

CPD Points: 2 ECSA CREDITS



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INFRASTRUCTURE
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Pioneering the Future Eskom's RT&D Role in
Advancing Energy Engineering and Innovation

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Theme: Pioneering Change Engineering Infrastructure for Inclusive Growth

Outline

Clean Coal Projects

Clean Coal Supporting Projects

Clean energy Projects

Gas and Renewable Research Projects

Digitalisation Portfolio

External Participation on RT&D research Projects

What role Consulting Engineers play in SA future energy



Clean Coal Projects

High Efficiency and Low Emission

Circulating Fluidised Bed Combustion

technology has been identified for repowering purpose. The CFBC project aligns to the Integrated Resource Plan (2025)

CFBC is a clean and efficient coal technology used for power generation.

Because of its fuel flexibility, lower emissions, and improved heat transfer

Coal combustion & Firing Systems

Eskom aims to mitigate its carbon emissions and explored the option of **co-firing biomass and ammonia** with coal at its power stations.

A co-firing test using biomass and ammonia was conducted on the RT&D test rig in December 2025.

Overall, biomass co-firing demonstrated favorable SO_2 and NO_x performance within compliance limits, while ammonia co-firing showed potential for CO_2 reduction.

Carbon Capture Utilisation and Storage

Eskom has initiated a research project to demonstrate a **Carbon Capture Utilisation and Storage (CCUS)** technology at a coal-fired power station within the fleet.

The **CCUS** technology is important to support decarbonization within the energy sector.

A **demonstration** plant of a post-combustion chemical absorption technology has been selected for demonstration at **Kusile Power Station**

Duct Sorbent Injection (DSI)

Eskom is investigating cost-effective ways and water conscious **Flue Gas Desulphurisation** to reduce **SO₂** emissions at some operations to meet statutory requirements.

Evaluating **DSI-FGD**. According to literature, calcium-based sorbents can remove SO_2 at 30% - 60% efficiency and sodium-based ones have indicated as high as >80% efficiency in some cases.

Test are conducted for **Majuba and Lethabo Power Station**.

Clean Coal Supporting Projects

Low Fuel Igniters

Eskom have initiated a project on **Low fuel igniters** technologies, such as **plasma ignition and mini-oil gun**.

The use of **Low-fuel igniters** will result in a significant operational cost saving in fuel oil that is required for unit light-ups, shutdown,.

This will improve the **unit flexibility**, particularly **low load** operation without the requirement for **fuel oil support**.

Successful implementation of this project is critical capability to manage **transmission network** requirements and **overall system costs** which otherwise would require curtailment of renewables or substitution of coal with more expensive generation options to manage the variability

Management of Coal Combustion by-products

Novel techniques for ash utilization (**road construction**), novel techniques to utilize **FGD Gypsum utilisation** and utilisation of future emission control by-products.

- Kusile road completed.
- Matla-Kriel in progress.
- Komati-Hendrina planned

Other ash utilisation/beneficiation options are explored – ash poles for **Tx/Dx** lines.



Clean Energy Portfolio

Long Duration Energy Storage

Long Duration energy storage technologies **providing storage more than 8 hours**. Critical for grid **decarbonization** and grid stability. Technologies that are available globally includes but limited to the following :

- Pumped Thermal Energy Storage.
- Carbon Dioxide (CO₂) Battery.
- Gravity Energy Storage.

Nuclear SMR

The scope of deploying Small Modular Reactors (SMRs) for the **coal-to-nuclear** transition at retiring coal-fired power plants. The main benefits associated with coal to nuclear conversion include:

- Infrastructure Reuse.
- Avoids stranded assets
- SMRs provide **24/7 dispatchable**, zero-carbon electricity, and stabilizing the grid.
- Economic & Social Impact **Preserves jobs**.
- Energy Security: Mitigates **intermittency** challenges from renewables.

BESS Manufacturing

To drive South Africa's energy transition and ensure grid stability, Eskom is prioritizing the development of both **Battery Energy Storage Systems (BESS) technologies**.

