

MEDIA RELEASE

BCIA R&D Projects Herald New Era for Brown Coal

Brown Coal Innovation Australia (BCIA) today announced initial results of its \$8.3 million 2011 funding round, with up to \$4.2 million awarded for six world-class R&D projects in brown coal low-emissions and product innovation technologies.

BCIA Chair, Gerry Morvell, said: “Our 2011 R&D funding round proves the significant international industrial interest in Australia’s world-class brown coal resource and the enormous potential to create new industry and employment opportunities for our nation.

“We have an opportunity to lead the world in the creation of new low-emissions coal technologies and to ensure Australia’s future economic prosperity. Each project funded by BCIA offers Australia a substantial opportunity to maximise low-emissions utilisation of our natural resources for the benefit of all Australians.”

BCIA is a not-for-profit, member-based company with a mandate to invest in the development of skills, networks and low-emissions technologies that will broaden the use of brown coal for a sustainable future. The Company’s primary focus is to accelerate, develop and promote early-stage science and engineering technologies in the brown coal innovation chain – spanning from mine mouth to the capture of greenhouse gas emissions.

Announcement of the 2011 funding round results caps off a strong eighteen months of achievements for BCIA including significant investment in skills development and finalisation of State and Commonwealth funding agreements; the latter via a relationship agreement with Australian National Low Emissions Coal (ANLEC) R&D.

The total leveraged value of the initial BCIA 2011 research projects is \$10 million including industry, research institute and State and Federal Government funding.

As part of its initial 2011 R&D program funding release, BCIA has committed to R&D in emerging technologies for the capture of CO₂ at a lower energy and cost penalty compared with existing technologies and an international collaboration to enable gasification for brown coal-fired power generation; thereby reducing CO₂ emissions and lowering generation costs.

BCIA’s 2011 R&D funding program will also support trials to determine the merits of using brown coal to improve soil health and plant yields and research of processing methodologies to reduce spontaneous combustion of dried or de-watered brown coal. “Both of these projects offer the potential of significant new domestic and global markets for Australian brown coal,” Mr Morvell said.

The remaining two projects in the initial 2011 funding program are focused on determining the best-performing, most cost-effective solvent absorbent technologies for the capture of CO₂ emissions from brown coal and a literature review of next generation high-efficiency, low-cost, integrated drying and gasification systems for the production of power and high-value products from brown coal.

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BCIA established ambitious cost and risk reduction targets¹ as focus areas for its 2011 R&D investment program; the Company's second R&D funding round. "We believe these targets - which seek to demonstrate cost-effective technologies to significantly reduce emissions from brown-coal utilisation by 2020 - are necessary to ensure a sustainable future for brown coal," said BCIA's Chief Executive, Dr Phil Gurney.

BCIA is continuing to negotiate contracts for a further four R&D projects submitted via the 2011 funding round; these projects are expected to be announced during the next two months and represent a further \$4.1 million in BCIA funding (plus an additional \$10.6 million in total leveraged funds).

The BCIA 2011 R&D funding round was undertaken in two stages: a call for Expressions of Interest, followed by an invitation for shortlisted applicants to submit full proposals. The BCIA Research Advisory Committee assessed both EOIs and full proposals and provided advice to the BCIA Board.

The BCIA Research Advisory Committee is chaired by experienced research leader; Dr John Burgess. Dr Burgess said: "The full applications were of a very high calibre and, together with our investment in skills development and research leadership, these projects will make a significant contribution to Australia's scientific standing in low-emissions utilisation of our vast natural resource."

The Company's direct skills development investment to date includes the awarding of two BCIA Research Leader Fellowships and five postgraduate research scholarships, plus the immense training and educational opportunities created via BCIA's R&D portfolio.

BCIA Chief Executive, Dr Phil Gurney, said: "BCIA's strategic investment portfolio is proving to be a key entry point and focus for significant funding by brown coal industry participants including coal-fired energy operators and new technology providers, governments, research funders and tertiary education institutions.

"As a not-for-profit company, we rely on input from our members to help inform the direction of our research funding activities and skills development programs. Our members represent a wide range of stakeholders including technology suppliers, resource owners, research providers and funders, tertiary education institutions and government.

"BCIA members benefit from working with the only organisation dedicated to addressing the technological and workforce challenges of utilising Australia's brown coal in a low-emissions environment. Over the coming year, we will be seeking to extend our membership offering and expand our membership base," said Dr Gurney.

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¹ Refer 2011 Funding Round targets, p.4

BROWN COAL INNOVATION AUSTRALIA FUNDING ROUND FACTSHEET

Brown Coal Innovation Australia (BCIA) today announced \$4.2 million in funding for six highly meritorious research and development projects in brown coal low-emissions and innovation technologies.

The total leveraged value of the selected projects is \$10 million including research institute, industry and State and Federal Government (via Australian National Low Emissions Coal R&D) contributions.

BCIA is continuing to negotiate contracts for a further four R&D projects submitted via the 2011 funding round; these projects are expected to be announced during the next two months and represent a further \$4.1 million in BCIA funding (plus an additional \$10.6 million in total leveraged funds).

ABOUT BROWN COAL INNOVATION AUSTRALIA

Brown Coal Innovation Australia (BCIA) is a not-for-profit company with a mandate to co-invest with stakeholders in brown coal innovation and emissions reduction technologies.

BCIA funds and facilitates multi-million dollar research and skills development investments to drive innovation in the brown coal value-chain, from mine-mouth to the capture of CO₂. The company's mission is to invest proactively in the development of technologies and people that broadens the use of Australia's world-class brown coal resource for a sustainable future.

Strategic management of its R&D investment portfolio underpins BCIA's innovation support and operational activities. The company is addressing the challenges and opportunities of fostering low-emissions brown coal development by:

- providing a key entry point to progress shared research and development activity between industry, research and government stakeholders
- focusing strongly on skills-development and the expansion of training opportunities to secure the scientific, engineering and trades expertise needed for development of new low-emissions brown coal technologies.

BCIA innovation funding supports research and development initiatives that are technically excellent and that will lead to increased commercial deployment of low-emissions brown coal technologies in the short, medium and long term.

Australia has vast brown coal reserves; encompassing about a quarter of the world's known reserves. However the nation lacks world-scale, private-sector companies that operate in coal exploitation generally, and in brown coal utilisation particularly.

As a result, private-sector capacity and capability for investment in brown coal R&D is restricted. Innovation of improved technology for brown coal usage involves substantial costs and time and continuing under-investment in R&D has significant implications for industry competitiveness and Australia's future economic prosperity.

To date, the vast majority of R&D activity in brown coal technologies has focused on power generation and, more recently, efficient water removal technologies. Beyond emissions reduction, current and future international price indications for oil, gas and metallurgical coal provide new exploitation opportunities for the conversion of brown coal to liquids and other high-value commodities.

In particular, