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INVITED PAPER
THE ROLE OF ACARP IN SUPPORTING AUSTRALIAN COAL RESEARCH

Bruce Robertson[1]

ABSTRACT: The Australian coal industry is significant in many ways and is serviced by a number of research activities, but it is unique, globally, in relation to the Australian Coal Industry Research Program (ACARP) – a Research & Development (R&D) investment program funded by a 5c per saleable tonne levy and owned and managed by representatives of the industry.

ACARP has been in operation since 1992 and currently supports research activities into the safety, sustainable production and marketing of coal (but excluding the sustainable use of coal). With an expenditure of about A$15 million per year, the program supports a critical mass of R&D activities covering issues determined to be of interest to coal producers and other key stakeholders. Outcomes of ACARP include new knowledge and technology, and importantly, an informed, representative and cohesive forum for identifying and responding to critical technical issues of importance for the coal industry. This role of ACARP in the Australian industry is described with particular emphasis on the underground sector.

INTRODUCTION

There are a number of technical, sustainability and competition challenges facing the Australian coal industry. A strong and focused research program is a critical element of any significant industry in order to survive and prosper. The coal industry in Australia is served by a number of research providers and initiatives including ACARP (the Australian Coal Industry Research Program), which is somewhat unique in the way that it is funded and managed. This paper examines the way that ACARP operates in supporting R&D that contributes to the sustainability of the coal industry.

Significance of the Industry

The size and significance of the Australian coal industry is well understood by its participants. It is the fourth largest producer of black coal behind China, USA and India, producing about 334 million tonnes of saleable coal in 2008-09 (ABARE, 2009). As the world's largest coal exporter, Australia generated A$55 billion of income for the nation last year. There are about 30,000 people directly employed in coal mining and an estimated additional 100,000 who derive a livelihood from servicing the industry.

Growth outlook

The last few years have seen turbulent economic times, but the outlook for Australian coal remains positive. Global demand for coal is expected to increase, and Australia should be a beneficiary, notwithstanding impacts from climate change policies and increased competition from other significant producers such as Indonesia and China. This is because Australia has abundant reserves of high quality coal, a reliable sovereign risk profile, strong competition between producers and a demonstrated capacity for development and growth. The biggest risks lie in port and rail constraints, increasing license to operate restrictions and possible inability to service projected labour requirements.

The critical trade contribution that the coal industry (and other resource sectors) makes to Australia's economy is well understood by government, as reflected by supportive policies implemented in the past. However, given the relatively small percentage of the Australian population directly engaged in the industry, pressure from groups opposed to coal mining is having increasing impact. This necessitates cohesive, informed responses from industry members to ensure that appropriate decisions can be made regarding coal's future in this country.

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Role of ACARP

The original agenda for ACARP was biased towards productivity and cost reduction but there has since been a steadfast shift through safety towards license to operate issues. In this regard, ACARP plays an important role, not only in identifying and characterising the issues to be addressed but also in targeting and managing the R&D to generate the required information. Whilst individual producers can, and do establish their own databases to support the sustainability of their business interests, there is an increasing reliance on material developed by ACARP-funded projects because it is independent, representative and available. This is particularly relevant for safety, environment and community issues.

Some examples of ACARP projects delivering important data to aid decision-making are:

- subsidence datasets and methodologies developed over many years in the Illawarra which are used to inform mining consent applications;
- empirical databases of geotechnical design and response cases underpinning nationally accepted design criteria for ground support stability assessment in underground workings.

THE COAL RESEARCH ENVIRONMENT

Research Community

As one would expect for a leading national industry, there is a strong researcher community servicing coal. CSIRO has for many years conducted R&D in the minerals sector, and particularly coal, through a number of divisions, and continues to be the leading research provider. CSIRO works closely with industry members to ensure that its programs meet industry needs as well as serving the national agenda. University-based research is also significant in coal, (including the University of Wollongong hosting this conference) with postgraduate programs and research infrastructure augmenting tertiary minerals education. Several Cooperative Research Centres were established specifically to consolidate and focus research capacity on issues impacting on mining and demonstrated commitment by the Commonwealth to supporting the mining industry. Private technology companies, semi-Government agencies and consultants make up the balance of Australia's coal mining research community. ACARP works closely with all of these research providers.

