

# Leading the way for RENEWABLE ENERGY



HySA Infrastructure is pioneering the production and usage of renewable hydrogen in South Africa for fuel cell and energy storage applications.

**T**HOUGH IT MAY SEEM futuristic, the capability to turn renewable wind or solar energy into hydrogen for fuel cell applications and energy storage in South Africa has already been developed.

The HySA Infrastructure DST Center of Competence at North-West University (NWU) and the CSIR has taken the first groundbreaking steps towards developing innovative applications and solutions for hydrogen production, storage, and distribution in South Africa. This will enable the country to use its wealth of solar and platinum group metal resources to generate high-quality, cost-effective hydrogen from renewable energy sources.

## HOUSEHOLDS AND INDUSTRY CAN BENEFIT

In the meantime, HySA Infrastructure at NWU is powering ahead with plans to engage with industries such as power, mining, petrochemicals, telecommunications, glass, and food manufacturing. Renewable hydrogen can greatly benefit the telecommunications industry since it can compete very well with diesel generators, which need much more maintenance.

There is an even bigger market for hydrogen in the mining industry, which uses diesel underground and has issues with ventilation and toxic exhaust fumes. By using green hydrogen underground, mines could save on ventilation and



## CURRENT AND FUTURE PROJECTS

Selected current projects include:

- Liquid organic H<sub>2</sub> carrier (LOHC) storage is identified as the preferred H<sub>2</sub> storage technology after high-pressure compressed H<sub>2</sub> storage.
- High-pressure tube cylinders are to be installed at HySA Infrastructure facilities to increase H<sub>2</sub> storage capacity.
- Initial feasibility H<sub>2</sub> fuel cell technology development, demonstration, and

deployment for underground mining operation.

- A H<sub>2</sub> generation system is being commissioned to produce H<sub>2</sub> for tests in underground ventilation environments.
- A Phase 3 electrochemical H<sub>2</sub> compression system is under development.
- High-pressure electrochemical H<sub>2</sub> compressor cell under development for up to 700 bar(g).

Selected future projects include:

- A power-to-gas research platform for South Africa, which includes methanation processes, fuel cell vehicles and dual fuel H<sub>2</sub> applications.
- Closed-cycle combined heat and power 3 kW (electric), 15 kW (thermal) dual fuel micro gas-turbine to prove the concept of mixing H<sub>2</sub> produced from renewable sources with natural gas to increase efficiency and reduce CO<sub>2</sub> emissions of South Africa's gas turbines.

**OPPOSITE PAGE** HySA Infrastructure facilities at North-West University

**RIGHT** HySA Infrastructure facilities at CSIR

**BELOW RIGHT** Compressor



## TRAINING AND SEMINARS

The following topics for training courses and seminars are offered:

- H<sub>2</sub> production technologies
- renewable energies for H<sub>2</sub> production
- H<sub>2</sub> as a storage medium and H<sub>2</sub> storage and compression technologies
- power-to-gas applications
- fuel cells in underground mining applications
- fuel cell mobility
- hands-on training of fuel cell operation and testing.

## SELECTED SERVICES

- ▶ Perform fuel-cell testing for the telecommunication, mobility and stationary power applications. Consultation on fuel-cell-powered vehicle development and conversions in collaboration with the North-West University's mobility research group famous for its award-winning solar-powered car. Consultation on MEA and CCM development for automotive fuel cell applications.
- ▶ Expertise at the renewable-to-H<sub>2</sub> project department at HySA Infrastructure includes:
  - 35 years' combined experience in sizing, design, and commissioning PEM-based H<sub>2</sub> production systems using renewable energy
  - renewable H<sub>2</sub> production system simulation and optimisation tool
  - experience and relationship with several PEM-based H<sub>2</sub> generator and fuel cell OEMs.

there would be no toxic exhaust. Over and above industries that already use hydrogen, new potential applications abound, such as in rural electrification in South Africa.

## HUMAN CAPITAL

HySA Infrastructure has developed a critical mass of human capital. It has a strong team of engineers, scientists and students who all know the technology and can look at improving its efficiency.

## FACILITIES AND CAPABILITIES

HySA Infrastructure offices and facilities of more than 1 000 m<sup>2</sup> are located on the Potchefstroom campus of NWU, as well as more than 400 m<sup>2</sup> at CSIR. **35**



