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Hydrogen market overview and outlook – Middle East

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Introduction

- The Middle East has **a distinctive advantage in becoming a leading region in the forthcoming low-carbon hydrogen economy** thanks to its **abundant natural resources, strategic location, existing LNG infrastructure and prior experience with oil & gas projects**. By investing in establishing a sustainable hydrogen ecosystem, the Middle East can emerge as a prominent producer and **exporter of low-carbon hydrogen to Europe and North-East Asia**
- However, there are several obstacles to overcome to realize these aspirations, particularly concerning **the current high costs of infrastructure, the lack of regulations, certifications and standards, and the high water-stress levels**
- Currently, the Middle East is embracing hydrogen opportunities by **announcing climate change and decarbonization goals, developing hydrogen project plans and establishing bilateral agreements**. However, by implementing well-informed national strategies and their effective execution, the Middle East can witness a surge in large-scale hydrogen projects, the expansion of hydrogen valleys, and reduced production costs
- This report explores the enablers that are driving the Middle East toward its vast potential in the low-carbon hydrogen market. It also examines the challenges that could hinder this progress while providing an up-to-date overview of the region's hydrogen projects, announced bilateral agreements, key players in the hydrogen market, and climate goals

The Middle East has significant potential in the low-carbon hydrogen market, supported by several enablers

Access to natural gas and renewable energy

The Middle East has access to natural gas reserves, abundant renewable energy sources such as solar and wind, and land to create both green and blue hydrogen

Pre-existing LNG and CCS infrastructure

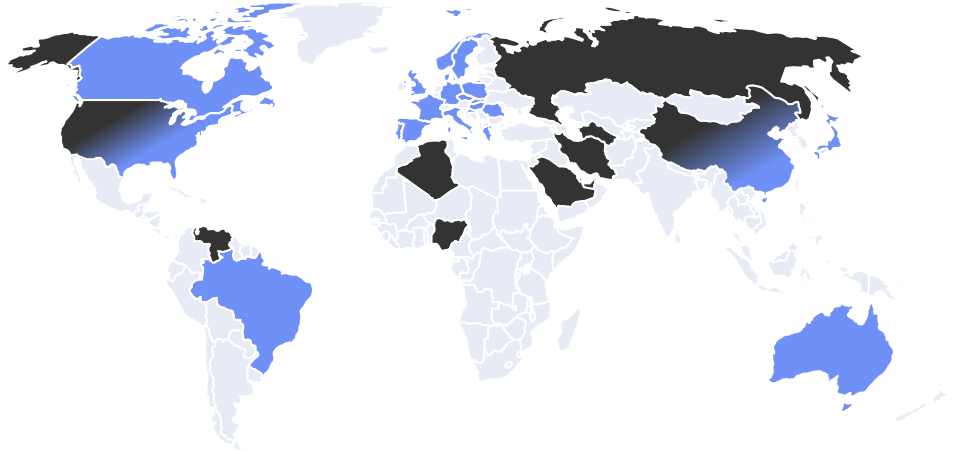
The Middle East can utilize existing infrastructure, including refining facilities and natural gas pipelines, for low-carbon hydrogen production and transportation. The region also benefits from suitable geological conditions for storage, reducing costs in the value chain

Central location providing export advantage

The Middle East has the potential to become a leading hydrogen exporter thanks to its central location, primarily shipping hydrogen, ammonia, and synthetic kerosene to Europe, Japan, and South Korea

The Middle East has significant potential for hydrogen production due to its vast gas reserves, abundant sunlight, and wind resources

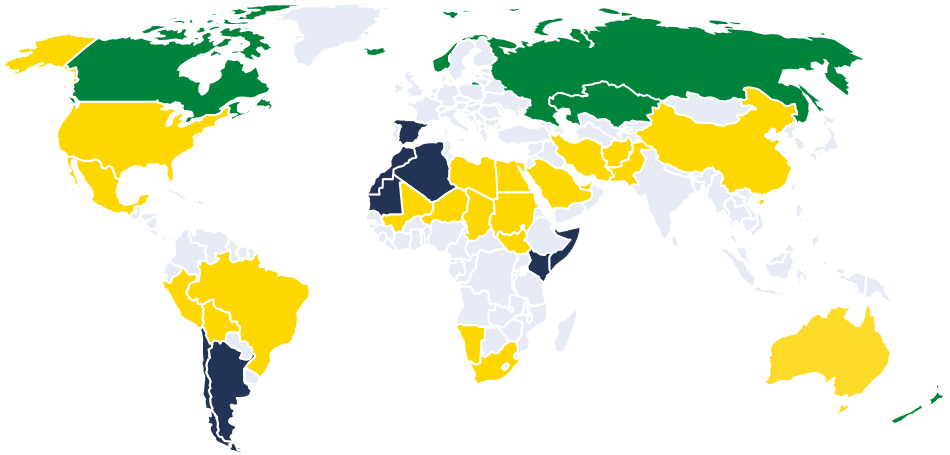
Blue hydrogen potential – The highest CCS[1] readiness indicator and biggest natural gas reserves



Largest natural gas reserves[2]

Highest CCS readiness indicator[3]

Green hydrogen potential – Strongest Renewable Energy Sources (RES) potential



Primarily PV[4]

Primarily Wind[5]

