Hydrogen South Africa: A National Initiative Towards a Knowledge Driven Economy

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Presentation Outline

- Policy Framework
- HySA Programme Implementation
- Examples of Technology Deployments
- Way forward & Opportunities for Partnerships

Guiding Policy Frameworks

- National Development Plan
  - Investments in *energy infrastructure*
  - Affordable *tariffs* for needy households
  - *Diversify* energy resources and supply options
- National Climate Change Response Strategy
  - Long Term Mitigation Scenarios (Peak, Plateau and Decline)
- Industrial Policy Action Plan
  - Re-industrialisation
  - Support for local beneficiation of SA resource base
  - Local manufacturing
- Energy Act (IEP and IRP)
  - Universal access to *modern forms* of energy services
  - Energy security through guaranteed supply
  - Optimal usage of economically *viable energy resources*
  - Addressing constraints on the development of the renewable industry.
- Minerals Beneficiation Strategy
  - Local value addition to SA's mineral resources.

Guiding Policy Frameworks, cont.

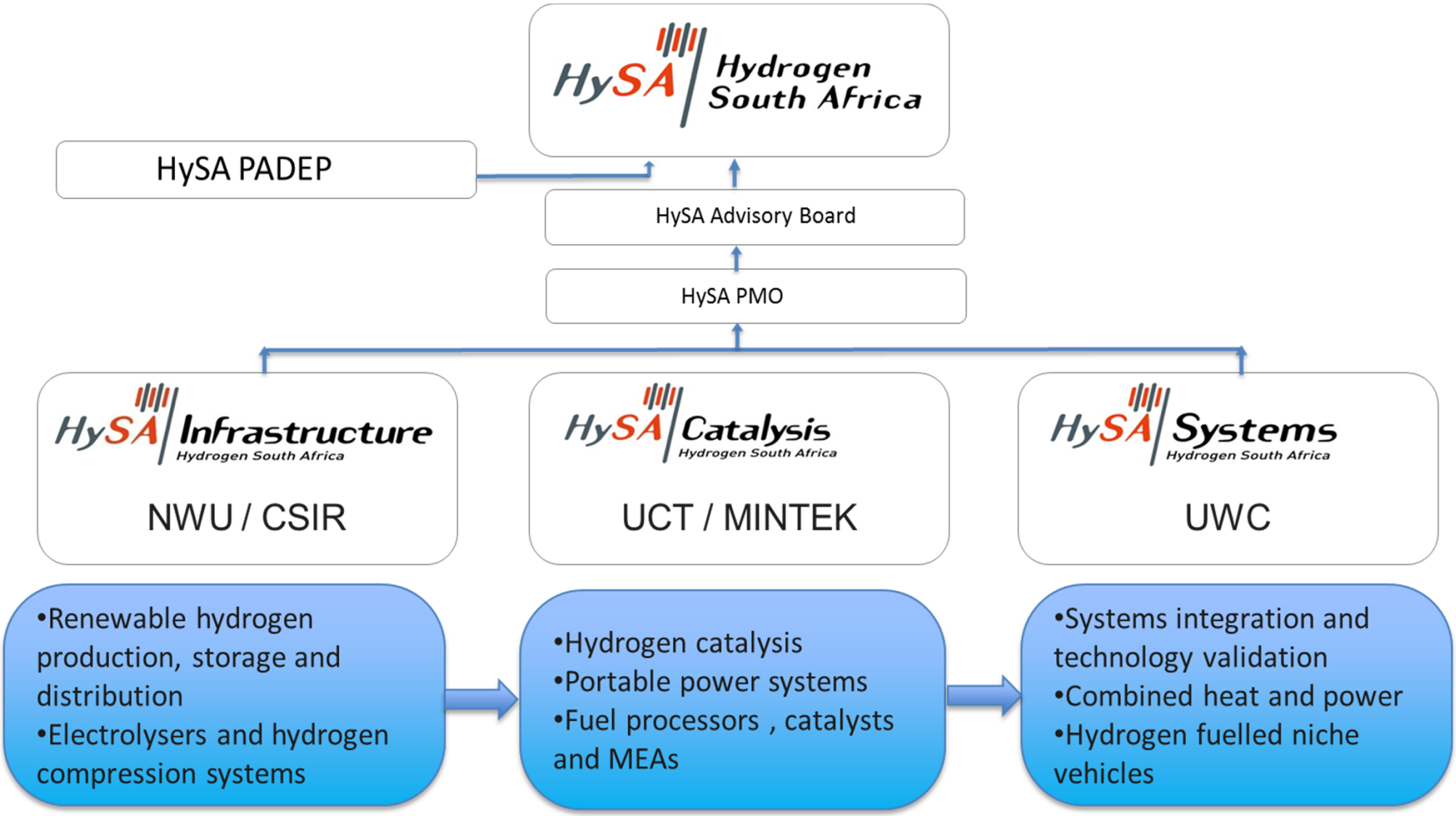
Policy Initiatives:

- Draft White Paper on Science, Technology and Innovation released in October 2018
- Green Transport Strategy approved by Cabinet

DST role

- To provide leadership, an enabling environment, and resources for science, technology and innovation in support of South Africa's development.
- The DST supports a number of Research, Development and Innovation (RDI) initiatives implemented through Universities and Science Councils
- Hydrogen and fuel cell technologies focused beneficiation of platinum group metals (PGMs) is one such initiative.