Moving away from a reliance on imports and their associated supply chain risks, the utility plans to establish fully integrated **domestic manufacturing value chains** ranging from silicon processing to the production of battery cells.

Eskom aims to **co-develop these technologies locally**, thereby securing energy independence, fostering industrial growth, and creating sustainable green jobs.



Gas and Renewables Flagship Research Projects

Project	Description	Value Add
<p>1 PV Manufacturing</p> 	<ul style="list-style-type: none"> Explore the feasibility of establishing a fully integrated PV manufacturing value chain in South Africa to contribute meaningfully to domestic industrialisation, local content development, and regional energy independence. 	<ul style="list-style-type: none"> Localisation, industrialisation, Job creation and development of new supply chain enterprises Capacity-building and skills transfer to South African workforce. Enhanced alignment with green procurement strategies by promoting localised clean energy value chain
<p>2 RHF Pilot Plant</p> 	<ul style="list-style-type: none"> Pilot a Renewable Hydrogen Facility (RHF) at ERIC. Integration with existing infrastructure to allow for green certification and testing related end-use applications. 	<ul style="list-style-type: none"> The location allows integration into the DSTI's National Hydrogen Valley. Internal skills development Presents Eskom with an informed pathway for the adoption of hydrogen at scale and cost that is competitive.
<p>3 HRES</p> 	<ul style="list-style-type: none"> Develop a Hybrid Renewable Energy System (HRES) for the benefit of Eskom 	<ul style="list-style-type: none"> Investigate the global state of technology, and Eskom needs for an HRES facility. Develop a design basis for an expandable, adaptable HRES facility for testing of future 'Green' technologies. Repurposing of the Majuba UCG site.
<p>4 Waste to Energy (WtE)</p> 	<ul style="list-style-type: none"> The project aims to establish a proof-of concept facility that demonstrate how WtE can become a sustainable and scalable solution to South Africa's waste and energy challenges 	<ul style="list-style-type: none"> Reduce landfill dependence by converting municipal waste to usable energy Generate electricity contributing to energy security and diversification Demonstrate environmental compliance Build local capacity and knowledge on the WtE systems
<p>5 Hybrid-CPV</p> 	<ul style="list-style-type: none"> Establishment of a pilot plant to further develop an existing prototype for generation of electricity yield data to demonstrate techno-economic feasibility, 	<ul style="list-style-type: none"> Opportunity to develop new, valuable intellectual property, commercialization, promoting further research and development opportunities,

Digitalisation Portfolio

Digitalisation

Research support **Eskom zero harm** by reducing human exposure to hazardous environments such as some facilities in **Koeberg Power Station** through exploring robotic system and digital twin.

AI-enabled robotic systems offer the capability for consistent, repeatable, and data-rich inspections to enhance Eskom's asset intelligence, enabling **earlier identification of emerging faults**, improved **condition assessment**, and more informed **maintenance planning**.

The long-term benefits include **potential cost savings** through reduced reliance on manual inspection, lower exposure-related costs, and avoidance of high-impact incidents.

Augmenting human teams with these digital and robotic systems will allow skilled personnel to focus on **higher-value tasks**, improving overall workforce productivity.



Strategic enablers for research delivery external to RT&D

22 Focus areas

2

22 Focus areas tendered and concluded with South African Public Tertiary Institutions

17 Memberships

4

17 memberships both local and international



1

Key driver

Strengthening partnerships (local and international) with stakeholders to improve technical, environmental, safety, and security performance

3

14 Universities

In collaboration with 14 universities thus far

Consulting Engineering in support of the net-zero by 2050 plays a major role in exploring technologies that drives:



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Eskom hydrogen technology applications & roadmap

Eskom hydrogen technology roadmap

Six Eskom identified use cases

Hydrogen production for sale/use

Hydrogen blending

Power wheeling

Mobility

Grid Services

Off grid solutions

Timeline of Activities

Preliminary design of concepts (2023-2025)

The pre-feasibility stage is intended to support Eskom in building its internal capacity, enhancing its resources to begin green hydrogen activities, develop project concepts aligned with its low-carbon roadmap strategies and net zero emission goals.

