Research, Testing and Development

Eskom

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Eskom Research, Testing & Development

Eskom

Testing the Boundaries of Possibilities.

Foreword

The Eskom Research & Innovation Centre (ERIC) based in Johannesburg is home to the Research Testing & Development (RT&D) business unit of Eskom. The ERIC facility was established in the early 1980s and over time experienced changes to its name, people and environment that it operates in. All the while, the mandate has remained largely unchanged, that being the provision of scientific and engineering capability to research, test and develop technologies to sustain the Eskom operating model.

In December 2018, Eskom announced a new business operating model. This model separated Eskom into three business entities: Generation (Gx), Transmission (Tx) now known as the National Transmission Company of South Africa (NTCSA) and Distribution (Dx). In support of the operating model, service functions such as RT&D were relinked to operations within Eskom Holdings.

The new business model has necessitated review of the RT&D Strategy. The RT&D Strategy is driven by a number of factors and considers the organisation's and divisions' roadmaps toward 2035. Because of the changes that the organisation has undertaken in implementing its turnaround strategy which focuses on improving the technical performance of Gx, Tx and Dx operations, improvements to the poor financial position of Eskom and the drive to reposition Eskom as a clean and green energy company, RT&D must be adequately set up and aligned with the new operating model to be able to address business needs.

Effective September 2021, the Eskom RT&D function now operates at a corporate level. Under this new operational structure, RT&D continues to focus on the following business areas:

Research: operational, applied, strategic, basic research, pilots and demonstrations and research work funded through the National Energy Regulator of South Africa (NERSA) allocation.

Specialised consulting: focusing on high-impact technical challenges as prescribed in the service level agreements (SLAs) with the line divisions, Eskom subsidiaries, Eskom Rotek Industries and NTCSA.

Specialised testing and analytical services: routine and specialised laboratory testing and analytical services for the line divisions.

We have further aligned with line divisions to make them more inclusive in the direction of work that is undertaken and reciprocally provide strategic direction through our work to them. We have also acknowledged the need for agility in conducting our work and delivering on outputs. As such, we have revised our Research Governance Framework to ensure agility and are now focused on delivery. In strengthening our capability, we have also assumed accountability for the university partnership oversight for Eskom through the Eskom Power Engineering Programme (EPEP) and have diligently reviewed and sustained our local and international partnerships.

As we enter into 30 years of our country's democracy, we embrace the transitioning energy landscape and look to innovatively and effectively guide our organisation forward, hand-in-hand with our most valuable asset: our people.

Prudence Madiba

General Manager
Research, Testing and Development

Vision

To be a sustainable world-class Eskom facility for applied research, innovation and specialised testing and consulting, that serves the needs of Eskom, South Africa and beyond, in a changing energy landscape.

Mission

- Deliver novel solutions and services for customers' growth, sustainability & competitiveness by exploring cutting edge technologies or business opportunities in the local and regional energy industry.
- Be the go-to hub for new technology research, development, testing, and consulting in the energy industry by exploiting the resources and capabilities within RT&D.
- Pioneer the introduction & rapid piloting/demonstration of cleaner energy technologies in a safe, cost-effective & sustainable manner.

The role of RT&D

The Research, Testing & Development business unit at Eskom plays a critical role in supporting the organisation with scientific and technical expertise. It provides research, testing, consulting and strategic technical planning services that help guide Eskom's technological direction. The unit's key function is to open new technological opportunities by offering R&D support for emerging and cutting-edge technologies, creating partnerships with universities and research institutions to address technological and skills challenges faced by Eskom plants.

RT&D's research agenda is primarily driven by the needs of Eskom's line divisions, which represent the company's core business and are the primary beneficiaries of its work. As such, the business unit focuses on applied research that delivers practical, operational solutions aligned with Eskom's strategic objectives. However, the unit also dedicates resources to exploring technology innovation and emerging technologies to ensure Eskom remains competitive and sustainable.

RT&D's work contributes to Eskom's sustainability, balancing financial, social and environmental factors while strengthening Eskom's internal competencies and ensuring the company remains at the forefront of energy technology advancements.


ENERGY
STORAGE SYSTEM

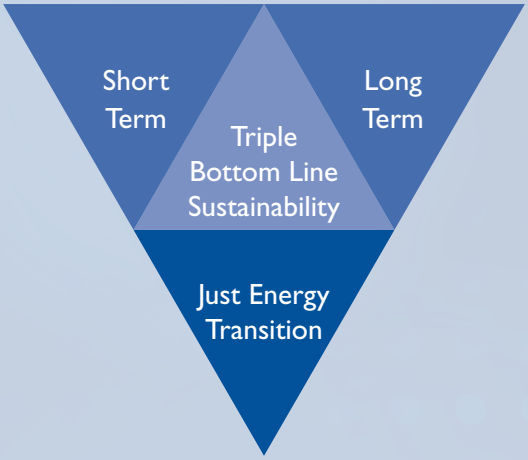
RT&D Strategy 2022/23 – 2034/35

Since September 2021, RT&D has transitioned to operate at a corporate level, reporting to the Group Executive: Strategy & Sustainability. The RT&D Strategy is designed to align its business areas - research, specialised consulting and specialised testing and analytical services - with Eskom's new operating model. This entails a dedicated focus within RT&D on Generation (Gx), Transmission (Tx), and Distribution (Dx) research, in line with Eskom's strategic direction.

The strategy aligns RT&D's efforts to conduct strategic and blue-sky research, as well as support line divisions in operational recovery initiatives for short-term challenges while catering to transitioning towards clean coal and conducting strategic and next horizon research to position Eskom as a smart and green utility.

Eskom Turnaround plan

- Strengthen Balance sheet
- Improve Income statement
- Build High Performing Culture
- Improve Operations
- Drive restructuring



JET

- Accelerate the repurposing and repowering of stations
- Actively pursue share in renewable energy allocation in line with IRP
- Implementation an integrated socio economic strategy including reskilling
- Smart industrial policy can drive manufacturing investment

Transitional utility

- Achieve net zero emissions by 2050 factoring in the need to continuously nurture economic value
- Ensure effective and equitable access to electricity by modernizing our power systems
- Facilitate competitive energy industry for the future
- Financially and operationally stable

RT&D supports Eskom line functions with operational recovery initiatives such as solving technical challenges related to Eskom's line divisions. This includes research on emissions control, frequency control and other technical solutions to address immediate challenges such as the energy trilemma by prioritising technologies and projects that deliver long-term sustainability while addressing the immediate need for energy security and affordable access. RT&D research ensures that South Africa's energy future is inclusive, environmentally responsible, and economically viable.

The business unit assists with the transition towards clean coal solutions and green energy generation by positioning Eskom for the Just Energy Transition (JET), including research to accelerate the JET process for Gx, Tx and Dx. Examples include work on microgrids, repurposing/ repowering projects, smart electricity, e-mobility and digital transformation.

Lastly, RT&D's efforts to assist in positioning the business to be a greener and smarter utility are dedicated to research and product development, aimed at positioning Eskom for new growth areas and ensuring long-term competitiveness. This includes explorations into green hydrogen and other emerging technologies. Our rapidly increasing knowledge about new and suitable technologies helps accelerate our drive to implementable energy solutions.

RT&D's long-term strategy is also informed by major trends reshaping the global electricity sector, focusing on four key areas:

- **Decarbonisation**: A shift towards reducing carbon emissions and the commitment to achieving net zero emissions by 2050.
- **Digitalisation:** Maximising the use of digital technologies to optimise operations and drive cost reductions.
- **Decentralisation**: A change in a single utility direction electricity model to a more decentralised model (seeing growth in residential and commercial self-generation).
- **Democratisation:** Shift in the energy market to include more players such as renewables co-operatives and municipal/- and/or community-owned power stations.

Decentralisation, decarbonisation, digitalisation, and democratisation are not independent terms and their interplay is relevant when trying to describe the ongoing transformation. It is widely recognised that the future of energy will need to be characterised by all four of these dimensions for overall long-term effectiveness and success. Cooperation, rather than competition, will be fundamental.

By aligning its efforts with these short- and long-term goals, RT&D is positioned to drive Eskom's transformation into a sustainable, future-ready utility that remains competitive in a rapidly evolving global energy landscape.

RT&D structure and functions

RT&D is structured into four departments that align with Eskom operations and its mandate, namely Generation Delivery, Transmission/ Distribution Delivery, Specialised Testing and Sustainable Energy Research, Technology Strategy and Research Management, supported by the Business Enablement Department.

Technology Strategy and Research Management

The Technology Strategy and Research Management (TS&RM) department serves as the steward of RT&D business unit's technology strategy. This entails developing the Eskom Research Strategic Direction report which aligns with the corporate plan and addresses the organisation's short-, medium-, and long-term technical challenges.

The implementation of the strategy is facilitated through RT&D Centres of Excellence (CoE) under an agile research governance framework overseen by TS&RM.

TS&RM further assesses the research's value addition to line divisions and manages the research programme, project portfolio and execution of initiatives such as the Underground Coal Gasification (UCG) demonstration project. In addition, TS&RM promotes innovation within Eskom through cross-cutting CoE's like intellectual property management, digitalisation and system dynamics, gas and renewables and through university - and industry partnerships.

Generation Delivery

Generation Delivery (Gx Delivery) oversees the provision of engineering solutions, research consulting and testing services; and support to maintain the integrity of Eskom's plants throughout the value chain. This entails offering technical solutions to operational plant engineering challenges while also advancing next-generation technologies. These efforts align with Eskom's key strategic objectives, including ensuring reliable electricity supply, thereby contributing to the organisation's overarching goal of addressing the energy trilemma of energy security, energy sustainability and energy affordability.

The department plays a pivotal role in ensuring coal quality compliance and improvement, as well as emissions compliance and improvement, within the organisation's Generation operations.

Specialised Testing & Sustainable Energy Research

Specialised Testing and Sustainable Energy Research (STSER) offers research and consulting services focusing on sustainable development solutions to bolster Eskom's future business and operations. The department's primary objective is to deliver research and consulting services to enhance the technical and compliance performance of Eskom operations. This includes addressing various aspects related to chemical sciences, air quality, climate change, environmental impacts, water and waste management, and social impacts. By providing expertise in these areas, STSER contributes to Eskom's commitment to sustainable practices and operations.

Transmission / Distribution Delivery

Transmission / Distribution Delivery (Tx/Dx Delivery) conducts applied research and offers technical consulting to the NTCSA Eskom's Distribution divisions. Its focus areas include power systems technology development and application, network reliability, high-voltage engineering, network and system modelling and planning, as well as control and Instrumentation. Key initiatives include future customers, devising sustainable and efficient solutions spanning from the meter and beyond.

Business Enablement

The Business Enablement department serves as the cornerstone of support services and compliance functions within RT&D division. Its primary role is to uphold governance and assurance standards within RT&D, ensuring adherence to organisational requirements regarding business risk, the Public Finance Management Act, document management and ethics.

