

The Coaltech Research Brief

The month's developments from the Coaltech research portfolio and beyond.

ISSUE 02 · OCTOBER 2026

COALTECH.CO.ZA

THE MONTH IN BRIEF

The HELE circulating fluidised bed programme of Coaltech, the CSIR, Eskom and SANEDI has moved from feasibility into detailed engineering design.

A first mine-closure liner made from ash, tailings and brine measured a compacted-clay-range permeability in early laboratory testing.

Early leaching trials at the University of the Witwatersrand indicate rare earths report more readily from fly ash than from gasification ash, bottom ash or feed coal.

A commercial-scale trial irrigating crops with gypsum-rich mine water finished its ninth successive cropping season.

A new final report on underground stress measurement for falls-of-ground prevention has been filed in the research library.

A United States study puts about eleven million tonnes of rare earth elements in the country's coal ash, charted on page 4.

WHAT MOVED THIS MONTH

FUTURE TECHNOLOGIES

HELE clean combustion moves into detailed engineering design

F2026-5 · HELE CFB PHASE 2 · CSIR, WITH COALTECH, ESKOM AND SANEDI

The four-party circulating fluidised bed programme run by Coaltech, the CSIR, Eskom and SANEDI has moved from feasibility into the detailed engineering design of a 500 kW test facility. Circulating fluidised bed boilers are designed to burn low-grade coal and discards at lower temperatures than conventional plant, holding sulphur and nitrogen oxides down while the coal still generates power. The design work now under way is setting out what a demonstration plant would need, ahead of any decision to build.

AT THE OPERATION The programme is working towards a locally engineered clean combustion route for low-grade coal and discards, with the design phase there to show what a demonstration plant would take.

SURFACE ENVIRONMENT

First waste-based liner formulation tested against compacted clay

E2026-1 · SUSTAINABLE LINER TECHNOLOGY USING INDUSTRIAL RESIDUALS · ARC INNOVATIONS

The project building mine-closure liners from industrial residues has produced a first baseline formulation from ash, tailings and brine, with an early hydraulic conductivity measurement of about 1.26×10^{-8} metres per second, in the range expected of a compacted clay liner. This is one laboratory measurement at the start of the work rather than a proven material. The team is now optimising the mix and running durability cycling.

AT THE OPERATION The work is testing whether waste already on a site could in time stand in for the scarce natural clay used in closure liners.

FUTURE TECHNOLOGIES

Screening trial narrows the grasses for panels over rehabilitated soil

F2025-1 · AGRIVOLTAICS ON REHABILITATED MINE SOILS · UNIVERSITY OF THE FREE STATE

The agrivoltaics project, which places solar panels over rehabilitated mine soil and grows crops beneath them, has completed its vegetation screening trial. In that screening, buffalo and St Augustine, LM and Berea, and zoysia grass came through as the more shade-tolerant options, with kikuyu and couch grass less so, and creeping bentgrass and annual ryegrass as possible cool-season choices. The field site has moved to Kriel, where microclimate sensors and lysimeters are being installed for the trial that follows.

AT THE OPERATION The screening is narrowing the grasses the field trial will test under panels on rehabilitated ground, with that trial running to 2028.

SURFACE ENVIRONMENT

A ninth season of crops grown on gypsum-rich mine water

E2025-2 · FACILITATING IRRIGATION AS A MINE WATER MANAGEMENT STRATEGY · UNIVERSITY OF PRETORIA

The commercial-scale trial irrigating crops with mine-affected water has completed its ninth successive cropping season and filed its second long-term monitoring report. The work so far indicates that circum-neutral, calcium and sulphate rich waters, and even untreated acid mine drainage of that chemistry, can support a range of crops where the soil is limed and managed, with long-term sustainability still being tracked season by season. The trial covers food, fodder and industrial crops on rehabilitated and unmined land.

AT THE OPERATION The trial is building the long-run evidence for whether gypsum-rich mine water can be put to work growing crops on managed land.

FUTURE TECHNOLOGIES

Early leaching trials rank the coal and ash streams for rare earths

F2026-3 · VIABILITY OF SASOL COAL AND ASH AS SOURCES OF CRITICAL RAW MATERIALS · UNIVERSITY OF THE WITWATERSRAND

Leaching trials on coal and ash samples are so far indicating that rare earth elements report most readily from fly ash, then gasification ash, then bottom ash, with feed coal lowest, and that samples carrying more rare earths give up more of them. The team has been roasting and hydrothermally treating the material with caustic soda before leaching with hydrochloric acid, and is working out the acid strengths and liquid-to-solid ratios to use. Separating the rare earths cleanly from the other dissolved elements is still ahead.

AT THE OPERATION The work is building a picture of which coal and ash streams might repay rare earth recovery, ahead of any route to extract them.

