



**ACARP assists the Australian coal industry to develop and adopt technology and mining practice that leads the world. The program is entirely funded, owned and managed by the Australian black coal producers.**

These priorities have been developed by the five technical committees responsible for proposal development and selection and are separated into the areas of:

- Underground
- Open Cut
- Coal Preparation
- Technical Market Support
- Mine Site Greenhouse Mitigation

ACARP is a collaborative program that utilises the experience and technical strength of both the coal mining industry and research institutions in solving technical problems and addressing issues of significance to the industry's long term future. Any proposed research project that is strongly supported by a mine site and is of interest to a number of coal operations is encouraged. Safety and environment remain key drivers in the program and will continue to be the focus of much of the underground work and a significant component of the open cut and coal preparation programs.

These priorities are not prescriptive but should act as a guide to the areas in which ACARP is seeking research proposals.

### HOW TO APPLY FOR FUNDING

ACARP seeks proposals in accordance with a yearly timetable; with short proposals of no more than 6 pages being requested in the first instance. Short proposals should be prepared under the headings listed in the guidelines included in this document.

Short proposals are ranked primarily according to the importance of the problem and the credibility of the proposed approach, enabling the committees to quickly gain a broad appreciation of these features.

Short proposals must include the 2018 version of the Proposal Summary Sheet and be emailed to [anne@acarp.com.au](mailto:anne@acarp.com.au). The proposal summary sheet and further information can be obtained from [www.acarp.com.au](http://www.acarp.com.au).

The closing date for receipt of short proposals is **Wednesday, 2<sup>nd</sup> May 2018**.

### TIMETABLE

If short proposals receive a favourable industry review; long proposals will be requested as per the following timetable:

#### 27<sup>th</sup> July

Applicants notified of success in moving to second stage – long proposal is requested.

#### 29<sup>th</sup> August

Deadline for submission of long proposals.

#### Mid December

Applicants notified by letter of funding outcome.

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# UNDERGROUND

The Underground Committee is seeking research proposals to materially improve the health and sustainability of underground mining operations. To achieve this, research in the following areas should be considered.

## IMPROVED HEALTH AND SAFETY

- Prevent Harm from Spontaneous Combustion, Ignitions, Mine Fires, Extreme Heat, Explosions, Outbursts, Coal Bursts, Ventilation and Strata Failures - Improved understanding, detection, prediction, protection, selection and design of major hazard management systems.
- Management of Health – including mental health and fatigue.
- Communication to Employees and Contractors of Safety Measures - Improvement such that the information, training and instruction is understood and retained.
- Operator Interfaces and Vehicle Interaction - Improving equipment, automation and remote monitoring and control, also addressing musculoskeletal disorders, improved ergonomics and improved roadway conditions.
- Airborne and Noise Contaminants - Reduce exposure to airborne dust, diesel emissions, and noise.
- Emergency Response Measures - Adequacy and effectiveness.
- Investigation of key practices, including legislative, leading practice alternatives and culture.

## IMPROVED TECHNICAL ASSESSMENT OF COAL DEPOSITS

### Exploration

- Exploration Data - Innovative methods for the acquisition, capture and modelling of exploration.
- Downhole Geophysical Surveys - Improved processes for the derivation of additional value from surveys.
- Hydrocarbons in the Overburden and Floor Strata - Development of methods to understand the nature and quantity of hydrocarbons to assist with risk management.
- Geological Features - Better resolution in the interval between surface and target seams with emphasis on near surface.
- Rehabilitation of Boreholes - Methods and materials, including the integrity of grouting.

### Resource Evaluation

- Coal Deposits at Depths of 500-1,000m - Studies on the development of coal deposits with specific focus on ground conditions and applicable mining methods.
- Validation and Integration of Multiple Exploration Data Sets - Practical and automated techniques.
- Reconciliation and Updating of Exploration Data - Improved methods with real time operational data.
- Practical methods for increasing confidence in resources and reserves.
- Yield Estimates - Optimisation of the coal quality testing process to improve estimates.

