



# WHITEPAPER

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## **HYDROGEN IN THE 2020s How can Fossil Fuel Operators Align with Clean Hydrogen Markets to Support Net Zero?**



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# Hydrogen in the 2020s: How can Fossil Fuel Operators Align with Clean Hydrogen Markets to Support Net Zero?

## Source

This White Paper highlights the key takeaways made by high-level energy executives at a roundtable hosted by Sharjah National Oil Corporation in Abu Dhabi in November 2021. Leaders across national oil companies (NOCs), international energy companies and their partners openly discussed the critical question: "How can Fossil Fuel Operators Align with Clean Hydrogen Markets to Support Net Zero?"

**The global energy industry faces many disruptions, powered by technological advancements, market instabilities, international policies and growing populations that demand commitment to climate action and sustainable development objectives.**

**A**s economies continue to grow, how can countries best diversify their energy mix towards a net zero future, while at the same time ensuring energy security and affordability? Should they pursue clean coal, nuclear power or renewable resources? How important is R&D and the advent of new technology? What about addressing state subsidies that risk the frittering of cheap state energy?

Many argue that an inclusive energy mix is not possible without the inclusion of sustainable strategies within existing business models. Declining renewable electricity costs and digital technologies are driving a more widespread adoption of renewable sources for power generation but they still only account for a quarter of global power generation, short of the estimated 85% share required by 2050 to comply with climate objectives. Will oil and gas continue to play a prominent role in the energy mix? And how can NOCs and IOCs in the Middle East – and beyond – transition while enabling the inclusion of low-carbon resources?

Hydrogen is one of the solutions being put forward. More than 30 countries worldwide have unveiled hydrogen roadmaps, with 228 large-scale hydrogen projects announced across the value chain. Of those, 85% are in Europe, Asia, and Australia. If all the projects come to fruition, total investments will exceed \$300 billion in spending through 2030.<sup>1</sup> The Middle East, home to some of the world's biggest oil and gas companies, is on an ambitious hydrogen track. The UAE's Mubadala, ADNOC, and ADQ created the Abu



**“Infrastructure and distribution remain a challenge. Certain gas networks in Europe have run up to 20% of their capacity with hydrogen to date, but immediate solutions to expand the user base must be found if hydrogen is to take off in the numbers required for it to be commercial.”**

Dhabi Hydrogen Alliance in 2021, aimed at establishing the country as a leader in low-carbon green and blue hydrogen in emerging and international markets. Saudi Aramco has signed an MOU with Japan's ENEOS to develop a new hydrogen and ammonia supply chain, and Oman's Green H Project at Duqm will supply Germany's Uniper with ammonia. Many other such agreements and alliances continue to be built by producers in the region.

## MORE, BETTER, FASTER

As things stand, hydrogen is forecast to be only 5% of the total global energy mix by 2050.<sup>2</sup> That is not enough, and while hydrogen will never be a direct substitute for fossil fuels, it doesn't mean to say that operators cannot leverage their experience to also become significant producers of what's being dubbed as the 'fuel of the future'. It is essential that the fossil fuel industry drives a hydrogen agenda. Energy

transition efforts by major oil and gas companies into offshore wind, solar power, and electric vehicles are all good efforts to develop low carbon businesses but it has also been a challenge for them as other companies have already built supply in that space. The energy transition to renewables still requires massive investment in infrastructure to make grids fit for enabling offshore wind and solar to reach demand centers.

## BLUE HYDROGEN IS THE WAY TO GO

Gas, on the other hand, is very much the core business of the oil and gas industry, and so places blue hydrogen as a much better fit to develop than wind or solar. Gas is available, predictable, transmissible and can be stored. Gas networks can gradually be converted to accommodate hydrogen. Already developed processes in carbon capture and storage can also be brought in. Combining the CO<sub>2</sub> with hydrogen to produce synthetic fuels would provide a good alternative to aviation fuels, for example. Marine fuels is another compatible area with the existing oil and gas infrastructure that can be developed. These are all important windows of opportunity for the oil and gas industry to grab. Particularly NOCs that need to make the most of the value of their oil and gas resources within a global climate-compatible future. NOCs are also able to leverage long-standing relationships with customers such as Japan, Europe and South Korea to supply blue hydrogen products.

