COAL RESEARCH FOR THE COALTECH COMMUNITY | NOVEMBER 2026 | ISSUE 3

The Coaltech Research Brief

Coal on the move: *de-stoned coal leaving a belt-type X-ray transmission sorter at Arnot Colliery, the pilot unit that Coaltech put through a year of test runs in its dry processing programme.*

PHOTO: COALTECH DRY PROCESSING PROGRAMME, ARNOT COLLIERY

Coaltech

THE MONTH IN BRIEF

MINING & PROCESSING

Rescue and contact top the wearables list

Field work with 178 mineworkers at five sites puts being found, being known to be hurt and staying in contact after an incident at the top of the list for wearable safety technology. Five opportunity areas go forward for validation. Page 3.

MINING & PROCESSING

A house wall moves twice as much as the ground

Blast monitoring at two test houses beside an opencast pit finds the walls responding at about twice the ground vibration measured beside them, in the same low-frequency band. The damage criteria will have to be built on the wall figure. Page 4.

MINING & PROCESSING

Filtration reaches its limit at 10 bar

Pressure filtration tests on fine discard reach the same final moisture at 10 bar that plant practice reaches at 16 bar. If it holds with flocculant, that is a setpoint change rather than a plant change. Page 3.

SURFACE ENVIRONMENT

Discard in the mix beats the clay liner

A closure liner mix carrying 5 percent coal discard measured lower permeability than the clay and bentonite reference. The discard is doing work in the mix, not riding along as a disposal route. Page 5.

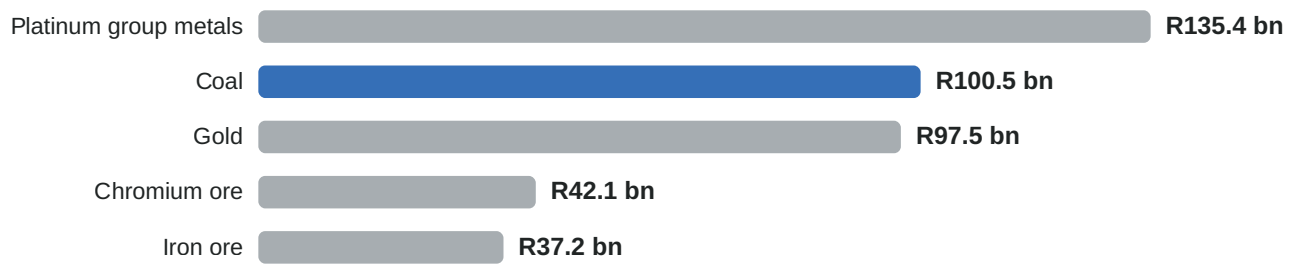
SURFACE ENVIRONMENT

The algae project is complete

The University of Cape Town has completed its final report on indigenous microalgae that capture carbon and strip metals from mine water, closing six years of work; it goes into the research library during November. The portfolio now stands at fifteen projects. Page 7.

THE FIGURE

South African mineral sales by commodity, March to August 2026, in billions of rand.



Statistics South Africa, **Mining: Production and sales, August 2026** (release P2041, preliminary, 13 October 2026), Table 11, six months summed. Coal sold between R15.9 billion and R18.1 billion in each of the six months, the steadiest line in the table.

MINING & PROCESSING

M2026-2 · RIIS

Mineworkers rank rescue and contact after an incident as the biggest safety gap

THE WEARABLES project has completed its primary data collection and reported its stakeholder engagement findings to the steering committee. Survey teams worked with 178 workers, supervisors, managers and worker representatives at five sites across three mining companies, with 16 one-to-one interviews and a focus group alongside.

Across the 47 safety outcomes mapped, workers feel best served at spotting and avoiding immediate hazards and least served after an incident: being found, being known to be hurt and staying in contact. Five candidate opportunity areas go forward for validation in the next milestone, with post-incident presence, location and contact the strongest; proximity detection was not carried, because the installed systems work apart from their false alarms. ■

AT THE OPERATION

The one past wearable scheme workers described ended with the devices left in lockers. The interviews give six design requirements, from no effort to use to a battery that outlasts a shift and charges with the cap lamp, that any device offered to a mine can now be measured against.