MINING & PROCESSING

Discard characterisation turns to where the recoverable value sits

P2025-1 · WASTE TO RESOURCE: WASHABILITY STUDIES FOR THE CIRCULAR ECONOMY · UNIVERSITY OF CAPE TOWN

The project characterising coal discard streams has completed its head-sample analysis, sink-float test work and density-stream characterisation, and has moved into the washability studies. Those studies are testing how rare earths and other critical elements spread across the density fractions of a discard, and whether the aluminosilicate-rich material carries more than the pyrite-rich fraction. Techno-economic and environmental assessment is running alongside.

AT THE OPERATION The work aims to show where any recoverable value sits in a discard stream, before a reprocessing route is weighed.

THE PORTFOLIO AT A GLANCE Sixteen projects are running across the three research streams: five in Mining and Processing, five in Surface Environment and six in Future Technologies. The full register, with what each project is solving for, is on page 5.

NEW IN THE LIBRARY

The final report filed since the last issue.

Stress Measurements for Falls-of-Ground Prevention, Final Report

M2025-1 · CSIR

The newest final report in the library tests whether a lower-cost borehole method, diametrical core deformation analysis, can estimate underground stress in coal mines alongside the established overcoring technique. Field work at Kriel Colliery found both methods workable, with the new one sensitive to drilling and core quality and clearest at picking up changes in stress direction rather than its magnitude. The report sets out where the method helps and what would strengthen it.

[Download the report](#)

It is the final report filed since the last issue. The full library holds more than 180 member-funded reports, each free to download.

[Browse the research library](#)

WORTH YOUR HOUR

A Masterclass every month

A short online talk by a leading researcher on the last Wednesday of each month at 15h00, free for member staff and followed by questions. Every session is recorded.

Next: Wednesday 28 October, 15h00 · Recordings on YouTube

Coaltech at Mining Indaba

Coaltech is a strategic partner to Investing in African Mining Indaba in Cape Town, putting member-funded research in front of investors and policy makers from across Africa.

8 to 11 February 2027 · miningindaba.com

DID YOU KNOW?

Findings from the Coaltech research archive.

Kenaf grows on raw coal tailings

Kenaf, an industrial fibre crop, held its photosynthesis and chlorophyll and drew heavy metals into its tissue when grown on coal tailings, pointing to a crop that yields fibre while helping clean the surface.

[Read the kenaf report](#)

Coal waste can go into road asphalt

Coal waste fines and fly ash work as aggregate and filler in asphalt, and their pozzolanic activity lifts the mix's stability and stiffness, a route to put washery waste into road surfaces.

[Read the asphalt report](#)

A coating that keeps brine crystallizers clear

A graphene-modified surface cut the ice scaling that has blocked eutectic freeze crystallization, the process that splits hypersaline coal brine into salts and clean water.

[Read the report](#)

Diatoms read a stream's acid-mine-drainage load

An index built from the diatom species living in a stream scores how far acid mine drainage has disturbed it, and was packaged so a non-specialist can run it without lab chemistry.

[Read the report](#)

A field guide to opencast coal fires

Coaltech's best-practice guideline sets out how to spot a spontaneous heating early and treat it before it takes hold as a fire in an opencast pit.

[Read the report](#)

Cattle and crops together can make rehabilitated land pay

An integrated crop-and-livestock system on rehabilitated coal land turned a profit at the 200 hectare scale, with grazing lifting soil organic matter and trace metals staying within livestock-safety limits. [Read the report](#)

THE WORLD RADAR

Coal research and funding developments from beyond South Africa.

A United States study puts billions in rare earths in coal ash

A University of Texas at Austin assessment estimates about 11 million tonnes of rare earth elements in accessible United States coal ash, worth around 8.4 billion US dollars and close to eight times the country's current domestic reserves. A team at Worcester Polytechnic Institute has since won a 3.3 million dollar National Science Foundation award to develop lower-energy extraction. South African coal ash carries rare earths at comparable grades, the resource three of Coaltech's Future Technologies projects are testing.

[Read the study summary](#) · [the resource assessment](#)

A pilot turns hypersaline mine water into clean water and salts

A near-zero-discharge pilot on coal mine water measured at eight percent dissolved solids recovered more than 90 percent of the water at high purity while precipitating saleable magnesium hydroxide, calcium carbonate, gypsum and sodium chloride, at about 421 kilowatt hours per tonne of salt. The work was published in *Desalination*. eMalahleni's mine water sits at similar salinities, and recovering both water and salts is the case Coaltech's brine and battery-metals projects are built on.