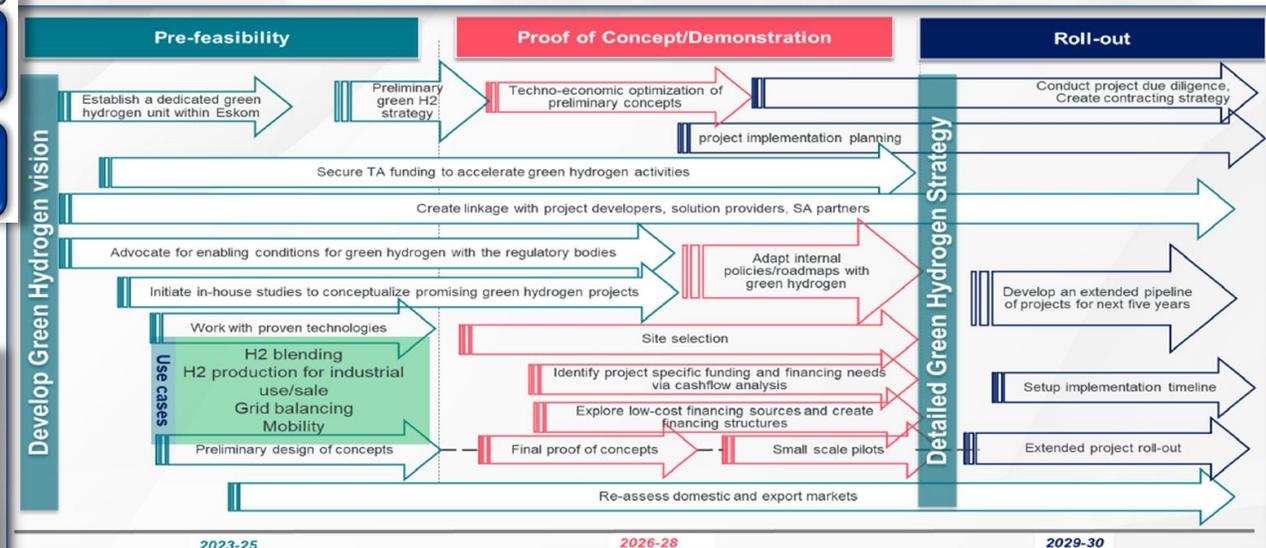
Full feasibility/proof of concept (2026-2028)

The proof of concept stage will leverage on the earlier preliminary project design concepts, market linkage activities and already established cooperation frameworks with external partners.

Demonstration and early "Roll-out" phase (2029-2030)

The activities in this phase will focus on successful implementation of the pilot demonstration projects identified during the earlier proof of concept stage, by securing investment, funding and partnerships to support project's implementation

Eskom hydrogen technology roadmap framework



Green hydrogen certification system for South Africa

Eskom Research and Development [In Progress from 2021]

- To enable preliminary design, feasibility/proof and roll out steps
- Pilot plant to develop skills and information to support road map phases

Solar PV Manufacturing Facility Project

Project Background

- ❖ South Africa has significant solar resources, an established module assembly sector, but remains dependent on imported PV cells and upstream materials. Most of Africa also lacks upstream manufacturing capacity, leading to value leakage and supply chain risks.

Project Objectives

- ❖ Develop a fully integrated PV manufacturing value chain, from raw materials to finished modules, with an initial capacity of 1 GW per annum, scalable to 4 GW per annum.

Strategic Benefits for Eskom

-  **Accelerates Grid Decarbonisation**
Enables faster domestic PV production for a cleaner, greener grid.
-  **Revenue Diversification**
New income streams beyond electricity generation
-  **Just Energy Transition Leadership**
Pioneering clean energy manufacturing
-  **Import Dependency & Foreign Exchange Exposure**
Stabilises project costs and shields against global supply chain disruptions.
-  **Skills Development**
Advanced manufacturing capabilities
-  **Stimulates Local Industrial Development & Job Creation**
Revitalises existing manufacturing sectors and fosters new supply chain enterprises