P2026-1 · NORTH-WEST UNIVERSITY

Fine discard reaches its filtration limit at 10 bar, not 16

Under glass: *the vacuum bell of the new filtration rig at North-West University.*

PHOTO: NORTH-WEST UNIVERSITY

THE PRESSURE filtration campaign on ultrafine discard, run on a high-quality and a low-quality feed without flocculant, puts the irreducible saturation at about 23 percent moisture. That point was reached at an applied pressure of 10 bar; the plant that supplied the sample runs its pressure filters at 16 bar.

Tests with flocculated feed and with the industry filter cloth follow, and the vacuum filtration rig, with its frame, vacuum bell and gauge built, is due for completion by the end of the year. ■

AT THE OPERATION

If the result holds with flocculant, a filter plant could reach the same cake moisture at lower pressure and lower energy, which is a change to a setpoint rather than to the plant.

MINING & PROCESSING

House walls respond at about twice the ground vibration measured beside them

SAFE CRITERIA LIMITS OF BLAST-INDUCED GROUND VIBRATION AND AIR OVERPRESSURE FOR RESIDENTIAL STRUCTURES · M2025-2 · UNIVERSITY OF THE WITWATERSRAND

THE STRUCTURE monitoring phase at the opencast test site is complete and the records are being downloaded and matched to blast data. Two test structures built to typical residential standards, with seismographs on the ground beside them and on their walls, recorded mean wall peak vector sums of 13.05 and 11.16 mm/s against ground readings of 5.77 and 5.79 mm/s, a median amplification of 2.46 and 1.95 times.

Ground motion and structural response sat in the same low-frequency band, mainly 6 to 8 Hz, so resonance on individual blasts is being checked, and the horizontal response was larger than the vertical, which is the direction that opens cracks. The remaining task is to match each detonation to the seismograph record where two or three blocks are fired across different pits within seconds of one another. ■

Under watch: *the two instrumented test structures at the opencast site, with the weather mast and antennae that feed the monitoring record.*

PHOTO: UNIVERSITY OF THE WITWATERSRAND

AT THE OPERATION

Blast vibration is normally assessed from ground readings. On this evidence a ground reading of 10 mm/s near a house can mean about 20 mm/s in its walls, and that is the number the criteria will have to be built on.

SURFACE ENVIRONMENT

Five percent coal discard makes a waste-based liner less permeable than the clay reference

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

HYDRAULIC CONDUCTIVITY OF FIRST FORMULATIONS, M/S

Clay soil 92% + bentonite 8% (reference)	**5.48×10^{-9}**
Water treatment residuals, control	**3.46×10^{-9}**
Residuals 95% + legacy ash 5%	**6.25×10^{-9}**
Residuals 95% + unburnt coal discard 5%	**6.58×10^{-10}**
Residuals 95% + burnt coal discard 5%	**3.84×10^{-10}**

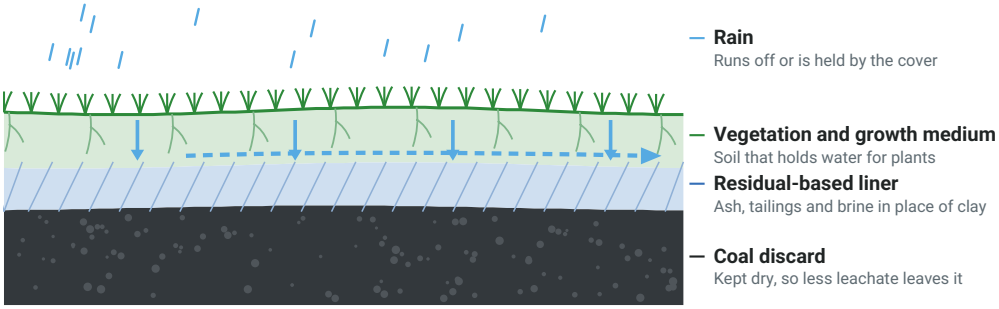
THE SECOND laboratory milestone, intermediate validation and benchmarking, is complete. Formulations built on water treatment residuals were tested against a conventional reference of 92 percent natural clay soil and 8 percent bentonite, which measured a hydraulic conductivity of 5.48×10^{-9} m/s.

