Achieving Net Zero With Hydrogen

July - 2021

Webinar Series
Whitepaper

The Al-Attiyah Foundation

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INTRODUCTION

ACHIEVING NET ZERO WITH HYDROGEN

To continue delivering interactive content during the COVID-19 pandemic, the foundation started a webinar series in partnership with Refinitiv. In the series, internationally renowned experts offer their unrivalled knowledge and opinions as we discuss key trends in the energy industry, and debate the need to transition to cleaner resources.

Webinar Series

H.E. Abdullah Bin Hamad Al-Attiyah founded the Foundation as a platform for knowledge exchange and support for the global community in the quest towards a sustainable energy future. The Webinar Series, which have been hosted in Qatar for two years, are a crucial networking and learning opportunity in the calendar of industry CEOs, Members, and Foundation Partners.

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The foundation's most recent webinar explores how hydrogen could accelerate the world's journey toward net-zero carbon emissions and the obstacles that must be overcome for it to replace fossil fuels in "hard-to-abate" sectors such as transportation, power aluminium, concrete and steelmaking (which all require high temperature process heat).

An area where hydrogen may be used is transportation. Transportation accounts for nearly a quarter of energy-related carbon dioxide emissions, according to the International Energy Agency (IEA).

So-called green hydrogen, which is produced via the electrolysis of water, where the electricity is provided by renewable electricity, offers a long-term, environmentally friendly alternative to fossil fuels in many chemical and industrial processes and could be key to decarbonising the global economy. However, most of the 70 million tonnes of hydrogen manufactured worldwide in 2019 was made through steam reforming, a carbon-intensive process based on natural gas.

Cleaner alternatives for manufacturing green hydrogen are possible. Saudi Arabia's $5 billion NEOM green hydrogen project will be the world's largest, producing 650 tonnes of hydrogen daily when production starts in 2025. The kingdom's vast renewable energy resources (chiefly solar) make such a project possible, and it will produce the cheapest green hydrogen to date. But production costs are still expected to be considerably higher than "brown" hydrogen made by steam reforming methane.

Jeffrey McDonald, Hydrogen Pricing & Content Specialist, S&P Global Platts.

Therefore, many experts urge policymakers to also prioritise "blue" hydrogen, which uses carbon capture and storage (CCS) to prevent carbon dioxide produced in the steam reforming process from entering the atmosphere.

Hydrogen demand has grown threefold since 1975, according to the International Energy Agency (IEA). Today, there are around 50 targets, mandates, and policy incentives in place that directly support hydrogen. Therefore, world interest and activity on hydrogen, while at an early stage, is high.

The annual carbon emissions from conventional "grey" hydrogen production from the refining industry are also high, and equal to the total of emissions from Indonesia and Britain combined.

"Cleaning up those processes would create a significant dent in CO2 emissions," said Jeffrey McDonald, citing IEA estimates.

According to his firm, S&P Global Platts, the refining sector uses more than 35 million tonnes of hydrogen annually – around half

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of global production – and will increase its consumption to 40 million tonnes by 2025. Mr McDonald also forecasts that green hydrogen production capacity could increase by up to 1 million tonnes per year over the next five years, while blue hydrogen production could increase by the same amount over the same timeframe.

As well as its use in industrial processes and to power transport (via fuel cells or directly), hydrogen could also store excess energy produced via renewable energy resources such as solar and wind. This energy can then be consumed at night or when there is little wind, solving renewables' problem of intermittency.

Martin O'Neill, Vice President, Product Management at GE Gas Power & Head of GE's Center for Decarbonisation.

Ongoing deliberations over the "colour" of hydrogen – whether grey, blue or green – is stymieing the development of a large-scale hydrogen industry, panellists warned.

"Despite all its great potential, there's a chance that hydrogen markets could fail to materialise. The current thinking around pathways and obsession with colours could potentially fracture markets and keep them from getting off the ground," said Mr McDonald. Instead, hydrogen should be graded according to its carbon intensity, with certification independently audited and based on the carbon emitted in producing one kilogram of hydrogen, he continued.

Another major factor slowing the development of a global hydrogen industry is the lack of buyers (off-takers for the gas). More demand is required in order to expand capacity, said Martin O'Neill. For example, there are about 7,000 GE gas turbines in use today. If just four of the largest of these turbines were powered by hydrogen that would consume one million tonnes of hydrogen annually – or about one-seventieth of global hydrogen production.

Mr O'Neill recommended increasing production of blue hydrogen in order to improve both output and costs while at the same time subsidising the construction of hydrogen infrastructure. He believes that even with subsidy, green hydrogen infrastructure has some way to go to be anywhere close to been economically viable compared with other forms of hydrogen production.

In March, a partnership of Australian and Japanese companies launched the Hydrogen Energy Supply Chain (HESC) pilot in Victoria's coal mining heartlands. This will make hydrogen from coal, deploying carbon capture and storage technology to place the resulting CO2 deep underground in exhausted gas fields. At full scale, the plant will make 225,000 tonnes of hydrogen annually, which will abate about 1.8 million tonnes of CO2 per year or the equivalent of emissions from 350,000 cars. "The carbon intensity of blue (hydrogen) is in fact close or even at parity with green hydrogen," said Mr O'Neill. "We need to have a much more balanced discussion about low-carbon hydrogen of any colour should be produced at scale if we really want to go after this."