Australia has been blessed with some world class engineers and scientists working in coal research. Concerns exist however about the future supply of researchers, especially in some critical fields. Perceptions in the community about the image and outlook for coal do have an influence on career choices for young people.

How ACARP started

ACARP was established in 1992 (commencing operations in July 1993) when industry members successfully lobbied the Federal Government to transfer control from the existing National Energy Research and Development Program (NERDDP). NERDDP had been established in 1977 (The Coal Levy Act) to ensure an ongoing commitment to industry coal research through a levy fund, matched by Federal funds. Project selection and expenditure was recommended by two committees, covering production and coal use, and made up of representatives of government, researchers and producers and a Commonwealth secretariat.

NERDDP was successful in stimulating new research activities but attracted mixed responses as to the quality and relevance of some of the program content. Under an MOU with the Commonwealth, the black coal industry assumed full ownership of the administration and decision making of the research program, pitched at a 5c per tonne levy rate, over a trial three year period. Strategies were developed to address the perceived shortcomings of NERDDP and ACARP was established (under the Coal Research Amendment Act) with the following purpose:

"To provide for the establishment of an industry research arrangement….. designed to provide for collective and integrated research on coal for the purpose of:

- *providing strategic leadership to industry R&D and to act as a catalyst to stimulate R&D interest within the coal and associated industries;*

- *improving the management and application of coal research in Australia;*
- *ensuring the more effective use of Australia's black coal resources;*
- *increasing the economic, environmental, safety and social benefits to the industry and wider community;*
- *promoting the competitiveness, sustainable use and management of Australia's coal resources."*

It is clear that ACARP was established to be much more than a research funding agency.

The establishment of ACARP resulted in an increase in industry ownership of the research program to meet its needs. Australian Coal Research Limited (ACR) was established to manage the program. Under Board and research committee governance, ACARP has been subjected to ongoing review and discussion to improve its performance and deliver maximum value for its levy payers. This has largely been via a process of five year extensions and associated Business Plans, with the latest extension recently approved from June 2010 to June 2015. The basic administration structure has not changed significantly since it started, but the program content has changed with industry's needs and there has been a concerted effort to increase awareness and engagement.

One of the more challenging aspects of ACARP is to maintain compliance with a critical clause of the Commonwealth agreement – 100% participation by all black coal producers. From time to time, there are some industry members, who for various reasons have a view that paying a 5c per tonne levy is not an optimal allocation of investment funds for their business. Sometimes this is born out of lack of understanding of the value proposition for ACARP and sometimes it is a consequence of a particular management style. The case has been successfully put to such minority interests that ACARP participation is for the overall benefit of each member and those benefits can be maximised through collaborative participation in the ACARP processes.

How ACARP works

The vision and mission of ACARP are as follows:

Vision:

To assist the Australian coal industry develop and adopt world-leading sustainable mining practices and, through collaboration, to ensure a sustainable position for the global use of coal.

Mission:

Utilise the collective technical competence and resources of the Australian coal industry to develop and manage a comprehensive research program which, through technological and process innovation assists coal producers achieve their financial, environmental and social objectives for sustainable development.

An underpinning element of the effectiveness of ACARP is the committee structure that draws expertise and representation from all sectors of the industry. Figure 1 shows the committee structure and highlights the division of technical work. Some I task groups support both underground and open cut committees. There are currently over 140 industry experts making voluntary contributions of their time to ACARP. This high level of participation has the added advantage of improving awareness and uptake of research outcomes.

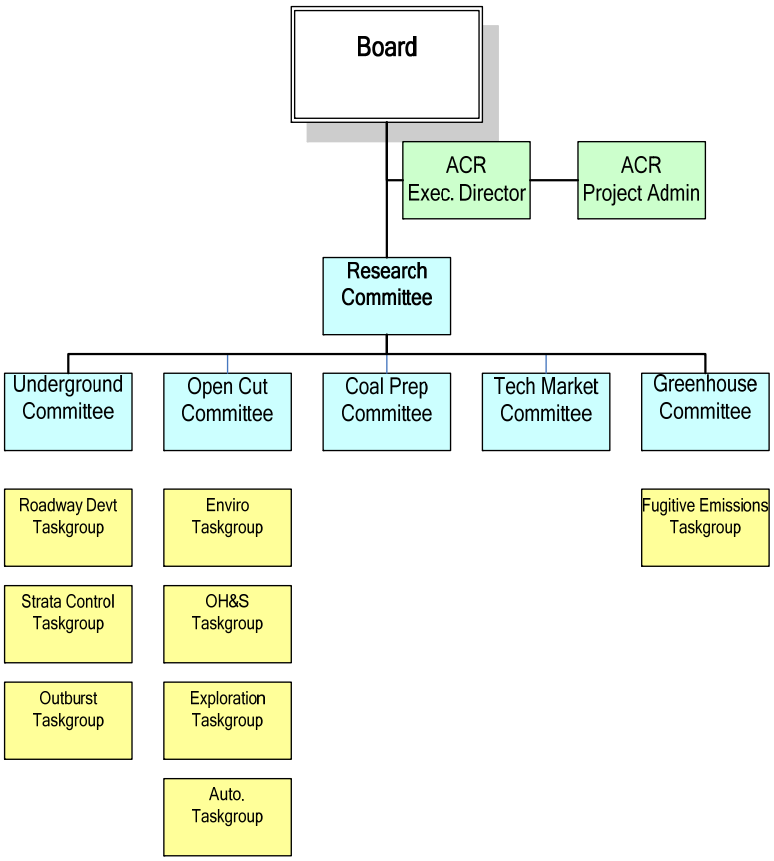

Figure 1 - ACARP committees

Coordination is provided by the Executive Director of ACR Ltd and administration services are contracted to ACR by Australian Research Administration Pty Ltd (ARA). The key accountabilities of the different committees are illustrated in Figure 2. Recently there have been concerted efforts to strengthen the quality of communication between:

- Task groups and technical committees;
- Research committee and Board; and,
- ACARP and its stakeholders.

ACARP RESEARCH STRATEGY

Research focus

ACARP research has in the past funded projects addressing both the sustainable production and use of coal. To support a national effort to reduce greenhouse emissions from coal, ACARP has participated in three cooperative research centres - CCSD, CO2CRC and CLET. In order to generate funding for abatement demonstration programs, ACALET (ACA low emissions technologies fund) was formed in 2007 and the responsibility for funding R&D in sustainable coal use was taken over from ACARP. The focus for ACARP research is now on people, productivity and the environment.

