

South African Hydrogen Economy Activities - National Hydrogen Energy & Fuel Cell R&D Strategy development

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THE HYDROGEN ECONOMY FOR SUSTAINABLE
DEVELOPMENT
REYKJAVIK, ICELAND SEPTEMBER 2006



Presentation Outline

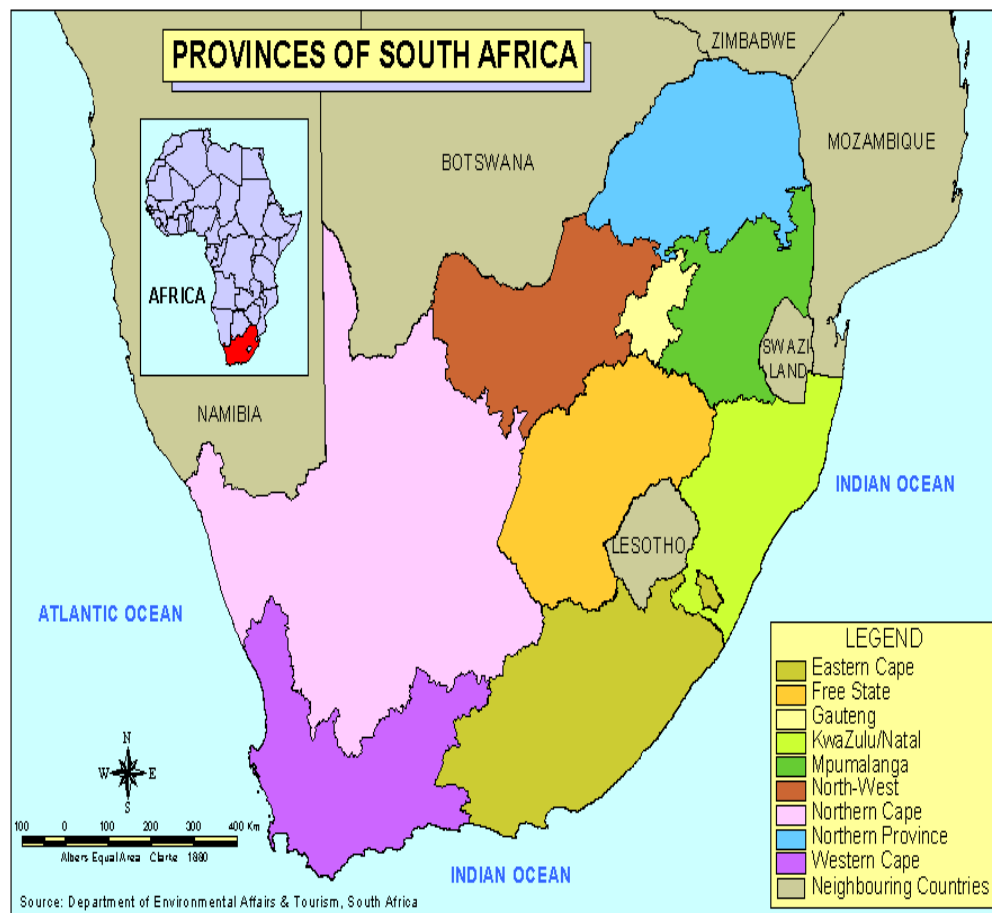
- Useful facts on South Africa (SA)
- South African Energy Policy
- Diversification of SA energy systems
- South African National Hydrogen Energy and Fuel Cell (HEFC) R&D strategy
- Human Capital Development
- Summary

Useful facts on South Africa

Facts(July 2006)

- **Population** – 44.2M
- **GDP** - \$187.3 billion (2005 est.)
- **Literacy** – 86.4% total population
- 2/3 of populations have access to electricity
- 0.81% of GDP spent on R&D
- **Electricity - production**
215.9 billion kWh (2003)
- **Natural gas - production**
2.35 billion cu m (2003 est.)

- **Good infrastructure**



Drivers for Energy R&D in South Africa

- Security of supply: Eskom predicts it will run out of excess electricity generation capacity by 2007
- Environmental issues: >75% of SA green house gas emissions result from energy generation and use
- Energy equity: 1/3 of SA population still does not have access to reliable sources of energy
- Retain our cheap electricity status, to attract job creation through localisation of manufacturing activities
- Finite resources

South African Energy Policy

➤ 1998 White Paper on Energy

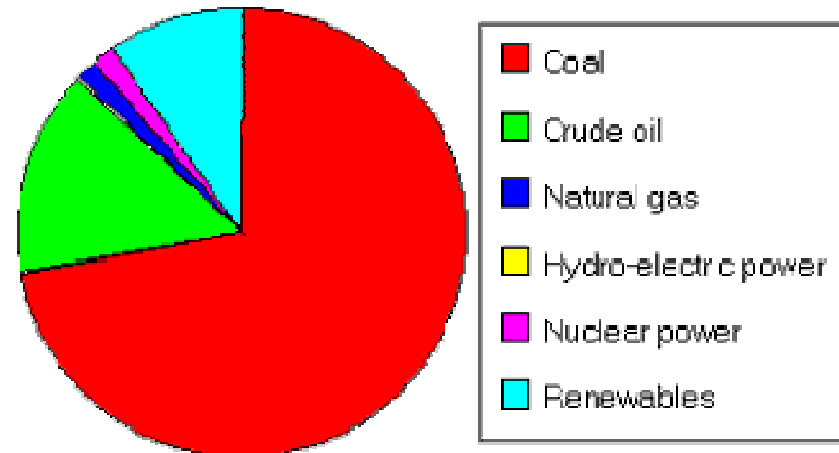
➤ 5 objectives with earmarked priorities in the short, medium and long term:

