is likely to decline in the upcoming years and the interest in green energy is growing, the kingdom aims to promote its energy transition by heavily investing in alternative energies such as hydrogen. As such, Saudi Arabia is positioning itself as a new regional and global hub for hydrogen, pushing its efforts to develop comprehensive capacities to [export clean hydrogen \(and derivatives\)](#) to global markets. Based on large gas resources for blue hydrogen and abundant solar radiations and wind speeds for green, combined with outstanding expertise as a global energy leader, Saudi Arabia has the potential to establish itself as [a champion of hydrogen](#).

Against this backdrop, the long-term promotion of renewables is part and parcel of the ambitious goals of “Vision 2030”, the modernisation agenda spearheaded by Crown Prince Muhammad bin Salman. Initiated in 2016, “Vision 2030” serves as the blueprint for the comprehensive socio-economic, educational, cultural, and social transformation the kingdom is undergoing. By addressing not only labour market reforms or infrastructural developments but also Saudi national identity, cultural heritage, and social belonging, “Vision 2030” has initiated a substantial process of adaptation and transformation to establish Saudi Arabia as a “[global investment powerhouse](#)” and a [know-how society](#) in which energy transition is a fundamental cornerstone. In this regard, Saudi Arabia aims to increase its share of renewables to [50% of the energy mix by 2030](#), and is pursuing [net zero emissions by 2060](#).

As part of this endeavour, hydrogen has become a top priority in the kingdom’s energy diversification efforts, aiming to produce and export about [4 million tons](#) of hydrogen by 2030. Saudi Arabia’s flagship project, the new smart city NEOM located at the Red Sea, is [expected](#) to produce 650 tons per day of green hydrogen by electrolysis and 1.2 million tons per year of green ammonia, making it one of the largest hydrogen production facilities being built globally. The produced hydrogen will be converted into liquid ammonia on-site and exported globally by the US company Air Products. Furthermore, Saudi Arabia’s oil company Aramco published its first Sustainability Report in June 2022, outlining goals to reduce greenhouse emissions and produce [11 million metric tons](#) of blue ammonia – a relevant carrier of blue hydrogen – by 2030. Additionally, investments in blue hydrogen projects were at an estimated [USD 110 billion](#) in October 2021, mainly focusing on the Jafurah gas field in the Eastern Province. An existing hydrogen plant in [Jubail Industrial City](#) will also be upgraded.

To achieve such goals, the Saudi government has implemented a plethora of projects, instruments, incentives, and partnership models with international off-takers and access to new markets in Europe and Asia by developing new supply chains. In this regard, the kingdom signed energy partnership agreements with Japan in September 2020, including the [first shipment of blue ammonium in April 2023](#); Germany in March 2021 to [promote hydrogen cooperation](#); and opened an [office focusing on hydrogen diplomacy](#) in Riyadh in 2022, and South Korea and France in February 2023. Furthermore, the [Saudi Green Initiative and the Middle East Green Initiative](#), the [Circular Carbon Economy National Program](#), the [National Renewable Energy Program](#), and the [Saudi Energy Efficiency Program](#) have been introduced in order to promote the Saudi energy transition.

Consequently, Saudi Arabia clearly wants to hit two birds with one stone by developing a sustainable hydrogen industry. First, investments in the hydrogen industry aim to develop a new domestic energy sector and create new international partnerships. In doing so, the kingdom follows ambitious plans to become a global hydrogen forerunner in order to [increase resilience and energy security](#) in terms of energy exports and domestic use. Second, renewables are said to be an opportunity to create jobs for Saudi nationals. So far, parts of job market reforms introduced under “Vision 2030” have been successful, as indicated by a rise in female workforce participation from [17.5% to 33.6% between 2017 and 2022](#). The number of women already [exceeded](#) the number of men attending colleges and universities in 2015, and now, almost [40% of all SME are run by females](#).