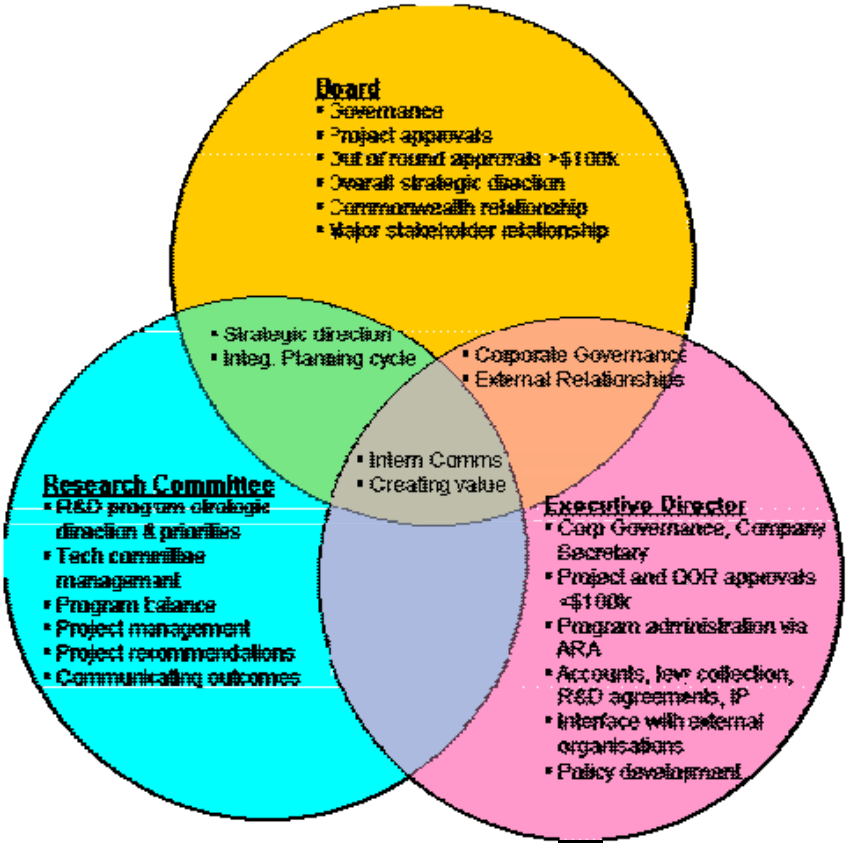

Figure 2 - ACARP committee accountabilities

ACARP committees endeavour to maintain a balance of funding for ongoing programs and emerging areas of importance. There is a view that the size of typical ACARP grants (A$ 150,000 – 200,000) is too small to attract a critical mass research team or to make a significant impact. In reality, projects usually make up a continuum of work in a program area characterised by an expanding body of knowledge whose direction and application can be more effectively managed by industry. The coal industry is conservative in nature and in a number of areas, ACARP funded research leads industry practice by a number of years.

Funding model

The ACARP funding model is an annual round process, although critical projects can be brought forward for consideration at any time (Figure 3). There also exists a "Landmark" concept for funding more significant programs of work; examples include the Longwall Automation and Roadway Development programs and ACARP's membership of CCSD, CLET and CO2CRC to ensure that levy payers have access to the work of these centres.

Each year, the various technical committees establish new R&D priorities and develop funding requests contingent with their proposed programs of work. The philosophy on funding is to achieve an efficient and equitable investment process with leveraged funds where appropriate. There is an element of competition for some of the funds, again managed by the Research Committee. Whilst there will always be winners and losers, in general there appears to be a healthy quantum of tension between committees for funding, with the best and most important projects receiving funding. Projects are closely managed by industry monitors appointed by the committees to ensure R&D performance expectations are met.

On average about $12 million is committed to R&D annually plus an additional 15% in administration costs. Since its start, ACARP has directed A$180 million of funding to 1,084 projects (ACARP, 2009). In 2009, 230 short proposals were received, which were subsequently short-listed to 86 long proposals, 12 of which were fast tracked. Another 63 projects were finally put forward for funding

	Board	Research Committee	Tech Committees
January			
February			
March	Review performance		Develop priorities
April		Call for short proposals	
May			
June			
July			Select short proposals
August		Budget proposal	
September	Strategy		
October			Select full proposals
November		Recommends projects	
December	Approves projects		

Figure 3 - ACARP funding timetable

Figure 4 shows the distribution of direct ACARP funds, amounting to A$36 million over the last three years. A further A$61 million of external funds and in-kind resources resulted in a leverage factor of 2.7 times investment. Underground projects have attracted some 34% of the pool, which has been expanded by the wind down of funding for the low emissions coal use committee since 2008.

