

ACARP



The business case for the extension of
ACARP to 30 June 2020

March 2014



A Most Successful Research Program

ACARP is funded, managed and governed by the coal industry for the industry's and Australia's long term benefit. At any time it manages around \$50-60 million across 200 projects targeted at addressing production, health and safety, technical market support, environmental and social licence to operate imperatives. Our program delivers world class research with practical outcomes that benefit your business. No other coal industry around the globe has access to technological and process innovation of this calibre.

As research and development capability within the industry declines in the current difficult market, ACARP remains as almost the only source of private R&D funding available.

Memorandum of Understanding

ACARP was established on 22 January 1992 through a Memorandum of Understanding (MOU) between the Commonwealth Minister for Primary Industries and the Chairman of the Australian Coal Association. The Commonwealth Government agreed to suspend the legislated coal levy in favour of a voluntary industry levy. It was established to provide strategic leadership to industry R&D, to foster a collective and integrated approach, and to act as a catalyst to stimulate interest in the R&D.

The MOU is extended every five years on two conditions - that the industry adheres to the MOU, and that every black coal producer in Australia participates without exception. A new MOU was executed by the Minerals Council of Australia and the Commonwealth in March 2014 following the wind up of the Australian Coal Association.

Governance

ACARP is governed by a board of 14 senior executives who represent Australia's black coal producers. The board, Research Committee, five technical committees and six task groups consist of more than 140 industry experts who volunteer their time to support ACARP activities. Since 1992 more than 170 industry people have been involved each year as committee members or monitors in 1,340 projects, with a total value of over \$240 million.



BOARD	<ul style="list-style-type: none"> • Strategic Planning • Allocation of Funds 	Australian Coal Research Limited (ACR) <ul style="list-style-type: none"> • Program management • Levy collection
RESEARCH COMMITTEE	<ul style="list-style-type: none"> • Program Overview • Definition of Strategic Projects • Sustainability issues 	
Underground Committee	<ul style="list-style-type: none"> • Definition of priorities • Project selection • Task groups • Project Monitoring and researcher management • Exit reporting and follow up 	Australian Research Administration P/L (ARA) <ul style="list-style-type: none"> • Project administration • Secretariat support for committees • Distribution of outcomes
Open Cut Committee		
Coal Preparation Committee		
Technical Market Support Committee		
Mine Site Greenhouse Mitigation Committee		

Research Committee

The Research Committee consists of senior technical people from within industry who have over two hundred years of technical experience between them. It includes several ACR board members, chairs of the respective technical committees, OHS and environmental specialists and others. Its role is to ensure balance and consistency across the research program, analyse industry research priorities, assess current and forecast future research demand. The Research Committee uses this data to recommend research budgets for the board’s endorsement. It also has overall responsibility for technical transfer strategies.

The Research Committee convenes at least three times a year. It also meets a further two times a year with the board to ensure its strategies remain aligned with the board’s vision and that it is delivering projects of benefit to the industry.

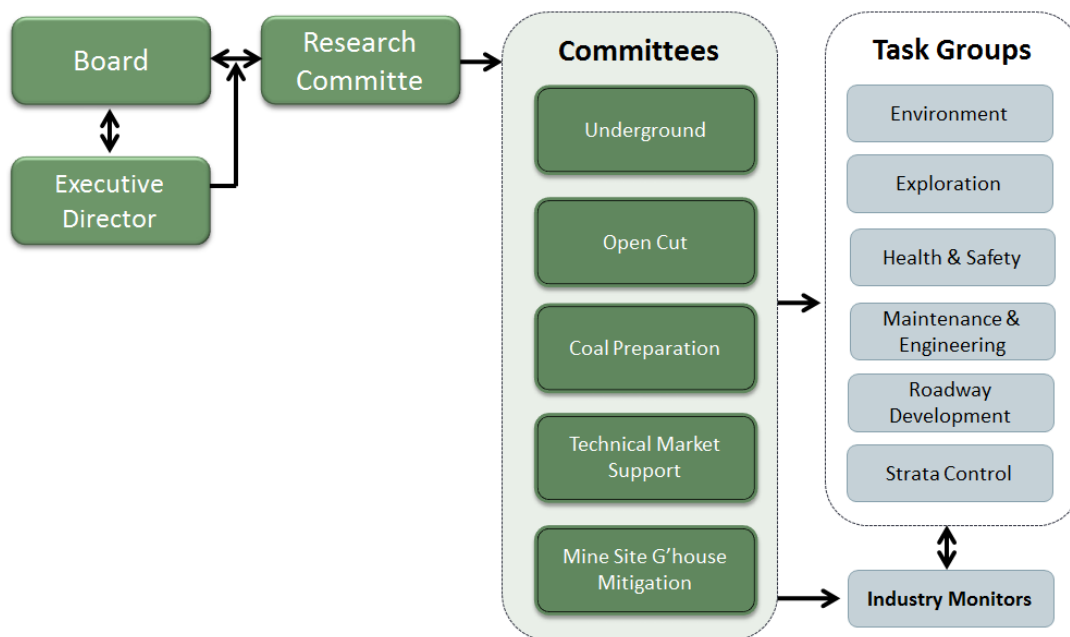
It ensures that ACARP maintains a highly adaptive committee and task group structure that ensures balance and flexibility across the program. It has demonstrated a capacity to be innovative in the way it assesses proposals, funds and manages a broad range of project types. It is confident that the committees and task groups are functioning well despite the work force challenges facing the industry and support continues to be strong, although it is