PV and Wind hybrid

- The Middle East region is home **to vast gas reserves**, including the **world's largest gas field**, the South Pars/North Dome Field. **Saudi Arabia and Qatar** rank among the top six countries globally in terms of proven gas reserves
- Currently, the Middle East holds **approximately 10% of the global CCUS[1] capacity**

- The Middle East is an ideal location for **cost-effective solar and wind projects** due to **abundant sunlight, powerful winds, and large, suitable land areas**
- It is also host to remarkable projects such as the world's **largest solar PV plant** (Al Dhafra, 2 GW) and **the largest reverse osmosis desalination plant** (Taweelah)
- In 2040, the GCC countries, along with Chile and Niger, are expected to have **the cheapest production costs (**1-1.25 EUR/Kg), compared to Europe (2-2.75 EUR/Kg) or Eastern Asia (1.50-1.75 EUR/Kg)

1: Carbon Capture (Utilization) and Storage 2: Countries with more than 2% of the world's natural gas reserves; 3: Indicator identifying the leaders in terms of enabling environment for the commercial deployment of CCS. (more than 40 for highest countries); 4: Countries with the highest potential for RES. Does not encompass every single country. 5: Only considers the primary renewable energy sources (might include others)

Sources: Frontier Economics "International Aspects Of A Power-to-x Roadmap" (2018), WorldMeters, Co2re CCS Readiness Index, lexilogy

GCC countries are well positioned to meet the demands of the hydrogen market due to their expertise in energy and its infrastructure

The emergence of a hydrogen economy will require the development of infrastructure, including hydrogen terminals at ports and new pipelines. With its extensive expertise in energy and transportation infrastructure, the Middle East, and the GCC countries in particular, are well positioned to meet the growing needs of the emerging hydrogen market

PRODUCTION

- The region can utilize existing infrastructure, particularly for **low-carbon hydrogen produced through fossil fuels and CCUS[1]**, leveraging its experience
- **Successful pilot projects in CCUS[1] with Enhanced Oil Recovery**, such as the Al Reyadah CCUS[1] project in the UAE, provide business models for CCUS[1] technology
- The region also possesses **extensive refining and petrochemical facilities**, including the **Ruwais ammonia plant, the hydrogen-based ammonia plant in Neom**, and the **Qatargas LNG plant**

TRANSPORTATION

- Hydrogen can be transported via **pipelines or shipping methods** (compressed hydrogen, liquefied hydrogen, or liquefied ammonia)
- GCC countries possess **robust infrastructure, including port and LNG facilities, natural gas pipelines, and carrier ships.** The existing natural gas pipelines in GCC countries can be **modified to accommodate hydrogen** transport
- Modifying the GCC's existing natural gas grids for hydrogen transportation can help **avoid the need for extensive grid reinforcement in full electrification**

STORAGE

- Underground salt caverns offer **low-cost hydrogen storage**
- GCC countries **offer ideal geology for large-scale underground storage**, including notable evaporite deposits like Gotnia and Hormuz salt in Kuwait, the Saudi-Kuwaiti Neutral Zone, the Hormuz salt in the UAE, and three Hormuz salt basins in Oman
- These structures are **commercially used**, **provide raw materials,** and are **already utilized for storage purposes.** They can **reduce costs** in the compressed gaseous hydrogen (CGH) value chain for the GCC region

1: Carbon Capture, Utilisation and Storage

Sources: Qamar Energy “HYDROGEN IN THE GCC” (2020), World energy insights “Regional insights into low-carbon hydrogen scale up” (2022)

The Middle East has the potential to become a major net exporter of hydrogen to Europe and East Asia

The Middle East will emerge as a hydrogen export hub, mainly for the export of **shipped hydrogen**, as well as **ammonia** and **synthetic kerosene**

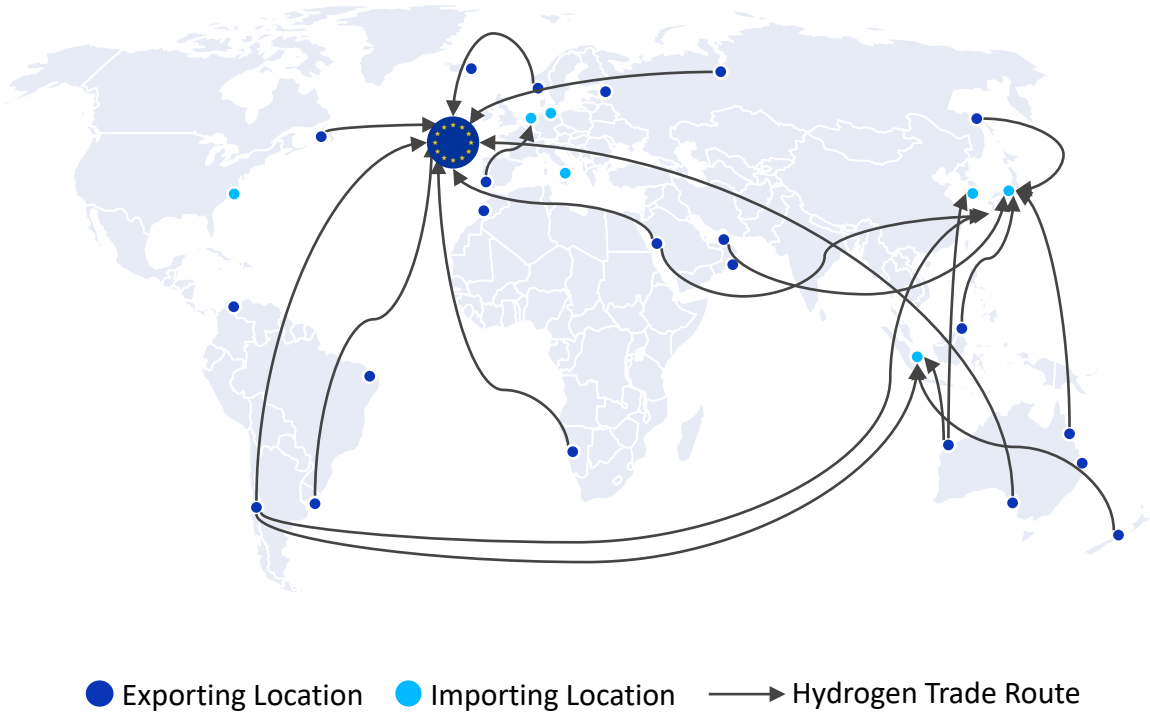
The potential export markets for the Middle East are:

- **Europe** is a key hydrogen market due to **its high energy consumption and focus on cleaner fuels.** Legislation, incentives, and infrastructure development, including a **6,800 km hydrogen pipeline network by 2030,** support hydrogen trade
- **Japan** is a potential target market thanks to it **already being supplied with blue hydrogen from Saudi Aramco and** operating the **world's first dedicated liquid hydrogen carrier ship, the "Hydrogen Frontier"**. Moreover, the country's strong interest in low carbon hydrogen is evident in its **willingness to pay a premium for blue ammonia over grey ammonia**. Japan also aims to **achieve a commercial hydrogen supply by 2030**, emphasizing its commitment to sustainable solutions

Several factors could affect the Middle East's trading potential, including:

- **Developing U.S. interest and investment in hydrogen.** However, the ME may be better positioned to meet the energy needs of emerging markets such as India due to transportation costs and domestic energy supplies in the U.S.
- **Spain's expansion of hydrogen production plants and import potential from North Africa**. However, the impact is uncertain due to high projected production costs and infrastructure development needs

Potential low-carbon hydrogen import-export dynamics in 2040



Sources: world energy insights "Regional insights into low-carbon hydrogen scale up" (2022), Addleshaw Goddard "The future of hydrogen" (2021), World Energy Council "Regional insights into low-carbon hydrogen scale up" (2022), IRENA "Geopolitics of the Energy Transformation" (2022), Press Search

The Middle East must overcome several challenges to realize its full hydrogen potential

Absence of a regulatory and certification framework

As more low-carbon hydrogen projects are announced, new policies and certification frameworks will be required and anticipated to regulate hydrogen production, promote transparency, stimulate demand, and maintain quality and traceability in the hydrogen trade

Water Shortage

Without being properly addressed, the growing local and international demand for low-carbon hydrogen in the Middle East can intensify water stress challenges in the region

High transportation and storage costs

Transporting hydrogen by ship from the Middle East to Europe and Asia can be costly, while building new clean hydrogen pipelines to Europe can be not only expensive but also challenging

Currently, the Middle East lacks a dedicated regulatory and certification framework to license and implement hydrogen initiatives (1/2)

MIDDLE EAST

As of 2023, there is **a lack of regulatory frameworks** specifically tailored to hydrogen projects in the Middle East. However, **efforts are underway to address this gap:**

- **The UAE** government has approved a new national hydrogen strategy, part of the national energy plan, aiming to produce 1.4 million tonnes of green hydrogen annually by 2031 and 15 million tonnes by 2050
- **Oman** has introduced a new legal framework through a Royal Decree, empowering Hydrogen Oman (Hydrom) to oversee the development of the green hydrogen industry. Hydrom will manage project allocation, infrastructure development, and attract foreign investors
- **Egypt** announced, in 2022, its National Hydrogen Strategy that aims to establish the nation's long-term objectives concerning future hydrogen legislation and policy
- **Saudi Arabia's** National Hydrogen Strategy, announced under development in 2022, concentrates **on crucial aspects of the hydrogen value chain**, such as production, exports, and infrastructure and aims to attract USD 36 Billion of investment by 2030

For countries without specific hydrogen regulations, **existing the oil and gas or energy sector laws** apply to hydrogen initiatives

GLOBAL

To promote hydrogen adoption, countries are adapting their regulations:

- **China**, for example, has classified hydrogen as an energy carrier in its draft Energy Law, meaning that hydrogen can now be freely bought and sold as an energy resource, and there will be less strict rules for transporting it compared to when it was considered a dangerous substance
- Other countries like **Chile, Colombia, Korea, and France** have modified their energy legislation to recognize hydrogen as an energy carrier, to promote the development of the hydrogen industry and table safety management
- The European Commission has recently put forth a proposal to amend the Energy Taxation Directive in order to prevent the occurrence of double taxation on energy products, including hydrogen
- **Germany** has exempted renewable hydrogen from levies to support clean power

Sources: CMS Law “Hydrogen law, regulations & strategy in the middle east” (2021); Hydrom; IEA “global hydrogen review” (2021), K&L Gates “Middle East H2 Handbook” (2023) Press Search

Currently, the Middle East lacks a dedicated regulatory and certification framework to license and implement hydrogen initiatives (2/2)