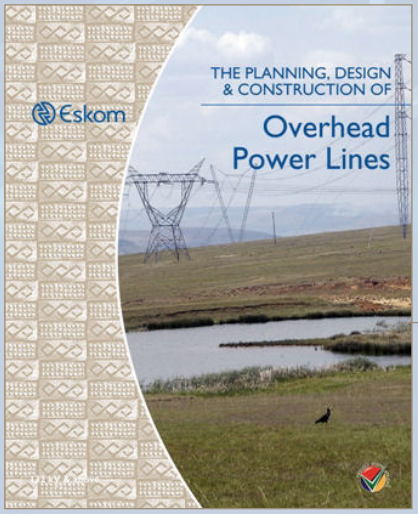
Business Enablement also provides vital support to divisional management, playing a key role in the development and monitoring of divisional business plans and the RT&D Operational plan.

Business Enablement's overarching mission is to bolster RT&D's performance by aligning with approved management system requirements. This also includes the measuring and monitoring the performance of RT&D. The department also creates capacity support to CoEs, as well as provides advice on internal business improvement. Through meticulous governance, quality assurance, reporting and compliance practices, Business Enablement empowers the four departments and the General Manager's office, overseeing aspects such as strategic support, SHEQ (safety, health, environmental and quality) management, occupational hygiene, communication and stakeholder management, risk and resilience.

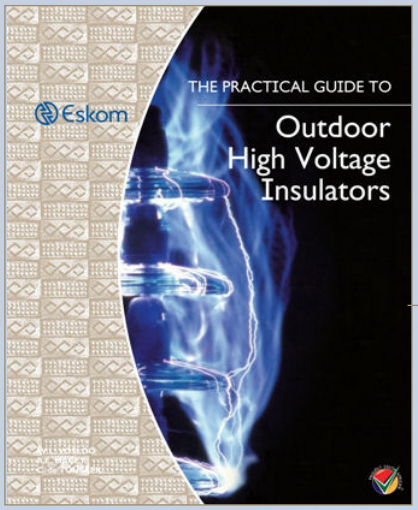
Additionally, Business Enablement is involved in knowledge capture and transfer via the Eskom Power Series Books. The Eskom Power Series was conceived because of a concern over the continuing loss of critical technical skills and experience within Eskom. A series of events spanning the past few decades has reshaped the electricity supply industry and retaining a skilled work force has remained a challenge. Each year a growing number of technical experts leave Eskom, and the country is deprived of a wealth of experience, knowledge, and expertise.

The Eskom Power Series is capturing the critical knowledge that local and world experts in the field have acquired over the years so that it can be shared within Eskom, the country, and the world. The books have also been used for university modules and courses attended by Eskom employees. Thus far a total of 21 books has been developed and six more are in the pipeline.

Some books developed are shown below and the balance can be views at https://www.eskom.co.za/about-eskom/about-electricity/power-series-books/



Volume 1: The planning, design and construction of overhead power lines



Volume 3: The practical guide to outdoor high voltage insulator

Volume 5: Theory, design, maintenance and life management of power transformers

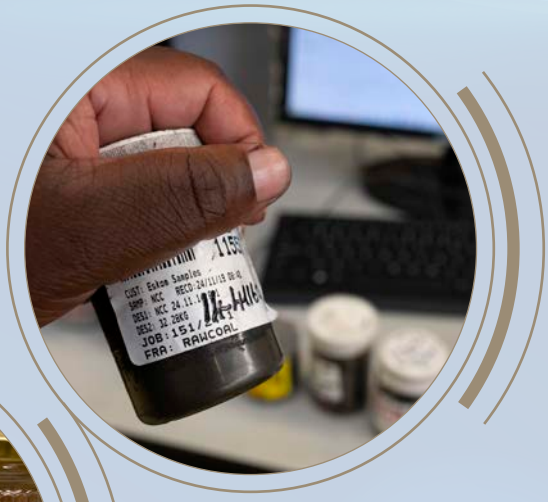
Furthermore, Business Enablement acts as a central point of contact for external stakeholders in the areas of research, innovation and accessing services from various stakeholders.

Divisional research road map

The divisional research roadmap focuses on maximising asset utilisation, operational recovery and performance improvement across Eskom's Dx, Gx and NTCSA divisions. Key activities include:

- **Modernising the power system** and facilitating a competitive energy industry
- Improving **supply reliability** and conducting research on **air quality, ecosystems and climate change**.
- Conducting **chemical research** on water, coal and petroleum.
- Driving **innovation** and managing intellectual property.
- Developing **specialised skills** through programmes like EPEP (Eskom Power Engineering Programme, TESP (Tertiary Education Support Programme) and JICA (Japan International Cooperation Agency).
- Enhancing security and leading **digital transformation**, including pilots for **AI, machine learning and advanced analytics**.
- Supporting existing tools and optimising **energy markets, tariffs and pricing**.
- Researching green hydrogen and renewabale energy resources for future sustainability.

Generation Delivery (Gx)



Coal quality compliance and improvement:

i

Advanced coal analytical techniques and consulting: The department conducts assessment of coal that is used in Eskom's power plants, by utilising advanced mineralogical analysis, combustion tests with state of the Drop Tube Furnace, Pilot Scale Combustion Test Facility, Combustion Simulation and Techno-economic Assessment of coal plants using an in-house developed Coal Quality Effect Model. These assessments support Eskom's Primary Energy Department in procuring coal and also power stations to optimise its operation.

ii

Techno-economic studies: The department evaluates various technologies aimed at reducing particulate nitrogen oxides, carbon dioxide and sulphur oxides emissions from coal combustion. These assessments are conducted to determine the feasibility and effectiveness of these various technologies, ultimately recommending further development towards the deployment of alternative technologies in Gx.