### Strata Control, Hydrology and Gas Management

- Scanning detection methods for underground roadway rock mass classification and hazard detection.

- Methods of detecting height of fracturing above longwalls particularly in relation to water and air connectivity.
- Improvements in understanding of roadway failure mechanisms (particularly shear displacement) and impact on support systems.
- Improvements in understanding of adjacent roadway stress shadowing.
- Improved rib control systems in friable coal.
- Improved support systems for longwall recovery.
- Anomalies and Discontinuities - Improved efficiency and effectiveness in detection ahead of mining.
- Gas and Hydrogeology - Improved assessment and evaluation including:
  - Impacts of groundwater on stability and degradation of material properties.
  - Impacts of mining on surface and groundwater including aquifer interaction and interaction with the mining horizon.
  - Strata gas reservoir characteristics and potential interaction with the mining horizon.
  - Impacts of dewatering and degassing on stress and strength resulting from gas drainage and or production.
- Gas Drainage Practices - Improvement efficiency and effectiveness for:
  - Rate of drainage.
  - Understanding and measuring outburst threshold parameters.
  - Promoting gas liberation from “tight” coals.
  - Hole stability design; issues and management.

## HIGHER PRODUCTIVITY MINING

- Roadway Development - Improvements in advance rates and environment conditions leading to an integrated system comprising cutting, strata support, continuous haulage, logistics, and panel advancement.
- Mine Logistics - Improved management, more efficient design of men and material transport and handling systems.
- Remote Control and Automation Processes - Application of advanced mining processes to increase productivity and reduce operator exposure to hazards.
- Reliability of Longwall Systems - Improved systems and further development of non-traditional longwall methods (e.g. top coal caving, thin seam mining).

## MINING SYSTEMS AND EQUIPMENT RELIABILITY

- Enhanced Safety, Output and Energy Efficiency – Particularly targeting alternate power storage and delivery e.g. electric, through improvements in design, operability and maintainability.
- Increased Output through Improvements in Uptime of Services Processes - Improvements to the design of mine services and infrastructure and improvements in the methods of advancing and retracting panel infrastructure such as pipes, cables, explosion suppression, and LW pump stations and transformers.
- Improved Process Management – Through automation, monitoring, management of big data and reporting of mining systems and sub-processes.
- Materials and Manufacturing Techniques – Reduction in weight, improvement in corrosion protection, fatigue and wear life.
- Advancing Standards to Facilitate the Introduction of Modern Technology – In particular for electrical equipment in hazardous areas.
- Alternates to diesel powered transport and haulage vehicles.

# OPEN CUT

## OCCUPATIONAL HEALTH AND SAFETY

The industry is looking for direct or indirect improvements in health and safety across all mining and exploration operations. Areas of interest for open cut mining are:

- Investigation of key health and safety issues and management systems, practices and culture, including legislative leading practice alternatives.
- Management of health including mental health, alcohol and other drugs, return to work and fatigue, e.g. by reduced exposure to noise, vibration, dust and heat, by determining mental health of employees, etc.
- Protection and removal of personnel from hazardous situations such as those around unstable ground, in the vicinity of voids, and around excavations particularly during truck loading.
- General improvement to the health and safety of mining and maintenance operations through novel manual handling aids, including automated technologies or equipment changes.
- Improving equipment operator interfaces, vehicle interaction management, automation and remote control.
- Development of safety in the design of systems and equipment that leads to the reduction of occupational exposure at the source, e.g. noise, dust, blast fumes etc.
- Improve the communication to employees and contractors of safety measures such that the information, training and instruction are provided in a method that allows cognitive retention.
- Development of a cognitive recognition method which addresses the normalising effects that are created due to the human brain predominantly operating in a subconscious mode and failing to recognise changes in their environment that could lead to adverse outcomes.

