DSTI HYDROGEN & ENERGY RESEARCH, DEVELOPMENT AND INNOVATION INITIATIVES

Presenter: Mandy Mlilo

Occasion: The 8th RD20 Conference

Date: 20 October 2026

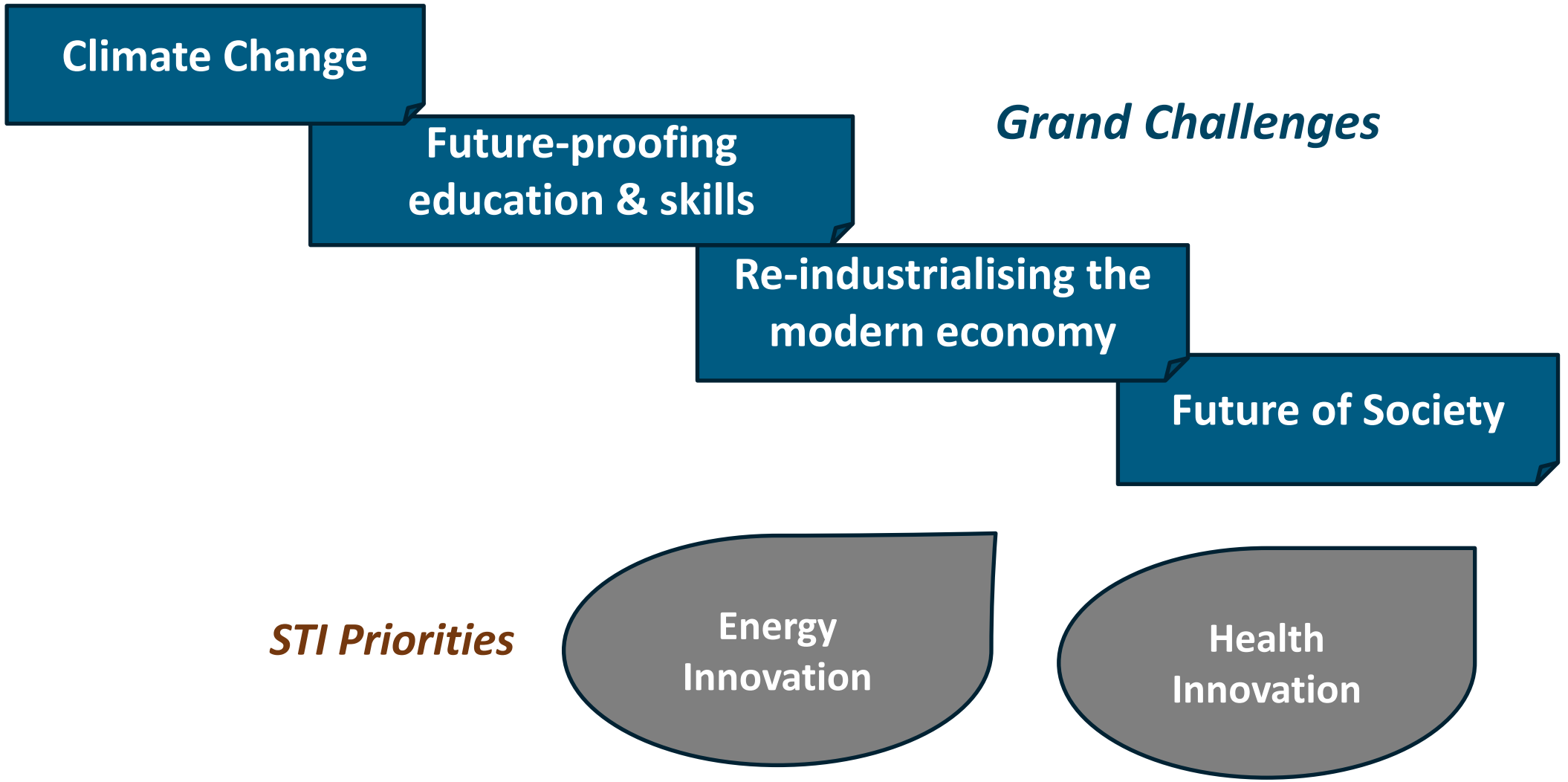


Making sure it's possible

science, technology & innovation

Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

2030 NDP


Climate Change
Future-proofing education & skills
Re-industrialising the modern economy
Future of Society
Grand Challenges
STI Priorities
Energy Innovation
Health Innovation

THE DECADAL PLAN

White Paper on STI core themes: ***Inclusivity, Transformation and Partnerships***

The Decadal Plan theme: ***"deepening knowledge economy for enhanced socio-economic impact"***



science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

NDP 2030

Policy Intents:

- ❑ Improve inclusion and build more linkages across the NSI
- ❑ Increase support for and collaboration with the business sector
- ❑ Support commercialisation of publicly funded intellectual property
- ❑ Innovation to revitalise existing sectors
- ❑ Strengthen skills in the economy
- ❑ Expand internationalisation and science diplomacy.

DSTI Mantra: Place STI at centre of government, education, society and economy
Mantra Meaning: Translating Science to solve societal, environmental and economic problems, in real time.

THE DECADAL PLAN

Chapter 3.5: Energy Innovation (STI in support of energy innovation, pg 47)

According to the International Energy Agency, increased government expenditure is required in critical areas such as electrification, hydrogen, bioenergy and carbon capture, utilisation and storage. Over the years, the NSI built strong STI capabilities in support of the energy sector under the following RDI flagship programmes:

- Renewable Energy Hub and Spokes: Supports the increased contribution of renewable energy to the energy mix through resource quantification, the provision of energy services and ensuring inclusion of SA innovations through localisation.
- Hydrogen South Africa (HySA): Supports the development of value-added components along the hydrogen and fuel cell value chain, including the local manufacturing of hydrogen and fuel cell components. The Department has developed a Hydrogen Society Roadmap.
- Energy Storage RDI Initiative: Leverages high-quality manganese reserves in SA and other key battery minerals within the Southern African Development Community (SADC) region to develop value-added precursor materials for lithium-ion batteries for the electric vehicle and energy storage markets, while developing skills to support the local manufacturing of the precursor materials.
- Carbon Capture, Storage and Use (CoalCO_2-X) RDI Programme: Focuses on the capture of flue gas from coal-fired boilers and combining the carbon dioxide, nitrogen oxides and sulphur oxides with green hydrogen to produce value-added products such as fertiliser salts, green ammonia and sulphuric acid. While addressing

THE DECADAL PLAN

Chapter 3.5: Energy Innovation (STI in support of energy innovation, pg 48)

2021-2024

PRODUCTION
- Small scale electrolysis production
- At least 1MW GH2 production piloted



USE
- At least 100 buses and trucks powered by H2 by 2025
- At least 20 forklifts converted to fuel cell power by 2025
- At least 5 refueling stations deployed by 2025
- Demonstration in power generation and stationary fuel cells in public buildings
- Industry demonstration including SAFs

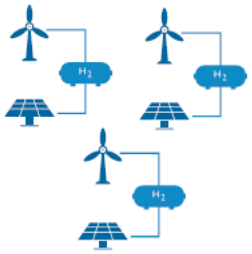


JOBS
- Upscaling of training and reskilling for new jobs



2025-2030

PRODUCTION
- 5GW electrolysis capacity under construction in NC
- 10GW electrolysis capacity deployed in NC by 2030
- 1.7GW electrolyser capacity deployed in H2 Valley by 2030
- At least 500kt H2 produced annually by 2030



USE
- At least 500 buses and trucks powered by H2 by 2030
- Power generation in turbines using H2 and ammonia
- Sector coupling and use in transport, industry