Replacing 5 percent of the residuals with unburnt coal discard gave 6.58×10^{-10} m/s, and with burnt coal discard 3.84×10^{-10} m/s, both below the reference and below the 1×10^{-9} m/s mark; the same dose of legacy ash raised conductivity instead, so its benefit is not shown at this dosage. These are preliminary results from first formulations, with cycling, leachate analysis and external verification still to run before the Phase 1 technical report in December. ■

AT THE OPERATION

The discard is doing work in the mix rather than riding along as a disposal route, which is the case that would have to hold before a site lines a discard facility or a stockpile footprint with its own waste.

HOW AN ENGINEERED COVER WORKS



Closure in section: *vegetation and growth medium over a low-permeability liner keep rain out of the discard below; the ARC Innovations project builds that liner from ash, tailings and brine instead of scarce clay.*

SURFACE ENVIRONMENT

E2025-2 · UNIVERSITY OF PRETORIA

On rehabilitated land, drainage decides the crop before the water does

THE 2025/26 summer season of small-plot trials on rehabilitated land irrigated with untreated circumneutral mine void water (pH about 7.15, conductivity about 250 mS/m, sulphate about 1,500 mg/L) has been reported. Soybean, sorghum, a lucerne and fescue mix and a paspalum and clover mix were grown on nine sites chosen for their differences in topsoil, landscape position, drainage and depth to the restrictive layer, with about 256 mm of irrigation on 495 mm of rain.

Every crop showed clear yield differences between the poorly drained and the well-drained sites, and even the salt-tolerant crops could not make up for poor rehabilitation. ■

AT THE OPERATION

Where mine water is to go onto rehabilitated ground rather than unmined land, the quality of the rehabilitation sets the ceiling on what that land can then produce.

E2025-3 · UNIVERSITY OF CAPE TOWN

Sodium is the most abundant battery metal in coal mine water, and brine concentrates it up to eight times

THE DESKTOP study of historical water quality data from coal mine-influenced water and treatment plant brines finds sodium, now used in sodium-ion batteries, far more abundant than lithium, which remains poorly characterised in both the literature and the historical datasets. At one site, reverse osmosis and nanofiltration raised sodium from about 9 mg/L in the feed to 62 mg/L in the brine; at another from about 189 mg/L to 1,768 mg/L, concentration factors of four and eight.

The feed carries the larger sodium load by volume, while the brine carries it at far higher concentration in a small stream. Field sampling is under way, with the first batch of samples due to be consolidated in December. ■

AT THE OPERATION

The team needs at least 5 litres from each sampling point at pits, holding dams, reclamation plants and brine ponds, with historical water quality and flow data. Members with access to such streams can offer sample points through cbergman@coaltech.co.za.

FUTURE TECHNOLOGIES

Preconcentrated discard carries lithium, gallium and uranium well above crustal levels

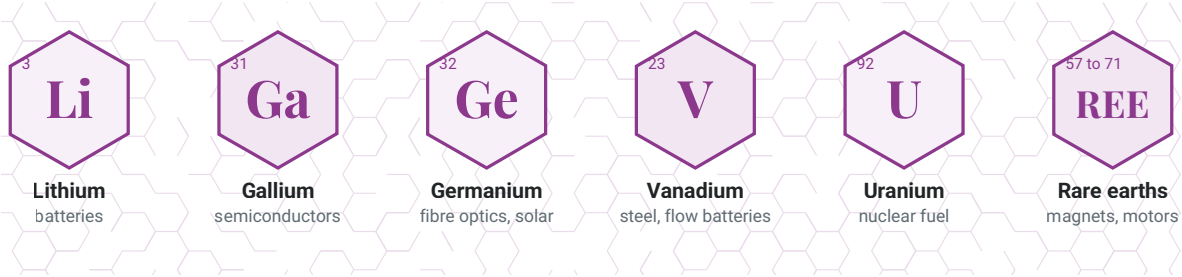
VIABILITY OF MPUMALANGA DISCARD COAL AS A SOURCE OF CRITICAL ELEMENTS · F2026-1 · UNIVERSITY OF JOHANNESBURG