MIDDLE EAST

- The Middle East currently lacks **technical standards for low-carbon hydrogen production, distribution, storage**, **and utilization**, as well as local certification schemes
- Establishing credible and transparent certification schemes is crucial to build **buyer confidence**, stimulate **local and export demand**, and ensure **the quality and traceability** of hydrogen supply
- **Currently,** Abu Dhabi is developing a low carbon hydrogen **certification regulatory policy**, technical standards, and licensing, to support the sector

GLOBAL

- Presently, the European Union takes **the forefront in leading defining and establish programs for certification** of low-carbon hydrogen as a renewable fuel
- The **EU developed Certify**, a certification for economic operators to demonstrate **compliance with the relevant Acts** in the production of hydrogen. The EU is actively promoting it and **engaging with over 900 stakeholders to** co-develop it
- Moreover, many countries within the EU developed their own certifications. For example, **Germany developed TUV SUD**, providing traceability to identifiable and quantifiable sources and minimal CO2 emissions

Example of EU and International Hydrogen Certification Initiatives

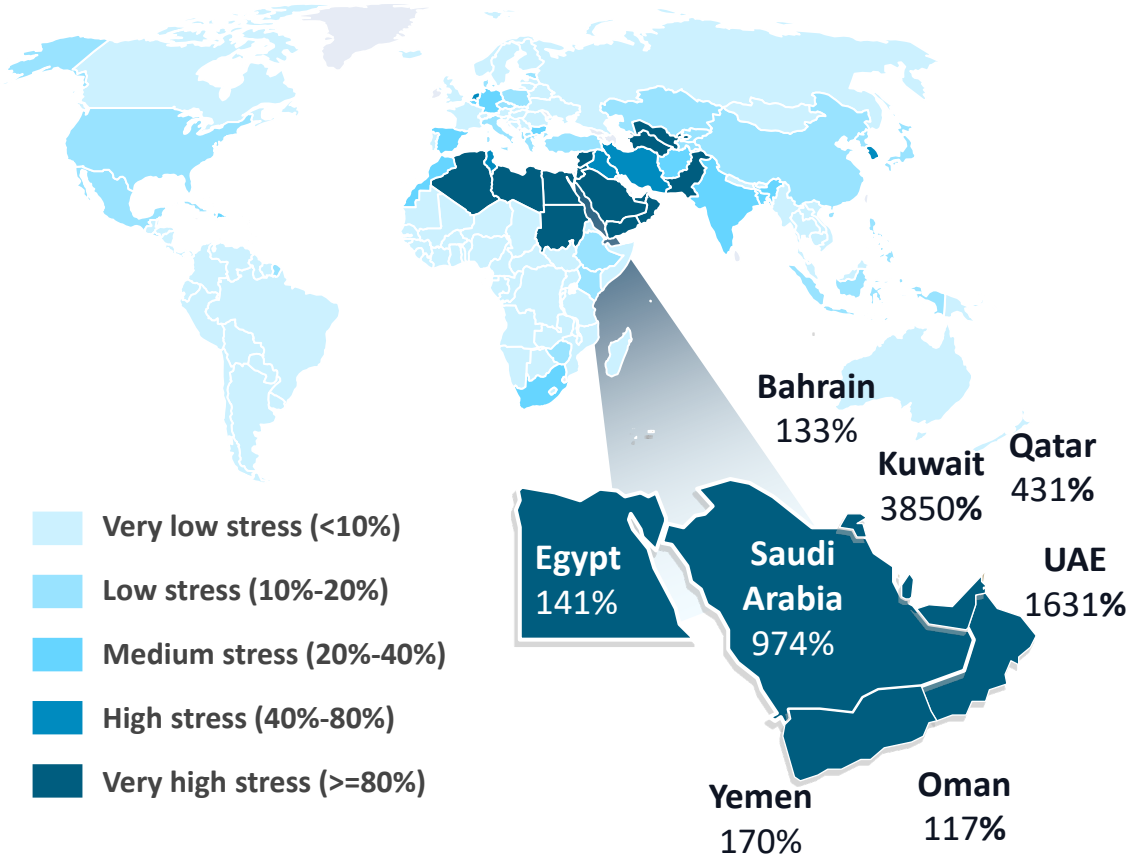
	TUV SUD	AFHYPAC	BEIS	CERTIFY
Type	Voluntary renewable H2 standard	French low-carbon h2 standard	UK low-carbon h2 standard	Voluntary H2 standard
Country	Germany	France	UK	European development + EEA + CH
Categories	Renewable H2	Renewable / low-carbon H2	Renewable / low-carbon H2	Renewable / low-carbon H2

Sources: Roland Berger “Unlocking Hydrogen Growth in the Middle East” (2023); Clean Air Task Force “How the EU can certify low-carbon hydrogen” (2022), Clean Hydrogen Europa “CertifHy” (2022)

If not addressed, meeting future local and international demand for low-carbon hydrogen can exacerbate water stress in the Middle East

- **The production of green hydrogen** through electrolysis currently requires **high-purity water quantities** (9 – 28 kg pure water per 1 kg hydrogen produced), which poses challenges in **regions with high water stress levels**
- Significant quantities of water are also **necessary for the** steam reforming technology **in blue hydrogen production**
- **Desalinating seawater** can help purify it, but it has drawbacks. It **raises energy demand** for hydrogen production and **creates toxic brine**, posing environmental concerns when disposed of in the sea
- Emerging advancements in electrolysis technology show promise **for potentially eliminating the need for purified water**, although these innovations have not **yet become commercially viable**

Water stress in the middle east region, by country (2019)[1]