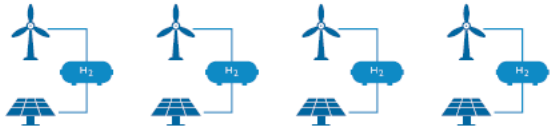


JOBS
- At least 20 000 jobs created annually by 2030

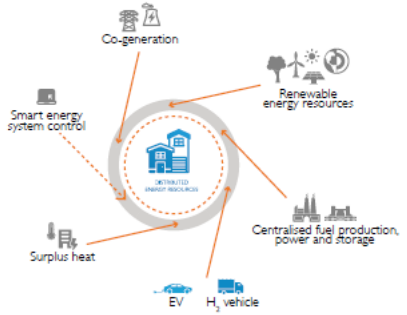


2030-2040

PRODUCTION
- Increase electrolysis capacity to at least 15GW by 2040



USE
- Sector coupling and full use in transport, industry and power



JOBS
- At least 30 000 jobs created annually by 2040



Establish targets and policy signals

Support demand creation

Mitigate investment risk

Harmonize standards and remove barriers

Promote Research, Development and Innovation

Strategic demonstration and deployment projects

Skills development and public awareness

SOUTH AFRICA'S COMPETITIVE ADVANTAGE: STRATEGIC INTENT

2009 Estimates

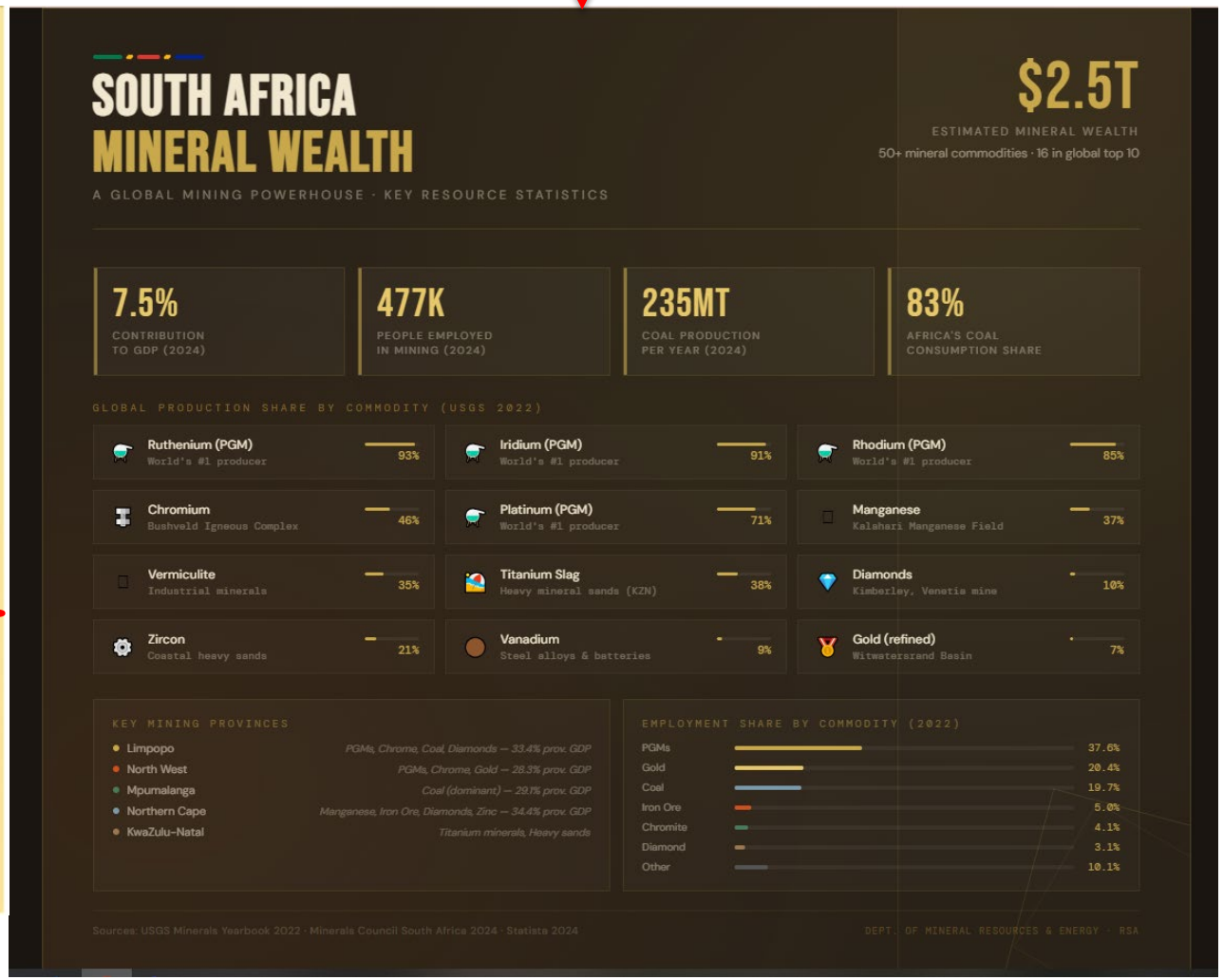
South Africa is well-endowed with mineral resources

South Africa's Mineral Reserves, World Ranking, 2009 Production & Nominal Life (assuming no further reserves) at 2009 Extraction Rates

Mineral		RESERVES			PRODUCTION 2009			LIFE
		Mass	%World	Rank	Mass	%World	Rank	Years
Alumino-silicates	Mt	51	*	*	0.265	60.2	1	*192*
Antimony	kt	350	16.7	3	3	1.6	3	*117*
Chromium Ore	Mt	5500	72.4	1	6.762	*	1	*813*
Coal	Mt	30408	7.4	6	250.6	3.6	7	*121*
Copper	Mt	13	2.4	6	0.089	*	*	*146*
Fluorspar	Mt	80	17	2	0.18	3.5	5	*444*
Gold	t	6000	12.7	1	197	7.8	5	*30*
Iron Ore	Mt	1500	0.8	13	55.4	3.5	6	*27*
Iron Ore - incl. BC	*Mt*	*25000*	*~10*	*	*55.4*	*3.5*	*6*	*451*
Lead	kt	3000	2.1	6	49	1.2	10	*61*
Manganese Ore	Mt	4000	80	1	4.576	17.1	2	*874*
Nickel	Mt	3.7	5.2	8	0.0346	2.4	12	*107*
PGMs	t	70000	87.7	1	271	58.7	1	*258*
Phosphate Rock	Mt	2500	5.3	4	2.237	1.4	11	*1118*
Titanium Minerals	Mt	71	9.8	2	1.1	19.2	2	*65*
Titanium- incl. BC	*Mt*	*400*	*65*	*1*	*1.1*	*19.2*	*2*	*364*
Uranium	kt	435	8	4	0.623	1.3	10	*698*
Vanadium	kt	12000	32	2	11.6	25.4	1	*1034*
Vermiculite	Mt	80	40	2	0.1943	35	1	*412*
Zinc	Mt	15	3.3	8	0.029	0.2	25	*517*
Zirconium	Mt	14	25	2	0.395	32	2	*35*