increasingly difficult to secure hosting of ACARP projects at mine sites.

The Research Committee also identifies and addresses areas of significance that fall outside the scope, priorities or charter of the technical committees. This includes gaps in research and determining whether particular fields of endeavour require more emphasis. While allowing for a balance of 'blue sky' and 'evolutionary' research, the Research Committee encourages all committees to support and foster proposals that define a clear path to implementation or commercialisation.



Communicating Outcomes

ACARP uses a broad range of methods to communicate research outcomes to key stakeholders. A comprehensive website (www.acarp.com.au) provides report abstracts and final reports, allowing free electronic report downloads for all employees of participating companies, and for consultants working on behalf of coal producers. Subscribers can receive automatic email alerts on new project reports across a range of areas of interest.

Each completed project goes through an exit review process. This ensures that important outcomes are published in the manner most easily assimilated by industry. In addition to 4,000 report downloads (annually), technical transfer occurs through opt-in email alerts, ACARP Matters Newsletters, mine site visits, handbooks and best practice guides, websites, videos, seminars, workshops and industry conferences.





All producers have regular opportunity to meet with the ACARP Executive Director to receive company-specific updates for the senior management team. This is of particular benefit to small and medium-sized companies, who may not have the capacity to participate in committees, task groups or projects. The Executive Director is also available to visit mine sites to update senior staff.

To keep pace with technological developments and member company needs, the Research Committee recently reviewed ACARP's communication strategy and made a number of recommendations which were approved by the ACR board. These included a website upgrade, improvements to electronic and paper-based materials, improvements in awareness raising of ACARP at mine sites, publishing articles in member company newsletters and, where appropriate, better use of face-to-face opportunities.

Five Year Research Strategy

The Research Committee recognises the challenging market conditions the industry is currently facing. Its overall strategy for 2015-20 is to focus on projects that reduce the cost of production, improve safety and address social licence to operate issues.

Automation and operator-assist technologies such as the autonomous continuous miner and shovel load assist projects will continue to be strongly supported. Automation/assist projects increase production, reduce costs, address growing human resource constraints, provide opportunity to remove workers from hazardous areas, reduce maintenance costs and increase availability of plant and equipment.