[Read the paper](#)

India commissions a pilot to pull rare earths from fly ash

On 19 August NALCO opened a 50 kilogram per day pilot plant at its Bhubaneswar research centre, recovering alumina, silica and a rare-earth-enriched residue from bituminous fly ash, with scandium a particular target. It runs a jointly patented process from India's CSIR-IMMT and NALCO. South African fly ash is chemically similar, so a working pilot is a marker for the ash-to-metals route that local teams are researching.

[Read the announcement](#)

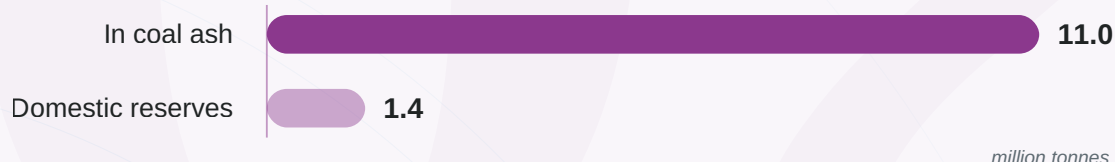
India and Australia back critical minerals across the value chain

CSIRO reported in September that a 22.6 million Australian dollar India–Australia programme has run projects across exploration, rare earth beneficiation, titanium and vanadium processing and battery cathode manufacture. Governments are treating critical minerals, including those won from mining and combustion residues, as strategic supply. That is the same argument for developing South Africa's coal-derived critical minerals through Coaltech's research.

[Read the CSIRO update](#)

THE FIGURE

Rare earth elements held in United States coal ash, against the country's current domestic reserves, in million tonnes.



Assessment of recoverable rare earths in United States coal ash by a University of Texas at Austin team, reported September 2026. The coal ash resource is close to eight times the current domestic reserves.

MEMBER RETURN

One case from the Coaltech record, and what it gave back.

Mines were rehabilitating coal land to a national standard from 2007 that a decade of new soil and vegetation research had overtaken. In 2017 Coaltech funded the Land Rehabilitation Society of Southern Africa to rewrite it. The new guideline came out in 2019 under the Society, Coaltech and the Minerals Council, with a companion on engineered soil covers in 2022. Coaltech made it openly available rather than keeping it to members. It now appears in closure plans, environmental authorisations and audits across the coalfields, written up by consultants with no link to Coaltech. [Read the case study](#)

Ask Coaltech

The Coaltech library holds more than twenty-five years of member-funded research. If your team has a technical question, reply to this Brief or write to us and we will send you what the research says, with sources. This Brief may be shared freely within the Coaltech community; pass it on to colleagues who would use it.

[Write to cbergman@coaltech.co.za](mailto:cbergman@coaltech.co.za)

THE ACTIVE PORTFOLIO

Every project currently running, and the problem it is working on.

MINING & PROCESSING

M2025-2	Safe Criteria Limits of Blast-Induced Ground Vibration WITS UNIVERSITY	Blast damage criteria that let opencast operations work safely near surface structures and communities.
M2026-1	Coal Mining Digital Evaluation Platform DIGITAL TWIN	A platform for mines to weigh up digital technology options on cost, efficiency and safety before investing.
M2026-2	Wearable Technologies for Mine Safety RIIS	Field research with mineworkers that defines what wearable safety technology must do before anything is built.
P2025-1	Waste to Resource: Washability Studies for the Circular Economy UNIVERSITY OF CAPE TOWN	Washability studies on discard streams, mapping what can be re-covered and sold.
P2026-1	Development of a Fine Coal Discard Dewatering Strategy NORTH-WEST UNIVERSITY	Filtration and drainage test work to cut the moisture in fine discard so it can be handled and stored.

SURFACE ENVIRONMENT

E2020-4	Carbon Capture and Energy Recovery from Waste Water Using Algae UNIVERSITY OF CAPE TOWN	Algal systems that capture carbon and take up metals from mine and plant waste waters.
E2024-1	Irrigation of Natrophile Grass Species UNIVERSITY OF PRETORIA	Salt-tolerant grasses irrigated with mine-affected water, producing usable land and fodder.
E2025-2	Facilitating Irrigation as a Mine Water Management Strategy UNIVERSITY OF PRETORIA	Best-practice guidance for irrigating rehabilitated and unmined land with mine-affected water.
E2025-3	Investigating Coal Mine-Influenced Water for Battery Metals UNIVERSITY OF CAPE TOWN	Whether coal mine water and brine can be a secondary source of lithium and other battery metals.
E2026-1	Sustainable Liner Technology Using Industrial Residuals ARC INNOVATIONS	Engineered liners made from ash, tailings and brine to replace scarce clay in mine closure.