HySA Structure



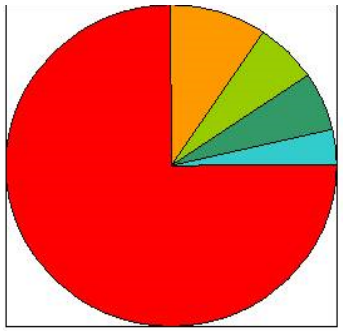
HySA Implementation Phases

2008 - 2013	2014 - 2018	2019 - 2023
Establish R&D Capability	**Demonstrate and Validate Technology**	**Commercialise South African Innovation**
▸ Recruit mission-critical staff ▸ Identify initial markets ▸ Develop first-pre commercial technologies	▸ Establish critical supply chain capability ▸ Deliver first products to market ▸ Demonstrate capabilities in pilot markets	▸ Contribute to international innovation ▸ Compete successfully on world market ▸ Capture 25% of global catalysis value chain in hydrogen and fuel cells

HySA Value Proposition

World Platinum Reserves

- Zimbabwe
- Finland
- Russia
- North America
- South Africa



South Africa possesses 75% of global Pt reserves

BENEFICIATION VALUE CHAIN

STACK

MEA

CATALYST

PGM

HySA Strategy

- Wealth creation through value added manufacturing of PGM catalysis with a goal of supplying 25% of PGM catalysts demand by 2020
- Promote equity and inclusion in the economic benefits of South Africa's resources
- Develop local cost competitive hydrogen generation solutions based on renewable resources

$14 400/ounce

$9 500/ounce

$2 200/ounce

Export $1090/ounce

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HySA Funding

- Fuel Cell Funding for 2018/19 financial year (1 April 2018 to 31 March 2019) is as follows:
- Government: R108 million (USD 8.00 million);
- R43 million for technology demonstration and deployment (MTSF target of 25 HySA units by 31 March 2020);
- R19 million additional funding from Private Sector.

Technology Deployment Update: Completed Projects

Name of Prototype	Brief Description	HySA IP or know-how used	Date installed	Number of Units	Project Partners
1. 2kW Hydrogen fuel cell system	The fuel cell system uses bottled hydrogen supplied from gas companies.	HySA Systems integration expertise.	October 2014	1	HySA Systems and Hot Platinum
2. Solar PV to hydrogen system	System demonstrating renewable hydrogen production from water electrolysis using solar PV.	HySA Infrastructure integration expertise.	December 2014	1	HySA Infrastructure
3. Hydrogen fuel cell powered forklift	Battery electric forklift coverted to hydrogen fuel cell power.	HySA Systems integration expertise.	August 2015	1	HySA Systems and Impala Platinum
4. Metal hydride compressor and refueling station	Metal hydride compressor and refueling station	HySA Systems integration expertise.	August 2015	1	HySA Systems and Impala Platinum
5. Liquid organic hydrogen carrier (LOHC) unit	An LOHC unit used to produce LOHCcarry hydrogen, which was sold to a local private company during the 2017/18 FY.	The HySA contribution was in the form of know-how on putting together the LOHC reactor.	April 2017	1	HySA Infratructure
6. 2.5 kW Hydrogen fuel cell system for off-grid rural applications	The fuel cell comprises, 17kW of solar PV, 28.8kW battery storage with onsite hydrogen production from water electrolysis and onsite hydrogen storage	HySA catalyst, MEA, stack, HySA Systems and Infrastructure integration expertise.	April 2018	1	Joint HySA CoC project

Fuel Cell Deployment in Material Handling Equipment

Hydrogen Fuel Cell powered forklift

Hydrogen Refuelling Station (200bar) ~ R2m

- Locally developed IP on metal hydride hydrogen storage material
- Metal Hydride material enables low pressure (200 bar) refuelling
- Refuelling of the forklift takes 15mins and enables 2-3 days of operation
- System costs are far below typical commercial products.