## MINING

A reduction in unit costs of existing mining systems is a key driver for the industry. Some specific focus areas are:

- Innovative mine design, methods and tools (mitigating weather impacts, pre-mine gas drainage and integration of operating open cuts above old undergrounds).
- Cost effective designs and methods to close and rehabilitate mines dealing with dumps, drainage systems and tailings facilities.
- Improve the productivity of trucks and excavators.
- Develop common operator interfaces to support interoperation of technical systems on mobile equipment to avoid clutter in the operator cabin (vehicle interaction management, fleet management, GPS, fatigue systems and vital signs, etc).
- Develop systems that allow interoperation of technical systems on mobile equipment between different manufacturers (collision management, fleet management, GPS, fatigue systems and vital signs, etc) including control of critical machine functions (e.g. startup interlocks, emergency braking/shutdown).
- Develop decision support systems for managing data by operators (in-cab interfaces), supervisors (production information) and engineers (HPGPS data into designs, strata recognition into load sheets, etc).
- Establish new methods of fragmentation or improvements on existing methods (e.g. linking strata recognition with explosives optimisation and diggability).
- Develop innovative coal recovery methods, improve dilution rejection in pit and advanced sensing technology to detect variation in coal seam quality.

Safe implementation of new technology to reduce operating unit costs is also

a key driver for the industry. Some specific options are:

- Integration of SLAP (Shovel Load Assist Program) for hydraulic excavators shovels.
- Develop remote, semi-automated or automated mining systems (draglines, excavators, dozers and explosives trucks).
- Continuous mining technology e.g. cutting technology for overburden and coal removal without the need for drill and blast.
- Establish selective mining techniques (thin seam mining, steep dip [20-90°] highwall/ floor mining, remote access of deep seams from boreholes).
- Strata recognition from production drill rigs.

## MAINTENANCE

Improve equipment efficiency, reliability and services supported by or integrated with OEMs:

- The application of alternative materials to high maintenance areas.
- Reliability engineering, including whole of asset approaches.
- Effective condition monitoring, real time monitoring and its useful integration.
- Integrate existing data acquisition systems.
- Innovations that help mine operators improve tyre life.
- Advances that help relate duty to work done across a range of equipment to define maintenance needs.
- Improved methods for reducing catastrophic equipment failures.
- Technologies that improve energy efficiency across the mine including fuel/electricity/gas for fixed and mobile equipment.

- Robotic assistance for routine mobile maintenance.
- Modularised systems for equipment maintenance.
- Reduce labour intensive field maintenance activities (e.g. GET, rigging) through design.
- Remote maintenance management; condition monitoring, diagnosis, repair etc.
- Predictive analytics and machine learning.

## GEOLOGY AND GEOTECHNICAL

Improved geological definition and geotechnical assessment of coal deposits represent key focus areas.

### Exploration

- Innovative methods for the acquisition, capture and modelling of exploration data.
- Improved processes for the derivation of additional value from downhole geophysical surveys, specifically in the areas of:
  - Identification and evaluation of discontinuities.
  - Improved rock mass characterisation.
  - Derivation of credible coal quality estimates from non-destructive processes ie. geophysical logs, CT etc.
  - Establishment and development of leading practice work processes.
- Better resolution of geological features in the interval between surface and target seams with emphasis on near surface.

### Resource Evaluation

- Improve understanding of key aspects of Australia's coal basins and how they impact on mining conditions (including structure, stratigraphy, groundwater, coal rank and quality trends).
- Innovative practical automated techniques, improved methods for the validation and integration of multiple exploration data sets.
- Real time improved methods for reconciliation and updating of exploration data with real time operational data.
- Practical methods for increasing confidence in estimation and classification of resources and reserves.
- Optimisation of the coal quality testing process with a view to improving yield estimates.