Emissions compliance and improvement:

i

Pulse jet fabric filter demonstration: The department conducts demonstrations of high wear-resistant bags on Medupi and Kusile power plants to improve the durability and lifespan of pulse jet fabric filters. This initiative aims to enhance emissions control and reduce maintenance requirements.

ii

Full-scale plant demonstration of coal fines agglomeration: The department conducts full-scale plant demonstrations to recover coal fines and agglomerate them effectively. This process will enable the efficient utilisation of coal across the coal fleet, minimising fines deemed as waste and thus improving overall efficiency and reducing coal cost.

iii **Flue gas desulphurisation (FGD) performance recovery:** The department conducts independent plant review assessments on aintenance and process operating parameters related to FGD systems. This helps optimise FGD performance and ensure compliance with emissions regulations.

iv **Mercury emissions baseline:** The department establishes a baseline for mercury emissions across the coal fleet to comply with environmental regulations such as the Minimata convention ratified by the South African government. This initiative provides crucial data for regulatory reporting and environmental management.

v **Carbon capture pilot plant (CCPP) FEED Study:** The department conducts Front-End Engineering Design (FEED) studies for CCPPs to understand and promote sustainable coal usage. This aligns with efforts to reduce carbon emissions and mitigate climate change.

Real time asset management and improvement:

i **Real time on-line condition monitoring:** Operational support including data analysis and reporting, for the installed Eskom-developed generator online condition monitoring system for nuclear and coal-fired power plants ensuring early warning and subsequent pro-active operational and maintenance planning responses to developing faults, in support of availability.

ii **Generator on-line monitoring system enhancement:** Advanced research, development and demonstration of a new enhanced printed circuit board for the installed Eskom developed generator online condition monitoring system, to provide a sustainable condition monitoring solution for Generation.

iii **Mechanical testing services:** The strength and durability of materials through tensile, impact, and dynamic testing can be determined for various material types. Tensile tests measure a material's ability to resist stretching under load. Impact tests assess its resistance to sudden force, while dynamic tests evaluate its behaviour under repetitive stress. This information is crucial for engineering design, quality control, and material selection.

Other activities:

- Research into, and supporting the roll-out and implementation, of technologies aimed at improving plant operations, maintenance, early warning on developing faults and overall plant availability.
- Analysis of Flexible Generation Plants to enable dynamic load following and accommodate renewable energy penetration.
- Review of Small/Modular High-Temperature Nuclear Reactors for potential future implementation, positioning the department on emerging technologies for power generation.
- Clean Coal Research covering Ash Beneficiation, Water Use Management and Optimisation and Alternative Coal treatment technologies.

Transmission / Distribution Delivery (Tx/Dx)

Ensuring reliable and efficient electricity transmission:

i **Power system stability and inertia:**
The department is researching power system stability phenomena such as system strength and inertia, along with their associated risks, particularly focusing on the implications of increasing renewable energy (RE) penetration. This research is crucial to ensure grid reliability as the energy mix evolves.

ii **Measures for "greening the grid":**
Researching measures to reduce the environmental impact of transmission operations, such as minimising the use of mineral oil and SF6 gas. This aligns with sustainability goals and reduces the carbon footprint of the transmission infrastructure.

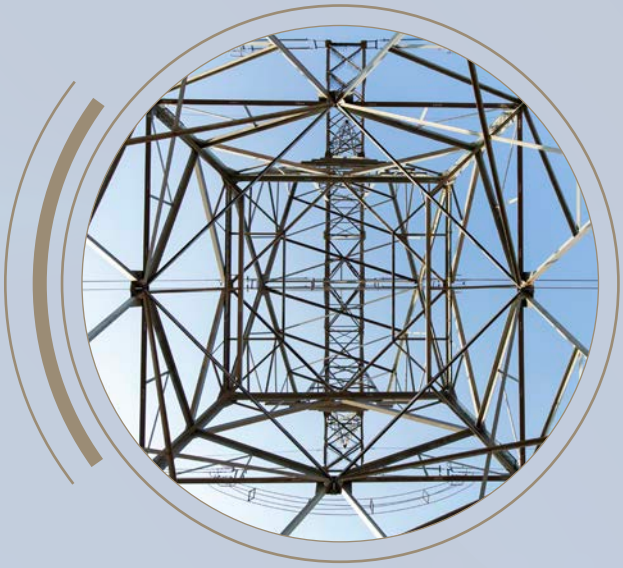
iii **Grid readiness assessment and flexibility modelling:**
Develop models to assess grid readiness and evaluate the impact of integrating multiple generators, particularly focusing on renewable energy sources. Advanced research into grid flexibility, planning and system operations is conducted to adapt to changing grid dynamics and optimise grid performance.

iv **Transmission system and component research:**
Research activities encompass various aspects of transmission system components including overhead lines, insulators, transformers, switchgear and system performance. This research informs asset management strategies and facilitates the development of more reliable and efficient transmission infrastructure.

v **High renewable energy penetration:**
Research focuses on understanding and mitigating the associated risks and impacts of integrating high levels of renewable energy into the grid. This includes assessing grid stability, voltage control and system balancing to maintain reliability amidst variable renewable generation.

vi **Advanced technologies for future transmission grids:**
The department explores emerging technologies and innovative solutions for future transmission grids. This includes advancements in High Voltage Direct Current (HVDC) and Alternating Current (HVAC) transmission, Flexible AC Transmission Systems (FACTS) and other grid enhancement technologies to accommodate evolving energy needs and improve grid performance.