Fuel Cell Deployment to Power Social Infrastructure

17kW Solar PV System

On-site hydrogen production and storage system

Power Management System
including 28.8 kWh Battery Storage

2.5 kW Hydrogen Fuel Cell System

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Development of Educational Material

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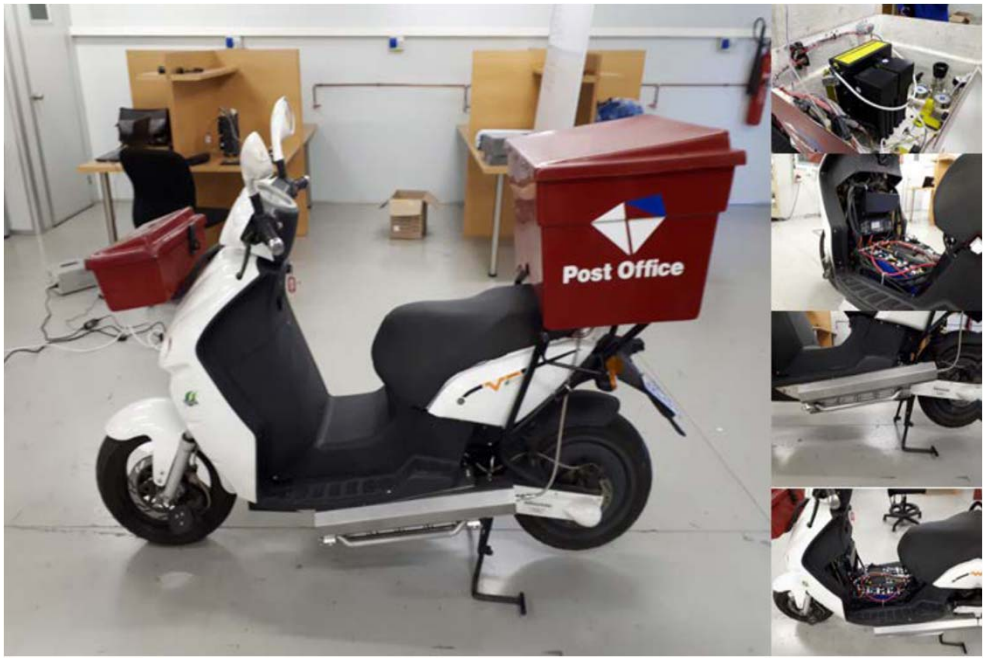
Fuel Cell Powered Forklift

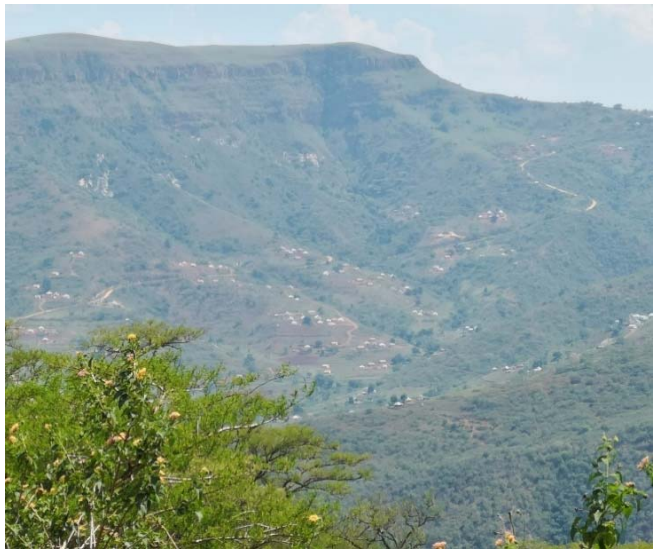


- The integration of a fuel cell unit in a battery electric scooter as a range extender has been completed.
- A canister based refueling system incorporating the new metal hydride recipe has been developed and is being deployed to support the electric scooter.

Off-grid Rural Electrification Project

- DST and Department of Energy (DoE) are collaborating in fuel cell field trials for rural electrification
- The goal is to supply electricity to 5 communities, i.e. ~540 households, including rural clinics and schools and high mast lighting, for 36 months (or longer, subject to agreements and Eskom electrification plans for the area/s)
- Partners are currently reviewing 5 proposed sites in KwaZulu Natal Province
- CHEM's fuel cell DC Charging stations will be deployed in each community
- HyPlat to supply MEAs for the fuel cells upon qualification of the MEAs by CHEM
- Bambili Group (local BEE partner) will coordinate the project
- DST will fund the Fuel Cell component while DoE will fund the reticulation and high mast lights through their Energy Efficiency and Demand Side Management Programme.

Off-grid Rural Electrification Project



Some of the proposed sites for deployment

Off-grid Rural Electrification Project, cont.

House Hold Starter Kit

- Compact, high power density
- Smart ID, theft deterrent
- Single battery can power system for a day

- Bright LED lighting
- Phone charging
- Radio / MP3 player

- 19” color TV
- 12VDC, high efficiency
- Potential need for theft deterrent, Smart ID

Way forward & Opportunities for Partnerships

Way forward:

- 2nd HySA Five-Year Review
- Establishment of the Fuel Cell Task Team

Partnerships are being sought in:

- Taking technology to the market in collaboration with local companies, particularly SOEs
- Supporting skills development through internships (universities & TVETs) to support technology deployment
- Facilitating the development of infrastructure that enables the regional deployment of emerging technologies
- Developing material value chains to ensure security of supply
- Stimulating local demand for emerging technologies to power social and economic infrastructure
- Facilitate the establishment of manufacturing facilities in the country based on locally developed IP where appropriate
- Leverage international developments through global forums to increase public awareness of hydrogen and fuel cell technology

Thank you

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