

Overview of the Energy RDI Programme/Strategy to leverage funds for demonstration

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Occasion: DSI- Eskom bilateral

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science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

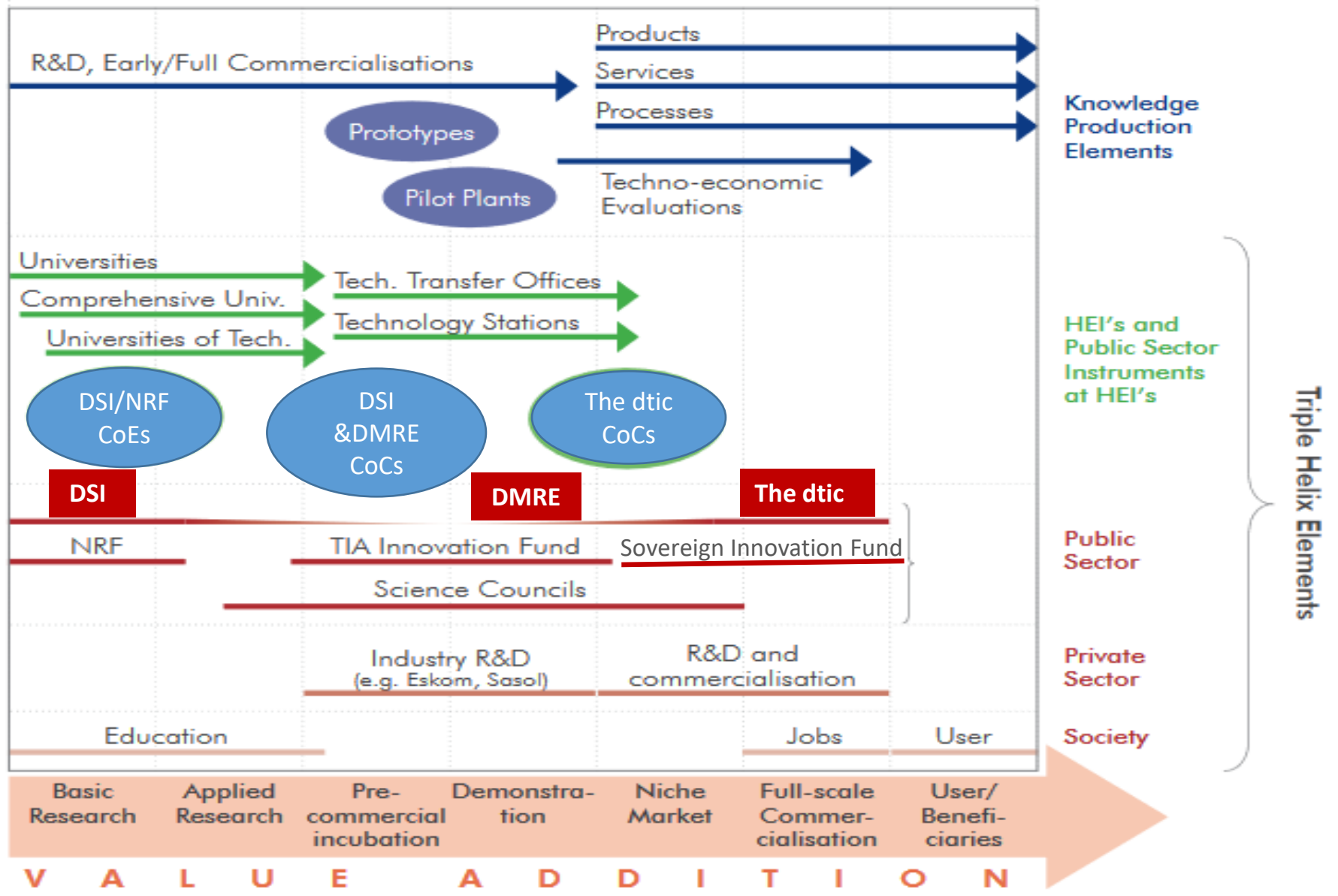


White Paper on Science Technology and Innovation

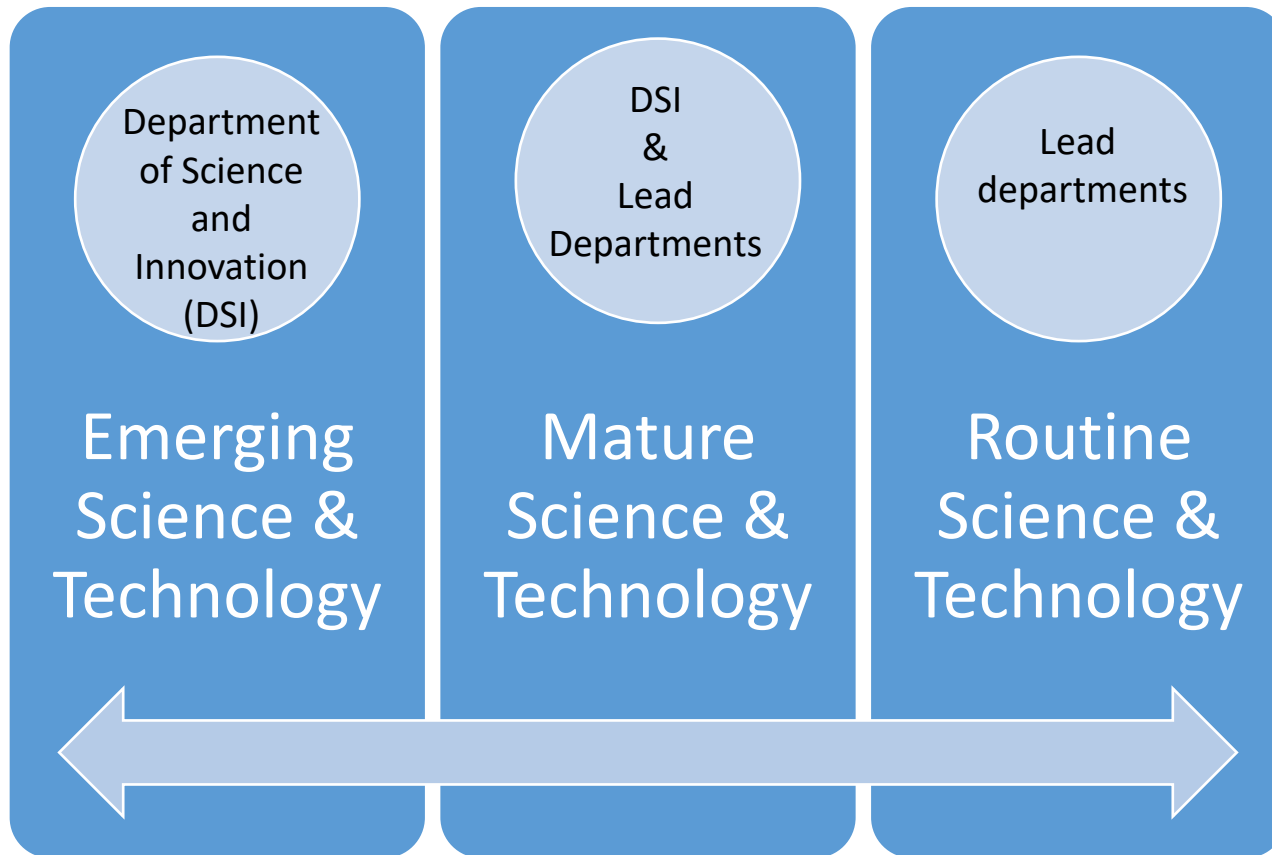
- Fully-fledged Department of Science and Innovation (DSI) with the mandate of a:
 - Responsive, coordinated and efficient ***National System of Innovation***
 - Human capital development for science
 - Increased knowledge generation
 - Using knowledge for economic ***and inclusive*** development
 - Innovation for a capable state
- March 2019 New White Paper on Science, Technology and Innovation