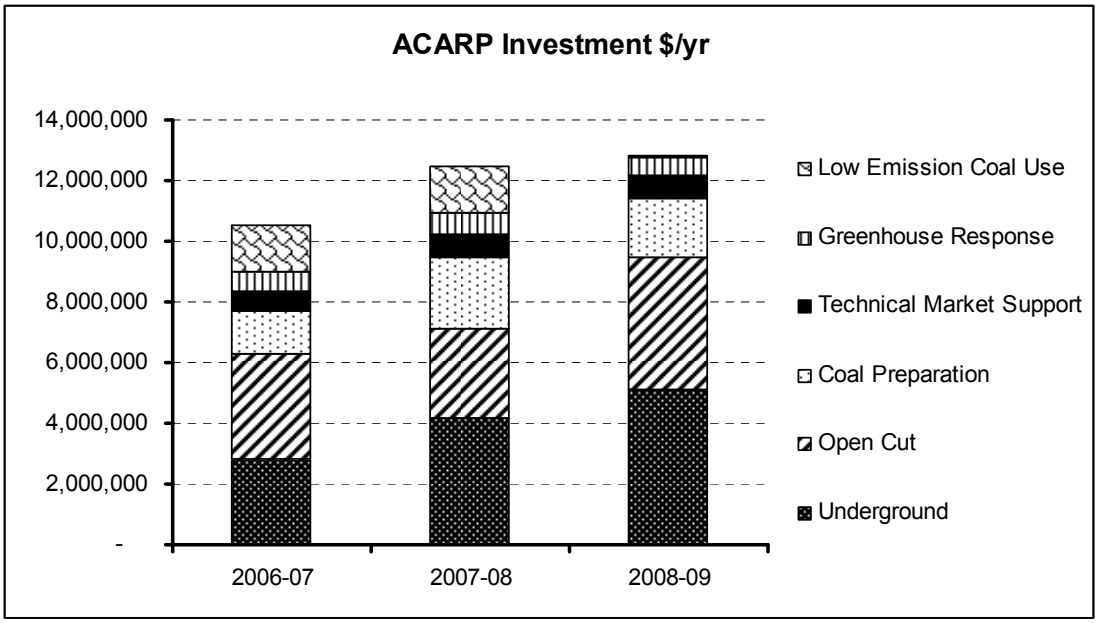

Figure 4 - ACARP funding distribution

Underground Priorities

The strategy for the ACARP underground program is expressed as:

'increasing levels of safe reliable underground production through the application of automation technologies and improved management of risk and impacts on people and the environment'

Priority setting is a key aspect of ACARP's strategy to ensure that R&D matches industry's needs. Priorities are overhauled each year to take into account industry circumstances, outcomes from previous research programs and input from industry members. Priorities are clustered into strategic areas, which for the underground technical committee for 2009 were:

- Improved Health & Safety;
- Management of Mining Conditions;

- Higher Productivity Mining;
- Equipment and Mining Systems Reliability;
- Sustainability.

Within these categories, guidance is provided for researchers on the issues that technical committee members (and the relevant task groups) agree are most important. Program themes are continued as the body of knowledge is developed with each project. Table 1 summarises the underground program areas supported in recent times (ACARP, 2009).

Table 1 - 2009 Underground Priority programs

Program	Strategies	Focus
Improved health and safety	Reduced operator exposure to hazards, fires & explosions and health management tools; escape capability	• safety & risk mgt systems; • dust; noise exposure; • fatigue; vibration; • ergonomics; collision avoidance; • high pressure fluids safety; • diesel emissions; • Ventilation, gas & outbursts; • spontaneous combustion, fires and explosions; • emergency management, escape & rescue
Management of Mining Conditions	Better exploration methods; Strata characterisation and design tools	• exploration techniques; detecting geological anomalies; • resources and reserves estimation; • geotechnical characterisation of strata; • improve ground support technologies; • windblast management
Higher Productivity Mining	Improved underground mining methods & equipment; automation, training	• roadway development; • longwall; • remote control & automation; • improved blasting systems; • training systems
Equipment systems and reliability	Root cause analysis, increased asset utilisation	• improve uptime; • conveyors; transport; • electrical power systems; • intrinsic safety and flameproof protection
Sustainability	Knowledge building, assessment tools, case studies & best practice	• subsidence management; • aquifer management; • streams; vegetation; biodiversity; • dust & noise impacts; • fugitive emissions; • energy efficiency

Future focus

On occasions, a "blue sky" project is funded if the opportunity is compelling. The underground technical committee has demonstrated a desire to recommend major investment in "step change" technology areas which are seen as pivotal to the industry's future, such as longwall automation and roadway development systems. Scoping studies are routinely commissioned to clarify the status of knowledge in

a topic or to define research goals. The L15 study completed in 2007 had the aim of identifying barriers to a single longwall producing 15 Mtpa.

The critical issues identified were:

- High capacity gas drainage;
- Increased roadway development performance;
- Engineering design of system elements;
- Real time maintenance;
- OHS issues – dust, heat, fatigue;
- Prediction of adverse geological & geotechnical conditions;
- Subsidence & aquifer disturbance;
- Water efficiency.

ACARP ADDING VALUE

Measuring value

An issue of interest to levy payers is the value that their levy generates. For some contributors, 5c per tonne amounts to a considerable sum of money which could otherwise be invested elsewhere. The portfolio of projects funded by ACARP creates different value drivers including productivity and cost savings initiatives, health and safety improvements and environmental safeguards, each with different value measures. Perhaps more significantly, the value generated from research outcomes depends on the quantum and quality of uptake as much as the research product itself. The challenge of articulating a value stream that represents an acceptable return on investment has been dealt with in several ways:

- Selecting a subset of projects where there has been a clear financial benefit developed for the industry (eg longwall automation) and estimating the net present value of the research projects;
- Showcasing a number of significant projects where the value is clearly significant but difficult to quantify (eg EMESRT – the Earth Moving Equipment Safety Round Table);
- Harnessing the collective opinions of the technical leaders of the industry to generate a qualitative view of the gross worth of the ACARP program.

This highlights perhaps the key strength of an industry R&D program such as ACARP in providing a vehicle to conduct research on the industry's behalf. Important cross sectoral issues such as cumulative impact of mining, subsidence impact or sensitive legislative matters can be more appropriately funded and managed at the industry level rather than at company level. A good example is the current program of work being managed by the Fugitive Emissions Steering Committee to develop draft standards for emissions measurement and reporting. ACARP has been able to respond quickly to the need for funding and industry representation to keep ahead of the Government regulatory agenda.

Leveraging value

In most cases, ACARP projects include funding from the researcher or other parties in addition to ACARP money. The leverage rate over the last three years has been 2.7 times ACARP investment, expanding the resources applied to coal research to about A$30 million per year. There is no doubt that ACARP funding has provided an important core of support for several R&D entities in Australia, allowing such organisations to secure essential researchers and infrastructure for specific programs. ACARP projects normally have a maximum limitation of three years and it has been suggested that this should be lengthened to provide even greater security for staff retention. This has not been possible in the past due to the limited forward tenure of the ACARP contract with levy payers. However, now that ACARP is secure into at least its 23rd year in 2015, it has become a stabilising funding influence.

Level of investment

It will come as no surprise that the topic of research levy quantum stimulates debate when raised. Five cents represents somewhere between 0.01% and 0.1% of revenue, depending on coal price. After adding leverage of 2-3 times and bearing in mind significant R&D funding from other sources, the total level of investment still falls well short of typical industry investment rates of, say 3 - 5%. There are of course many suitable research opportunities in coal. A significant increase in ACARP funding would test research capacity in Australia, although the CRC program has demonstrated that resources can be marshalled if required. ACARP grants have largely been directed to upstream research and development, rather than downstream demonstration and commercialisation, which requires significantly more funds and time. To date there has been a reliance on OEMs and individual mining companies to take over the pre-commercial development of ACARP outcomes, which takes time and can slow uptake. For some critical breakthrough technologies, a coordinated effort with ACARP acting as a facilitating agency has been effective.

Facilitating collaboration

Perhaps one of ACARP's most valuable advantages is the opportunity that the program creates to get capable people together to solve common problems. This is not easy in a competitive business environment with onerous trade practices constraints, so it is useful to acknowledge some of the successful collaboration activities made possible under ACARP:

- regular practitioners workshops to disseminate progress updates on ACARP projects and capture vital intelligence from operators to feed back into R&D efforts (eg, the inseam drilling and outburst workshops coordinated by John Hanes for many years, and the recent series of roadway development workshops coordinated by Gary Gibson);

- research projects requiring participation by a number of different industry members to develop consensus decisions, sufficient funding or multiple site access, and thus providing opportunities for rich interaction and learning; (eg greenhouse measurement standards development, geotechnical and environmental projects and the longwall automation program).

The technical people that sit on ACARP committees represent, in many instances, ideal candidates to represent the industry's interests on Standards committees. The role of ACARP in the Standards process, as it relates to coal, has come under the spotlight recently. This is in response to significant changes taking place around Standards development and because there are few mechanisms other than ACARP to access collective industry expertise.

Tackling difficult topics

Some of the research programs carried out in ACARP address topics that are more effectively dealt with at an industry rather than enterprise level - typically regulatory issues. An ACARP-supported approach allows engagement between a cross section of stakeholders, increasing the quality of participation and maximising the likelihood of a successful outcome. In many instances, individual companies might have been reluctant to take on the responsibility of leading a reform agenda. Some examples of this process at work include:

- the EMESRT program to develop industry engagement between operators and OEMs;
- research, development and demonstration of new escape and rescue systems (eg development of self rescue vehicle, new fire and ventilation modelling technologies);
- various mine safety research programs (eg stone dust improvements, intrinsic safety testing, coal blasting products, inertisation)

Over the years, a significant body of knowledge has been built up in a number of programs as a result of research strategies managed by technical committees. The process of progressively developing incremental understanding and research outcomes through the stepwise interaction between researchers, project monitors and the sponsoring technical committee has in most cases been very effective. Example programs include management of spontaneous combustion and gases in goafs, longwall geomechanics and dust control.