## ECONOMICS REMAINS MAIN DRIVER

Shifting from a world where oil is providing a high quality of life at a reasonable price to something that is more sustainable will take time. Economics will continue to be the main driver and hydrogen has proved that it can be a safe and stable fuel. The technology – whether for green, blue or grey – has also been proven. The biggest challenges, however, remain cost and scale. Grey hydrogen can be produced for a little above \$1/kg, and blue hydrogen for about \$1.50-\$2/kg as the technology capability and feedstock can already be deployed on a large-scale. However, green hydrogen today can only be produced at multiples of these costs. For hydrogen to become more economically viable over time, we must change some of the traditional methods of how we build, design, and execute projects. Green hydrogen also requires cheap electrical power and therefore much more investment and R&D on

**“To make enough green hydrogen to satisfy global energy demand today, excluding power, we would need four times the total existing power generation produced in the world today.”**

technology and system designs. Its viability is unlikely to come to fruition for another decade.

## STEP-BY-STEP AND REDUCE COSTS

That said, cost should not act as a deterrent to investment. As an example, when the UAE embarked on its renewables journey in 2006, high development costs, an uncertain supply chain, and intermittency issues meant that there was no economic case for implementing independent power-producer projects with solar PV. The country started by building a handful of pilot projects to learn from, and once costs could be reduced with new technology, it embarked on larger projects. A decade later, renewables are undercutting prices in conventional energy, and the UAE is now home to 1.3GW of operating renewable energy capacity, and today constructing the world's largest single-site solar PV plant in Al-Dhafra.<sup>3</sup> There's no reason why the same can't be done for hydrogen. A country like the UAE can make a success of blue ammonia for export. It has the experience, network of buyers, exporting facilities, carbon capture know-how and established shipping facilities. As a longer-term goal, it can aim to be an early mover in green hydrogen and green ammonia production, catering to demand centers in Asia and Europe.

## EUROPEAN MARKET FOR REGIONAL HYDROGEN?

External demand is important to advance hydrogen production in the region. There is a big market for hydrogen and blue ammonia in Europe's steel industry for example – very

large players who need hundreds of thousands of tons of hydrogen. And while green hydrogen and ammonia offer European countries the most hypothetically viable clean energy alternative compared to imported fossil fuels or nuclear energy, supply chains are relatively untested and we still need major investment in infrastructure and rapid capacity build-up in the Middle East & North Africa, along with a secure pipeline of off-taker agreements. There's also the question around how and when storage systems will become economically viable.

## BALANCE INVESTMENT TOWARDS NET-ZERO

It is not realistic to rely on hydrogen alone to achieve net zero goals. The level of understanding around it is yet to mature with regulatory frameworks and certification to be figured out. And a clear dialogue between government and industry is still lacking. The oil and gas sector needs to balance its investments between conventional and green energy until the latter is 100% ready and becomes affordable. The end goal of reaching net zero is clear but the path to get there is not as predictable. Will customers in future prefer a battery truck or a hydrogen truck? What works for one company or country may not work for another. Some countries are in a position to phase off electricity and water subsidies and curb consumption and waste. Others have rolled out policies on electric vehicles, waste energy, and green building standards. The pressure is on to cut carbon emissions, but it must be done in a measured way.

**75%**

Fall in cost of solar PV electricity between 2009 and 2018. Price per unit of wind power dropped 50% in the same period (IRENA).

**25%**

Share of renewables in global power generation (IRENA).

**\$1.2trn**

Investment required by 2030 to put hydrogen sector on net zero path (IEA).

**\$2/kg**

Benchmark cost of green hydrogen by 2030 if hydrogen industry scales up. \$1/kg could be achieved in certain parts of the world by 2050.

<sup>1</sup> Hydrogen Council <sup>2</sup> DNV Outlook 2021 Report <sup>3</sup> BNP Paribas



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