National System of Innovation



New Department of Science and Innovation mandate

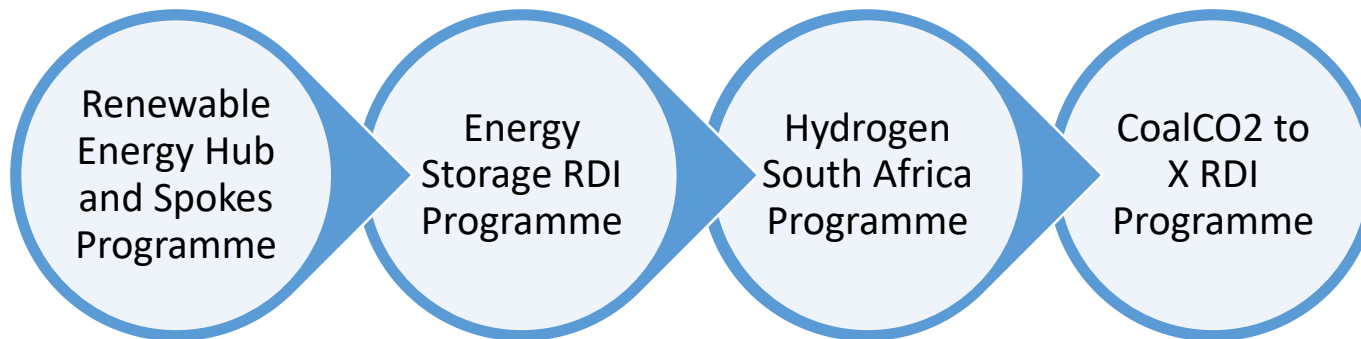


- New mandate of the new Department of Science and Innovation: Addition of the innovation function.
- Decadal Plan to give expression for the stronger systemic coordination role assigned to the DSI by the White Paper.

Hydrogen and Energy Chief Directorate

- Hydrogen and Energy Chief Directorate is to support:
 - 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;
 - 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.

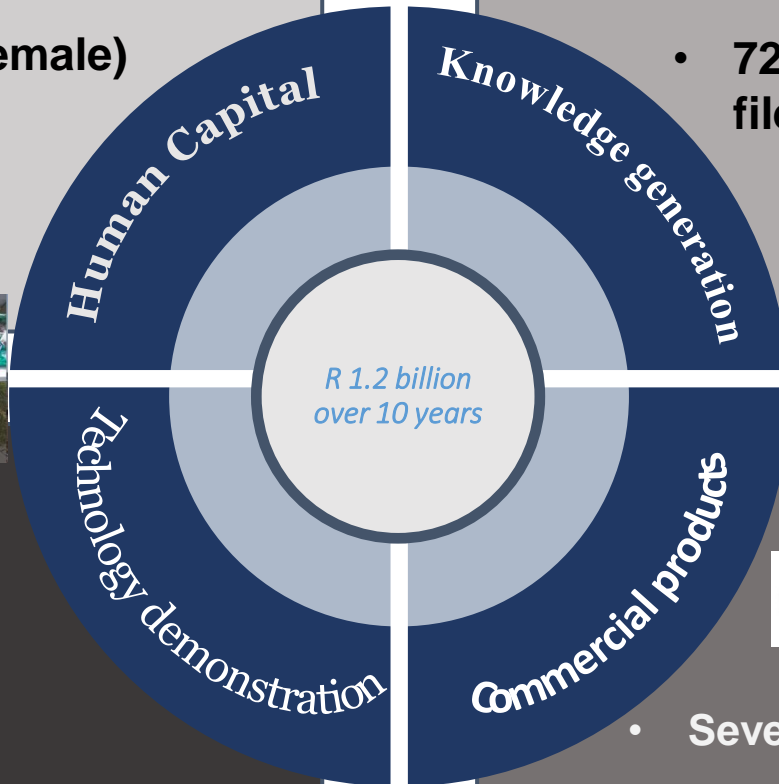
Energy RDI Flagship Programmes



Overview of Energy RDI Programme Outputs

- 635 (436 MSc, 199 PhD) graduated
- (57% black and 33% female)

- 961 Publications
- 72 patents filed/granted



- 32 technology demonstrations (pilot plants, 15 fuel cell deployments, solar water desalination plant, PV installations)