Carbon capture and storage will enable production of hydrogen at scale, said Mr O'Neill, noting that hydrogen in any colour is significantly more expensive than natural gas in terms of units of heat. Even the most efficient green hydrogen will be 5-7 times more expensive than natural gas by calorific value. "Blue hydrogen will be the first domino to fall," he said.

Hydrogen was initially made via water electrolysis; it was only when natural gas became abundant that production switched to steam reforming. Electricity represents two-thirds of the cost of producing green hydrogen, with renewable electricity costs – especially solar – tumbling in recent years.

During the webinar the audience were given a poll to garner their opinions on issues surrounding the discussions at hand. The first poll asked what will make the biggest difference in enabling hydrogen technology to become more viable. Among audience members, 35% said making large-scale, centralised electrolysers, 35% said fuelling hydrogen into a fleet of fuel cell electric vehicles, and 29% said distributing the fuel from electrolysers to where hydrogen stations are located.

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Frank Wouters, Director, EU-GCC Clean Energy Technology Network

In response, Frank Wouters, remarked that "the way to get to a more cost competitive position is building it, and doing it."

"We've seen that with other technologies: the more you make, the cheaper it gets whether it's a mobile phone or a solar panel - an electrolyser isn't any different. The number one thing we have to do is build capacity and then we will get to cost competitiveness."

"What is often more difficult is the offtake – many people know where to make hydrogen and how much it will cost, but what then to do with it? Who is going to be your client, at what price point, and why? "In terms of getting this market going and getting to the scale that provides cost effectiveness, there's a role for governments to make that happen," Mr Wouters added.

Panellists noted that oil and gas companies (particularly the European ones) are transitioning to become energy companies and will have a big role in developing the hydrogen industry.

"Anyone involved in hydrocarbon extraction has the ability to put carbon in the ground and at the same time offset with carbon credits," said Mr O'Neill.

A second poll asked which area of the hydrogen economy governments should prioritise. Among audience members, 62.5% said hydrogen production, 21.9% opted for storage and 12.5% chose transport.

Hydrogen could prove to be the ultimate renewable, carbon-free energy resource that enables us to limit global temperature the increases. However, as panellists warned, creating a viable global hydrogen market will require the public and private sectors to co-invest and collaborate.

WEBINAR SPEAKERS

Moderator:

Stephen Cole, Host & Executive Producer, The Agenda.

Speaker:

Jeffrey McDonald, Hydrogen Pricing & Content Specialist, S&P Global Platts.

Speaker:

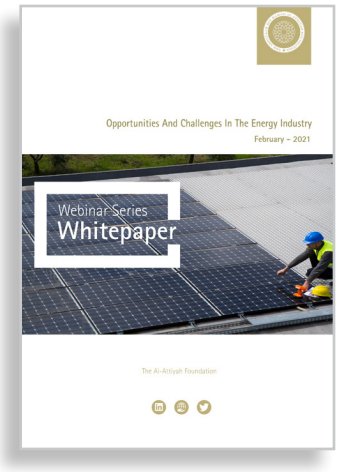
Martin O'Neill, Vice President, Product Management at GE Gas Power & Head of GE's Center for Decarbonisation.

Speaker:

Frank Wouters, Director, EU-GCC Clean Energy Technology Network.

PAST ISSUES

Have you missed a previous issue? All past issues of The Al-Attiyah Foundation's Research Series, both Energy and Sustainability Development, can be found on the Foundation's website at www.abhafoundation.org/publications



February – 2021
Opportunities And Challenges In The Energy Industry

In 2020 and continuing into 2021, the Al-Attiyah Foundation hosted a webinar series, in partnership with Refinitiv, to explore key trends and insights, in the wake of the continuing impact of the coronavirus pandemic on the energy industry, and the increasing debate on the need to transition to renewable energy.

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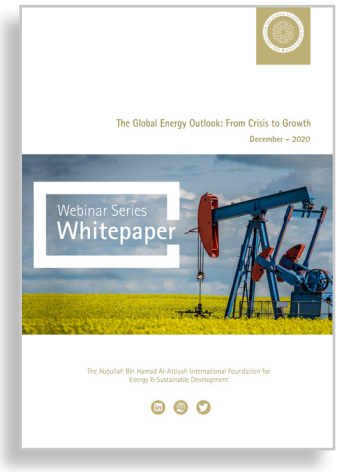

December – 2020
The Global Energy Outlook: From Crisis to Growth

The Al-Attiyah International Foundation for Energy and Sustainable Development, in partnership with the Financial Times, held a webinar on "The Global Energy Outlook: From Crisis to Growth", on Tuesday, 8 December 2020. The purpose of the webinar was to reflect upon the highs and lows of 2020, and what might unfold in 2021.

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November – 2020
LNG Market Road To Recovery

The Abdullah Bin Hamad Al-Attiyah Foundation for Energy and Sustainable Development provides robust and practical knowledge and insights on global energy and sustainable development topics, communicating these for the benefit of the Foundation's members and community.

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OUR PARTNERS

The Al-Attiyah Foundation collaborates with its partners on various projects and research within the themes of energy and sustainable development.

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