As a result, the increased participation rate of women in the workforce has already exceeded the 2030 target. Nevertheless, job market challenges remain high: in 2022, total youth unemployment (15-24 years) was still high at [23.8%](#), and in the same year, [26.4%](#) of the female labour force were unemployed. By 2030, up to [4.5](#)

[million](#) young Saudi nationals are expected to enter the job market, who can no longer be absorbed by the over-bloated public sector. Thus, by investing into non-oil sectors and promoting industrialisation, it is the kingdom's intention to create jobs for the vast majority of young Saudi nationals, with a particular focus on women.

Against this backdrop, the development of a domestic hydrogen industry could also create a number of jobs for Saudi nationals on different professional levels. So far, no concrete data for Saudi Arabia exists, but the [potential for hydrogen-related job creation](#) in the member states of the Gulf Cooperation Council (GCC) is estimated at 40,000-80,000 for 2030, and 400,000-900,000 for 2050. As the kingdom has the largest population across the GCC, it seems likely that the vast majority of those jobs could be created in the Saudi hydrogen industry in light of ongoing localisation and nationalisation efforts.

However, the current national workforce is lacking, as the local human capital and the educational institutions do not yet meet the [high expectations](#) of the Saudi energy transition, despite the fact that educational reforms have been introduced to improve human resources in green technologies, engineering, and the hydrogen industry. Still, the Saudi economy is relying on international experts who are promoting the development of the domestic hydrogen sector. They are recruited by national champions that are implementing the green and blue hydrogen projects, such as ACWA Power and Saudi Aramco.

So far, only a limited number of educational institutions are offering tailor-made training courses and specified programs for hydrogen education, but "Vision 2030"'s [Human Capability Development Program \(HCDP\)](#) aims to promote Saudi empowerment among young Saudi nationals in different sectors. Although hydrogen is not mentioned explicitly in the program, HCDP outlines renewable

energy and engineering among the four main fields of knowledge upon which the educational reforms aim to focus. Hence, hydrogen offers the potential to foster job market nationalisation and create "[better jobs tomorrow](#)". Those "[good jobs](#)" not only provide basic needs and a reasonable salary, but also the opportunity to live a productive and healthy life.

Against this backdrop, new jobs in the hydrogen sector fit into the current *zeitgeist* that is driven by growing interest in environmental issues, climate action, and green sustainability among parts of the well-educated young urban middle class. It considers hydrogen as an attractive sector that offers both a potential opportunity to contribute to the national energy transformation, and find a long-term job. As part of the Saudi leadership's identity politics, hydrogen is promoted as a driver for Saudi nationalism and "green patriotism", which further pushes the demand for comprehensive hydrogen education.

Job demands in renewables (mainly solar and wind), electrolysis systems producing hydrogen from up-, mid- and downstream, in addition to innovative demand-side processes, are likely to grow in the future. Along the supply chain, additional direct and indirect jobs in the petrochemical and chemical industry, mobility, mining, and the steel, cement, food and beverage industry or agriculture are expected to generate high interest. Regarding green hydrogen, jobs could be created in road transport and cooling for buildings. Human capital in transport, storage, services, maintenance, or management is needed in [specific sectors](#) such as the manufacturing of non-complex PV components, wind energy components, electrolyzers, or the automotive industry, which aims to produce [electric vehicles](#) (EV) domestically.

As the kingdom has already developed outstanding long-term professional and institutional expertise in the oil, mining, and petrochemical sectors, such know-how could contribute to the development of an efficient hydrogen educational system.

As compatibility in skills exists between the oil and hydrogen industries, requirements to start developing an educational system from scratch are reduced. As of today, some academic institutions, universities, and centres of excellence have already started to introduce hydrogen engineering programs and training courses. For instance, King Saud University (KSU) in Riyadh has developed a [Master of Science in Renewable Energy](#) in which courses in hydrogen energy technology are offered. At the KSU, the [Sustainable Energy Technologies Center \(SETC\)](#) has established a Hydrogen Energy Group which provides training courses and cooperates with the Électricité de France (EDF), the German National Aeronautics and Space Research Center (DLR), Tokyo University from Japan, and the Massachusetts Institute of Technology (MIT).