Source: SAMI 2009/2010, DMR 2010; and Wilson & Anhaeusser 1998: "The Mineral Resources of South Africa", CGS Pretoria (for BC- Bushveld Complex)

2024 Estimates



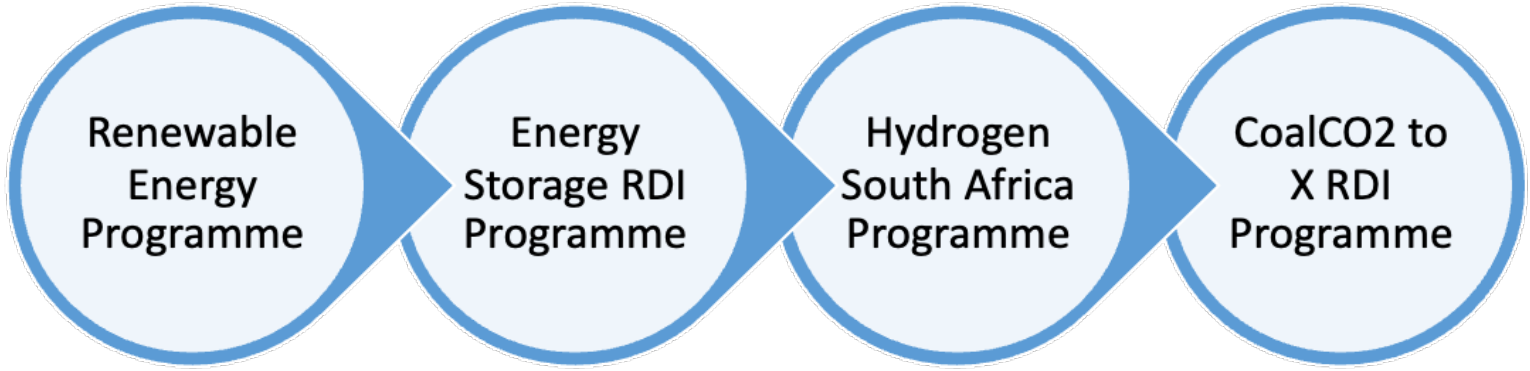
- ❑ The Missing Link: Connecting deep-tech PGM R&D with commercial, industrial-scale deployment capabilities.
- ❑ The Solution: Transitioning from a raw materials exporter to a high-value, high-tech manufacturer of commercial hydrogen & energy solutions (Implementing agencies exist to fill this gap).

HYDROGEN AND ENERGY CHIEF DIRECTORATE

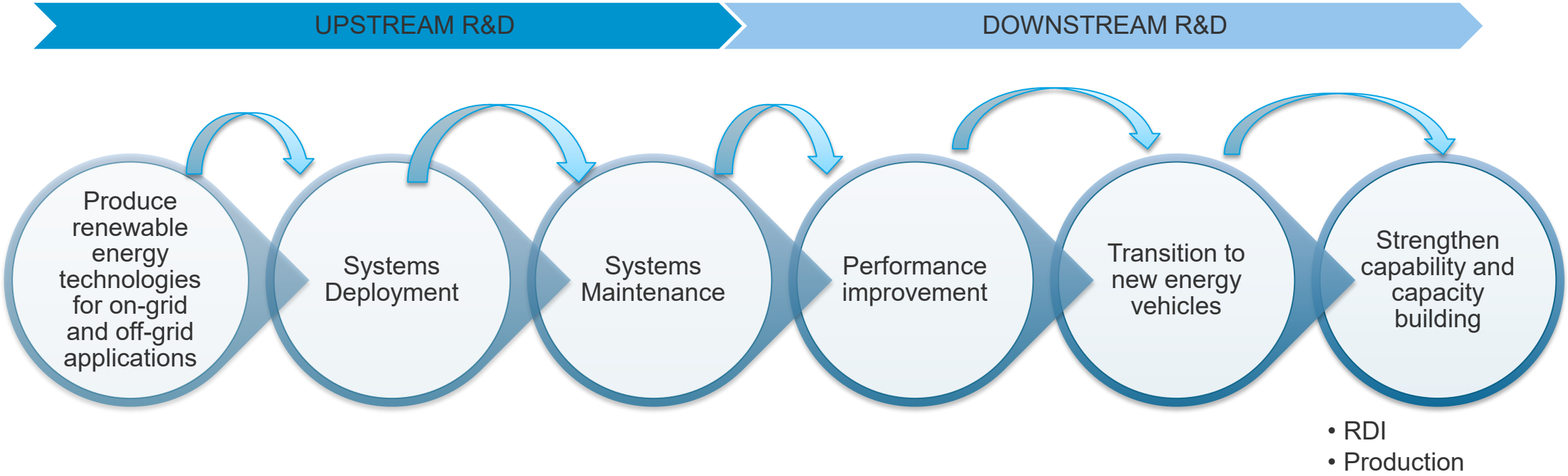
The H&E Chief Directorate is responsible for supporting:

- Reduction in greenhouse gas emissions and air pollution while contributing to a more diverse and sustainable energy mix by enabling the widespread commercialisation of battery, fuel cell, renewable and net zero carbon technologies based on publicly funded intellectual property rights; and
- Penetration of clean and alternative energy technologies – through research, development and validation efforts – to be competitive with current technologies in terms of cost and performance while fostering strategic partnerships with public and private sector to reduce the institutional and market barriers to their commercialisation.

Energy RDI Flagship Programmes

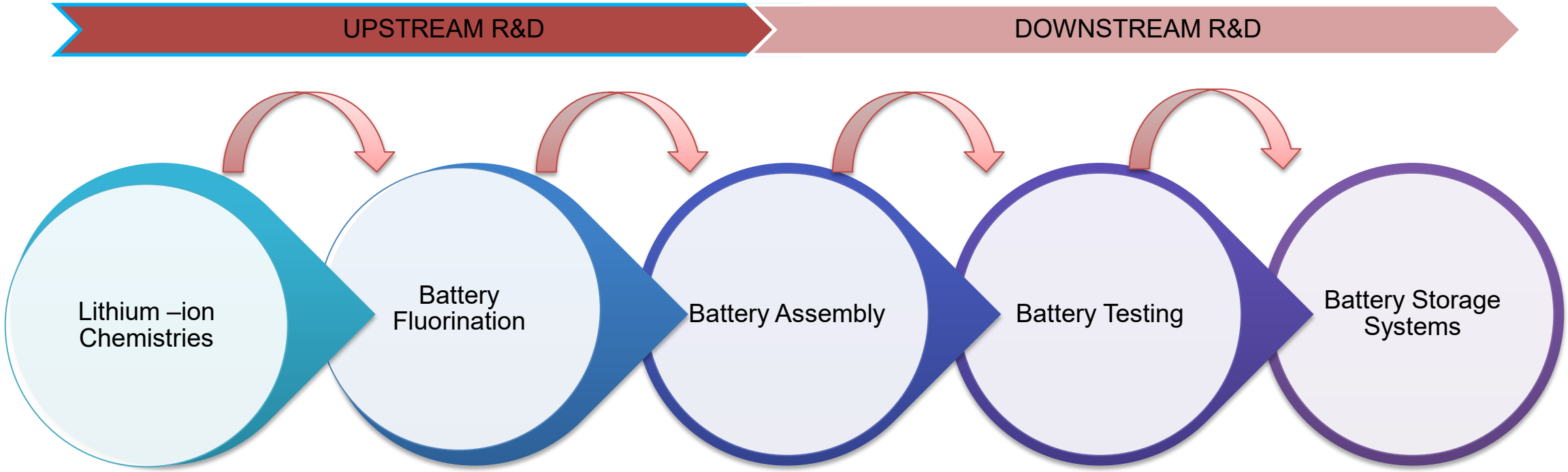


RENEWABLE ENERGY HUB AND SPOKES



Hub	Solar Thermal Spoke	Solar Photovoltaic Spoke	Wind Energy Spoke
Center for Renewable & Sustainable Energy Studies	Wits (Gauteng, JHB)	NMU (Eastern Cape, Gqeberha)	SU (Western Cape, Stellenbosch)
	UP (Gauteng, Pretoria)	UFH (Eastern Cape, Umthatha)	UCT Western Cape, Cape Town)

BATTERY ENERGY STORAGE EXPERTISE



University of Limpopo (Mpumalanga, Mbombela)

CSIR (Gauteng, Pretoria)

Necsa (Gauteng, Phelindaba)

UWC (Western Cape) and NMU (Gqeberha)

BATTERY VALUE CHAIN DEVELOPMENT



Graphite Mine (4% C)
Location-Limpopo
[R0.5k/t]



Graphite conc. (94% C)
[R20k/t]



Battery Grade Graphite (99.95% C)
[R180k/t]

CSIR



Manganese Ore (37%)
Location-Northern Cape
[R2.4k/t]



Battery Grade
$MnSO_4$
[R20k/t]

Manganese Metal Co

University of Limpopo



LMO Cathode
[R120k/t]

University of Limpopo

800% gross value uplift

Gross value uplift 50%



PGM Ore
Location-North West



Thakadu $NiSO_4$
[R85k/t]



Lithium Ore [R40k/t]
KZN, Eastern Cape



Battery Grade
Li_2CO_3 [R250k/t]

