

THE HYDROGEN AND FUEL CELL TECHNOLOGIES STRATEGY

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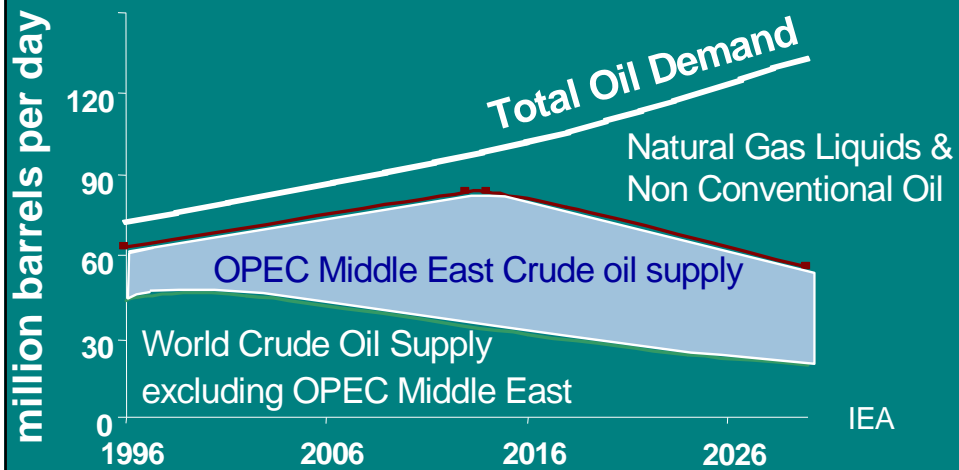


Presentation Outline

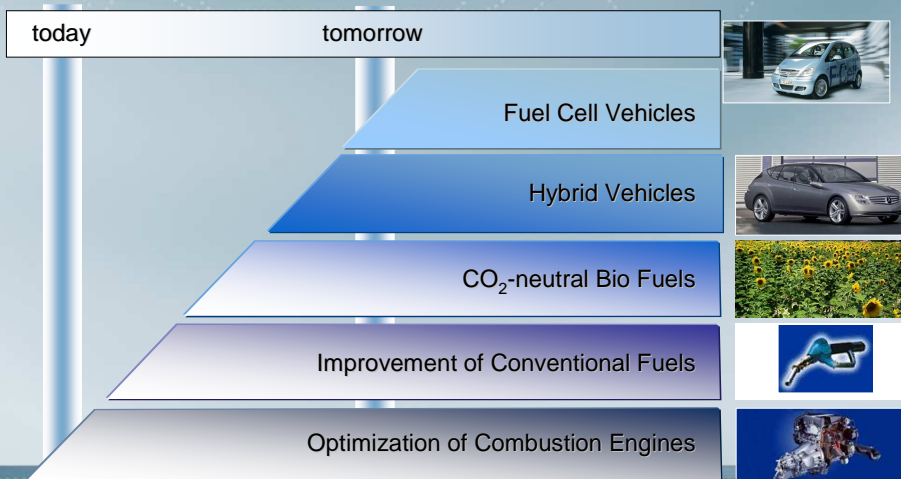
- ✓ Why is South Africa talking Hydrogen?
- ✓ Strategy in brief
- ✓ Implementation plan
- ✓ Competence Centres
- ✓ Planned outputs
- ✓ Value chain management



