HYDROGEN IN THE UAE

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OVERVIEW OF CURRENT PROJECTS

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Hydrogen is an exciting and dynamic industry in the UAE, with the construction of green hydrogen facilities already planned and underway. Examples of current projects include:

• Siemens Energy has collaborated with DEWA (the state electricity and water company of Dubai), to build the first solar-driven electrolysis hydrogen facility in the Middle East. The facility is designed to showcase the UAE's hydrogen potential at EXPO 2020 (taking place from October 2021) and will be used as a prototype for larger capacity facilities in the Middle East; and

• Masdar (the renewable energy arm of the Abu Dhabi sovereign wealth fund), have partnered with Siemens Energy, the Abu Dhabi Department of Energy, Etihad Airways, Lufthansa, Marubeni Corporation and the Abu Dhabi based Khalifa University to develop an electrolysis facility to produce green hydrogen for the transport industry. The consortium will initially test green hydrogen for road transport, whilst constructing a kerosene synthesis plant to convert the majority of it into sustainable aviation fuel. The second phase of the programme will explore decarbonisation in maritime fuel.

These are ambitious projects and the calibre of the partners that Dubai and Abu Dhabi are working with demonstrates their commitment to hydrogen and the potential of the hydrogen market in the UAE.

HYDROGEN STRATEGY IN THE UAE

There is currently no published hydrogen strategy for the UAE, and it is uncertain whether the UAE as a country, or any individual Emirate, will publish and implement one. It is of course not unusual in the Middle East for infrastructure and energy projects to proceed without a defined strategy and the absence of a such a strategy should not in itself be taken as indicating a lack of interest or enthusiasm.

In lieu of a specific and joined up hydrogen strategy, there are several individual initiatives being pursued that involve, to a greater or lesser extent, various hydrogen objectives:

- the Energy Strategy 2050, the wider renewable energy vision of the UAE;
- the UAE/German hydrogen study; and
- partnerships and programmes involving state companies.

Taking these in turn:

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Energy Strategy 2050

Energy Strategy 2050 was launched in 2017. The US$160bn strategy is the principal framework for renewable energy and wider sustainability initiatives in the UAE. Its goal is for 44% of the energy consumed in the UAE to be from renewable sources by 2050, with a further 38% from natural gas, reducing the carbon footprint of power generation by 70%. The hydrogen projects that we are seeing in the UAE are to help achieve these goals.

UAE German Hydrogen partnership

The UAE and Germany entered into an energy partnership in 2017 to promote dialogue and research on the transition to renewables and provide a framework for collaboration on individual elements of sustainable energy. Germany considers hydrogen to be an important tool to meet its commitments to the Paris accord (more detailed information on the German Hydrogen strategy can be found **here**) and sees the UAE's potential for hydrogen production. The basis of the cooperation between the countries is obvious; a hydrogen-hungry Germany and a UAE seeking diversification of its energy exports away from oil.

In January 2021, the countries released a study document entitled "*The Role of Hydrogen for the Energy Transition in the UAE and Germany*". The study is high level; however, it is interesting given official insights into the UAE's hydrogen strategy are rare. Whilst the study does not address policy, it does confirm:

- the UAE will transition from grey hydrogen to blue and then green hydrogen;
- the UAE sees hydrogen as an important economic export;
- green hydrogen may be used internally in the UAE for steel making and power-to-chemicals; and
- a solution to the challenges of transporting pure hydrogen needs to be developed.

The study states the benefits of "*revenue potentials for countries with good production potentials (like the UAE) and cost savings for importers (like Germany)*". This proposed model could be rolled out to, and form the basis of, similar relationships with other European countries. Many of Europe's larger economies have built hydrogen strategies based upon hydrogen imports and the oscillations of seasonal energy demand provide similar challenges for many European nations.

Partnerships and programmes involving state companies

Abu Dhabi Hydrogen Alliance

ADNOC (the state oil company of Abu Dhabi), Mubadala and ADQ (all significant Abu Dhabi state-owned entities) signed an MoU to create the Abu Dhabi Hydrogen Alliance, a collaboration to establish Abu Dhabi as a leader in green and blue hydrogen in emerging international markets. The alliance will develop a roadmap to accelerate the use of hydrogen in major state sectors. It is also significant given that the activities of the constituent companies cover the potential utility and lifecycle of hydrogen, from production to transport to end-use. The alliance epitomises the convergence of the UAE's fossil fuel industry (through ADNOC, which brings decades of experience of handling hydrogen as well as carbon capture and sequestration) and clean energy sector (through Mubadala-owned Masdar and ADQ, which intends to leverage and transform the activities of its extensive portfolio of companies in renewable and nuclear power, chemicals, metals, manufacturing, transport and logistics sectors). Each of the members therefore adds value to the alliance by bringing its own experience and expertise.

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DEWA

DEWA has confirmed it is developing a hydrogen "roadmap", however there is currently no information as to what this will entail.