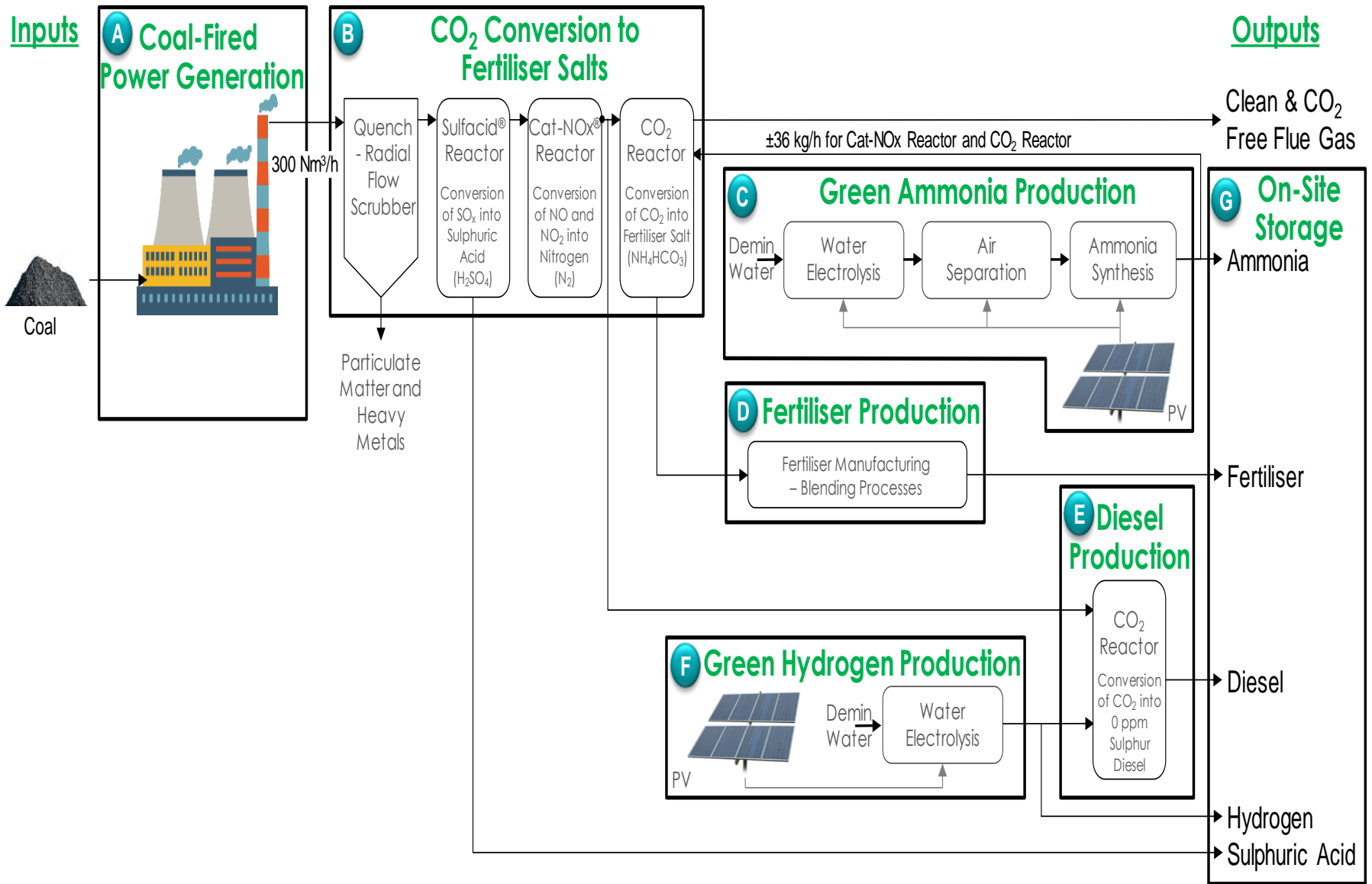
- Seven spin out companies
- (28% female CEOs)



Phase 1: Coal CO₂ to X RDI Programme

- The Coal CO₂ to X RDI Programme currently is funded with a R60 million commitment over three financial years (from March 2020 to March 2022) by the Department of Science and Innovation High End Infrastructure Programme. The second phase of a proposal for R 60 million will be submitted to CLIENT II Programme with an allocation that will support the development of Green Ammonia Production facility by German partners:
 - The vision of the CoalCO₂-X™ carbon capture and conversion economy RDI Roadmap is that the development and deployment of integrated green technologies for the capture and conversion CO₂ from industrial processes will deliver a significant contribution to the abatement of flue gas emissions. That it will lead to the development of a sustainable secondary commodities economy to create significant social, economic, and environmental benefit in South Africa;
 - Building upon the capabilities developed under Hydrogen South Africa to produce solar from hydrogen demonstrate the technical viability of decentralized Green Ammonia production with a zero CO₂ footprint using renewable energy;
 - Demonstrating the paradigm shift that a “dirty” coal-fired power plant could actually form the basis of a future modern CO₂ free chemical factory that generates revenue beyond electricity production.