### Geotechnical and Hydrogeological Evaluation

- Detection and characterisation of minor discontinuities and hazards in the distressed, degassed and dewatered zones ahead of mining.
- Improvements in rock mass classification specific to open cut slope stability.
- Methods for open cut slope geotechnical mapping and deformation monitoring.
- Minimisation of geotechnical risk with a particular focus on deeper excavations and higher spoils; including the improved understanding, modelling, monitoring and management of principal hazards.
- Investigate material properties, implications on dump design, capping and stability of alternative methods of tailings disposal in spoil.

- Identify risks associated with interaction of planned/advancing open cut and underground workings with old underground workings.
- Improve methods for understanding strata failure mechanisms in open cut slope stability.
- Investigate novel applications of existing data sources.
- Improve assessment and evaluation of hydrogeology on mining including:
  - Impacts on slope stability and degradation of material properties.
  - Impact of mining on groundwater including aquifer interaction.

# ENVIRONMENT AND COMMUNITY

Proposals in this category will be considered by the Underground, Open Cut or Coal Preparation Committees, as appropriate.

The industry is calling for research to enable it to continually improve its ability to manage environment and community issues. Research is needed to fill knowledge gaps in, and identify, future issues such that stakeholders have confidence in the industry's ability to manage and reduce its impacts.

Proposals are being sought relating to the coal mining industry's license to operate, water management and effective mine site closure and lease/property relinquishment. It is particularly keen to see research address the following aspects:

## WATER

- Improved management of the potential impacts of open cut and/or underground mining on surface waters, groundwater and the local and/or regional ecosystems supported by these resources.
- Improved techniques to achieve efficient use of raw water; innovative reuse of mine impacted water; and effective management of treatment by-products including brine.

## NOISE AND AIR

- Improved methods for the prediction and management of dust, overpressure, vibration, fumes and noise impacts, in the context of both environment and community health impacts and suited to informing policy frameworks for the development of local and regional air quality criteria.

## REHABILITATION AND CLOSURE

- Improved understanding/management of land use conflicts across the mining life cycle including the early identification of issues/aspects necessary to promote win-win outcomes and encourage consensus from competing interests.
- Sustainable coal washery by-product management with a focus on beneficial use.
- Sustainability of mine rehabilitation including aspects such as landform design and evolution, subsidence, performance assessment, biodiversity reinstatement, reestablishment of agricultural land uses, landscape function and alternate post mining land uses.
- Revegetation including species selection and improved methods for the introduction of recalcitrant and/or high interest native species in mine rehabilitation.
- Management of problematic overburden materials including dispersive, saline, sodic, acid and spontaneous combustible materials.
- Investigation into aspects of effective mine closure including:
  - Tenure and property relinquishment and the improvement of policy framework and options for relinquishment.
  - Sustainable land use and the integration of post mining land use with neighbouring/regional land use.
  - Final voids and the stability of highwall/low walls in perpetuity.
  - Long term impacts that may be associated with post mining surface water and groundwater.
  - The management of residual risk.

The industry faces a range of challenges which in coal preparation research, translate to:

- Occupational health, safety and environmental improvements.
- Energy and water efficiency improvements.
- Optimal resource/reserve recovery within specification.

Proposals offering practical and commercially viable outcomes that can be implemented relatively quickly are especially encouraged. Consideration will also be given to projects addressing the traditional areas of coal preparation improvement, such as efficiency optimisation, moisture and cost reduction.

## THE PLANT OF TODAY

Projects are sought to deliver lower cost, higher efficiency, and higher throughput from existing operations. Specific needs include:

- Optimising the process efficiency of individual unit operations.
- Optimising maintenance practices and equipment designs to deliver improved process efficiency at lower costs, with increased asset utilisation and reliability.
- Development of total cost of ownership and effective maintenance strategies for the development of infrastructure (e.g. to ensure structural integrity).
- Developing leading practice operations and maintenance guides for existing unit operations.

- Constructing tools to monitor and quantify the effect of sub-optimal operation.
- Increasing the efficiency of fine particle size and density separations.
- Development of processes that facilitate new coal utilisation pathways.
- Encourage the use of high definition analysis techniques such as CGA and XT.
- Enhancing performance of existing technologies.