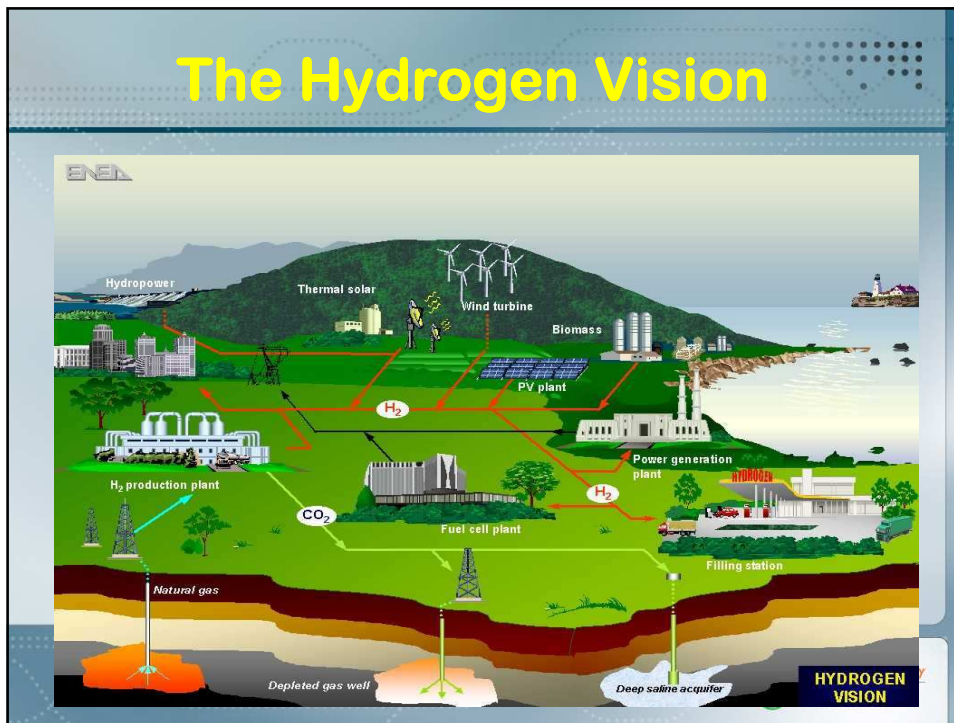
Global Drivers



Global Drivers



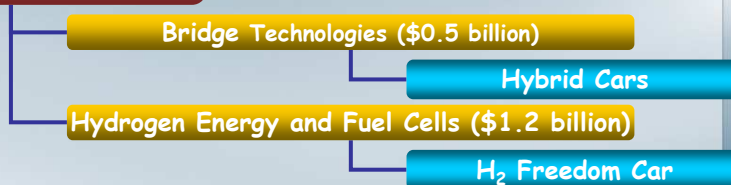
The Hydrogen Vision



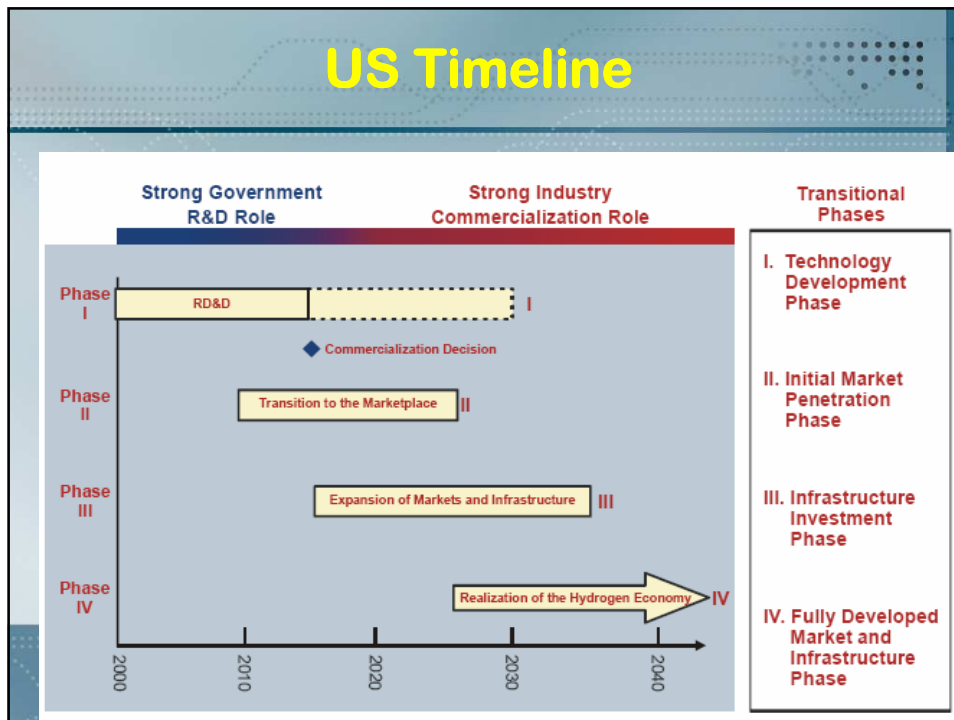
USA

- ✓ Security of supply a major driver
- ✓ Focus is transportation: A Hydrogen fueling station opened in Nov 2004

**2 prong strategy
\$1.7 billion over 5 year**



US Timeline



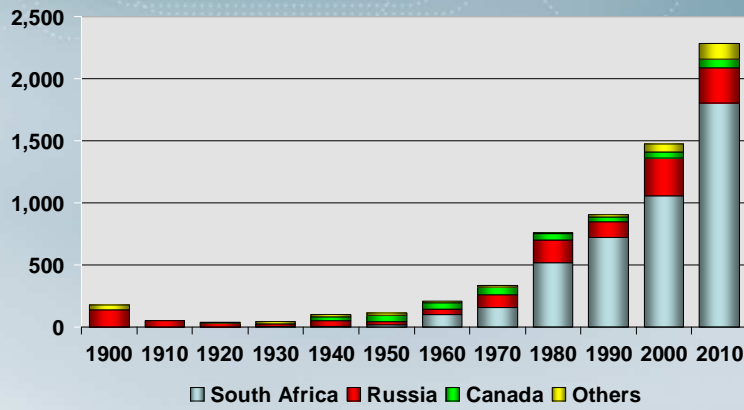
Questions to answer

Pt role in the future H₂ Economy

- ✓ How much platinum is there?
- ✓ What are the current markets?
- ✓ How much platinum will fuel cells need?
- ✓ Can the mines supply this platinum?