Phase 1: Coal CO2 to X RDI Programme



Coal CO2-X System Lever Integration

Deliverables for R80M @ 3 Years




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 Endorsement








BLACK BUSINESS COUNCIL

Chemistry 1.0 = Coal Chemistry
 Chemistry 2.0 = Petrochemistry
 Chemistry 3.0 = Globalisation & Specialisation
 Chemistry 4.0 = Digitization, Circular Economy & Waste Gas Conversion

Compliance Limits for Local Pollutants

Local Pollutant	Cat. 1.1 Power Generation - Coal	Cat. 4.7 Steel – Electric Arc Furnace	Cat. 3.2 Steel – Coke Production	sappi	Cat. 4.17 Precious Metal Refining	 PPC	 ENVIROSERV <small>WASTE MANAGEMENT</small>
PM	50	30		50	50	30	10
SO ₂	500	500		300	400	50	50
NO _x	750	500		300	300	800	200
CO							50
H ₂ S			7	15			
Hg						0,05	0,05
HCl					30	10	10
HF					30	1	1
Pb + As + Sb + Cr + Co + Cu + Mn + Ni + V						0,5	0,5
TOC						10	10
PCDD/PCDF (ng I-TEQ/Nm ³)						0,1	0,1

Abbreviated and selected activities from section 21 (Act. 39 of 2004)

All values except PCDD/PCDF indicated in mg/Nm³, dry, 10% O₂, 273K, 101,3 kPa

CoalCO₂-X Technology Demonstration Capability

Towards a Carbon Capture and Conversion Economy

CoalCO₂-XTM Technology captures industrial process flue gas multi-pollutant emissions

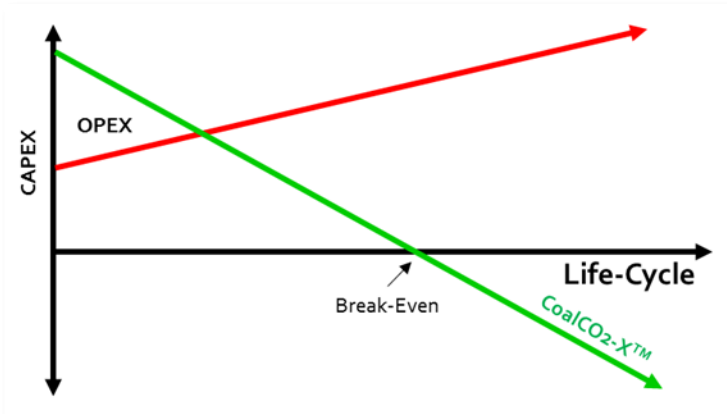
Description	% Reduction
Particulate Matter	>1%
Sulphur dioxide (SO ₂)	>99%
Nitrogen Oxide (NO _x) as Nitrogen Dioxide (NO ₂)	>72%
Carbon dioxide (CO ₂)	>97%

and then

converts sulphur dioxide and carbon dioxide to produce multiple saleable commodities

Saleable Product Streams	Mass Flow
Sulphuric acid (49 wt.%) H ₂ SO ₄	6,7 kg/h
Green Ammonia (NH ₃)	3,6 kg/h
Commercial fertiliser	500 kg/h
Diesel production	6,67 l/h
Hydrogen production	0,25 kg/h
CO ₂ savings (Carbon tax)	0,09 t/h

CoalCO₂-XTM Provides a Return on Investment compared to other flue gas emissions abatement technology



Positive ROI

Example Gross Income per annum over a 10 year period*

*On 300Nm³/h gas inlet plant

Saleable Product Streams	Price - ZAR	Income / Savings pa.
Sulphuric acid (49 wt.%) H ₂ SO ₄	1 450 / t	69 948
Green Ammonia (NH ₃)	4 495 / t	116 510
Commercial fertiliser	3 300 / t	11 286 000
Hydrogen production	12 / t	887 040
CO ₂ savings (Carbon tax)	40 / t	26
SO ₂ savings (Externality cost)	7.6 / kg	96 115
NO ₂ savings (Externality cost)	4.45 / kg	6 247



Dankie

Ro livhuwa

Enkosi

Siyabonga

Ha khensa

Siyathokoza

Re a leboga

Thank you