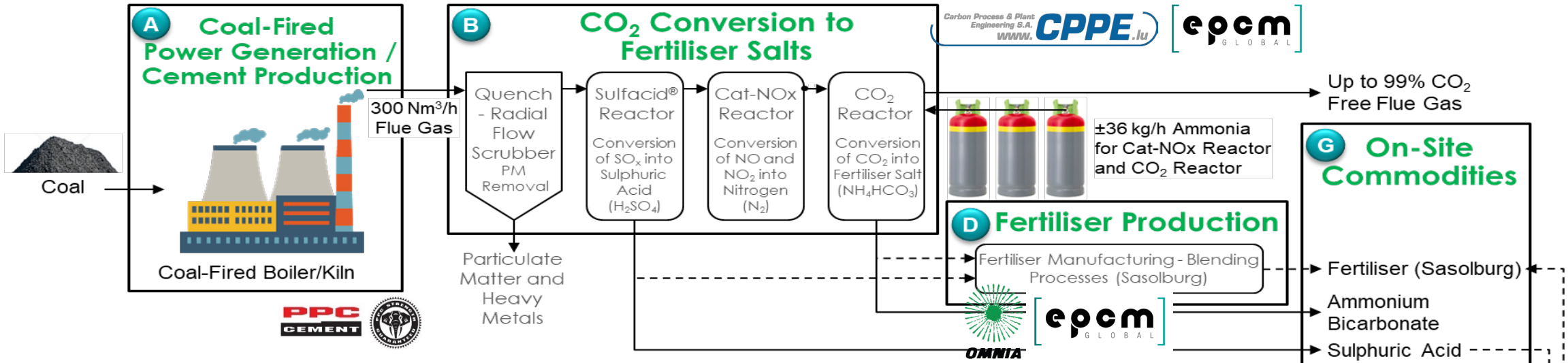


LFMO Cathode
[R350k/t?]

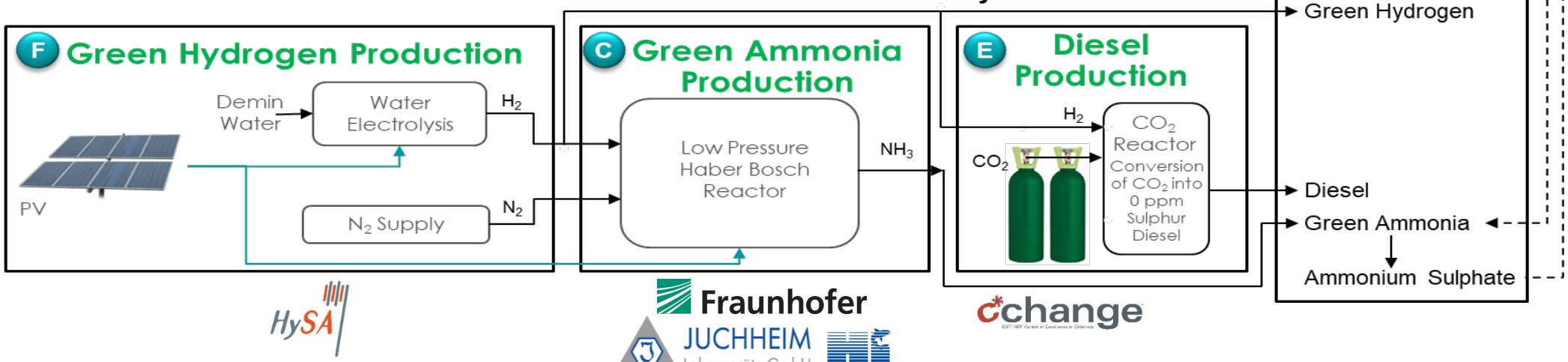
CSIR

CCU: DEVELOPMENT AND PILOT DEMONSTRATION OF LOCAL AND INTERNATIONAL INTELLECTUAL PROPERTY

Pilot-Scale Demonstrations in South Africa at a Coal-Fired Boiler and Commercial Fertiliser Factory



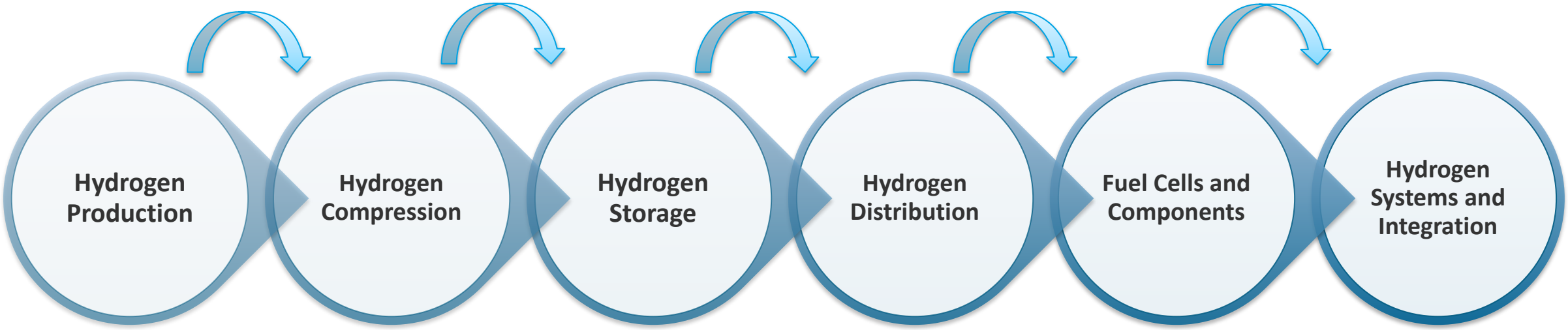
Pilot-Scale Demonstration in South Africa at the North-West University