## THE PLANT OF THE FUTURE

Research is required to generate step change technologies that materially change the plant and/or markets for coal utilisation of the near future. Levers may include:

- Development of new processing technologies that are higher capacity, lower cost, or more efficient.
- Deployment of existing technologies and approaches from other industries in a coal specific context.
- Automation of mobile equipment in coal handling applications such as dozer push.
- Development of high capacity dry processing techniques that are less sensitive to feed size.
- Automation to boost productivity and reduce cost.
- New and improved sensors to measure critical process parameters and track coal losses in real time.
- Development of data analytical tools.

## SUSTAINABILITY

It is imperative to continue to improve health and safety outcomes and reduce the environmental impacts of the coal preparation plant process. This may include:

- Developing tailings disposal processes to reduce cost and improve environmental outcomes.
- Reducing noise and dust generation at the coal handling and preparation plant and along rail corridors.
- Improving the dewatering of fine product and reject streams.
- Developing improved tailings reprocessing methodologies.

# TECHNICAL MARKET SUPPORT

Australian coal producers face increasing competition for market share from:

- Coal users seeking to reduce cost through lower quality coals, substitutes and alternate technologies.
- Increasing regulation impacting traded coal quality, transport and utilisation.

The Technical Market Support Committee seeks to address these pressures and deliver maximum market benefit for Australian coals through selection, funding and monitoring of priority research projects.

The industry encourages the adoption of new analytical techniques and equipment, and innovative technologies and processes that have been successfully used in other areas of science and technology.

Proposals are being sought in areas relating to coal properties and coal technology which impact market value, and to the market impact portion of the value chain which runs from sea port to customer.

Specific priorities are:

- Actual and relative utilisation behaviour of Australian coals compared with those from competing supply regions facilitated by international collaboration.
- Effective and consistent characterisation techniques for thermal coals, metallurgical coals and cokes, and their impact on coal blends, to enable rational market valuation.
- Development of applied tools for thermal, coking and PCI applications based on coal quality parameters.
- Fundamental and applied understanding to relate properties of cokes to those of the coals from which they are made.
- Response to regulatory impacts on trading, handling and transport and utilisation of Australian coals.

Additional detailed information specifically targeted to thermal coal and metallurgical coal research opportunities are available by emailing [anne@acarp.com.au](mailto:anne@acarp.com.au) or from the ACARP website <https://www.acarp.com.au/funding.aspx#TechnicalMarketSupport>.



# MINE SITE GREENHOUSE MITIGATION

Fugitive gases are the largest source of greenhouse gas emissions from coal mining operations and as such are a primary focus of the Mine Site Greenhouse Mitigation Committee. The industry seeks innovative means for mitigation and accurate measurement of fugitive mine site gas emissions.

Before submitting a proposal in this area, it should be noted that:

- Demonstration and large scale test work is beyond the financial capability of ACARP.
- The Committee will only consider proposals addressing greenhouse gas emissions resulting from the production of coal, not due to the utilisation of coal.
- Commercial power generation technologies for high purity methane such as drainage gas are being increasingly adopted and are not seen as a high priority for further ACARP research.

## UTILISATION OR DESTRUCTION OF MINE GAS

Dilute sources of seam gas such as mine ventilation air are a significant challenge. Proposals aimed at combusting or utilising dilute gas (0.5% or less methane), or increasing the methane concentration to usable levels, in a safe and cost effective manner without the need for a supplementary fuel are encouraged.

## CAPTURE OF MINE GAS

The Committee is interested in proposals addressing open cut or underground operations with the potential to:

- Reduce gas drainage costs.
- Maximise pre and post mining gas recovery.
- Improve the quality and consistency of mine gas production.

## MEASUREMENT OF FUGITIVE EMISSIONS

Proposals are sought for the improvement and measurement of fugitive emissions from operating and decommissioned mines.