1 Percentages refer to the share of annual water demand or withdrawal out of the water supply from renewable resources

Sources: Addleshaw Goddard "The future of hydrogen" (2021); International Journal of Hydrogen Energy "Hydrogen Economy for sustainable development in GCC countries" (2023), Our world in Data, "water stress" (2019)

Transporting hydrogen over long distances and storing it on a large scale is currently costly and requires new pipelines or the use of ammonia as a carrier

- **Shipping hydrogen is expensive**, increasing production costs and posing challenges for major import markets such as Europe and East Asia. Although it is currently the primary option, it increases production expenses and landing costs
- Repurposing pipelines **reduces costs by 10-15%,** but requires detailed engineering studies, compressor replacement, and an **existing gas pipeline network**. Currently, **OQ in Oman** is testing a 4000km-long gas pipeline system for its readiness to be repurposed to transport hydrogen
- Since no LNG pipeline from ME to the EU can be repurposed, a **new dedicated clean hydrogen pipeline** is a **potential long-term solution**. However, building it is **expensive and challenging** due to permit and land acquisition issues. So far, there is a joint **feasibility study** by AFRY and RINA for a pipeline to Europe that can transport hydrogen at **around 1.2 EUR/kg H2**. The GCC could supply Europe with hydrogen at costs ranging from 2.7 EUR/kg in the 2030s to 2.3 EUR/kg in the longer term
- Another option is using **ammonia** for transportation, which offers affordability and ease of transport. However, ammonia conversion adds **substantial costs when hydrogen is the desired end-product**

GCC to Europe pipeline route conducted in the AFRY-RINA feasibility study

Sources: Addleshaw Goddard "The future of hydrogen" (2021); Qamar Energy "HYDROGEN IN THE GCC" (2020), Clifford Chance "Focus on hydrogen: the new oil in the middle east?" (2021), AFRY, press search

Middle East countries are active in the hydrogen market, with many project announcements and investments

ME countries hydrogen factsheets

Supplying details about the country's key hydrogen projects, their key players, their bilateral agreements, and their climate change goals and projects

Bahrain and Kuwait's hydrogen stance

Bahrain and Kuwait have started to explore the potential of hydrogen by announcing recent projects and Memoranda of Understanding (MoUs)

Hydrogen Factsheet – UAE

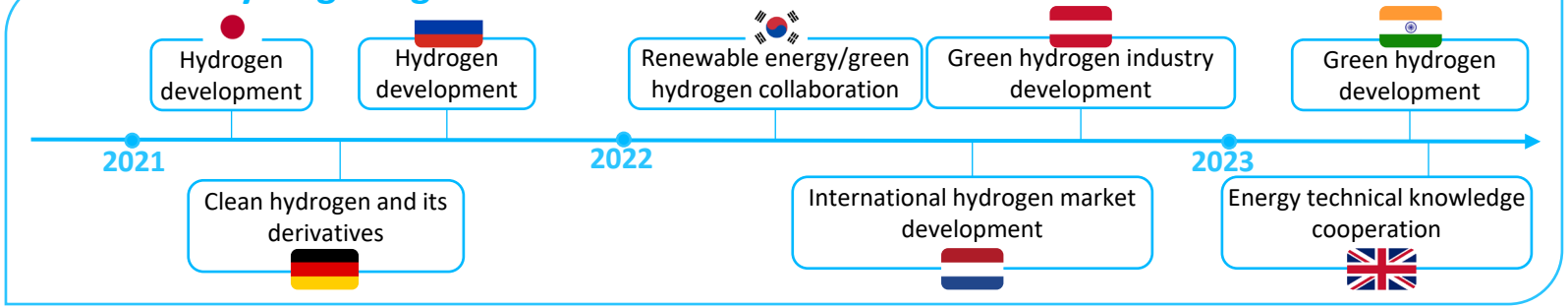
Hydrogen Key projects*

- **DEWA's Pilot Green Hydrogen Project:** DEWA is developing a USD 14Mn green hydrogen pilot project for Expo 2020 in Dubai in partnership with Siemens
- **Masdar Green Hydrogen Project:** Masdar and ENGIE formed a USD 5Bn alliance to boost the UAE's green hydrogen economy, including a 200 MW plant with Fertiglobe
- **ADNOC Ruwais blue hydrogen plant:** The facility is expected to be operational by 2025 with a capacity of up to 1 million tons of blue ammonia per year
- **Mubadala and SNAM to Explore Green Hydrogen Potential:** Mubadala and Snam have signed an agreement to explore hydrogen development and investment opportunities
- **TAQA AD Ports green ammonia plant:** TAQA Group and Abu Dhabi Ports plan a 2 GW green hydrogen-to-ammonia project

Key Players

Masdar A MUBADALA COMPANY · TAQA · ADQ القابضة · Fertiglobe · dewa ديوا · ADNOC أدنوك

Bilateral hydrogen agreements*



Climate change goals and projects

- The UAE plans to **invest AED 600bn (~USD 164bn)** in clean and renewable energy over 30 years
- The UAE's second Nationally Determined Contribution (NDC) aims to **reduce GHG emissions by 23.5% by 2030**
- UAE's clean energy goals: **14 GW of clean power capacity by 2030, 30 million mangrove seedlings for carbon sinks and sea level rise by 2030 and 50% clean energy by 2050**
- In 2021, the UAE unveiled the **Hydrogen Leadership Roadmap** with the aim of capturing a **25% market share** of the global hydrogen market by 2030