History of Pt production

Pt tonnes produced per decade since 1735

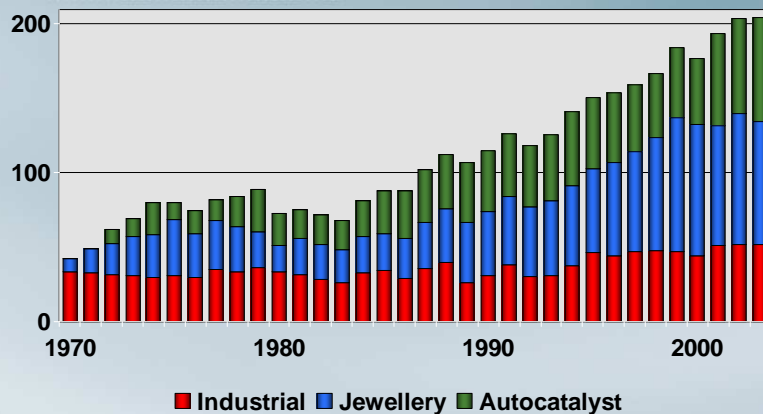


(1900 figure is cumulative from 1735)



Pt markets since 1970

Pt tonnes sold per year



Additional Pt resources likely

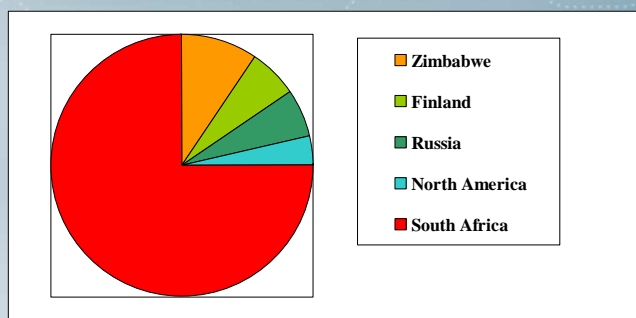
- ✓ Old data was based on 1.2km max depth
- ✓ Northam Platinum already mine at 2+km
- ✓ Bushveld drilled down to 3.3km
- ✓ Gold Mines in SA operate at ~4km already
- ✓ Seismic data suggests reefs at 6km
- ✓ Some estimates* say 64000 tonnes Pt in SA

TIAX Study D0034 "Pt Availability & Economics for PEMFC Commercialisation" December 2003



Why is South Africa talking H2

World platinum resources: Cawthorn, 1999



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

Pt in a car today vs. fuel cell car

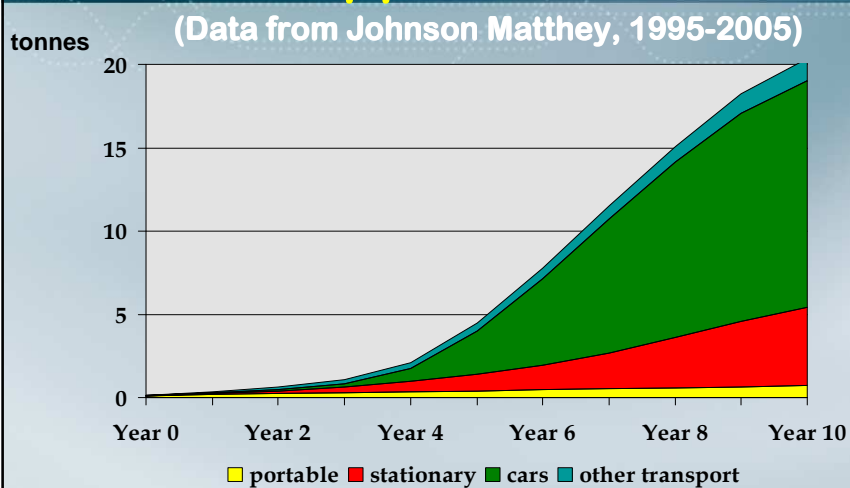


Car today : 2 – 5g Pt



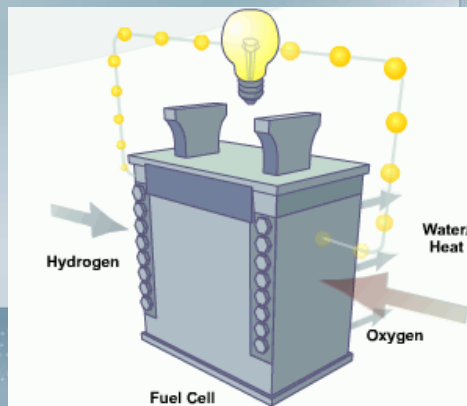
Fuel cell car : 60g Pt

Pt demand for Fuel cell applications



What is a Fuel Cells?

- ✓ A fuel cell is a device that uses hydrogen (or hydrogen-rich fuel) and oxygen to generate electricity by an electrochemical process
- ✓ Fuel Cells resemble batteries - electrical output is due to an electrochemical process
- ✓ Unlike batteries, fuel cells
 - operate off a continuous stream of O_2 & H_2 fuel
 - the active elements are not consumed by the chemical reaction



The Mining and Minerals Sector Downstream Dimension

“We have always been a supplier of minerals to the world, what we are now finding is that the world economy is changing rapidly and is expecting an economy such as ours to be able to produce higher-value manufactured products.