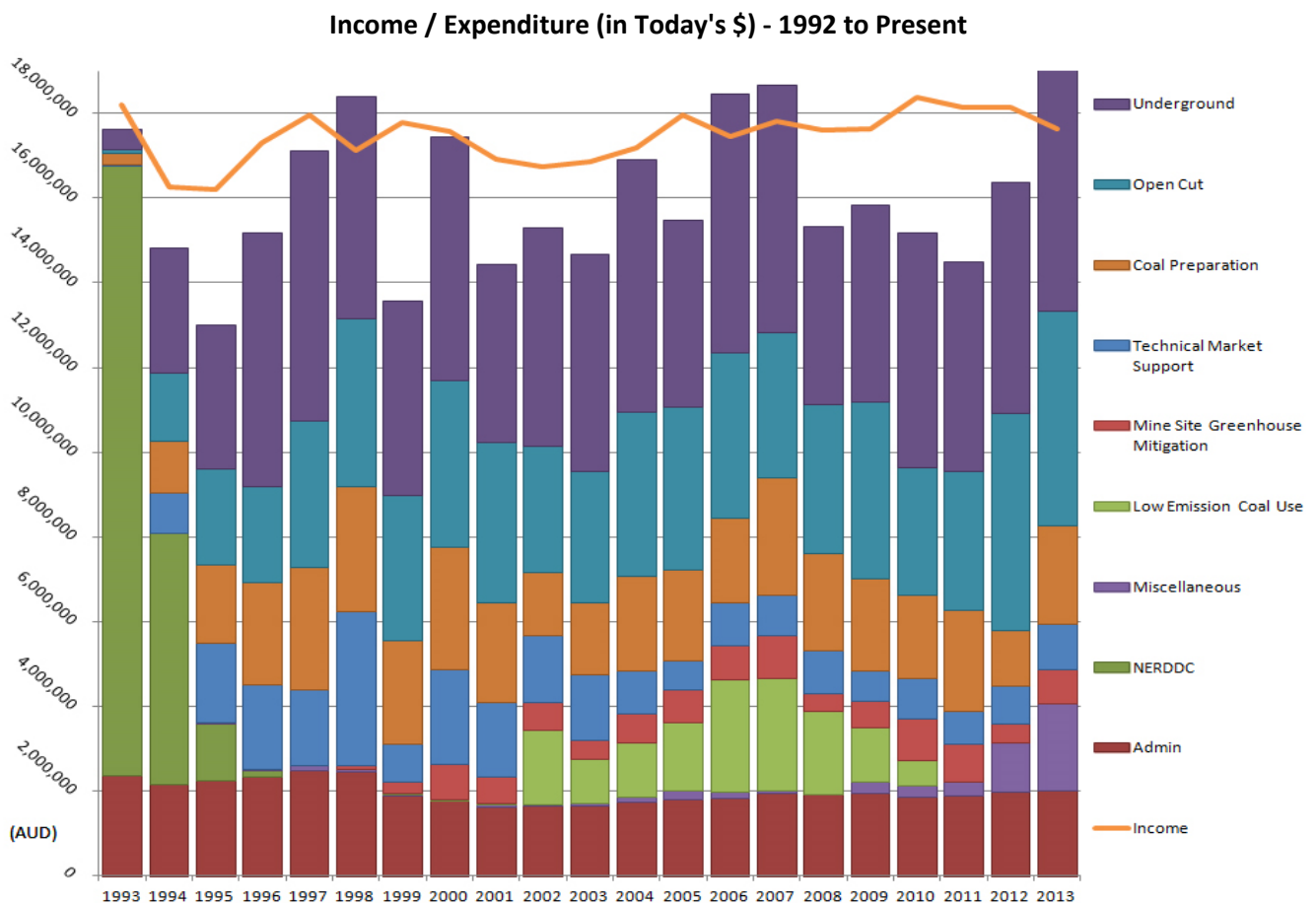
The Research Committee will continue to take responsibility for major projects such as RISKGATE, and also for PhD scholarships offered to industry personnel to grow the industry's research capacity and expertise.

Each technical committee has developed a strategic R&D plan out to 2020. The plans outlined below form an integral part of the Research Committee's overall strategy. Each committee seeks to ensure its plan offers value for money in terms of research and potential benefits to the industry, and that it meets the shared vision of the board, the Research Committee and the industry.



Funding History

ACARP has maintained the 5 cents per tonne contribution rate over the past 20 years. The various committees expect to spend between \$75 million and \$85 million to deliver its R&D program for the period 2015 to 2020, which is based on the expected research demand and the availability of suitably qualified researchers. Comparative expenditure between committees remains relatively consistent. Administration costs remain consistently low. Project and management expenditure will be adjusted to suit the circumstances.



Underground Committee

The Underground Committee is also strongly supported by industry, with more than 20 active members. Safety and productivity are paramount issues for this committee and, with the assistance of the roadway development, exploration, strata control, maintenance, environment and safety task groups, manages a wide range of projects.

The committee scopes proposals and tightly manages each project to ensure they have a



definable benefit to industry and can be implemented as easily as possible. The committee is now applying the learnings from the successful automated longwall commercialisation process to the autonomous continuous miner research program and other large projects that are under way.