Enhancing efficiency, reliability, and sustainability of the distribution network:



i **Photovoltaic (PV) and battery energy storage technologies:**
The department reviews designs and regulatory requirements focused on both photovoltaic and battery energy storage technologies. This includes efforts to stimulate local manufacturing, thereby contributing to economic growth and job creation.

ii **Technologies for improving network reliability:**
Focus on implementing technologies within distribution networks to improve network reliability e.g. reduce SAIFI (System Average Interruption Frequency Index) or SAIDI (System Average Interruption Duration Index). The aim is to enhance network resilience and reduce downtime through the application of new technologies and monitoring systems.

iii **Impact of PV generation on distribution grids:**
Research efforts are directed towards understanding the impacts of PV generation on distribution grids. This includes devising preventative measures to protect distribution feeders and transformers from potential challenges associated with PV integration.

iv **Affordable energy solutions for off-grid microgrids:**
The department conducts research to assist distribution in providing affordable energy for off-grid microgrids. This involves developing innovative solutions and pricing models to ensure energy access in remote areas at competitive rates.

v **Distribution system performance and asset management:**
Research activities encompass distribution system performance and component research, with a focus on asset management. This includes addressing electricity theft, non-technical losses, natural pollution and ageing testing of high voltage insulators, including condition assessment and in-service life expectancy of polymer insulators using statistical techniques.

vi **Distribution digital revolution and cybersecurity:**
Promoting the Distribution grid's digital revolution by leveraging advanced digital technologies for improved monitoring, control, and optimisation. In addition, cybersecurity measures are prioritised to safeguard critical distribution infrastructure against cyberthreats.

vii **Future customers and electric mobility:**
The department conducts advanced research into future customer needs, covering products, pricing and tariffs. This includes developing research models and tools to quantify the potential uptake of electric vehicles in South Africa and the potential financial impact on Eskom. Integration of power systems, transport systems, and vehicle technology for electric mobility is also explored to support the transition towards sustainable transportation solutions.

Research, piloting, and demonstrations

The RT&D unit is setup to inform the exploration, development and/or definition of the emerging technologies for suitability of application(s) within the Eskom's strategic direction in the future. By building demonstration plants, emerging technologies can be introduced into the mainstream of Eskom with minimal risk.

Fluid dynamics research

Eskom's flow laboratory is essential for fluid dynamics research in power generation and distribution. It focuses on optimising power plant hydraulics by studying flow patterns, pressure losses and heat transfer in turbines, condensers, cooling systems and piping networks. The lab also works on improving cooling tower performance and water efficiency while reducing environmental impacts.

Research on fluidised bed combustion enhances coal-fired power plants' sustainability by improving combustion efficiency and particle mixing. The lab also addresses grid fluid dynamics to boost equipment reliability, especially in transformer and switchgear cooling systems. In addition, it supports environmental compliance by assessing effluent dispersion and ash slurry transport.

High-Voltage Direct Current (HVDC)

HVDC projects involve the research and development of high-voltage direct current transmission technologies. HVDC is used for long-distance transmission of electricity with lower losses compared to traditional alternating current (AC) transmission.

Smart metering (smart grid technologies)

Smart metering involves the deployment of advanced metering technologies that provide real-time data on electricity consumption and enable two-way communication between utilities and consumers. Eskom faces significant challenges in adequately balancing the national supply and demand of electricity, often resulting in the need for loadshedding to protect the power system. To address these challenges, Eskom has initiated a pilot project to explore load limiting as an alternative to loadshedding. Targeting selected customers equipped with smart meters, this project aims to better balance the supply and demand of electricity on the grid during stages 1 to 4 of loadshedding, allowing customers to continue using essential appliances with a capacity of up to 10 amps.

Acoustic emission partial discharge

This project involves using acoustic emission technology to detect partial discharges in electrical equipment. AE-based monitoring systems detect and diagnose partial discharge in transformers, switchgear and other critical components to prevent failures and ensure grid reliability. Partial discharge is a localised electrical breakdown that can occur in high-voltage equipment, indicating potential insulation problems. Partial discharges can be indicators of insulation degradation in high-voltage equipment. By monitoring acoustic emissions, Eskom identifies potential issues early and take preventive measures to avoid equipment failures and ensure grid reliability.

Smart integration of embedded generation

Embedded generation refers to small-scale electricity generation connected to the distribution network, such as rooftop solar panels or wind turbines.

Ash Beneficiation

This research aims to utilise ash as a beneficial raw material/ product for projects including mine backfilling, road construction, soil amelioration, brick and block manufacture, cement less concrete products and plant protective coatings.

Future strategic focus areas

Eskom's future strategic focus areas encompass a diverse array of energy sources and technologies aimed at ensuring a sustainable and reliable power supply.