(Min. Alec Erwin)

- SA holds a significant share of the worlds minerals resources and production
- However, we have not been able to use this endowment to attain a satisfactory economic and social performance

The Natural Resource Curse

- ✓ Economists believe there is a causal relationship between natural resource endowment and economic development
- ✓ The Natural Resource endowment tends to channel economic policies towards capturing the primary products market and less emphasis is put on manufacturing

Beneficiation for economic growth

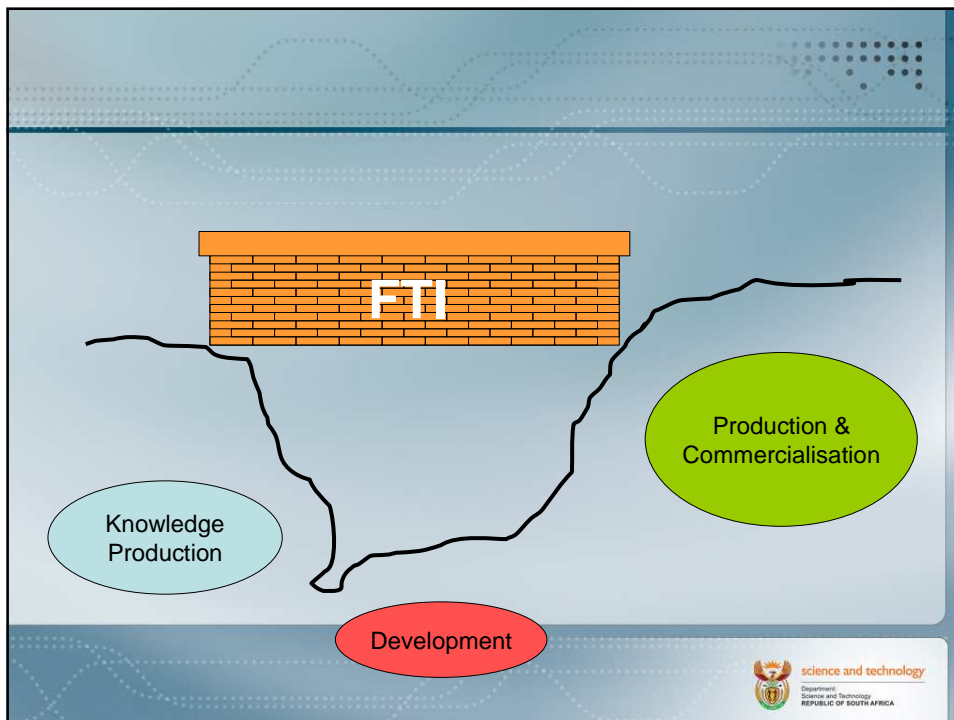
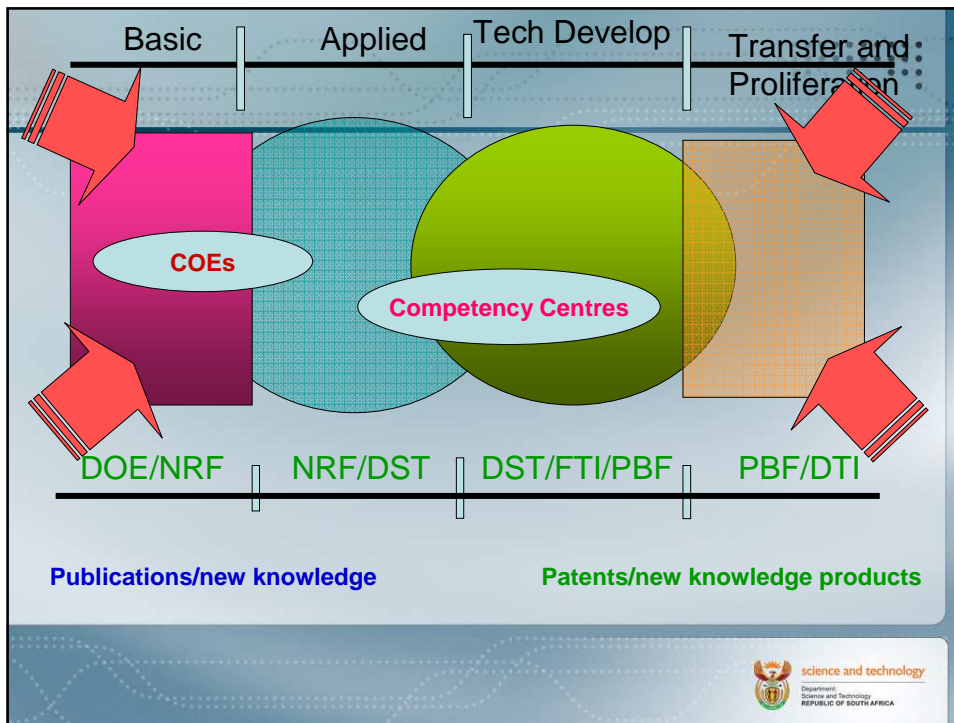
- ✓ IT and services are helping India log 6% year-on-year increases in GDP
- ✓ China's vast manufacturing base is raising its GDP by around 9% a year
- ✓ What technology missions will put us on the map?
- ✓ Value addition contains more learning effects that impulses the rest of the economy into a steeper productivity curve