Underground Committee R&D Program for 2015-20

Program	Strategies	Tactics and typical focus areas
Improved health and safety	Identify and analyse hazards including emerging health issues	<ul style="list-style-type: none"> • Fitness for work • Dust hazards • DPM management
	Develop new OHS management tools	<ul style="list-style-type: none"> • Risk assessment, including quantitative risk assessment • Managing equipment injury risks
	Improve escape and rescue options	<ul style="list-style-type: none"> • Optimise escape strategies • Data acquisition and response management
	Tactical safety initiatives	<ul style="list-style-type: none"> • Control of electrical and hydraulic energy • Gas, fires and explosions, spontaneous combustion management • Ergonomics and proximity detection • Legislative support
Higher productivity mining	Stimulate new mining methods	<ul style="list-style-type: none"> • Automation of core mining and development processes • Productivity improvement of services, e.g. gas drainage • Coal clearance performance
	Improve systems	<ul style="list-style-type: none"> • Skills enhancement technology • Robust, flexible communications
Equipment systems and reliability	Root cause failure analysis and response	<ul style="list-style-type: none"> • Equipment and system failure analysis
	Maintenance systems	<ul style="list-style-type: none"> • Transfer of surface technologies • Condition monitoring
Management of mining conditions	Integration and knowledge management	<ul style="list-style-type: none"> • Resource definition • Gas drainage parameters
	Develop new geological and geotechnical tools	<ul style="list-style-type: none"> • Continuous improvement in remote sensing applications, especially seismics • Characterisation of strata • Improved strata control
Sustainability	Assessment tools and knowledge building	<ul style="list-style-type: none"> • Water management • Ecological sustainability
	Case studies and best practise	<ul style="list-style-type: none"> • Subsidence management
	Carbon pollution reduction	<ul style="list-style-type: none"> • Energy management • Reduce fugitive emissions





Open Cut Committee

The Open Cut Committee enjoys strong industry support. Its members, who represent a broad spectrum of producers, have expertise in geology, operations, maintenance, environment and safety.

The committee has demonstrated solid project management capability, the ability to respond quickly to emerging issues, and flexibility. It acts proactively to develop projects for emerging industry concerns and opportunities. The committee is assisted by the exploration, environment and safety task groups, which overlap with the underground and coal preparation areas.

The committee selects only proposals that demonstrate a clear and direct path to implementation, including overcoming commercial and regulatory hurdles. It is now experienced in managing larger projects, drawing on the steering groups when required, and engaging with OEMs early in the project lifecycle to help define the commercialisation pathway. Proposals (including 'blue sky' research) do not proceed if they cannot define a clear path to commercialisation.

Open Cut Committee R&D Program for 2015-20

Program	Strategies	Tactics and typical focus areas
	Remote control and automation	<ul style="list-style-type: none"> • Improve operation reliability • Remove operators from danger • Sensing and perception to assist operators and enable autonomy
Improved health and safety	Continuous improvement of major risks and health hazards	<ul style="list-style-type: none"> • Proximity detection tools and systems • Tyre management • Whole body vibration • Risk assessment tools • Real time slope monitoring
	Improved training and management	<ul style="list-style-type: none"> • Behavioural management • Fatigue management • Knowledge management, e.g. databases
Productivity of mining operations	Develop automation, sensing and perception	<ul style="list-style-type: none"> • Remove operator unpredictability • Promote standards for development of compatible systems between OEMs
	Develop planning, optimisation and training tools	<ul style="list-style-type: none"> • More productive operating techniques • Dragline and truck shovel productivity • Improved planning tools



Efficiency and reliability	Management and elimination of peak stresses	<ul style="list-style-type: none"> • Evaluate new materials options • Improved lubrication opportunities • Operating practices to reduce failure rates
	Condition monitoring	<ul style="list-style-type: none"> • New predictive failure methods
Geology	Advanced techniques for processing and interpreting geophysical data	<ul style="list-style-type: none"> • Remote sensing, especially 3D seismic imaging
Environmental management	Assess community impact	<ul style="list-style-type: none"> • Blasting impact management • Biodiversity impact
	Landform management	<ul style="list-style-type: none"> • Post-mining stability
	Water management	<ul style="list-style-type: none"> • Conservation, salinity



Coal Preparation Committee

The members of the Coal Preparation Committee clearly understand the challenges facing coal preparation because they are directly accountable for production at their sites and face these challenges on a day-to-day basis. As a result, this committee has identified and managed research of direct benefit to the industry. It provides a forum to identify and direct research that addresses risks or opportunities involving technology, safety and sustainability on behalf of the entire industry.