Additionally, the [King Fahd University of Petroleum and Minerals \(KFUPM\)](#) launched a research centre for hydrogen and energy storage in May 2021, which aims to explore multiple promising fields in applied sciences with a special focus on the production of blue and green hydrogen, hydrogen separation and storage, and hydrogen utilisation.

Finally, the [King Abdullah Petroleum Studies and Research Center \(KAPSARC\)](#), located in Riyadh, has emerged as a flagship institution in Saudi Arabia's efforts to promote research on renewable energy such as hydrogen, oil and gas, and sustainability. Besides academic educational institutions, business entities such as Aramco, NEOM and ACWA Power have also introduced hydrogen education and training courses.

Despite such promising perspectives, the Saudi hydrogen industry is still facing tremendous challenges: it requires substantial infrastructure development, initial [R&D](#), transmission, transportation, technology development and support, and [operation services and maintenance](#). As a national hydrogen strategy has not yet been developed, a coherent strategy for hydrogen education that includes demands and needs, institutional capacities and legal modalities, also does not exist. As a consequence, the landscape of hydrogen education providers is fragmented, and coordination limited.

Here, enhanced cooperation between Saudi Arabia and the European Union in the hydrogen industry could not only promote business ties, but also political dialogue through joint educational activities and measures. Both Saudi Arabia and the EU show interest in mutual cooperation, know-how transfer, capacity development, and joint training programs. Developing joint curriculars for hydrogen engineering or working on [renewables-powered desalination solutions](#) to improve the sustainable disposal of brine in green hydrogen production could serve as drivers for an EU-Saudi hydrogen educational partnership model.

Therefore, the current hydrogen hype should not only focus on business interests and return of investment, but also need to be considered as a driver for energy diplomacy, regional integration, and educational cooperation. Since Russia's war on Ukraine started in 2022, [energy partnerships between](#) Europe and GCC countries such as Saudi Arabia have intensified, and European countries needed to look for [alternative suppliers of energy](#). Those established business partnerships could also boost educational collaboration.

However, expectations need to be managed carefully: political mistrust in both Saudi Arabia and the EU is increasing, technical obstacles and safe transport of hydrogen remain hard to solve, and Saudi Arabia also aims to develop its blue hydrogen

industry – whereas the EU is more interested in green hydrogen. The political partnership and public perception have also become more strained after the Hamas attack on Israel on October 7th, 2023. Since then, polarisation increased, and from a Saudi perspective, the [image of Europe](#) has further suffered. Against this backdrop, enhanced cooperation between the EU and Saudi Arabia in the hydrogen industry and education could serve as a confidence-building measure that could provide a pragmatic window of opportunity to overcome mutual concerns. Saudi and European partners could jointly engage in upskilling or reskilling of the existing workforce, initiate academic exchange formats and summer schools in hydrogen education, or develop scholarship programs.

EU educational initiatives such as [Erasmus+](#) and [Erasmus Mundus](#) could also focus on participants from Saudi Arabia. In turn, Saudi academic and research institutions such as KFUPM or KSU, as well as companies such as ACWA Power or Aramco, could enter partnerships with the EU by establishing joint exchange formats in which both sides could benefit from their respective expertise.

As outlined in the [REPowerEU](#) decarbonisation strategy and the Joint Communication “[Strategic partnership with the Gulf](#)”, the EU considers energy and education as relevant pillars to enhance cooperation with the GCC. As Saudi Arabia – and also the UAE and Oman – aim to position themselves as early movers in the hydrogen industry and consider Europe as an important off-taker market, joint efforts in hydrogen education could help to boost the future partnership and create people-to-people networks on a commercial, academic, and political level. Here, hydrogen education could promote youth and female empowerment, which is a top priority for both Saudi Arabia and the EU. Such a collaboration could thus foster the development of a hydrogen ecosystem based on local knowledge and European expertise.

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The BIC is an independent, non-profit, think-and-do tank based in the capital of Europe that is committed to developing solutions to address the cyclical drivers of insecurity, economic fragility, and conflict the Middle East and North Africa. Our goal is to bring added value to the highest levels of political discourse by bringing systemic issues to the forefront of the conversation.

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