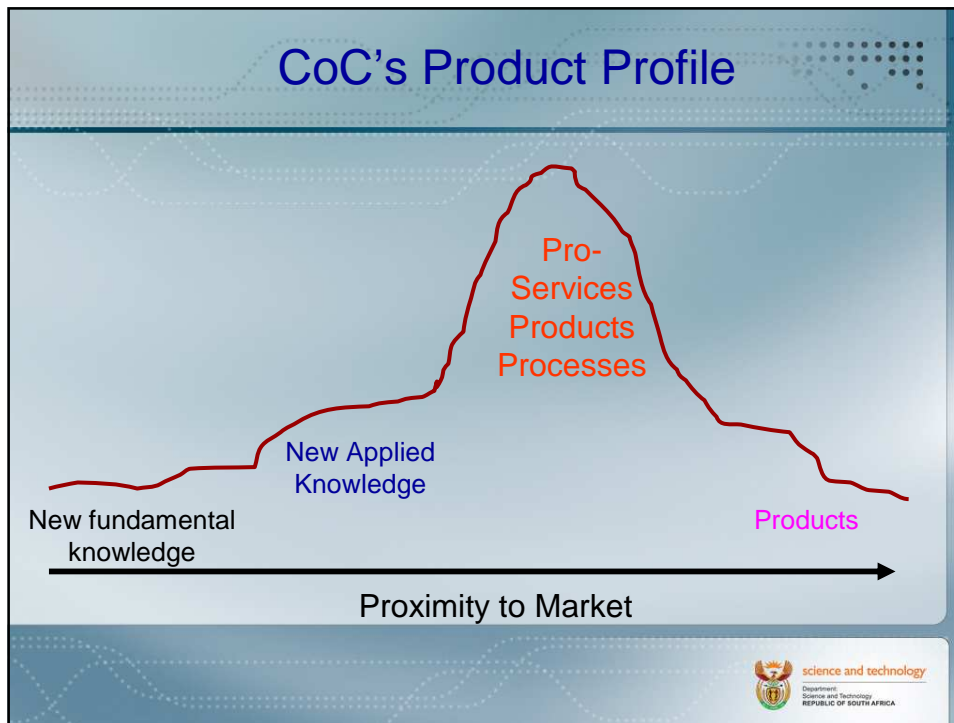
Our Hydrogen Vision


“ to create knowledge and human resource capacity that will develop high value commercial activities in hydrogen and fuel cell technologies utilising local resources and existing know-how”

Strategic Goals

- ✓ Develop PGM-based catalysts in South Africa: supply 25% of catalysts demand for the global fuel cell industry by 2020
- ✓ Develop local cost competitive hydrogen infrastructure solutions (based on natural resources)
- ✓ Promote beneficiation, develop downstream industries & create sustainable jobs linked to our minerals wealth





- ## DST Objectives re CoC
- ✓ Competence centres would be complementary to Centres of Excellence
 - ✓ Deliberately target industry participation and development
 - ✓ Competence Centres are far more than networks: they involve contractual relationships between the parties, clear short medium and long-term innovation objectives, the establishment of specialized infrastructure, shared staffing between partners, proactive attention to intellectual property issues
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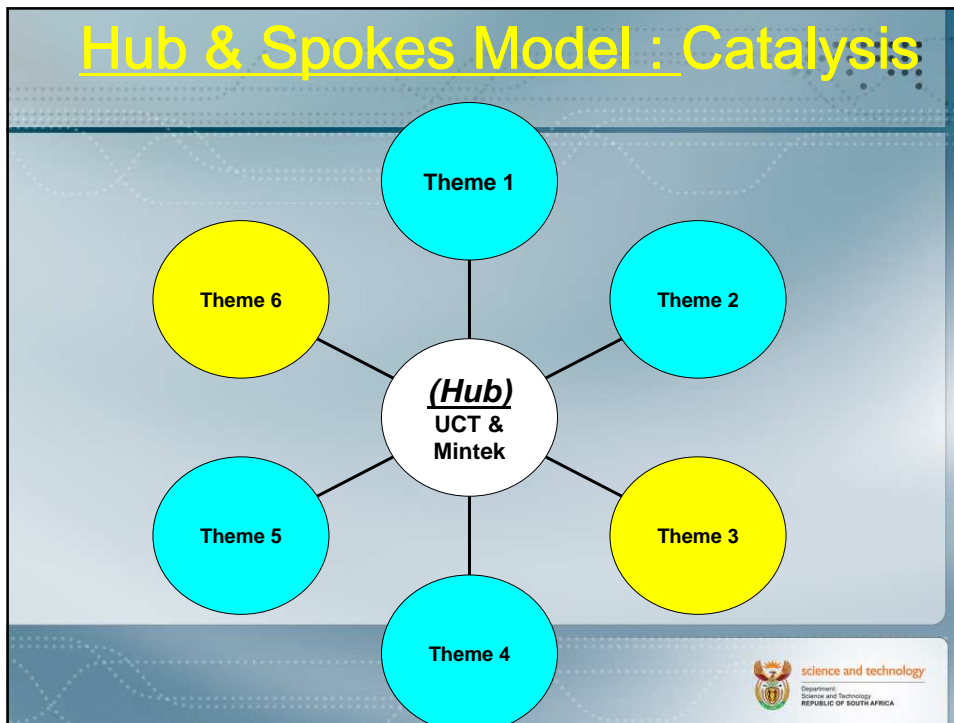
DST Objectives re CoC

- ✓ They may be on University Campuses, but do not operate directly under academic supervision
- ✓ Competence Centre programmes will be placed in the envisaged Technological Innovation Agency
- ✓ H&FC CoC will have the flexibility of an emerging R&D area
- ✓ Adopt best practices of other systems rather than sticking to fixed guidelines