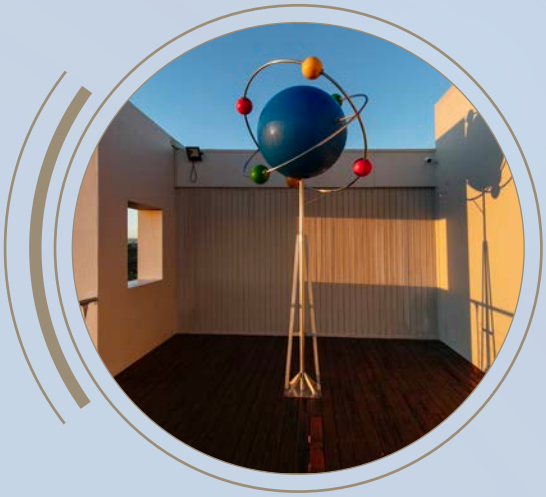
i **Clean coal:** Despite the environmental challenges associated with coal-fired power generation, Eskom continues to explore technologies and initiatives aimed at reducing emissions and improving the efficiency of coal-based power plants. This includes investments in combustion technologies, such as FGD and low fuel ignitors, as well as carbon capture utilisation and storage (CCUS) initiatives to mitigate greenhouse gas emissions. The research work focused on FGD will support the Gx business in ensuring compliance to the minimum emissions standards and multiple technologies are planned for demonstration within the fleet. The plasma burners and mini-oil gun technology are technologies to be demonstrated at two of Eskom's sites, as these technologies provide benefits to the organisation as in the reduction of the amount of fuel oil required for start-up, shut-down and at low-load operations. The CCUS technology serves in the reduction of CO_2 emissions by converting captured CO_2 into useful products, mitigating the environmental impact resulting from power generation processes and supporting the Eskom strategy to move towards net zero emissions by 2050. The alternate FGD project is intended to move to the pilot and demonstration phase, the low fuel ignitors and CCUS projects are currently in the concept design phase.

ii **Gas:** Gas-fired power generation offers a cleaner alternative to coal and can serve as a flexible complement to intermittent renewable energy sources. Eskom is exploring opportunities to leverage natural gas and liquified natural gas (LNG) as a transitional fuel, particularly as South Africa seeks to diversify its energy mix and reduce its reliance on coal. In addition, Eskom is exploring and assessing the development and maturity of green hydrogen production and its related applications.

iii **Renewables:** Eskom recognises the importance of renewable energy sources, such as solar, wind and hydroelectric power, in achieving sustainability goals and reducing carbon emissions. The utility is actively involved in procuring renewable energy through initiatives like the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which aims to increase the share of renewables in South Africa's electricity generation mix.

iv **Energy storage:** As intermittent renewable energy sources like solar and wind become more prevalent, the need for energy storage solutions becomes increasingly important to ensure grid stability and reliability. Eskom is exploring various energy storage technologies, including batteries, pumped hydroelectric storage and thermal energy storage, to address the intermittency of renewable energy generation and optimise grid operations. The technology is also intended to ensure that the electricity grid maintains a constant balance between the supply of electricity and the demand for it, while utilising storage technologies beyond battery storage, the project is currently within the feasibility phase.

v **Nuclear**: Nuclear power represents a low-carbon source of baseload electricity and plays a significant role in Eskom's long-term energy strategy. The utility operates the Koeberg Nuclear Power Station and has expressed interest in expanding its nuclear fleet to meet growing electricity demand while reducing carbon emissions. However, nuclear energy development involves substantial investment with stringent regulatory consideration. In this context, Eskom is evaluating the feasibility of future nuclear projects for power generation production and related applications to meet energy demands of the future in line with the broader energy policy objectives and environmental considerations.



Memberships and Partnerships

At RT&D, we recognise the importance of collaboration and innovation in advancing research and development within the engineering and scientific community. Our memberships with esteemed organisations provide invaluable resources and expertise to enhance our capabilities and make these international resources available to Eskom technical teams.

Memberships/ Institutes

1	Electric Power Research Institute (EPRI)	12	International Smart Grid Action Network (ISGAN)
2	International Centre for Sustainable Carbon (ICSC)	13	Global Smart Energy Federation (GSEF)
3	VGBe Energy	14	CoalTech Research Association
4	Power Institute for East and Southern Africa (PIESA)	15	The Source Testing Association (STA)
5	DLMS User Association	16	Doble Engineering (USA) Membership
6	American Clean Power Association (ACP)	17	The Welding Institute (TWI, UK)
7	South African Energy Storage Association	18	The Southern African Institute of Welding (SAIW)
8	Illumination Engineering Society of South Africa (IESSA)	19	South African Smart Grid Initiative (SASGI)
9	Eighty20	20	International System Dynamics Society
10	Corrosion Institute of South Africa (CORRISA)	21	International Energy Agency (IEA)
11	International Council on Large Electric Systems (CIGRE)		

The Welding Institute (TWI, UK)

Our TWI membership provides access to bespoke, one-on-one support for industrial challenges, ongoing ad-hoc consultations on key areas such as fitness for service assessments, materials and corrosion protection, advanced non-destructive testing (NDT) inspection qualification and friction stir welding. Members receive the *Welding & Joining Matters Journal*, featuring the latest developments and industry-specific case studies, along with access to over 1 100 research reports through TWI's Core Research Programme.

Coaltech Research Association

Coaltech is dedicated to optimising the utilisation of declining and discarding coal qualities by removing stone and pyrite, thereby reducing load losses and emissions. The membership is designed to promote communal and group interests by developing innovative technologies and applying research findings that will enable the South African coal industry to remain competitive, sustainable and safe well into the 21st century. To achieve this, RT&D conducts regular reviews of coal processing techniques and equipment, ensuring that Eskom stays informed about the latest developments in the industry.