Research priorities are reviewed annually and current projects range from fundamental research to practical outcomes. Most of its research program is evolutionary rather than revolutionary, seeking to incrementally improve yield, boost recovery and drive down costs. It has also supported ground-breaking research, some of which has been unsuccessful, and some which has provided a step change to performance in coal beneficiation.

Results have included the development of new measurement tools and stretching the performance envelope for dense medium cyclones (DMCs), screens and other equipment. The committee has made a real effort to promote best practice and to capture the wisdom of the best practitioners in an effort to lift the industry benchmark.

Technical transfer occurs through structured visits, reports, handbooks, seminars and industry conferences.





Coal Preparation Committee R&D Program for 2015-20

Program	Strategies	Tactics and typical focus areas
Recovery improvement	Efficiency at higher throughput	<ul style="list-style-type: none"> Dense medium cyclone performance improvements Evaluation of new equipment, e.g. Reflux Classifier for larger size fractions
	Fine coal sizing and screening	<ul style="list-style-type: none"> Increased separation efficiency and de-sliming of fine coal
Higher productivity unit operations	Increased plant utilisation, productivity, efficiency and durability	<ul style="list-style-type: none"> Maintain equipment performance database Understanding 'tipping points' as feed rates increase and/or feed quality decreases
Adaptation from other industries	Sensors, models, processing equipment	<ul style="list-style-type: none"> Equipment for sizing at 100-200 microns Using CFD for modelling flotation
Measurement drives operations	Improved flotation prediction, flow rate, density control	<ul style="list-style-type: none"> Develop non-nuclear density gauge Acoustic monitoring MIBC alternatives
	Health and safety management	<ul style="list-style-type: none"> Improvements in operations and maintenance practices and procedures
Sustainability	Water quality and usage	<ul style="list-style-type: none"> Electro-kinetic dewatering of ultra-fines Using saline water in prep. plants
	Tailings and rejects	<ul style="list-style-type: none"> Tailings storage facility alternatives and treatments
	Energy efficiency	<ul style="list-style-type: none"> Knowledge sharing, specific initiatives and case studies
Plant of the future	Alternative processing technologies	<ul style="list-style-type: none"> Automation In-pit processing



Technical Market Support Committee

The Technical Market Support Committee addresses technical issues that are likely to significantly affect the value-in-use of Australian coals and to position Australian coals favourably against international competitors. With many decades of the combined experience of representatives from the metallurgical and thermal sectors of the industry, it can respond quickly to emerging issues from coke quality to changes in shipping and maritime requirements.

The committee initiates and funds research to protect and advance the interests of the Australian black coal industry at state, national and international levels. It has supported the industry's role in maintaining Australian and ISO Standards and includes work on mercury, synthetic sulphur calibrants and new test procedures.

The committee has made a real effort to capture the knowledge of the industry's best



practitioners in an effort to ensure this body of knowledge is not lost. The output of this work is a number of handbooks and reference books that should be part of any corporate library. Technical transfer also occurs through technical brochures, reports, reference books and industry conferences.

The committee also supports development of new test procedures and advanced characterisation techniques that could enhance the value-in-use of Australian coals.

Technical Market Support Committee R&D Program For 2015-20

Program	Strategies	Tactics and typical focus areas
Current and emerging markets	<p>Understand value in use; emphasis on quality parameters.</p> <p>Quick response to emerging market issues as they arise, especially utilisation performance and market acceptance.</p> <p>Understanding properties of coals from key competitor nations and the opportunities for Australian coals</p>	<ul style="list-style-type: none"> • Predicting coke strength and physical structure • Trace elements for export thermal coals • Coal blend dilatation studies • Influence of mineral/maceral associations on coke quality • Influence of coke production methodologies on coke performance • Obtaining coal quality information by coal grain analysis • Image analysis to determine microstructure of coke • Bulk density influence on coking pressure • Pre-empting potential state, national and international legislative change • Understanding the susceptibility of coal to fluidise and become unstable in modern bulk carriers, and quantification of associated transportable moisture limits
	ISO participation	<ul style="list-style-type: none"> • Maintain ISO participation by Australia to ensure the industry's views are represented
Maintain critical R&D infrastructure	<p>Encourage research providers to upgrade facilities and test methodologies.</p> <p>Encourage R&D projects to attract and develop researchers.</p>	<ul style="list-style-type: none"> • Characterisation of metallurgical coals – coke properties and reactivity • Measurement of emissions and trace elements from a pilot scale boiler