DST Objectives re CoC

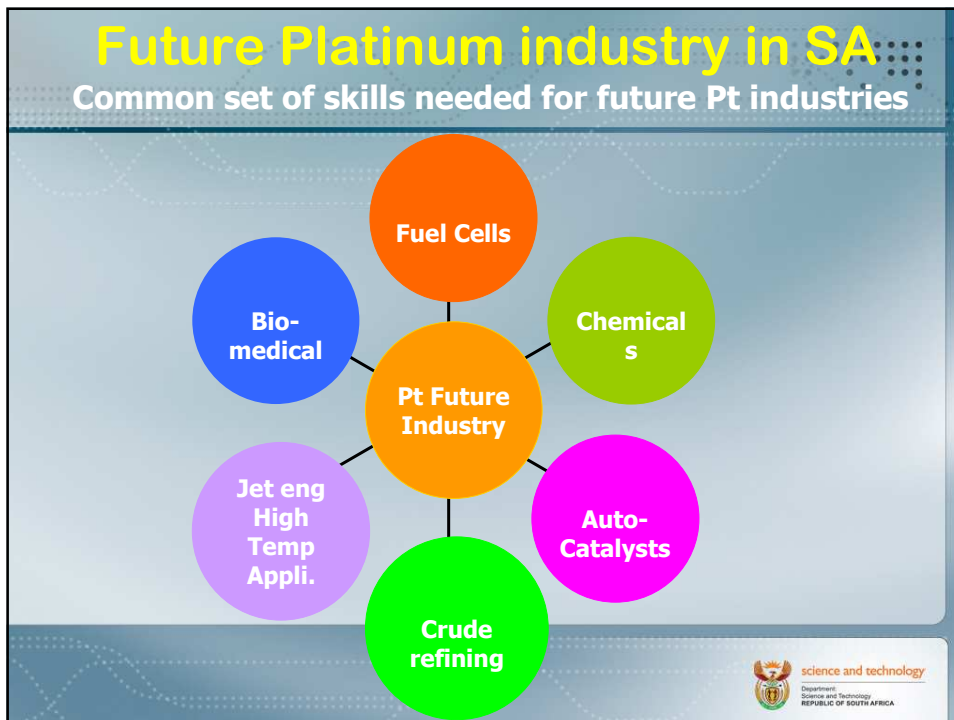
- ✓ Centres of Excellence for Innovation
- ✓ Multidisciplinary Teams
- ✓ Industry partnerships are key
- ✓ Long term funding commitment (with appropriate M&E)
- ✓ Initially, we need to recruit aggressively from abroad (NRF, DST Bilaterals etc.)
- ✓ Focus on expertise development initially (for a specified product pipeline)

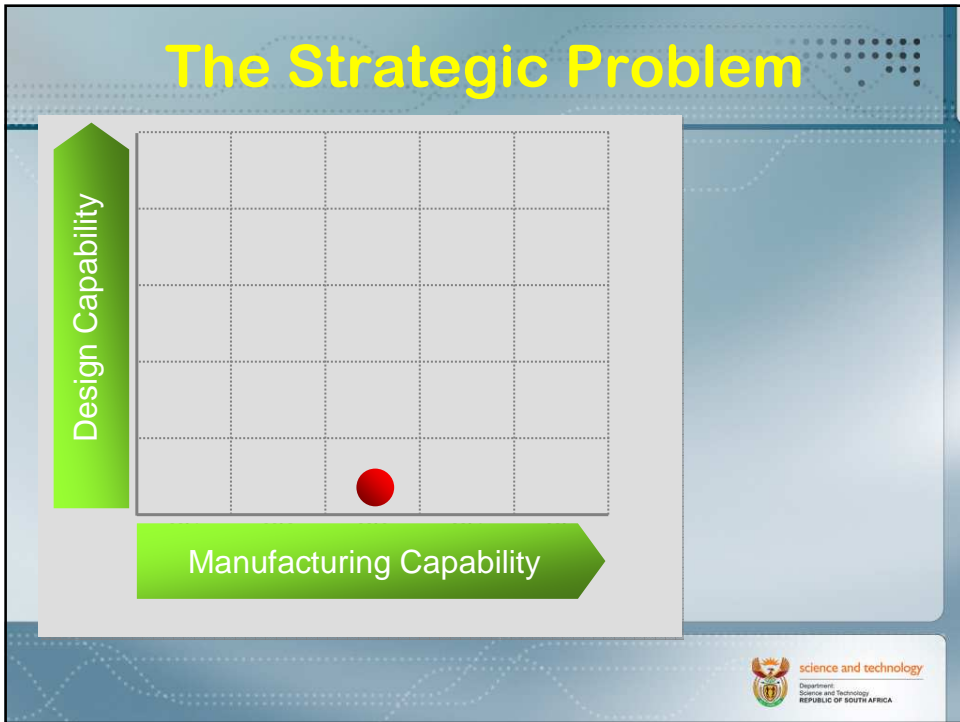
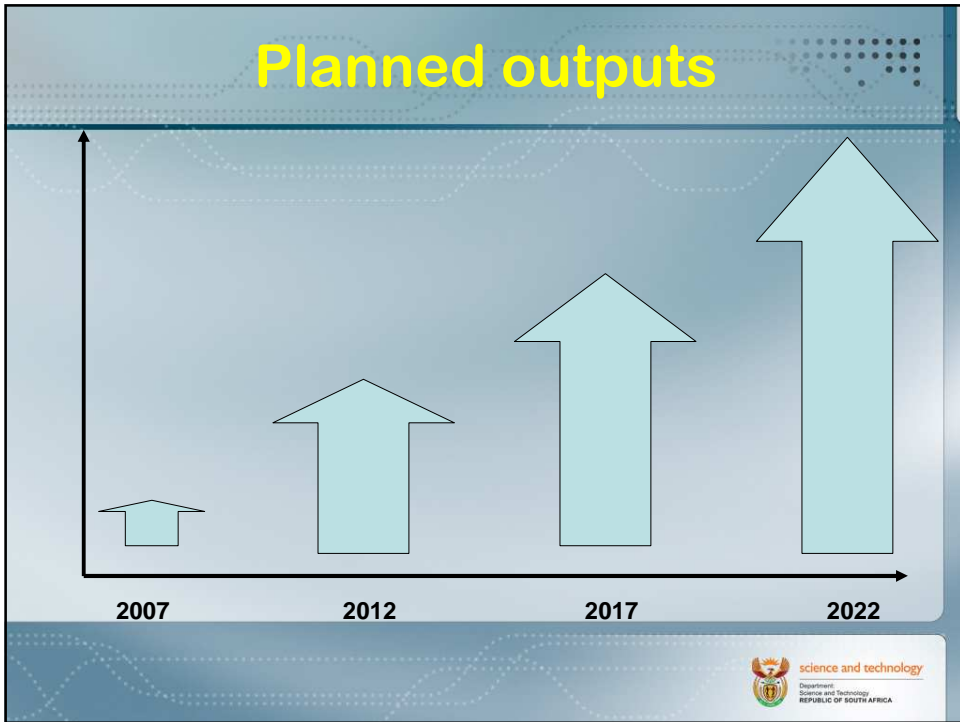
Hub & Spokes Model : Catalysis