THE PROJECT testing the discard left behind by a reprocessing plant in the eMalahleni coalfield took its results to the ICCP symposium in Lisbon in September and is finalising the MSc dissertation. In the second phase all 16 samples classified as promising on the rare earth outlook coefficient, with preconcentration improving the composition, and the sink fractions host critical elements at concentrations well above the upper continental crust.

Lithium, gallium and uranium reach their highest enrichment in the second float fraction, germanium is spread across the fractions and vanadium follows its own pattern, with lithium in some fractions above 140 ppm against a global coal median of 12 ppm. The report to Coaltech is due in November. ■

AT THE OPERATION

Without this picture of where the elements sit there is no basis for redesigning a reprocessing plant or adding an extraction step. With it, a member running a reprocessing plant can see which stream would repay a second look.



What the discard holds: *the elements found above crustal levels in the preconcentrated fractions, and what each is used for.*

NEW KNOWLEDGE IN THE LIBRARY

No new final report has been published since the last issue. The University of Cape Town has completed its final report on the algae project, E2020-4, and it goes into the **research library** during November.

THE PORTFOLIO AT A GLANCE

5 MINING & PROCESSING

4 SURFACE ENVIRONMENT

6 FUTURE TECHNOLOGIES

Fifteen projects are running across the three streams, with the algae project completed this month. The full register is on page 10.

DID YOU KNOW?

FROM THE ARCHIVE

A single pass through a centrifugal concentrator halved the ash in fine coal

Bench and pilot tests of four centrifugal concentrators on fine coal from two Mpumalanga collieries all cut ash, with desliming the decisive step; the best unit took ash from 35.2 to 18.47 percent and sulphur from 0.68 to 0.36 percent in one stage, lifting calorific value from 23.78 to 26.16 MJ/kg. **Read the centrifugal concentrator report**

FROM THE ARCHIVE

Community-built shutters repaired incised wetlands cheaper and faster than concrete

Two field trials, both built by community members, compared Dongalock shutters with concrete and gabions on cost, build time, footprint, durability and safety. The shutters were cheaper and quicker to install in small and medium incised wetlands and need no heavy plant; concrete still suits large wetlands carrying fast water. **Read the wetland report**

FROM THE ARCHIVE

Coal pillar strength stops falling with size at about two metres

Laboratory testing behind the revised pillar strength formula showed coal specimen strength rising linearly with width-to-height ratio and falling exponentially with specimen size, the size effect becoming insignificant beyond about 2 m diameter. **Read the pillar strength report**

MEMBER RETURN

A sealed refuge bay, with a crew inside, measured for a full shift

When an escape route closes behind a fire, a fall of ground or an irrespirable atmosphere, a crew retreats to a refuge bay and waits. Until recently no South African colliery had tested systematically whether a sealed, occupied bay would sustain life for as long as a rescue takes.

The question came through the Mining steering committee, and project M2022-2 assessed the life sustainability of refuge bays across the collieries, reporting in July 2023. Project M2024-2 then ran occupied trials: in June 2024 a full crew spent a working shift sealed inside a redesigned bay at a member colliery while heat, moisture and carbon dioxide were measured as they would build in a real entrapment, with the findings reported in 2025.

Confidence in refuge bays now rests on measured evidence gathered with people inside, and a mine can see which factors erode survivability and what to fix. Both reports are in the library for every member. **Read the case study**

THE WORLD RADAR

Coal research and funding developments from beyond South Africa.

COUNTY DURHAM, ENGLAND

Warm water from abandoned coal workings now heats 750 homes in County Durham

On 6 October the UK Mining Remediation Authority switched on the Seaham Garden Village heat network, which draws heat from naturally warm mine water at its Dawdon treatment scheme, one of more than 80 it operates, to serve around 750 of 1,500 planned homes and save an estimated 2,600 tonnes of CO_2 a year. The Authority notes that about a quarter of Great Britain's homes and businesses sit above former coal mines. The flooded workings of the eMalahleni coalfield are already pumped and treated for discharge, and the same plant can be a heat source for whatever is built next to it.

Read the announcement

ALASKA, MONTANA AND WYOMING

Microbes and AI get 6 million dollars to pull rare earths out of coal ash

The US National Science Foundation listed Transformative Bioprocessing and AI-Driven Frameworks for Sustainable Critical Mineral Recovery among eight EPSCoR awards worth 39.9 million dollars in August, and the four universities (Alaska Anchorage, Alaska Fairbanks, Montana Technological University and Wyoming) started the 6 million dollar programme in October. It builds a bio-refinery in which microbes bind and release rare earth elements from coal ash and coal dust, with AI tuning the process. Coaltech's critical-minerals projects at UJ, Mintek and Wits are working the same feedstocks by chemical routes, and a biological route is one more to keep in view.

Read the NSF announcement · the Alaska report

MELBOURNE, AUSTRALIA

Coal closure science fills a conference: ash capping at Hazelwood, lease relinquishment in New South Wales

The 19th International Conference on Mine Closure, in Melbourne from 15 to 17 September, published 163 papers with coal operations prominent among them. At the closed Hazelwood brown coal mine, settlement modelling for the in-pit ash retention area supports a 0.5 m compacted clay cap with a 50 mm allowance for differential settlement, with capping expected to finish in late 2026; other papers cover a closure water quality tool for Yallourn, growth media for coal mine rehabilitation and evidence-gated lease relinquishment for the New South Wales coal regions. These are the questions the Surface Environment stream is working on at home: covers over waste, relinquishment criteria and productive land after mining.

Read the proceedings · the Hazelwood paper

SHANDONG, CHINA

China's first 630 °C coal unit runs at a design efficiency above 50 percent

The world's first 630 °C ultra-supercritical double-reheat unit, a 1,000 MW set at Yuncheng in Shandong province, began full operation on 28 July with a design thermal efficiency above 50 percent, saving about 208,000 tonnes of standard coal and about 540,000 tonnes of CO_2 a year against conventional plant, with the boiler, turbine and generator supplied by Dongfang Electric. Every point of efficiency is coal not burned for the same power, which is the premise behind the HELE CFB programme of Coaltech, the CSIR, Eskom and SANEDI, aimed at low-grade coal and discards rather than top-grade steam coal.

Read the report · the grid connection notice

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 and Air Overpressure for Residential Structures** UNIVERSITY OF THE WITWATERSRAND	Blast damage criteria that let opencast operations work safely near houses and communities.
M2026-1	**Coal Mining Digital Evaluation Platform** DIGITAL TWIN	A platform for mines to weigh digital technology options on cost, efficiency and safety before investing.
M2026-2	**Smart Wearables for Occupational Health and Safety** RIIS	Field research with mineworkers that defines what wearable safety technology must do before anything is built.
P2025-1	**Characterisation of Coal Downstream Materials for Resource Recovery and Conservation** UNIVERSITY OF CAPE TOWN	Washability and characterisation of discard streams, mapping what can be recovered and sold.
P2026-1	**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 placed as backfill.

