

# African Hydrogen Partnership to foster green hydrogen

Ian Fraser, MD of RTS Africa, talks about the establishment of the Africa Hydrogen Partnership (AHP), a group of like-minded organisations and companies with a common interest in developing and financing a green hydrogen economy across the African continent.



Delegates at the first African Green Hydrogen conference in Addis Ababa in February 2020, which culminated in the formal registration of the AHP in Mauritius in November 2020.

According to Ian Fraser of RTS Africa, the idea for an African hydrogen association began in 2014, when Siggie Huegemann, a German who resides in the UK, launched a Website, Twitter account and a daily blog. Vincent Oldenbroek, a Dutch citizen based in Harare, joined Huegemann in 2018. These gentlemen formed an unincorporated association to formally establish the organisation in Africa, renaming the initiative the African Hydrogen Partnership (AHP).

"The very successful cooperation of the two partners culminated in a first conference in Addis Ababa in February 2020, which was attended by interested parties from several countries in Africa, including South Africa, as well as people from Europe and Asia, with the objective of developing opportunities associated with trans-African green hydrogen hubs and routes between cities, ports and mining centres," begins Fraser.

Fuel cell-powered trucks and buses refuelling with green hydrogen from power-to-gas or power to hydrogen (P2G/P2H) stations along major highways offer African nations massive economic and environmental benefits. The African Hydrogen Partnership was set up as a development and financing forum to realise this hydrogen-based green energy vision across Africa with the (specific) aim of using hydrogen to replace diesel in commercial vehicles and generators and to provide

hydrogen for fertiliser production.

In the middle of 2020, Fraser along and Catherine Scholtz, two directors of RTS Africa Engineering, joined the unincorporated association. Together with Oldenbroek and Huegemann, they formally registered the AHP in Mauritius in November 2020, with RTS Africa Engineering and Hypowa as the first two member companies.

"The AHP will be open to new member applications in Q1 2021. There are already a surprising list of potential members who are interested in joining the Partnership in the coming year. I have been elected as Chairman of the AHP Board, and we hope to start establishing a wider membership from January 2021, so the constitution of the board will increase as more members join," says Fraser.

## Fuel cell technology and green hydrogen vehicles

Fraser sees the hydrogen fuel cell as an ideal core technology to power road vehicles of the future, especially large commercial vehicles. This technology enables on-board hydrogen fuel to be used in a fuel cell to generate electricity, which is used directly as required to create traction via electric motors. "The Toyota Mirai, the Honda Clarity and the Hyundai Nexo are all commercially available versions of hydrogen powered vehicles that depend on fuel-cell technology, which essentially replaces the battery in an electric vehicle. These

power units are very similar to so-called self-charging hybrid vehicles, with the self-charging combustion engine, charger and battery storage combination being replaced by a hydrogen fuel cell," he explains.

He says that hydrogen technology for vehicles is far more common than people think. Our principle, NEL Hydrogen, is now the largest manufacturer of hydrogen electrolyzers in the world and many of these are being used to establish hydrogen refuelling stations: in Norway, Germany, Korea, Japan and all over the world.

"This has to happen in Africa too. Apart from a few countries such as Nigeria, Angola and Algeria, most countries in Africa spend millions of dollars of their scarce foreign exchange resources importing fossil fuels. Renewable energy in the form of wind, solar and hydro power is abundant, and can be directly used via an electrolyser to generate hydrogen fuel from water – and hydrogen electrolyser-based refuelling stations can be directly coupled to onsite or nearby solar, wind or hydro electricity generation plants.

"This is a huge advantage. It removes the need to import, transport or refine fossil fuels. It makes so much sense. We are already getting close to equivalence in terms of the cost of hydrogen fuel, though the vehicles are still expensive. But this is a scale issue. If you look at the mobile phone market, the original Philips and Siemens 'car phones' cost R25 000 when they first emerged. A phone with the same capability as the one I first bought is available for around R500, today. That is a 50-fold decrease in cost," Fraser, points out.

Studies indicate that demand for only 1 000 hydrogen fuel cell trucks would bring the purchase price down to a similar level to that of traditional fossil fuel trucks – and since operating costs can be even lower, especially with low green hydrogen prices, profitable projects will be easy to identify," he adds.