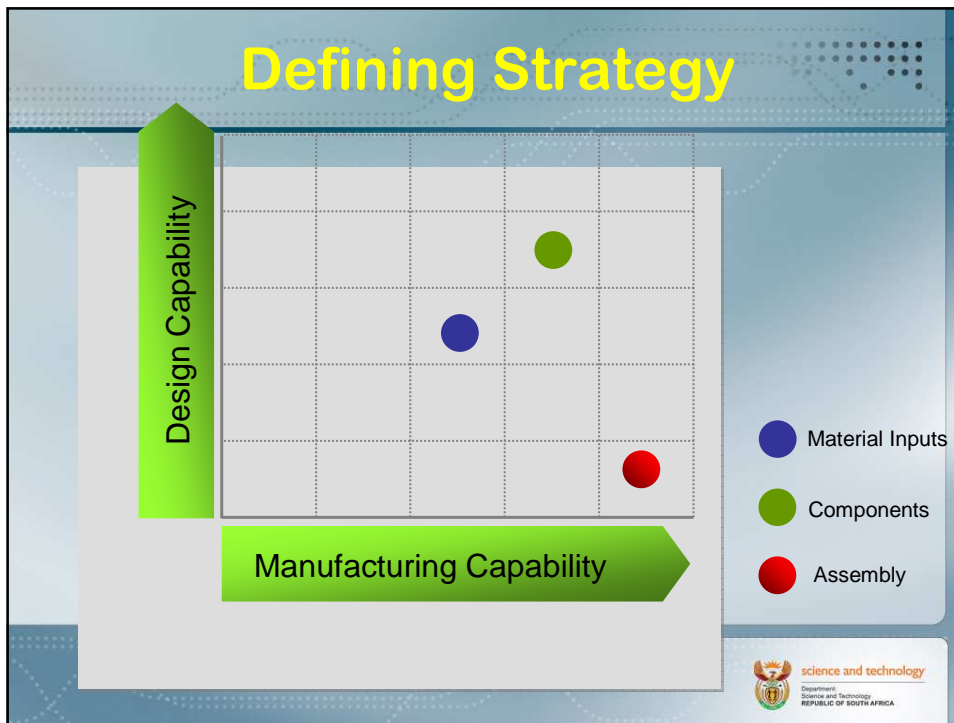


Future Platinum industry in SA

Common set of skills needed for future Pt industries

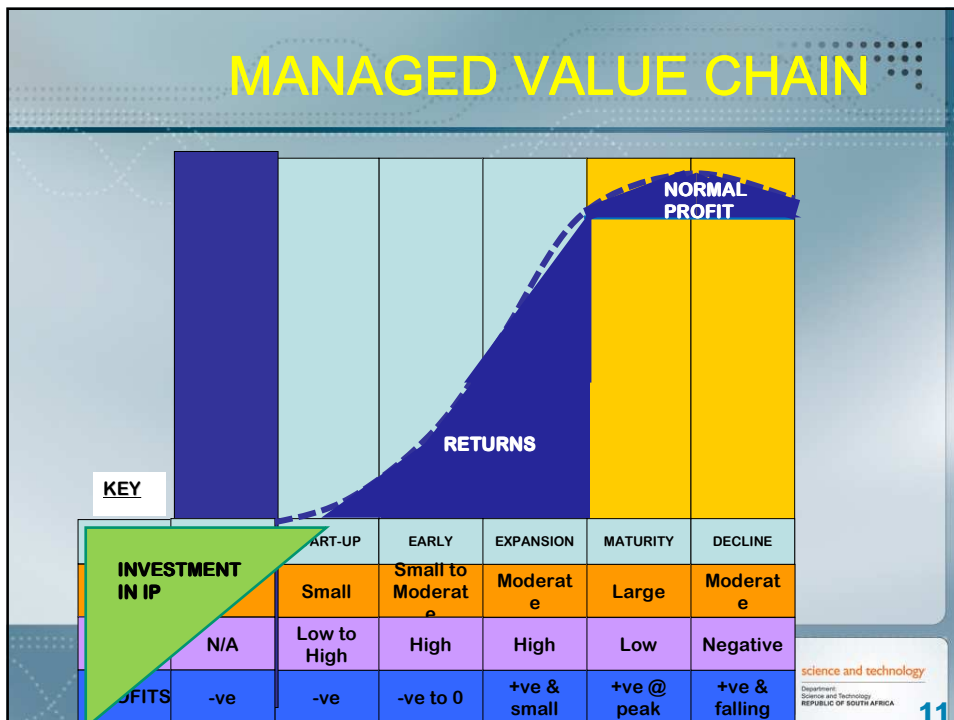
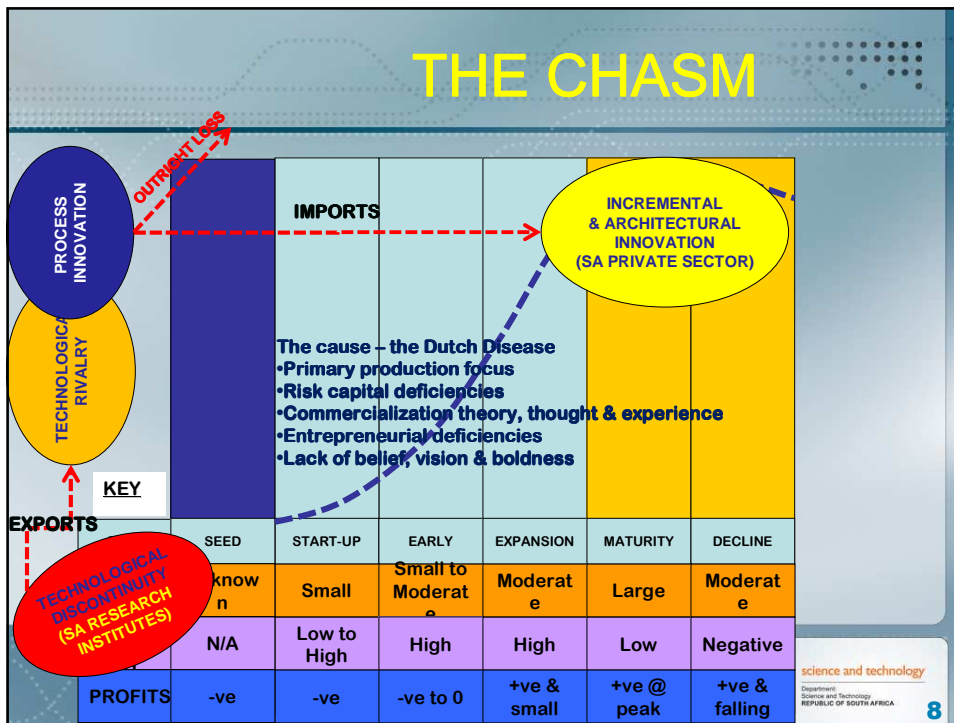






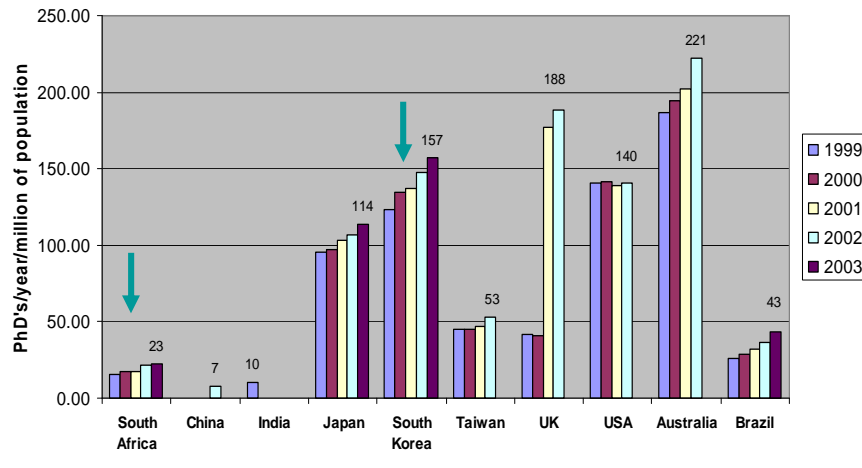
Technology Design Scale

National Innovation	TI5	Global IP leader. Systems level: Capability to develop comprehensive innovations within a field at a systems level that provides a sustained global competitive advantage in product development at systems level
	TI4	Global IP leader – component level: Capability to develop comprehensive innovations within a field at a component level that provides a sustained global competitive advantage in product development at systems level
Technology Transfer	TI3	Customisation of Licensed IP: Capability to customise existing design for national conditions.
	TI2	Component Integration - IP licensed: Ability to integrate licensed components into a system.
	TI1	Turnkey assembly: Ability to assemble turnkey solution.



Benchmarking

Selected Countries PhD production rates Profile



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Thank You

For more information on the South African Hydrogen Activities

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