

HYDROGEN FUEL CELL TECHNOLOGY

WHAT IS IT?

WHY IS IT IMPORTANT?



Dr Moegamat Wafeeq Davids is a key technologist specialist working at HySA Systems at the University of the Western Cape on hydrogen technology.



Dr Moegamat Wafeeq Davids working on bench top XRD machine at HySA Systems.

Hydrogen fuel cell technology is fast emerging as a viable energy source in South Africa, and extensive focus is being placed on its deployment. NRF-SAASTA spoke to Dr Moegamat Wafeeq Davids from HySA Systems about hydrogen energy and what it means for the country.

WHAT EXACTLY IS HYDROGEN FUEL CELL TECHNOLOGY?

Hydrogen Fuel Cell Technology (HFCT) is not new. In 1839, a Welsh scientist, William Robert Grove, discovered hydrogen fuel cells. Still, it was only in the 1960s that the value of this technology was utilised by the National Aeronautics and Space Administration (NASA) to power probes, satellites and space capsules.

The science is complicated, but hydrogen is a major component of water, oil, natural gas and all living matter. In fact, hydrogen is one of the universe's simplest and most abundant elements.

A hydrogen fuel cell is a device that generates electricity through an electrochemical reaction. In a fuel cell, hydrogen and oxygen are combined to generate electricity, with heat and water as by-products. Today hydrogen fuel cells are used in several applications, and can provide power to households, businesses and hospitals. They are also used in the transportation industry to power cars, buses, trucks, trains, ships and forklifts.

WHY IS HYDROGEN FUEL CELL TECHNOLOGY IMPORTANT TO SOUTH AFRICA?

There are several compelling reasons, but three of the most important are:

- > Firstly, South Africa's ongoing energy crisis means that all potential energy sources need to be investigated to assist in bringing security and sustainability to the country's energy grid.
- > The second is the need for the country to replace traditional fossil-based (coal) energy with clean, green, renewable energy to reduce carbon emissions and fight climate change.
- > Thirdly, beneficiation of mineral resources will create jobs and wealth for the country as South Africa has vast mineral resources to produce fuel cell catalysts, which are the main component of hydrogen fuel cells.

IS IT TRUE THAT PLATINUM IS USED FOR THIS PROCESS?

Absolutely – yes! Platinum is used as a fuel cell catalyst that enables the hydrogen and oxygen reactions to take place at an optimal rate, but at the same time, is stable enough to withstand the complex chemical environment within a fuel cell. South Africa produces 80% of the world's platinum output and is, therefore in the ideal position to supply the platinum needed for the production of fuel cell catalysts for the conversion of chemical energy into electrical energy.

TELL US MORE ABOUT HYSA AND WHAT YOU DO THERE

HySA was initiated by the Department of Science and Innovation (DSI) in 2007 to develop South African intellectual property, knowledge, human resources, products, components and processes supporting hydrogen fuel cell technology. The overall goal of HySA is to develop and guide innovation along the hydrogen value chain, focusing on renewable energy.

I work at the HySA Systems situated at the University of the Western Cape as a Key Technology Specialist for hydrogen technology. My primary duties are researching and developing hydrogen-related technologies for the country's hydrogen and fuel cell programme.

WHAT MOTIVATED/INFLUENCED YOU TO CHOOSE THIS CAREER PATH?

I am passionate about solving complex problems, innovating and developing technologies that will make a difference in society. There is also a high demand for skilled professionals in science and engineering, which means many career opportunities are often available.

WHAT DOES A HIGH SCHOOL LEARNER NEED TO DO TO ACCESS A CAREER IN HYDROGEN FUEL CELL TECHNOLOGIES?

To study for a Bachelor of Science or engineering degree at university, you must have done mathematics and natural science during your high school career. What is also essential is at least a bachelor's pass in matric to qualify for entrance into undergraduate degree programmes at universities.

WHAT AND WHERE DID YOU STUDY?

All my studies were conducted at the University of the Western Cape. I completed my BSc degree in Chemical Science in 2005 and an Honours degree in Chemistry in 2006. I then went on to do my Master's Degree that, focused on Sustainable Energy Technologies, specifically electrode development. In 2009 I started my PhD that was carried out in collaboration with the

Institute for Energy Technology in Norway, which specialises in Hydrogen Storage Materials. I completed my PhD in 2012.

WHEN YOU STARTED YOUR STUDIES IN 2002, DID YOU KNOW THEN YOU WOULD BE A PART OF REVOLUTIONARY ENERGY SUPPLY IN SOUTH AFRICA?

No, my main focus during my undergraduate years was completing my studies and obtaining a good job. However, during my Honours degree, I started to work on some small projects related to hydrogen technology, which really interested me. This encouraged me to enrol for postgraduate studies focusing on hydrogen technology, and I have never looked back since!

WHAT ARE THE PROS AND CONS OF THE FIELD AS A CAREER?

Working in the hydrogen renewable energy field has positive and negative aspects, which is typical for most careers. A big positive is the contribution this career makes to sustainability, as it allows you to positively impact the environment through the development and use of clean, sustainable energy sources.

It also allows for innovation and personal growth since the hydrogen energy sector is still in its early stages and offers many opportunities for innovation and development, which can be exciting for professionals looking for new challenges and opportunities.

The main negative aspect of working in the hydrogen renewable energy field is that the hydrogen energy industry is still developing and is subject to fluctuations in funding and investment, which can create uncertainty for professionals in the field. ●



Dr Moegamat Wafeeq Davids working in high-pressure hydrogen lab for testing materials for hydrogen storage.