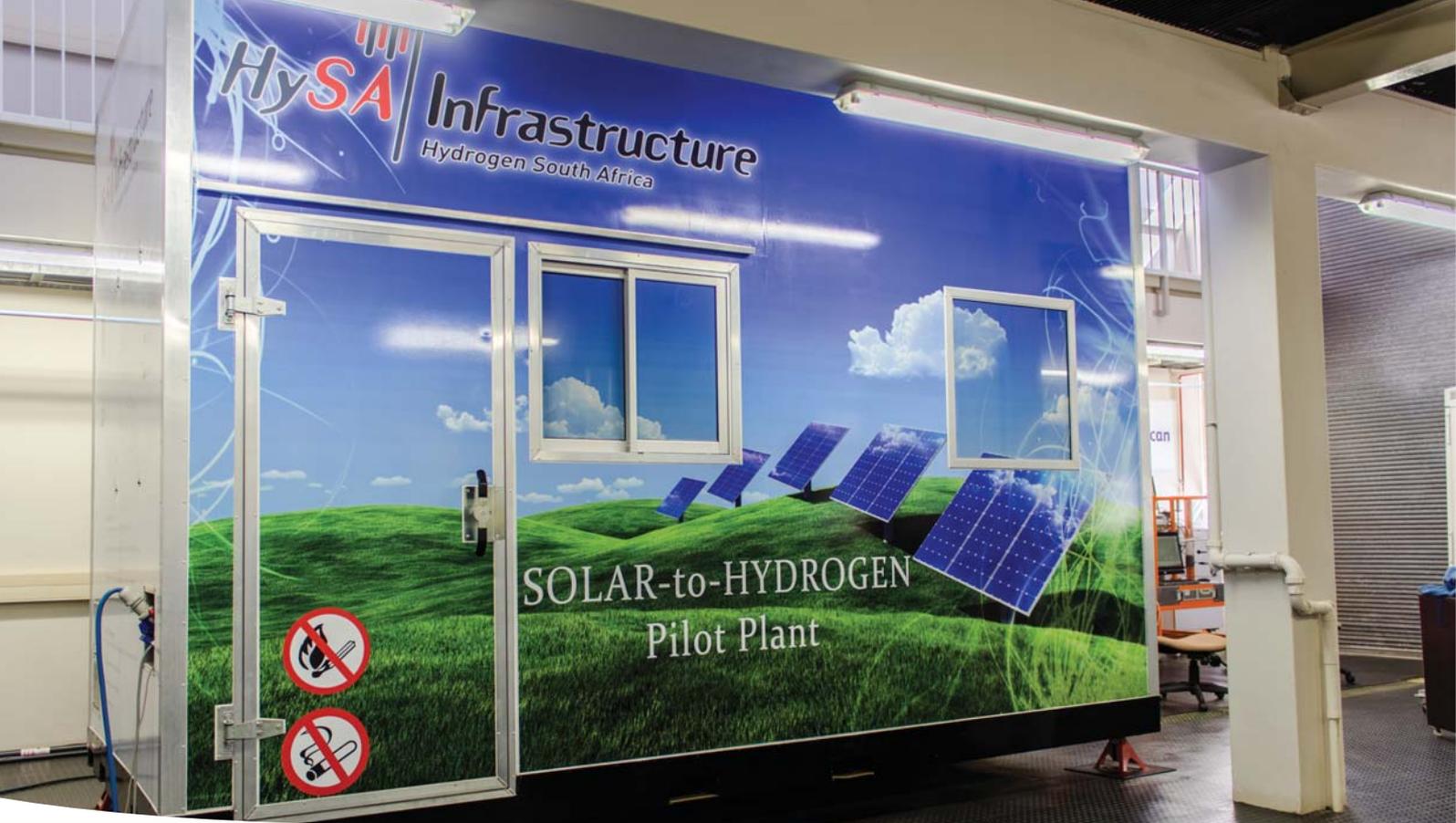
## PRODUCTS

The following products are available for order:

- laboratory-scale photovoltaic, wind turbine, electrolyser, and fuel-cell educational demonstration kits
- small electrochemical H<sub>2</sub> compressor demonstrators limited to 20 bar(g)
- larger-scale electrochemical H<sub>2</sub> compressors capable of pressurising 34.2 NI/h of H<sub>2</sub> up to 150 bar(g)
- PEM-based H<sub>2</sub> production systems for remote operation
- technology development matrix for fuel cell components.

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# HySA Infrastructure

Hydrogen South Africa

Renewable energy is becoming a vital component in the energy portfolio of many countries worldwide and hydrogen is one of the best options to store renewable energy. The HySA Infrastructure DST Center of Competence at NWU and the CSIR is a leading developer of related technologies in South Africa and HySA is also becoming a world leader in selected hydrogen and fuel cell applications. HySA Infrastructure's mission is to deliver technologies for hydrogen production (linked to renewable energy), storage and distribution. HySA Infrastructure develops applications and solutions for hydrogen production to be used in fuel cells and energy storage applications through innovative research and development.

Along with these goals, HySA Infrastructure is a leading developer of related supply chains and businesses in South Africa and internationally.

The overall aim is to become a significant player in renewable hydrogen production and storage research and development, leading to the development, advanced manufacturing and application of new products, hydrogen storage materials and processes that improve the competitiveness of the South African energy sector and the quality of life for all South Africans.

Future Hydrogen "HYWAY" is brought to you by Hydrogen South Africa (HySA) Infrastructure.

[www.hysainfrastructure.org](http://www.hysainfrastructure.org)