FUTURE TECHNOLOGIES

F2025-1	Agrivoltaics on Rehabilitated Mine Soils UNIVERSITY OF THE FREE STATE	Solar generation, agriculture and soil rebuilding on the same rehabilitated ground.
F2025-2	Recovery of Rare Earth Elements from Coal Discards Using Ion Exchange UNISA	Ion exchange chemistry for pulling rare earth elements out of coal-derived streams.
F2026-1	Resource Valorization and Critical Minerals UNIVERSITY OF JOHANNESBURG	Reprocessed coal discards from the eMalahleni coalfield assessed as a source of critical elements.
F2026-2	Turning Ash into Assets: Critical Material Recovery MINTEK	Processes that recover aluminium, iron, silicon and rare earths from coal ash.
F2026-3	Viability of Sasol Coal and Ash as Sources of Critical Raw Materials UNIVERSITY OF THE WITWATERSRAND	Whether commercial-grade rare earth concentrates can be produced from coal and ash.
F2026-5	HELE CFB Phase 2 CSIR	Carries the four-party clean combustion programme of Coaltech, the CSIR, Eskom and SANEDI from feasibility into engineering design.

HOW A MEMBER NEED BECOMES A PROJECT

01

MEMBERS RAISE NEEDS

Operational problems come to the three steering committees.

02

THE CALL GOES OUT

The committees set priorities for the annual call for proposals.

03

PROPOSALS ARE CONTRACTED

Members evaluate the shortlist and contract the work.

04

RESULTS GO TO ALL

Every finding goes to the whole membership, whoever raised the need.

MEMBERS & PARTNERS

The organisations behind this research.

PRIMARY MEMBERS



ASSOCIATE MEMBERS

Companies that actively support our work.

 ACRUX Sorting Technology Sensor-based ore sorting for coal and minerals.	 AGREENCO Mine rehabilitation and ecological restoration.	 AshResources Fly ash products Processes and markets fly ash for cement and construction.
 BLUGREY Occupational Hygiene Pty Ltd Occupational hygiene monitoring and compliance.	 CDC DUST CONTROL Dust suppression systems for mines and plants.	 CEM Geological exploration, mine planning and technical advisory.
 DMT DMT Kai Bala (Pty) Ltd Mining consultancy, exploration and laboratory services.	 ENPROTEC ENGINEERING THAT INSPIRES Mineral processing engineering recovering ultra fine coal and minerals.	 EXM EXM ENVIRONMENTAL SCIENCE Environmental science and advisory services.
 FlowCentric MINING TECHNOLOGY Dust control, waste-water evaporation and combustion solutions.	 FRASER ALEXANDER Tailings management and minerals processing services.	 GCS Geological Consulting Services Water, environmental and earth science consultancy.
 genet MINING TECHNOLOGY Coal processing plant operation.	 HLEL ENERGIES Mining and energy projects.	 JCI MINING Opencast mining contracting, load and haul, rehabilitation.
 Jones & Wagener Engineering & Environmental Consultants Consulting engineers: geotechnical, mine infrastructure, environment.	 MAPTEK Mining measurement, modelling and planning software.	 MCS Production monitoring and management systems for mines.
 MINOPEX Contract operation and maintenance of processing plants.	 MPBIASA Advancing mineral beneficiation and sustainable value across Southern Africa.	 nafasi water Mine water treatment plants and operations.
 NAMANE RESOURCES Coal mining group with operations in the Waterberg.	 PHATSEMA Dust suppression, haulage and spontaneous combustion prevention.	 razorlabs AI-driven predictive maintenance for mining equipment.
 TR TIMRITE Underground support products and timber systems.		

MEMBER BENEFITS

ALL FINDINGS, SHARED

Every result and the full library go to every member, whoever raised the need.

A SEAT AT THE TABLE

Members sit on the steering committees that set the research agenda.

SHARED COST AND RISK

Research is funded together, so no single company carries a project alone.

FIRST ACCESS

Members see trial results and can host trials before anything is published.

PEOPLE AND EVENTS

Masterclasses, the colloquium and postgraduate pipelines, open to member staff.



coaltech.co.za/join-us



RESEARCH COUNCILS, UNIVERSITIES AND PARTNERS

CSIR · Mintek · Agricultural Research Council · University of Cape Town · University of Pretoria · University of the Witwatersrand · University of Johannesburg · University of South Africa · North-West University · University of the Free State · University of Venda · Colliery Training College · [FutureCoal](#) · [Water Research Commission](#) · [Mandela Mining Precinct](#) · [SA Colliery Managers Association](#) · SACESHA · Nkangala Business Chamber

STRATEGIC PARTNER



8-11 FEBRUARY 2027
CTICC, CAPE TOWN

Coaltech is one of eleven Strategic Partners to Investing in African Mining Indaba, in Cape Town from 8 to 11 February 2027. The partnership puts the Association's applied research in front of investors, industry and policy makers from across Africa, and gives members early access to what the programme produces.

miningindaba.com/partner-list · [the Coaltech announcement](#)