* Chosen in terms of announced capacity and/or investments if available

Sources: K&L Gates "The H2 Handbook Middle East" (2023), DEWA, BP, Press Search

Hydrogen Factsheet – Oman

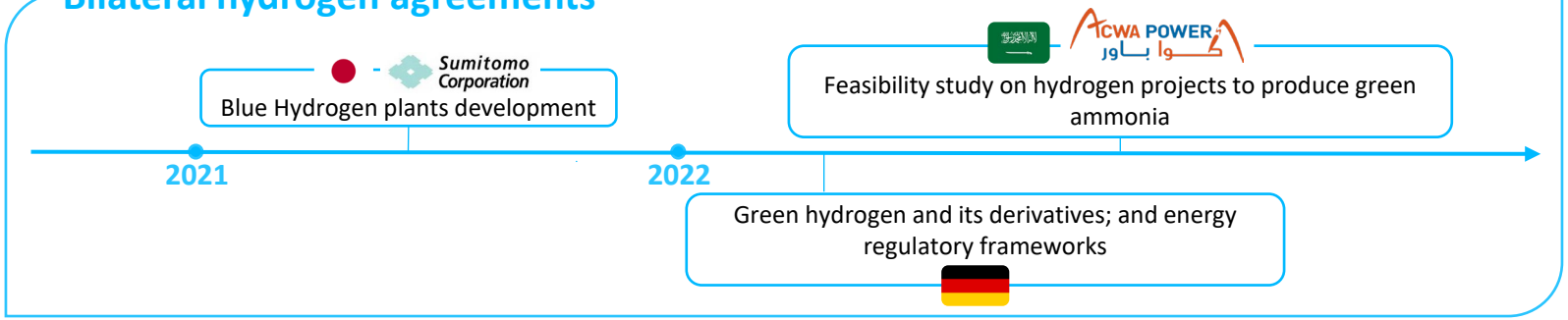
Hydrogen Key projects*

- **Sumitomo-Ara Petroleum Hybrid Hydrogen Project:** A project aiming to produce 300-400 tons of hydrogen annually from oil and gas byproduct gases for clean vehicle fuel
- **Acwa Power, OQ, Air Products H2 Oman:** Green Hydrogen Project that will use 3 GW of renewable energy to produce 1.1 million tonnes of green ammonia yearly
- **Sohar Port Green Hydrogen Hub**: the first green hydrogen hub to produce green hydrogen for clean vehicles using an initial phase of 35 MW electrolyzer by mid-2024 and an upscaling to 350 MW will be evaluated following the initial phase
- **Acme SEZAD Green Ammonia Plant:** a large-scale hydrogen facility in Duqm focused on producing 2,200 million tons of green ammonia per day using renewable energy
- **DEME-OQ Green Hydrogen Plant in Duqm:** a green hydrogen plant being developed with a first phase electrolyzer capacity of 250-500 MW, potentially scalable up to 1GW
- **Green Energy Oman (GEO):** InterContinental Energy and Hydrom targets 150 KTPA of green hydrogen from 25 GW of renewable energy, with first production to start in 2028

Key Players

hydrom Hydrogen Oman
OQ
شركة تنمية طاقة عُمان
ENERGY DEVELOPMENT OMAN
اسياد
ASYAD
HY-FLY National Hydrogen Alliance
GEO Green Energy Oman

Bilateral hydrogen agreements*



Climate change goals and projects

- Oman Power & Water Procurement Company aims for renewable projects to **reach 16% of electricity output by 2025 and 30% of generation capacity by 2030**
- Oman is constructing Manah I and II Sohar IPP with a capacity of **1,200 MW, the largest PV project in the country**
- These initiatives aim to **reduce greenhouse gas emissions by 7% and** slow down their growth by 2030 in Oman
- In 2021, Oman developed a national hydrogen strategy with ambitious targets **of 1GW by 2025, 10GW by 2030, and approximately 30GW by 2040**

* Chosen in terms of announced capacity and/or investments if available

Sources: K&L Gates “The H2 Handbook Middle East” (2023), Oman Vision 2040 “The Sultanate of Oman’s National Strategy for an Orderly Transition to Net Zero” (2022), Hydrom, Press Search

Hydrogen Factsheet – Saudi Arabia

Hydrogen Key projects*

- **NEOM Green Hydrogen Project:** the largest green hydrogen plant in the world with an investment of USD 8.5 bn, using 4GW of renewable energy for green ammonia
- **Aramco-Hyundai Oilbank Blue Hydrogen Project**: Collaboration between Aramco and Hyundai in South Korea to produce blue hydrogen using Aramco's LPG and CCS
- **Saudi Aramco's blue hydrogen project:** Saudi Arabia's USD 110 billion Jafurah gas development will be used to produce blue hydrogen
- **Acwa Power's Green Hydrogen Plants:** Acwa Power plans to develop 3 additional green hydrogen plants, similar in scale to its USD 8.5 billion Neom project
- **Green hydrogen export plant:** a project in the concept phase by PIF, Posco and Samsung C&T with a budget of USD 4 bn