Corrosion Institute of South Africa (CORRISA)

As a member of CORRISA, we gain exclusive access to a wealth of resources and opportunities, including participation in monthly technical forums and access to valuable studies and research, such as technical papers and bulletins. Our membership facilitates connections with other local industries, allowing for the sharing of critical information on corrosion and coatings-related matters such as national advancements in corrosion evaluation and protection techniques, and benefit from independent peer reviews on corrosion-related issues. Members also enjoy discounted rates for local and international courses and workshops, with the opportunity to influence the content of the corrosion engineering course.

Doble Engineering USA

As a member of Doble Engineering, we receive access to expert electrical engineers and oil specialists, along with comprehensive resources such as websites, information, instrument support and loan instruments. Our partnership includes a bi-annual Eskom/Doble conference, providing opportunities to connect and collaborate with industry leaders. Members can access an extensive archive of conference papers and tutorials dating back to 1958, as well as the DTA transformer fault website. This membership promotes collaboration and support in condition monitoring, testing and maintenance across various critical components, including transformers, bushings, circuit breakers, cables and protective systems in the transmission sector, along with multiple facets of distribution and generation.

Power Institute for East and Southern Africa (PIESA) Industry Association

PIESA is an industry association dedicated to enhancing electrification across Africa for the benefit of customers, suppliers and electric utilities through effective information sharing, advocacy and learning from shared experiences. It focuses on critical areas such as electrification, non-technical loss reduction, environmental and safety management, and standardisation.

As a member, RT&D can influence governmental policy related to the distribution industry in the SADC region and to develop African positions and solutions for implementation in South Africa. In addition, PIESA supports the development of electrification projects across the

continent, providing unique solutions for information sharing, policy formulation, research, technology, skills development and the standardisation of emerging technologies and non-technical losses. This membership also offers opportunities to partner with African utilities, enabling Eskom to expand its footprint throughout Africa while gaining valuable insights into the evolving needs of customers across the region.

Global Smart Energy Federation (GSEF)

As a utility member of GSEF, representing Africa, RT&D gains access to cutting-edge technical work focused on critical areas such as microgrids, flexibility, cybersecurity, power grid electrification, energy storage and grid connectivity of distributed generation. Our membership emphasises the interfaces of grid users with a focus on electric vehicles and local storage, as well as interoperability and standards. Members are encouraged to participate in and contribute to various working groups, promoting collaboration and innovation in the energy sector. In addition, we have the opportunity to publish white papers and reports that influence policy and regulatory decisions, ensuring that our insights contribute to the advancement of industry standards and practices.

South African Energy Storage Association

As a member of the South African Energy Storage Association, we gain access to comprehensive technical advice on energy storage solutions and the opportunity to influence the development of standards and specifications tailored for the South African market. The association advocates for support for business development initiatives and provides a platform for legislative development and decision-making. Members benefit from access to the latest standards, specifications and case studies, as well as opportunities to participate in technical committees and workgroups.

Illumination Engineering Society of South Africa (IESSA)

As a member of IESSA, we receive technical advice on all lighting-related issues and regular updates on lighting courses and events. Through IESSA's international affiliations, we also gain access to global lighting developments. Membership includes the opportunity to attend and present at the annual conference, participate in technical committees and workgroups, and engage in the active exchange of information to ensure that services provided by the Lighting Laboratory meet market requirements and adhere to current standards.

South African Smart Grid Initiative (SASGI)

The SASGI is a partnership between Eskom, local government, Council for Scientific and Industrial Research (CSIR), the South African National Energy Development institute (SANEDI) and municipalities aimed at advancing the adoption and integration of smart grid technologies across South Africa. This initiative promotes collaboration to drive the modernisation of the country's electricity grid, enabling more efficient, reliable and sustainable energy management. Through SASGI, stakeholders work together to implement cutting-edge smart grid solutions, promoting innovation and enhancing the performance of South Africa's energy infrastructure.

DLMS User Association

The membership offers access to international expertise on Device Language Message Specification (DLMS) / Companion Specification for Energy Metering (COSEM), the standard language for smart devices, along with free access to the latest versions of the DLMS conformance test tool. RT&D gains access to the latest specifications, technical support and the opportunity to participate in technical work. Through active information exchange, the association ensures that conformance testing and certification schemes for metering equipment remain current, providing vital support for the implementation and integration of smart metering technologies.

International Smart Grid Action Network (ISGAN)

ISGAN provides a strategic platform to drive high-level government action and accelerate the development and deployment of smarter, cleaner electricity grids worldwide. ISGAN offers access to international workshops and reports that share global experiences in smart grid deployments, helping shape policy, standards and regulations. The network supports advancements in finance and business models, technology system development, skills and knowledge enhancement, and customer engagement. By accelerating the development and demonstration of smart grid technologies across various applications, ISGAN helps ensure the robust, efficient and reliable operation of regional and distribution grids, as well as microgrids, in diverse geographic conditions. This, in turn, facilitates the cost-effective integration of renewable energy into power systems.

International System Dynamics Society (ISDS)

As a member of ISDS, Eskom is entitled to designate three individuals who will enjoy exclusive benefits for the year. These benefits include a $100 discount on conference registration (63% of the membership fee), access to a free monthly seminar series and discounts on system dynamics books. Members also receive full access to the System Dynamics Review journal and can take advantage of five free online courses for the three designated members, ensuring they stay updated on the latest advancements in system dynamics methodologies and applications.

Energy Storage Association (ESA)

As a member of ESA, Eskom benefits from exclusive access to strategic resources, including discounts on the GTM U.S. Energy Monitor, participation in the discussion forum and topical webinars. The membership also provides access to a wealth of industry resources, directories and valuable correspondence, including alerts and reports developed by ESA. Through active knowledge development and the incorporation of learnings into Eskom's standards, specifications and business cases, Eskom stays at the forefront of energy storage advancements. The membership further offers access to key decision-makers, timely insights into critical industry issues and expert analysis to support Eskom's energy storage business case and strategy.