Fraser emphasises that the advantages of hydrogen are already being recognised by some fleet operators in Africa. "An open-pit platinum mine in the Waterberg district of the Limpopo Province of South Africa is currently in the process of converting its big ore haulers to hydrogen power. We have now taken delivery of two electrolyzers to generate the onsite hydrogen needed and two trucks are being converted ready for a pilot that is set to begin in 2021. The electrolyzers will produce 350 Nm<sup>3</sup>/h each and ultimately, if successful, the aim is to convert the entire fleet to hydro-

gen in coming years," he tells *MechChem Africa*.

Citing another aspect, he says there are many diesel vehicles being used underground, so it makes total sense to convert these to less toxic and less polluting hydrogen power, which emits only water vapour into underground shafts. "A French company is already working in South Africa to convert diesel and other heavy vehicles to electrical drives powered by fuel cells, while NEL Hydrogen subcontracts to supply the electrolyzers that produce the hydrogen needed," he says.

## Hydrogen and safety

"If anyone came up with a new technology involving the use of petrol in the way we use it now, it would never be approved," Fraser argues.

Explaining why, he says cars are fitted with a thin-walled steel or even a plastic fuel tank. "The space above the liquid level in that tank has a perfect stoichiometric explosive mixture of petrol fumes, which if ignited, will destroy the tank instantaneously. The remaining petrol is in liquid form, so it spreads across the entire area as soon as the tank ruptures, setting everything around it aflame.

"Hydrogen, on the other hand, cannot ignite until mixed with oxygen. If a hydrogen tank is punctured, which is a difficult task since it is a pressure vessel and much stronger than a petrol tank, then, rather than explode, it will burn like a Roman candle, since only the exiting gas stream is in contact with oxygen in the air. The tank will not explode and, since the hydrogen is a volatile gas lighter than air, the flame does not tend to spread or ignite surrounding structures," he assures.

This, he says, has been demonstrated in Norway, where the fuel tanks of a petrol and hydrogen car were both punctured and set aflame. While a flare emerged from the hydrogen car, the car itself remained relatively undamaged and the flare died out when the hydrogen had been depleted. The entire petrol car, however, was aflame within one minute and was completely destroyed.

## Finance and the green bond market

Core to the increased use of hydrogen and the success of the AHP is finance. Participating African governments and companies need access to capital markets to raise funds for projects such as hydrogen truck and bus routes. "Green financial instruments are

now widely available from private and stock market investment sectors to fund environmental and/or climate change projects. Green Bonds, for example, first introduced by the European Investment Bank in 2007, are already providing low-cost, long-term source capital for green projects – and their use has doubled in value every year since their introduction 13 years ago.

"Green Bonds are ideal for African Hydrogen Partnership (AHP) programmes and the AHP aims to provide its members with financial support by developing efficient, standardised processes for accessing and issuing Green African Hydrogen Bonds," notes Fraser.

## Zero environmental impact

Ultimately, as a response to climate change and atmospheric pollution, the AHP sees hydrogen being used to power the massive numbers of trucks, buses and taxis on African roads and for transport all over Africa. "Using local renewable energy plants, we know that we can produce green hydrogen that does not produce any greenhouse gases whatsoever when used in a vehicle. This signals a path towards zero environmental impact for commercial transportation, which is a major objective of the AHP.

Africa has abundant renewable energy resources: lots of sunshine in many places, hydro opportunities in central Africa and many open spaces that are "astonishingly" windy, such as the middle of the Karoo, for example.

"There is also a massive export opportunity



The two co-founders of the African Hydrogen Partnership: Siegfried Huegemann, vice chairman, and Vincent Oldenbroek, secretary general.

to generate green hydrogen for use in Europe and places such as Japan. A novel pipeline project is already underway to take green hydrogen through the centre of an existing oil pipeline, from Morocco to Europe," Fraser informs *MechChem Africa*.

"The technology is also ideal for Africa's taxi industries. A green powered electrolyser refuelling station can be located at each local taxi rank, enabling onsite green hydrogen production and refuelling, with the costs and operational aspects such as fast refuelling being far more easily managed by taxi operators," Fraser says.

"The African Hydrogen Partnership is a serious and properly constructed initiative that really does offer a realistic way towards realising all of the advantages of the green hydrogen economy in Africa," he concludes. □



The AHP believes that fuel cell-powered trucks and buses refuelling with green hydrogen along major highways offer African nations massive economic and environmental benefits.



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+27 12 941 0600 | info@rtsafrica.co.za | www.rtsafrica.co.za

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