Key Players

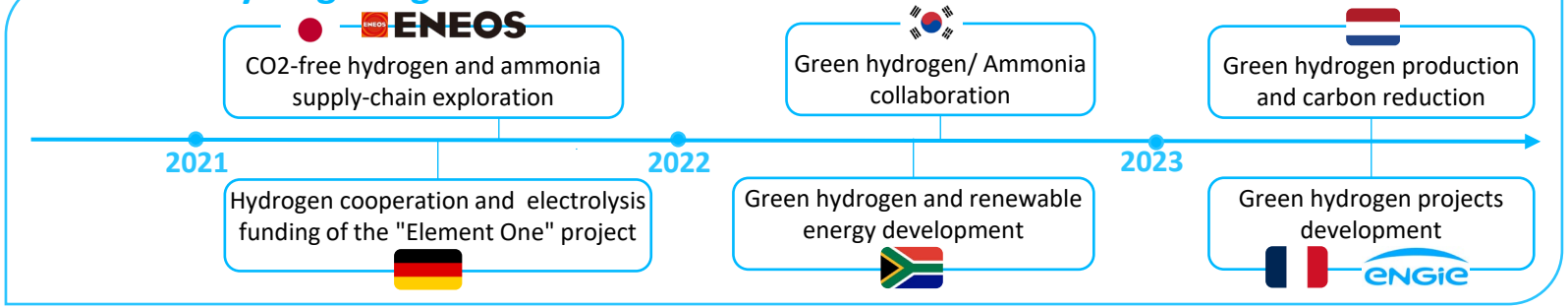
ACWA POWER أكوا باور

أرامكو السعودية saudi aramco

NEOM نيوم

سابك sabic

Bilateral hydrogen agreements*



Climate change goals and projects

- Saudi Arabia aims to reduce annual CO2 equivalent emissions **by 278 million tons by 2030** through a Circular Carbon Economy (CCE)
- The Kingdom is committed to the Global Methane Pledge, targeting a **30% reduction in global methane** emissions by 2030
- The country targets **50% renewable power and** plans to invest USD186.5 billion in renewable energy projects **by 2030**
- Saudi Arabia implements various emission reduction initiatives, including carbon capture programs

* Chosen in terms of announced capacity and/or investments if available

Sources: K&L Gates "The H2 Handbook Middle East" (2023), BMWK "Hydrogen cooperation potential between Saudi Arabia and Germany " (2021), Press Search

Hydrogen Factsheet – Egypt

Hydrogen Key projects*

- **Egypt-Siemens Green Hydrogen Pilot:** Egypt and Siemens collaborate on a pilot project for green hydrogen production
- **Fluxys, Antwerp Port and DEME's Green Hydrogen Production:** a project that will generate 700MW wind power and 800MW of solar energy to develop green hydrogen
- **Acme Group green hydrogen hub:** A project developed by ACME Group to develop green hydrogen with an investment of USD 13bn
- **ReNew Power Green Hydrogen Project:** an USD 8 bn project producing 220k tons of green hydrogen in the Suez Canal Economic Zone
- **AMEA Green Hydrogen Project:** AMEA Power will establish a 1,000 MW green hydrogen project, primarily focused on producing green ammonia for export
- **Egypt Green**: Fertiglobe, Scatec, Orascom, and the Sovereign Fund of Egypt develop a plant using 100 MW of renewable powered electrolyzes to produce green h2 and ammonia

Key Players

Scatec

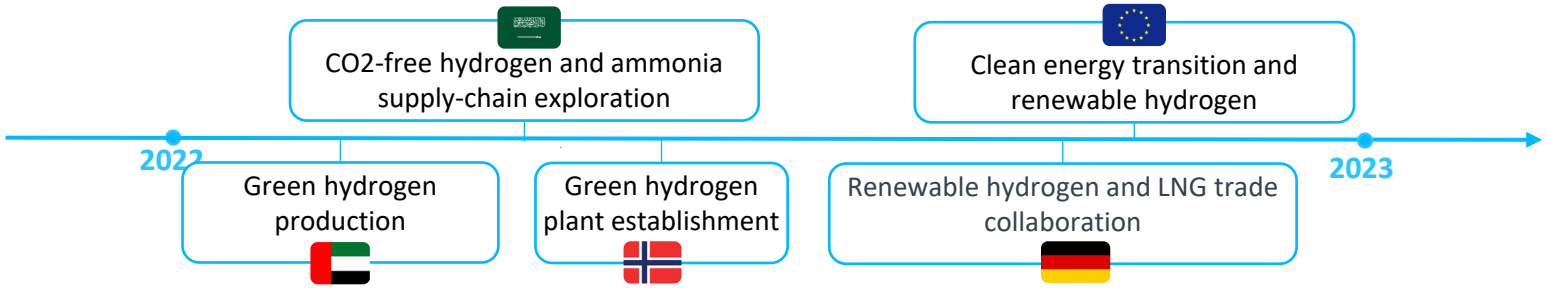
AMEA POWER

Africa · Middle-East · Asia

ReNew POWER

Fertiglobe

Bilateral hydrogen agreements*



Climate change goals and projects

- Egypt aims to **reach 42% renewable electricity in electricity supply by 2035**, with wind, hydro, and solar contributing 14%, 2%, and 25% respectively
- Energy interconnectors are established with Jordan (250 MW, expanding to 450-500 MW), Sudan (80 MW, expanding to 300 MW), Libya (200 MW), Cyprus and Greece **(two phases of 1000 MW each, totaling 2000 MW)** and in progress with Saudi Arabia
- Egypt pledged to reduce emissions by **33% in the electricity sector, 65% in the oil and gas sector, and 7% in the transportation sector** by 2030