Mine Site Greenhouse Mitigation Committee

The Mine Site Greenhouse Mitigation Committee comprises representatives of producers with a broad range of technical, strategic and policy competencies. This skills mix enables the committee to take a strategic approach to setting research priorities that fully recognises the interface between the technical aspects of measuring and mitigating greenhouse gas emissions, and the need to address changes in government policy. It has continued to enjoy strong industry participation and values the collaborative model whereby ACARP seed funding is directed to develop new knowledge and enabling technologies, with complementary resources contributed by industry for field trials and pilot demonstrations. For example, establishment of a Fugitive Emissions Steering Group led to new guidelines for measurement that were incorporated in NGERs in 2012. It successfully avoided the imposition of unwieldy regulatory constraints upon the entire industry.

The committee will focus on directing research funds into new approaches to mitigation, improved and more cost-effective measurement, sustainability and regulatory challenges. The aim is to provide better operational outcomes as well as independent research that can be used to influence the developing regulatory regime and maintain the 'right to mine'. A clear focus in the next five years is improved technologies to use or destroy fugitive emissions from Ventilation Air Methane (VAM) and other mine gas in a cost effective and safe manner.

Mine Site Greenhouse Mitigation Committee R&D program for the period 2015-20

Program	Strategies	Tactics and typical focus areas
Measurement of fugitive emissions	Develop efficient and effective methods for the measurement of fugitive emissions from coal mines and support their implementation across the industry.	<ul style="list-style-type: none"> • Work with the regulators and the major audit houses to refine the methods for estimating fugitive emissions from open cut and underground mines, and to give legal effect to them. • Facilitate research to meet identified gaps in measuring and monitoring equipment performance and availability. • Implement an outreach program to ensure consistent implementation of these new methods by the coal mining industry, and consistent interpretation of these new methods by auditors and government.
	Scope and test options	<ul style="list-style-type: none"> • Feasibility of enhanced gas drainage especially with improved drilling techniques • Strategic review of breakthrough drainage options for gassy mines • Capture of VAM on composite fibres or metal organics



	Research and Demonstration projects	<ul style="list-style-type: none"> • VAM abatement technologies • Utilisation options especially for lean VAM
Use or destruction of mine gas	Liaise with bodies representing industry, such as state minerals councils	<ul style="list-style-type: none"> • Development of draft standards, guidelines and discussion documents • Raise awareness of technical issues • Quantification of currently non-reportable emissions

ACARP's Intellectual Property Policy

ACARP's intellectual property (IP) policy specifies that IP ownership is retained by the research organisation that developed it. If the IP results in a commercial return, ACARP receives a negotiated royalty.

We have adopted this policy to avoid IP management and patent costs, to retain our not-for-profit status and to meet the requirements of our ATO Class Ruling (CR 2012/82). In addition, this policy provides researchers with an incentive to pursue commercialisation of their technology.

ACARP adds value by actively engaging OEMs to work with researchers early in the project to facilitate commercialisation and increase the likelihood of bringing a new process or product to market.

The Case For Extension

Global demand is cyclical in nature and we expect to continue managing the impacts of the current downturn for some time. Now more than ever, ACARP research benefits to your bottom line through efficiency and production improvements, enhanced competitiveness, better on-site safety performance and reduced environmental impacts from mining and transportation.


ACARP continues to demonstrate responsiveness and flexibility in research direction and careful control of program finances.

The Value Proposition

Not only do ACARP projects deliver quantifiable results such as

- reduction in rehabilitation costs
- life-of-mine haulage costs



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- mine closure costs and maintenance costs
 - lower fugitive emission liabilities for low-gas mines, and
 - an increase in usable coal and productivity improvements

but they also deliver less tangible results such as:

- Independent research that gains traction with government, regulators and OEMs
- Fostering innovation in a long established industry
- Financial benefit from implementing ACARP research outcomes
- Insurance against as yet unknown threats, and
- Maintenance of a solid and responsive research community available to producers.

Often the research benefits can only be fully quantified during late development stages or once implementation has occurred on site.

Producers in NSW and Queensland can deduct ACARP levy payments when calculating State royalty, and can also claim them as an R&D Tax Credit where company circumstances permit. The net cost of ACARP is negligible.

Demand Analysis and Levy Rates

A significant number of meritorious research proposals were not funded by the technical committees at the last project funding round due to budget constraints. These proposals:

- Met the industry's agreed research priorities
- Were of high quality, had a good chance of being successfully executed and would have benefited industry in the current environment
- Were expected to have been funded had finances permitted.