SURFACE ENVIRONMENT

E2024-1	**Land Use Potential of Natrophile Grass Species Irrigated with Sodium-Rich Mine Water** 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 in the Mpumalanga Coalfields** UNIVERSITY OF PRETORIA	Best-practice guidance for irrigating rehabilitated and unmined land with mine-affected water.
E2025-3	**Investigating Local Coal Mine-Influenced Water for Battery Metals** UNIVERSITY OF CAPE TOWN	Whether coal mine water and brine can be a secondary source of lithium, sodium 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	**The Application of Agrivoltaics in Improving the Regenerative Value of Rehabilitated Mine Soils** UNIVERSITY OF THE FREE STATE	Solar generation, agriculture and soil rebuilding on the same rehabilitated ground.
F2025-2	**Using Ion Exchange to Recover Rare Earth Elements from Coal Discards** UNISA	Ion exchange chemistry for pulling rare earth elements out of coal-derived streams.
F2026-1	**Viability of Mpumalanga Discard Coal as a Source of Critical Elements** UNIVERSITY OF JOHANNESBURG	Reprocessed coal discards from the eMalahleni coalfield assessed as a source of critical elements.
F2026-2	**Turning Ash into Assets: A Cost-Effective Pathway for Critical Material Recovery from Coal Ash** 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.

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PRIMARY MEMBERS

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ASSOCIATE MEMBERS

Companies that actively support our work.

ACRUX Sorting Technology Sensor-based ore sorting for coal and minerals.	**AGREENCO** Environmental rehabilitation, land restoration and dust suppression.	**AshResources** Fly ash products Fly ash products for cement and concrete.	**BLUGREY** Occupational Hygiene (Pty) Ltd Occupational hygiene monitoring, risk assessment and ventilation design.	**CDC** Dust Control Dust suppression systems for mines and plants.
CEM mining Geological exploration, mine planning and technical advisory.	**DMT** DMT Kai Batla (Pty) Ltd Minerals and mining consultancy within the DMT Group.	**ENPROTEC** Engineering that inspires Mineral processing plants recovering ultra fine coal.	**EXM** EXM Environmental Science Environmental management, impact assessment and compliance advisory.	**FlowCentric** Mining Technology Dust control, waste-water evaporation and spontaneous combustion control.
Fraser Alexander Tailings, remining, water treatment and minerals services.	**GCS** Water & Environmental Consultants Water, environmental and sustainability consultancy.	**genet** Mineral Processing Designs, builds and operates coal processing plants.	**HLELA** Energies Project management and engineering services for mining operations.	**JCI** Mining Opencast mining contracting, load and haul, rehabilitation.
Jones & Wagener Engineering & Environmental Consultants Engineering and environmental consultants to mining and industry.	**MAPTEK** Mining software, hardware and services from exploration to reclamation.	**mcs.** Production monitoring and management systems for mines.	**MINOPEX** Contract operation and maintenance of mineral processing plants.	**MPBIASA** The minerals processing and beneficiation industry association of Southern Africa.
nafasi water Funds, builds and operates water treatment plants.	**NAMANE** Resources Coal mining group with operations in the Waterberg.	**NuWater** Smart water treatment solutions, Cape Town.	**PHATSEMA** Dust suppression, haulage and spontaneous combustion prevention.	**TR TIMRITE** Steel, timber, polymer and cementitious mine support products.

RESEARCH COUNCILS, UNIVERSITIES AND PARTNERS

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JOINING US

Mining Indaba 8-11 FEBRUARY 2027 CTICC, CAPE TOWN

STRATEGIC PARTNER

Coaltech is one of eleven Strategic Partners to Investing in African Mining Indaba, in Cape Town from 8 to 11 February 2027, putting the Association's applied research in front of investors, industry and policy makers from across Africa. **miningindaba.com/partner-list**

HOW A MEMBER NEED BECOMES A PROJECT

01

Members raise needs

Operational problems come to the three steering committees.

02

The committees set priorities

The committees set priorities for the annual call for proposals.

03

Members contract the work

Members evaluate the shortlist and contract the work.

04

Results go to all

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

coaltech.co.za/join-us

Join Coaltech

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 first and can host trials on their own ground.
PEOPLE AND EVENTS	Masterclasses, the colloquium and postgraduate pipelines, open to member staff.

Coaltech

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Ask Coaltech

The 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 Carmen Bergman-Ally at **cbergman@coaltech.co.za** and we will send you what the research says, with sources.