* Chosen in terms of announced capacity and/or investments if available

Sources: K&L Gates "The H2 Handbook Middle East" (2023), Press Search

Hydrogen Factsheet – Qatar

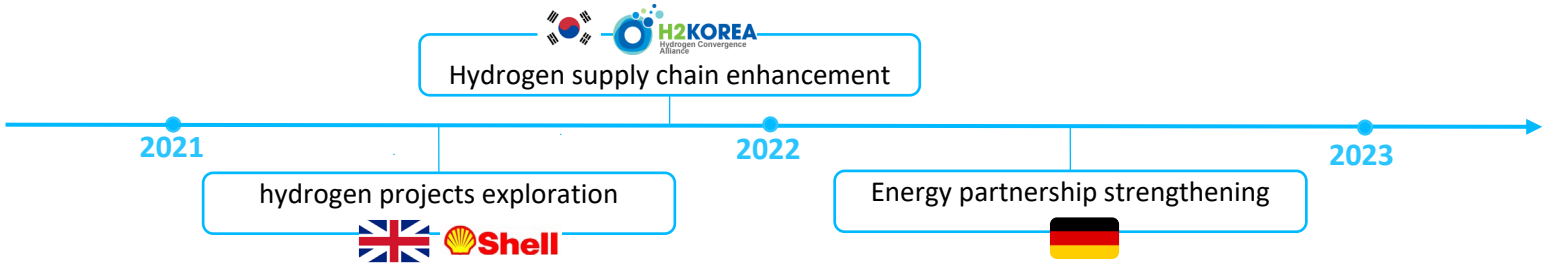
Hydrogen Key projects

- The Qatar Investment Authority (QIA) announced in May 2023, considering investing over **USD 1bn in a green hydrogen and ammonia project in the Suez Canal Economic Zone**
- The facility aims to produce green fuel for ships and export and to capture and **store 1.5 million tonnes of CO2 each year** through its manufacturing process. The specific details, **such as production capacity and timelines, are not yet available**

Key Players

قطر للطاقة
QatarEnergy

Bilateral hydrogen agreements*



Climate change goals and projects

- Qatar aims to **reduce GHG emissions by 25% by 2030** through measures such as flare and methane reduction and have allocated significant funds for this purpose
- By 2030, Qatar aims **to generate 20% of its electricity from renewable sources** and achieve a **carbon-neutral footprint by 2050**
- The government's goals include a **60% reduction in groundwater extraction** and implementing broader recycling and water efficiency measures
- The country has established a **Ministry for Environment and Climate Change**, rebranded **Qatar Petroleum to QatarEnergy**, and initiated investments in renewable energy, **including the launch of its first solar power plant**

Sources: K&L Gates “The H2 Handbook Middle East” (2023), Press Search

Bahrain and Kuwait are slowly embracing the hydrogen opportunity with recent announcements of projects and MoUs

Kuwait

- In January 2021, the Kuwait Foundation for the Advancement of Sciences (KFAS) published a **white paper on the Hydrogen Strategy**, outlining the groundwork for the Kuwait National Hydrogen Strategy (KNHS)
- Feasibility studies are underway for prominent **export projects targeting Asia** (Japan/South Korea) and **Europe** (Germany/Netherlands). Additionally, there are plans to engage with industry players involved in **blue hydrogen and ports that facilitate hydrogen trade routes**

Bahrain

- In July 2018, Bahrain and India signed a Memorandum of Understanding (MoU) to **collaborate on renewable energy initiatives**, including hydrogen
- In 2020, Nogaholding, Bahrain's investment and development arm for the oil and gas sector, signed an **MoU with Air Products** to **explore the potential of establishing a hydrogen economy** in the Kingdom
- In December 2021, plans were announced for a groundbreaking 4-MW green hydrogen plant in the region. The initial phase of the project, covering 20,000 sq meters of land, is projected to cost approximately USD 150 million

Sources: : K&L Gates “The H2 Handbook Middle East” (2021), GIZ “Hydrogen Factsheet GCC” (2022), Press Search

Conclusion

- Thanks to its abundant natural resources, strategic location, and strong political determination, the Middle East can **emerge as a major hydrogen export hub**, serving the EU, Japan, South Korea, and potentially India. However, to realize this potential, the region needs **to accelerate the deployment of renewables, electrolysers, and CCUS-integrated SMR units, along with implementing a clear policy roadmap and developing collaborations with EU/Asian governments**
- Moreover, the Middle East set **energy transition targets** that require them to **expand their energy generation beyond hydrocarbons**, necessitating the establishment of a policy roadmap and collaborations with EU governments, research bodies, and businesses
- To promote the hydrogen economy in the ME region, specific **hydrogen-focused legislation and regulatory frameworks**, with incentives for green hydrogen projects such as emissions schemes and financial support mechanisms, must be developed and implemented. This includes downstream **regulations for fuel cell vehicle manufacturing**
- To attract investment, governments should **allocate funds and create financing opportunities** for hydrogen projects and infrastructure. Encouraging **private equity investors and pension funds** can help address the liquidity shortfall. Advising especially **GCC sovereign wealth funds** to invest in the emerging hydrogen economy and making long-term investments in cross-border transport infrastructure are essential
- ME countries should focus on **developing integrated hubs combining green hydrogen and ammonia infrastructure** using both existing and new ports and industrial facilities. Creating a **regional demand for clean energy** produced locally will be beneficial. Moreover, developing **reliable and cost-effective storage solutions for renewables** can also lead to global export opportunities