- ✓ Increased access to affordable energy services
- ✓ Improving energy governance
- ✓ Stimulating economic development
- ✓ Managing energy-related environmental impacts
- ✓ Security of supply through diversification

SA Energy mix and R&D themes

Oil from coal synfuels plants provide a significant proportion of South Africa's liquid fuels

RSA Primary Energy Utilisation (1993)



- Energy infrastructure optimization;
- Energy efficiency and demand side management;
- Secondary beneficiation of mineral resources;
- Expanding socioeconomic and development opportunities of the poor;
- Renewable Energy Sources and energy planning, modeling and policy research; and
- Clean coal development

Diversification of the SA Energy Systems

- Clean Coal technologies
- Safe and efficient cooking fuels and appliances
- Bio-Fuels and alternative fuels to gasoline
- The Hydrogen and Fuel Cells Technologies
- The Pebble Bed Modular Reactor (PBMR)

Preliminary activities towards HEFC R&D strategy

- South African Fuel Cell Initiative (SAFCI) Baseline Study

- ✓ DST funded: <http://www.safci.co.za>

- The Hydrogen Economy Indaba May 2005

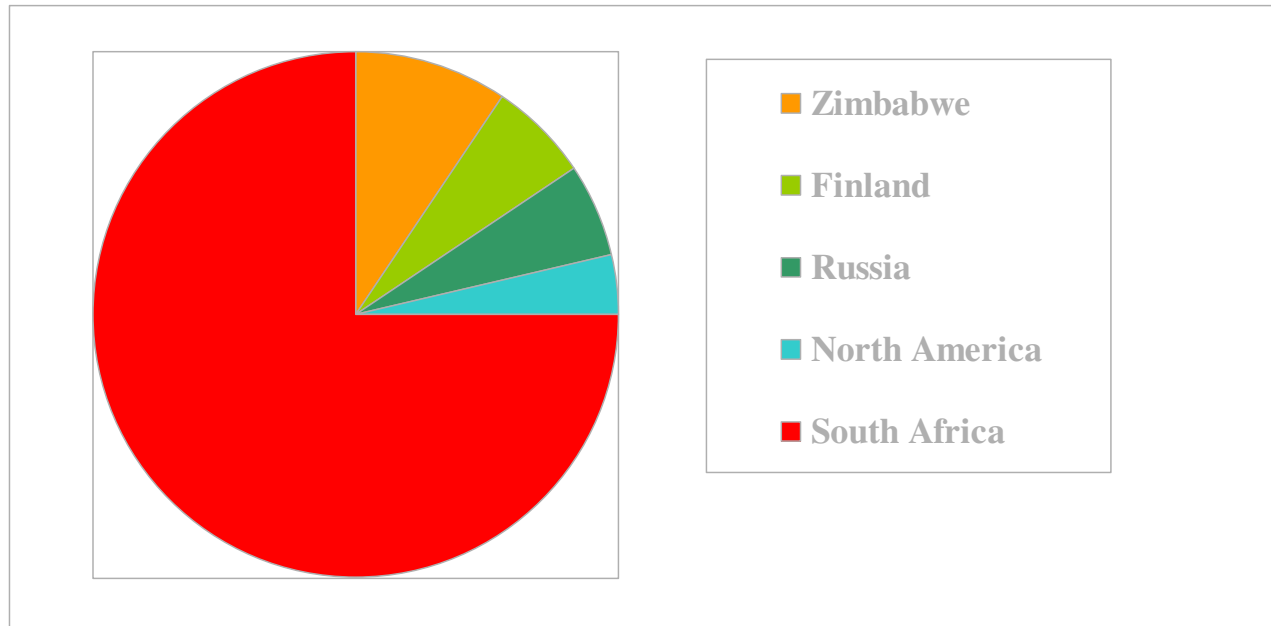
- **Purpose**

- ✓ Create awareness among top SA decision makers – potential impact Hydrogen economy & emerging Fuel cell technologies
 - ✓ To deliberate on South Africa's role in this field

- **Challenges & opportunities**

- ✓ Drivers in the development of the Hydrogen Economy and Fuel Cells: Energy security, depleting oil reserves, environmental concerns, equity of energy supply & economic potential.
 - ✓ South Africa would eventually gain as a customer of technology and major supplier of platinum
 - ✓ Government formulates an active national policy regarding Hydrogen Economy and SA joins IPHE

World Platinum Resources



- Pt- Good catalytic properties, substitutions investigated, platinum still shows superior properties
- Current investment in various applications R&D = US\$1b annually (outside of SA)

SA National HEFC R&D Strategy

- South African hydrogen R&D context – SA public sector investment in HEFC R&D is low – R5 million per annum
- VISION OF STRATEGY
 - ✓ South Africa has the vision to carry out R&D, create knowledge and human resource capacity and develop high value commercial activities in utilising local resources for the production and use of hydrogen as an energy carrier. This will contribute to energy solutions, enhanced social benefits, business competitiveness and environmental protection.