Pictures from: edurev.in, cppe.lu, swivelsecure.com, indiamart.com

HYSA PROGRAMME: COMPETENCIES

UPSTREAM R&D | **DOWNSTREAM R&D**



- PEM electrolysers CCM
- Portable PEM electrolyser
- Water electrolyser stacks

- Electrochemical hydrogen compressor
- Metal hydride compressor

- Metal hydride Medium pressure Hydrogen storage
- Liquid organic hydrogen carriers

- Green ammonia
- Liquid organic hydrogen carriers

- PEM fuel cells and MEAs
- Fuel cell catalysts

- Refueling stations
- Electric fuel cells powered modules

HySA Infrastructure Hydrogen South Africa

NWU (North West, Potch)

CSIR (Gauteng, Pretoria)

HySA Catalysis Hydrogen South Africa

UCT (Western Cape, Cape Town)

Mintek (Gauteng, Randburg)

HySA Systems Hydrogen South Africa

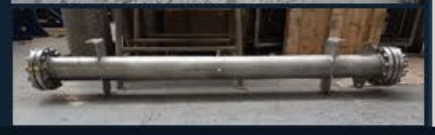
UWC (Western Cape, Belville)

HySA SYSTEMS PRODUCT HIGHLIGHTS

MH H_2 Storage Tank

- High-capacity prototype completed (up to 4Kg storage)
- Metal hydride (MH) powder
- Custom heating/cooling flange





Fuel Cell Forklift

- 3 generations developed
- Gen 1 → Gen 2 → Gen 3
- Fuel cell powered industrial lift





Fuel Cell Stacks

- 10 kW to 60 kW range
- Scalable modular design
- High-efficiency PEM stacks





Alloys for H_2 Storage & Purification

- Custom MH material powder
- Compression & purification alloys
- Raw material to MH powder pipeline

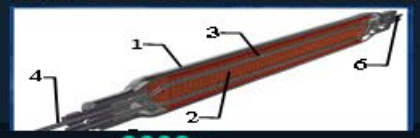




H_2 Refuelling Station

- 7–800 bar range (2008–2024)
- Up to 1 Nm^3/h throughput
- Utility vehicles & industry use





5 Product Lines

3 Forklift Generations

10–60 kW Stack Power Range

800 bar Max Compressor Pressure

2008+ Continuous Innovation

THE HYDROGEN SOCIETY ROADMAP (HSRM)



https://www.dst.gov.za/index.php/resource-center/strategies-and-reports/3574-hydrogen-society-roadmap-for-south-africa-2021

Vision

An inclusive, sustainable and competitive hydrogen economy by 2050 with the goal of achieving a Just and inclusive net zero carbon economic growth for societal wellbeing by 2050.

Purpose

To align stakeholders on a common vision on hydrogen related technologies in order to create an environment where investment decisions can be made to unlock the social economic benefits for the country.

IMPLEMENTATION & COORDINATING STRUCTURES

- DSTI Energy Secretariat
- Governance:

✓ ADDG: TI: Accounting Officer of the contract (ADDG Letter to ACEO of SANEDI)
✓ PSC for the DSTI Decadal Plan-related initiatives
✓ PSC on CCU
✓ Technical Review Committee
✓ Decision Oversight Committee

- Implementation of the 4 energy RDI Programmes:

✓ Contracting
✓ MTEL Framework
✓ Reporting: APP-related targets

- Hydrogen Coordination Office
- Interim Structure:

✓ Operationalisation of the HSRM
✓ IPHE chair support and coordination of local IPHE activities
✓ Marketing & awareness
✓ Development of the RDI strategy
✓ Coordination of targeted special events
✓ Continuation of support provided by Ms Humna Malik to DSTI within P2/H&E Chief Directorate
✓ MTEL Framework of SIPs (Informing discussions at IMC on Hydrogen Economy)

- Hydrogen Innovation Programme
- Pre-cursor: Transformative Hydrogen Fund

✓ Commercialisation of value-added components from the HySA Programme
✓ SMME support & skills development
✓ Innovation support: incubation