# GUIDELINES

- All proposals must have the proposal summary sheet attached **(2018 version)**. This is available from [www.acarp.com.au](http://www.acarp.com.au).
- **Proposals are to be submitted by email only to [anne@acarp.com.au](mailto:anne@acarp.com.au).**
- Proposals must be no longer than 6 pages (including the proposal summary sheet).
- Our preference is to receive the summary sheet and the proposal content as a single unsecured PDF document.
- Background materials such as company profile, publication lists and researcher CV should not be included. Should such material be included it will be detached and discarded.
- ACARP gives strong preference to proposals which comply with the requirements of the R&D tax incentive scheme. Proposals that do not meet the criteria will only be considered in exceptional circumstances. Details can be found at <https://www.business.gov.au/assistance/research-and-development-tax-incentive/eligibility#you-must-have-conducted-eligible-r-and-d-activities>.
- In preparing a proposal, consideration should be given to the justification for the project:
  - How will the results benefit the Australian coal industry?
  - Should funding other than by ACARP be sought?
  - Does the proposal address at least one of the priorities specified in this publication?

The proposal should clearly define the objectives of the research; describe the benefits to coal producers from the research and outline how the research will be carried out.

## FORMAT FOR SHORT PROPOSALS

Short proposals should be no longer than 6 pages (including the 2 page proposal summary sheet), and must include:

### Executive Summary

State the objective, outline the approach to be taken and state the expected outcome.

### Project History

If the proposal directly or indirectly follows on from a previous ACARP project, this should be noted, giving a concise summary of the previous project's outcomes (include ACARP project number, start/complete dates, and ACARP funding).

### Clear Statement of Objectives

It is essential that the objectives identify the problem to be solved. The objectives should not be a précis of the work program, but a simple statement of what is to be achieved, e.g. develop a prototype machine, develop a technique, understand a mechanism.

### Expected Outcomes and Benefits

ACARP recognises that every research project has an element of risk and not all projects will succeed. The risks and rewards in the project should be made clear. Proposals should indicate:

- The likelihood of success and how the work fits within the priorities.
- Estimate the size and nature of the benefits of success, in dollar terms if possible.
- The outcomes that can be expected at the end of the project should be clearly stated. For example, if a new device is to be developed, is this project proof of concept, or will it produce an industry scale prototype?

## Brief Summary of the Work Program

There is no need for a detailed work program at this stage. The methodology used to achieve the objectives, along with a technical justification, should be outlined. Points to cover include:

- Demonstrate a commitment to complete in a timely manner.
- Test procedures and facilities to be used.
- Whether this is a laboratory, pilot scale, or field demonstration project.
- Detail the critical problems and how they will be solved.
- Document methods of delivery for technology transfer e.g. Workshops, papers etc.

## Safety Implications, If Any

The safety aspects of the research must be clearly outlined:

- Detail any potential safety hazards in carrying out the research.
- Note the impacts of successful research on industry safety, health, environment and community.

## List of Key Personnel

- The project leader should be noted. This person will liaise with ACARP and will be responsible for the preparation of all relevant reports as well as the technical direction and management of the project.  
**Do not include detailed CVs, references or publication lists.**

## Budget

A detailed budget is not required at this stage, but proposals should demonstrate sufficient resources to ensure success. The total amount required, the funds requested from ACARP and funds from other sources should be indicated. The budget should include:

- Number of work days.
- Cost of work days including overhead component.
- Consumables and equipment purchases.
- Travel to site and six monthly review meetings.
- Costs related to site access (inductions etc).

Proposals should be costed on a GST EXCLUSIVE basis. Projects submit invoices quarterly, for agreed progress payments plus any GST payable.

## Support

If individual coal producers are to meet part of the project cost, or provide host sites for testing or other in-kind support, it is the responsibility of the researcher to confirm that this support has been received. Letters of commitment are not required at short proposal stage. Projects will not commence until ACARP is satisfied that this in-kind support will be realised.