Integration of Hydrogen strategy with existing energy markets

As highlighted by the UAE/German hydrogen study, Abu Dhabi (in particular) sees hydrogen as being an economic, rather than an energy, diversification. This is driven by:

• the maturity of solar as an energy source – with ample space for the construction of mega solar farms, and high irradiance during the summer months (when energy is required for cooling in the UAE), solar is expected to provide the bulk of the UAE's 44% by 2050 renewable goal, limiting the need for hydrogen as a domestic energy source; and

• Abu Dhabi's historical dependency on oil exports – which consistently made up around half of the UAE's annual exports during the previous decade. The UAE's need to pursue a diversified economy is emphasised by diminished oil demand caused by the proliferation of sustainability targets and the volatile price of oil. The UAE will expect to leverage its existing capabilities in the oil industry to boost its hydrogen capability, with the strategic location of the country and its established energy markets aiding the development of hydrogen exports.

Blue is the colour…for now…

The CEO of ADNOC recently told Abu Dhabi Sustainability Week that the UAE could be "*one of the lowest cost and largest producers of blue hydrogen in the world*".

The UAE, predominately through ADNOC and Emirates Steel, already has mature carbon capture, use and storage capabilities. The "capture" and "use" elements of which involve capturing CO_2 from the flue gas of a steelworks, to use in enhanced oil recovery techniques (fundamentally the process of injecting water and CO_2 into a maturing well, to eke out stubborn reserves).

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Given these established technologies, the UAE's abundant natural gas reserves and the fact that requirements for green hydrogen are still to be determined, it is expected that blue hydrogen will be the predominant hydrogen produced in the country for the medium to long-term future.

The UAE's (and wider GCC's) broader plans are for green hydrogen production and transportation, though this requires a number of strategic matters to be further considered and developed, including:

- developing capabilities to produce green hydrogen at scale and at the lowest possible cost;
- increasing green ammonia production;
- focussing on implementing cracking* in core export destinations (*the process by which green hydrogen, converted to green ammonia during transport, is then converted back to gaseous hydrogen at the destination); and
- developing integrated hubs that combine green hydrogen and ammonia infrastructure.

THE IMPACT OF HYDROGEN INITIATIVES ON THE UAE'S ENERGY, TRANSPORT AND INFRASTRUCTURE SECTORS

"We expect that hydrogen will principally be exported from the UAE, rather than used as a domestic fuel source."

Energy

We expect that hydrogen will principally be exported from the UAE, rather than used as a domestic fuel source. As stated above, the 44% clean energy target by 2050 will be met substantially by solar – whilst the highest months of irradiance are well matched to grid demands in the UAE, the country is located within the sun-belt, therefore excess power can be generated during the winter months, when electricity demands for cooling abate. A sensible application for the energy sector would be to use excess power generated during the winter to power electrolysis plants.

Transport

The police force of Abu Dhabi and the Dubai Taxi Corporation are both currently testing fuel cell electric vehicles (FCEVs), with Abu Dhabi police committing to converting its fleet to FCEVs by 2057. Draft legislation for electric vehicles is in place in the UAE.

"Aviation provides the most ambitious opportunity for the UAE to revolutionise the hydrogen market for transport."

Aviation provides the most ambitious opportunity for the UAE to revolutionise the hydrogen market for transport. Whilst the technology may be decades away from commercial use, the Masdar/Etihad/Khalifa University research is a fascinating development (see **here** for more information).

Infrastructure

Ports and terminals

A hydrogen economy will necessitate new infrastructure, including hydrogen terminals at ports and new pipelines. The UAE has decades of experience in energy and transport infrastructure, and should be well placed to meet the needs of the hydrogen market as it grows. However, a lack of a framework or supporting legislation may deter private finance, given the planning complexities associated with infrastructure construction.

Fuelling Stations

The UAE (and Dubai in particular) has a rare combination of a dense population and high car ownership, which provides fertile ground to explore the commercial feasibility of hydrogen refuelling stations. The 3,000,000 residents of Dubai live in an area of 1,500 sq miles, and are serviced by a handful of major roads, meaning relatively few fuelling stations would be needed to create adequate refuelling coverage (Air Liquide have estimated this could be as few as 12 stations across the entire UAE).

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COMPETITIVE ADVANTAGE OF THE UAE

There are a number of prevailing factors which give the UAE a competitive advantage and should allow it to become a regional and international hub for hydrogen production:

- its geographic location provides it with a unique opportunity to serve trade routes to the East and West;
- abundance of space;
- low cost of solar resources;
- economic benefit of replacing future shortfalls in oil revenues with hydrocarbon export revenues; and
- existing intellectual and physical infrastructure which can be repurposed.

SUMMARY

The UAE's ambition and early accomplishments in hydrogen are impressive. Whilst significant commercial production of green hydrogen is perhaps distant, the UAE is well placed to scale-up the production of blue hydrogen and therefore substantially decarbonise the hydrogen industry.

Hydrogen has the potential to be a significant trade and diplomatic tool for the UAE, however questions over the large-scale transportation of hydrogen remain, and could prove a bottleneck for exports.

It remains to be seen whether the UAE will develop a specific hydrogen strategy.

This is the final article in our 'Hydrogen – What is the hype about?' series, which provides an overview of the hydrogen sector and the strategy for its development in multiple jurisdictions. To read other articles in the series please click here.

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