International Council on Large Electric Systems (CIGRE)

CIGRE is an international organisation that facilitates the exchange of power system engineering knowledge, develops and distribute cutting-edge information, and share innovative practices. CIGRE membership connects Eskom employees with a vast network of experts, essential for addressing Eskom's day-to-day operations and business challenges. Recent benefits to Eskom include advancements in asset health index reporting, transformer procurement process mapping, combating corrosive sulphur and insights into renewable energy technologies. Through its technical publications, CIGRE provides unbiased, high-quality information that supports the evolving needs of society and the power industry.

Partnerships with Academic Institutions

At RT&D, we recognise the importance of collaboration and innovation in advancing research and development within the engineering and scientific community. Our memberships with esteemed organisations provide invaluable resources and expertise to enhance our capabilities and make these international resources available to Eskom technical teams.

A crucial element of Eskom Power Engineering Programme (EPEP) success is its strategic alliances with South African universities, focusing on promoting growth and development in historically underprivileged institutions.

EPEP forges strategic partnerships with universities, leveraging their distinctive technical expertise. At present, EPEP maintains agreements with 12 public universities, covering 19 essential focus areas. These partnerships not only advance research but also enable essential skills transfer, playing a vital role in cultivating a strong engineering workforce.

Some of the key university partnerships and their focus areas include:

- Stellenbosch University: Renewables, Power System Planning and Operation and Grid Flexibility.
- Tshwane University of Technology: Fibre Optical Ground Wire and WAMS.
- University of Johannesburg: Civil and Structural Engineering, Ash Dams and E-Mobility.
- University of Pretoria: Asset Management and Demand Management.
- University of the Witwatersrand: High Voltage Alternating Current (HVAC).
- North-West University: Emissions Control and Green Hydrogen.
- University of KwaZulu-Natal: High Voltage Direct Current (HVDC) and Flexible Alternating Current Transmission Systems (FACTS).
- Nelson Mandela University: Material Sciences and Mechanics.
- Mangosuthu University of Technology: Energy Storage.
- Sol Plaatje University: Wastewater Research.
- University of Fort Hare: Renewable Technologies.
- Cape Peninsula University of Technology: Bulk Materials Repowering, Repurposing and Smart Grids.

EPEP is committed to expanding its network of partner universities and broadening the scope of research focus areas, ensuring that it remains at the forefront of innovation in the energy sector. RT&D is in the forefront of forging these strategic alliances by establishing enabling contracts and facilitating the completion of technical research work.

Eskom Women Advancement Programme (EWAP) Annual Conference

The Eskom Women Advancement Programme (EWAP) is a comprehensive initiative dedicated to promoting gender equality and empowering women within Eskom. Established in 2013, EWAP takes a holistic approach to challenging perceptions that contribute to the underrepresentation of women in leadership and technical roles. Over the last 10 years, the programme has resulted in the advancement and empowerment of women across the company, contributing significantly to women's advancement in the energy sector and in South Africa.

On the 17th of July 2023 RT&D re-launched EWAP RT&D after a decade of EWAP contributing to gender equity and empowering women through various initiatives. The presence of EWAP at RT&D has taken the business unit a step forward towards the empowerment of women in different spheres. Various empowerment streams and initiatives have been established, catering to the needs of RT&D business units.

Five key pillars were developed to align with the broader Eskom Women Advancement Programme while being tailored to the specific needs of the RT&D business unit. Several streams and initiatives which have been up and running since the re-launch:

- **Mentorship and coaching** – Supporting mentor training, fostering a mentor-mentee culture, and promoting professional registration for RT&D staff.
- **Conducive work environment** – Addressing workplace challenges to create an inclusive and supportive space for all employees, particularly women.
- **Women in research** – Empowering women in both technical and non-technical scientific fields through targeted growth programmes.
- **Executive committee membership** – Enhancing the participation and representation of women in technical committees, research governance, and strategic collaborations.
- **Social outreac**h – Engaging with RT&D communities to address their specific needs and foster social impact.
- **HeforShe** – Highlighting the importance of male allies in promoting gender equality and encouraging active participation from all members of the business unit.

Since its re-launch, EWAP RT&D has made significant progress by introducing initiatives that add value to the business unit. Key projects include but not limited to:

- Assessing and improving accessibility for differently-abled individuals in RT&D buildings in collaboration with ERE.
- Conducting diversity and inclusion sensitisation training for managers.
- Advocating etiquette training for RT&D staff members.
- Establishing strategic collaborations with Vaal University of Technology to advocate for young girls in Science, Technology, Engineering, Mathematics, and Innovation (STEMI) programmes, in partnership with Eskom Development Foundation where attendees engaged with industry professionals, gained insights into the latest research, technologies, and trends in science, technology, engineering, mathematics, and innovation.
- Developing an internal mentorship training program tailored to RT&D's unique work environment and the needs of young professionals and staff.
- Hosting various professional bodies, such as Engineering Council of South Africa (ECSA) and South African Council for Natural Scientific Professions (SACNASP), to engage with RT&D staff members, ensuring they remain up to date with industry requirements and that RT&D fosters a community of well-informed and competent professionals.

Through these efforts, EWAP RT&D continues to drive meaningful change and support the advancement of women within Eskom RT&D.

Notes