Monthly meetings and quarterly meetings with all coordinating structures

LOCAL AND STRATEGIC PARTNERSHIPS



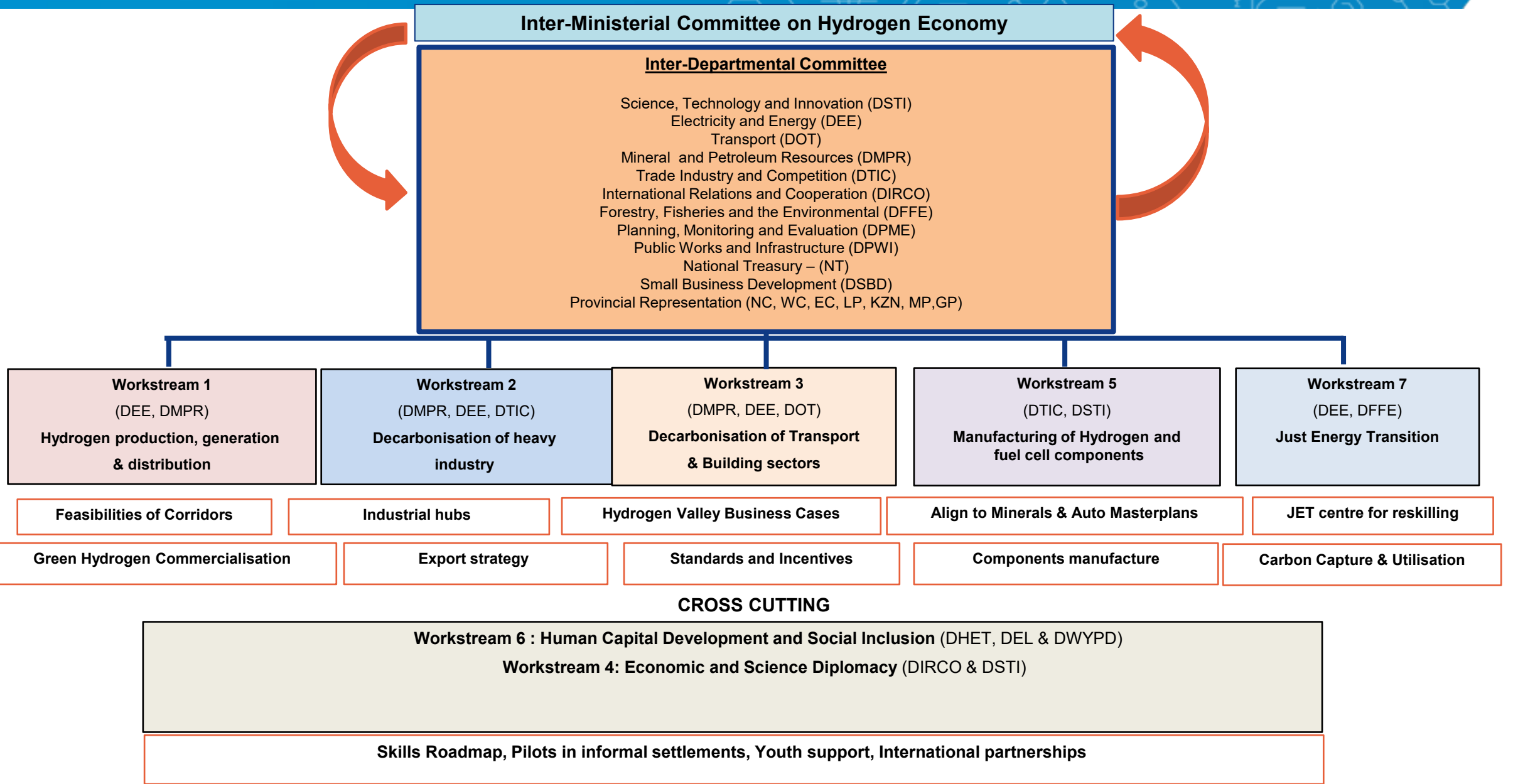
- The 8th Hydrogen Energy Ministerial Meeting took place on September 10, 2026, at Makuhari Messe in Chiba, Japan, co-hosted by Japan's Ministry of Economy, Trade and Industry (METI) and the New Energy and Industrial Technology Development Organization (NEDO).



- The Eastern Cape unveiled its official Green Hydrogen Strategy on 15 September 2026, at the African Green Hydrogen Summit in Cape Town to drive industrialisation, attract investment, and create local jobs.

- Strategy was developed in partnership with the Eastern Cape Provincial Government through the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), South African National Energy Development Institute, and Nelson Mandela University.

CABINET-APPROVED INTER-MINISTERIAL COMMITTEE ON HYDROGEN ECONOMY



Dankie
Enkosi
Ha khensa
Re a leboga
Ro livhuwa
Siyabonga
Siyathokoza
Thank you









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