

# HYDROGEN AND FUEL CELL TECHNOLOGY: ALTERNATE SOLUTIONS FOR THE 21<sup>ST</sup> CENTURY

Hydrogen and fuel cell technology (HFCT) uses fuel cells to convert the stored chemical energy in hydrogen into electrical energy. Hydrogen is the simplest element and the most plentiful gas in the universe.



Hydrogen is used as an energy carrier that stores and delivers energy in a usable form. A fuel cell operates like a battery, but does not run down or require recharging, as long as the hydrogen is sourced from clean alternative energy sources such as wind or solar energy, it can reduce the country's dependence on importation of oil and reduce greenhouse gas emissions that cause global warming. This technology is seen as an energy solution for the 21<sup>st</sup> century. An innovation strategy named Hydrogen South Africa (HySA) was launched in 2008 by the Department of Science and Technology with the main objective being to supply at least 25% of the future global fuel cell market with locally developed Platinum Group Metals by 2020.

## TYPES OF CELLS

Different types of fuel cells can be used to produce quite small amounts of electric power for devices such as portable computers and radio transmitters, or large amounts for power stations.



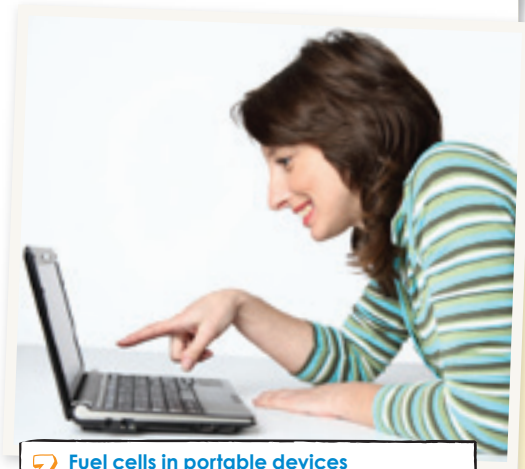
## APPLICATIONS OF FUEL CELLS

### 1 Fuel cells are very useful as power sources

Fuel cells are very useful as power sources in stationary applications for power supply or back-up power (e.g. in remote locations that are far from the electricity grid such as spacecraft applications, remote weather stations, nature reserves and camping sites, telecommunications in rural areas and certain military operations). A recent application is in micro-combined heat and power (CHP) generation for homes, office buildings and factories. A CHP system produces electricity and hot water, while the excess electricity produced can be sold back to the national grid.

### 2 Fuel cells in transportation

Fuel cells can also be used for transportation, for example in cars, buses, motorbikes, scooters, bicycles, utility vehicles and aircrafts. These cells emit less pollution as compared to internal combustion engines.



### 3 Fuel cells in portable devices

Fuel cells are used as power sources in small portable electronic devices such as laptops, digital cameras, video and audio recorders and cellular phones where alternating current (AC) charging may not be readily available.

## WHICH UNIVERSITY SHOULD YOU STUDY AT TO START A CAREER IN HFCT?

Several of South Africa's universities and science councils are already engaged in research on fuel cell technologies. Three Hydrogen Centres of Competence have been established at the following institutions:

- ✱ The University of the Western Cape (UWC) hosts Hydrogen South Africa (HySA) Systems Competence Centre. The main objective of this centre is to perform

technology validation and system integration in three key areas relevant to HFCT: (i) Combined heat and power (ii) Portable power, and (iii) Fuel cell vehicles.

- ✱ The HySA Catalysis Competence Centre, co-hosted by the University of Cape Town and the South Africa's Mineral Research Technology Organisation (MINTEK) is involved in research and development on

fuel-processor catalysts, mainly for hydrogen purification.

- ✱ The HySA Infrastructure Competence Centre, co-hosted by the North West University and the Council for Scientific and Industrial Research (CSIR) is developing technologies for hydrogen production, storage and distribution. These institutions have collaborative agreements with several SA universities

involved in research and development programmes in HFCT, including University of Witwatersrand, University of Johannesburg, University of Limpopo, Tshwane University of Technology, Nelson Mandela Metropolitan University and Stellenbosch University. Students can get involved in hydrogen and fuel cell research at the Competence Centres.

Students need to complete a BSc Engineering degree, BSc honours degree or a diploma in fields such as Physics, Chemistry, Applied Science or Material Science, Chemical or Mechanical Engineering, Electrical Engineering, Thermodynamics, Electronics or Metallurgy in order to study further for postgraduate degrees in this research field. Details about entry requirements can be obtained from the individual institutions.

### FOR MORE INFORMATION

Contact HySA Public Awareness Platform at the South African Agency for Science and Technology Advancement (SAASTA), on 012 392 9300 or [sharon@saasta.ac.za](mailto:sharon@saasta.ac.za) or visit [www.saasta.ac.za](http://www.saasta.ac.za) or [www.hydrogen.org.za](http://www.hydrogen.org.za)