If industry were to fund all these projects, the coal levy would have to be raised to nine cents per tonne. Even if \$2 million a year was used over the next five years from cash at bank, the levy would have to be set at 8.3 cents a tonne. However this scenario would not allow ACARP to respond to emerging issues and doesn't consider a fall in production.

Setting the levy at less than five cents per tonne would severely limit ACARP's capacity to fund its current research portfolio.

Over the past 21 years since ACARP's inception, inflation has increased by more than 40 per cent while the coal levy has remained unchanged at five cents per tonne. As mentioned



above all levy payments remain eligible for the Commonwealth R&D Tax Incentive, and all New South Wales and Queensland contributors can deduct ACARP levy payments when calculating State royalty payments.

After considering all the circumstances and options, the Research Committee agreed to maintain the levy at five cents per tonne for the next five year period to 2020.

ACARP Matters Because

ACARP continues to deliver value through a broad range of projects that address real coal industry problems. A number of project summaries that demonstrate a strong return on industry's investment have been prepared and a selection is included in this presentation that are most relevant to your company. The full list comprises:

- Emergency mine re-entry guidelines – tested at Pike River and Aquila
- Guidelines for reporting coal mine fugitive emissions saves industry millions
- Improvements to roadway development and the continuous miner automation program
- Life-of-mine landform planning through 3d-Dig
- Longwall automation boosts productivity and lowers costs
- Low-cost acid coal mine lake remediation
- Managing mine subsidence impacts improves understanding and models
- Mined land rehabilitation identifies sustainable end uses for mined land
- Optimisation of dense medium cyclones improves efficiency
- Reflux Classifier improves recovery of fines
- RISKGATE proactively delivers safety improvements
- Semi-automation of shovels boosts productivity, reduces accidents
- Technical Market Support increases market share of Australian coals
- ACARP as an investment in the future

The full set is available at www.acarp.com.au/media - you will also find a selection of videos on RISKGATE, Semi Automation and Active Explosion barrier testing.

What is lost if ACARP is gone?

ACARP provides an effective and industry wide mechanism to deal with emerging critical issues. Some research requirements come out of left field. Who would have believed a lightning strike could damage a longwall system? Through ACARP we have identified



methodologies for managing the risk of underground fires from these lightning strikes.

If ACARP did not exist and had not delivered the fugitive emissions reporting guidelines, coal companies in Australia would have been forced to accept an annual multi million dollar impost for methane emissions.

Inevitably new issues will arise that will require a collaborative research capability. Who will fund this important work if ACARP is gone? As companies cut back their R&D capability, ACARP is almost the only source of R&D funding available to the coal industry in Australia.


Without ACARP, the highly skilled scientists working full time on addressing coal industry problems would move into other fields and this research capacity we've worked so hard to build will be lost. Individual companies would receive a dramatic increase in the number of requests for research funds as the scientists remaining in the field seek to remain viable. The quality of undergraduate programs of relevance to the industry would diminish as students and academics move into better-resourced fields of endeavour.

If only one black coal producer withdraws from ACARP, it will trigger the dissolution of the MOU and the end of ACARP. Management of the program would revert to the Commonwealth. ACARP's focus, flexibility and control would be lost along with the funding. If ACARP goes, it is gone forever and in all likelihood it will be replaced by a tax, the beneficiaries unknown, and the royalty offset gone.

Conclusion

The ACR board and the ACARP Research Committee have reviewed the benefits of the program and concluded that:

- ACARP is an essential and significant element of the research capacity of the Australian coal industry that can ill-afford to be lost at this time
- ACARP has served the industry well for more than 20 years, and has continually improved and responded to industry's changing needs. It has produced results that projects funded by individual companies alone could not achieve
- It provides a measureable financial return on investment, is effective as an agent of change in respect to OEMs, regulators and research organisations; and is a valuable forum to address industry-wide issues in a collaborative and effective manner

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- There is a strong case to extend ACARP for a further term of five years with the levy remaining at the current level of five cents per saleable tonne
 - The assignment of the MOU to the MCA demonstrates that there is significant industry support for ACARP to continue.

Recommendation

The ACR board recommends that each producer agrees to continue to participate in ACARP and to sign a levy agreement through to 30 June 2020 to give this effect.

The board and Research Committee would like to express thanks to all who contributed to the development of this document. © March 2014