Key drivers shaping R&D requirements

- Wealth creation through leveraging the use of local strategic mineral resources
- Developing human capital at required levels
- Catalyse a new resource based industry
- Diversification of energy supply mix
- Reduction in global greenhouse gas emissions and particulate pollution

HEFC R&D Focus Areas

- Catalysis
- Materials
- Hydrogen production
- Hydrogen storage
- Direct Fuel Cells
- Analysis & Modelling

Human Capital Development & Needs

- Human capital strategy – to be based on skills and competencies demand in HEFC R&D
- Retention of trained human resources for FC industry growth
- Multidisciplinary approach – information technology, energy law, socio-economic and environmental impact, health issues and environmental resource economics

Status of H₂ Energy technology development in South Africa

➤ **Industry**

- ✓ Intelligent Energy
- ✓ IST
- ✓ ESKOM
- ✓ Sasol
- ✓ Afrox
- ✓ Air Products

➤ **Academia & Research Councils**

- ✓ CSIR - PEMFC
- ✓ Mintek – Gold usage in PEMFC
- ✓ Tshwane University of Technology
- ✓ University of Limpopo – Modelling
- ✓ University of South Africa
- ✓ University of the Western Cape – PEMFC & batteries
- ✓ Vaal University of Technology – Telkom Centre of Excellence



our future through science

Sustainable development through Hydrogen Energy

- 4 Elements of Sustainable Development (SD)
 - ✓ Environmental resources and capacity to absorb pollution
 - ✓ Social development out of poverty to productivity
 - ✓ Economic growth required to ensure technology development and trade
 - ✓ Institutional capacity to develop and implement new technologies

- SA SD PROFILE

Sustainable development through Hydrogen Energy

➤ SA SD Profile

➤ Current

- ✓ Agriculture food exporter 2005
- ✓ 4500 kW hr/capita electricity
- ✓ Electricity cost 10 to 20 cSA/kWhr (1 to 3 cUS)
- ✓ 7.6 tonnes CO₂/ capita
- ✓ Energy exporter net (coal) 30% of national consumption
- ✓ Energy use 92 tonnes oil equivalent per capita
- ✓ Liquid fuel from oil ±30%
- ✓ HIV/AIDS 19% (2005), life expectancy at birth 45 yrs (2004)
- ✓ 1/3 of population has no access to reliable energy, i.e. electricity
- ✓ Unemployment 14 to 24 yrs >55%

Sustainable development through Hydrogen Energy

➤ **Future**

- ✓ Negative population growth 0.7% pa
- ✓ Coal reserves – 50 to 200 years
- ✓ Gas imports from Mozambique, Namibia and Angola
- ✓ Oil from coal at expense of CO₂ emissions
- ✓ Petroleum peak expected by US DoE within 5 to 10 years
 - ✓ Pt for catalysis as % of world reserve

➤ **Technology**

- ✓ Current exports
 - ✓ Coal and gas to liquid – Middle East commissioned, North America, China in evaluation phase
- ✓ Future exports
 - ✓ H₂ Storage & distribution technologies, fuel cells and vehicles

➤ **Energy R&D**

- ✓ Pebble Bed Modular Reactor (PBMR)
- ✓ First solar powered electricity generation plant – (100 MW specification)

R&D for the H₂ Economy

➤ Technology Barriers and Challenges

- ✓ Hydrogen production – Gasification (Fischer Tropsch), Nuclear and Solar Thermal
- ✓ Hydrogen storage
- ✓ Fuel Cell components esp. catalysis

➤ Institutional Barriers

- ✓ Codes and Standards (safety)
- ✓ Hydrogen delivery infrastructure
- ✓ Education

➤ Roadmaps and Strategy Development in 2005/6

➤ Approx. R50 Million budget for R&D in 2006/7

North – South and South – South cooperation

- Technology transfer
- Human capital development
- Energy Cooperative arrangements: Alternative Energy, Bio-fuel, Hydrogen Economy, Fuel Cells, Solar Energy)
- Scientists exchange programmes

Summary

- Energy access for the 1/3 of the population and improved energy governance remain on the priority list for SA SD
- The South African National Hydrogen and Fuel Cell R&D strategy has been developed.
- The HEFC strategy need to be followed by roadmaps (other advantages is Coal Gasification technology)
- Human capital development should be accelerated through the North – South and South – South cooperations
- The realisation of the H₂ Economy will have major implications for SA Pt resources and SD

Thank you for you attention

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