OEM engagement

The major original equipment manufacturers servicing the underground industry operate in a highly concentrated and competitive environment. This has contributed to a slow evolution of mining equipment in the eyes of some producers, and frustration for researchers looking to develop their new technology. The experiences with commercialising LASC (Longwall Automation Steering Committee) technology and the EMESRT program have demonstrated that a coordinated industry effort (in these cases under ACARP) can make an impact that benefits all parties, if managed effectively. In reality, these initiatives provided market research and communication vehicles that identified what industry really needed.

Fostering research capacity

Bearing in mind the need to maintain a steady supply of new research personnel, ACARP offers post graduate scholarships, targeting industry staff with an interest in developing higher qualifications through research in a particular topic area. The scheme was introduced in 2003 and to date five scholarships have been awarded, all for PhD study. In addition, many of the research projects funded by ACARP include postgraduate or post doctorate researchers.

Technical committees tend to push back on research applications with significant funds directed towards asset building, but inevitably projects contribute to some consolidation of research facilities. Where appropriate, collaboration is encouraged between research organisations to expand the resource capacity available to the project.

Communicating Outcomes and Competency Development

Over the last two years ACARP has introduced a number of communications initiatives to increase the uptake of research outcomes. This was in response to criticism from some quarters that there was a lack of awareness of ACARP activities, results and value. The initiatives included:

- Streamlining the ACARP website and simplifying the means by which industry members can obtain project reports via downloads over the www; the uptake of reports has since skyrocketed;
- Maintaining the frequency and intensity of workshops in critical program areas such as Roadway Development to distribute topical information as well as gather input from industry members about future priorities;
- "ACARP Matters" bulletins to showcase new research outcomes concisely;
- Releasing short summaries of research findings via email to target recipients (including external stakeholders) as alerts;
- Upgrading the quality and content of annual reports;
- More recently, all NERDDP reports have been made available in digital form to complement the ACARP library of reports.

The ACARP website allows easy access to hundreds of ACARP and NERDDP reports. Furthermore, some information portals, developed with ACARP support provide ongoing information databases of interest to the industry (eg MIRMgate, undergrouncoal.com.au website). There are numerous opportunities for professional development of industry members who participate in ACARP research projects at mine sites, attend seminars or read research reports. In most instances the knowledge transferred in these events is interesting, topical and relevant to the competency development of individuals and teams. The barriers of access to ACARP knowledge have been purposefully lowered to enhance knowledge transfer.

CONCLUSIONS

Inevitably, the business of mining, processing and marketing coal in Australia will continue to evolve in response to different factors and forces, including:

- challenges from other coal-producing nations and sectors (renewable energy, nuclear, alternative steel making methods) that will put pressure on costs and reliability for Australian coal to remain competitive;
- new research issues, as existing mining districts are depleted and new areas are opened up; and,
- increased pressure on sustainability programs (GHG, environmental).

The role that R&D will play in the management response to these issues will depend on the structure and cultures within the industry and the ability to organise and fund research activities. ACARP has successfully demonstrated that an industry-based research program can be effective in delivering solutions to difficult problems, in a cost-effective way. In providing a reliable ongoing R&D agenda, capacity and activities, somewhat isolated from business cycles, the program provides a forum for discussion and collaboration which is more likely to achieve progress than uncoordinated company actions. In addition to the examples previously cited, the successful bioremediation trial with acid lakes at Collinsville is a good case study of how ACARP projects can deliver solutions to difficult industry problems.

It is expected therefore that ACARP will remain the central mechanism for coordinated coal research for some years into the future. It is also likely that collaboration with international agencies will increase in response to shortage of technical expertise and facilities and the desire to find common solutions to similar problems. Ultimately ACARP's future effectiveness will depend on the attitude and preparedness of coal producers to embrace innovation, new technology and risk taking to achieve solutions to significant problems.

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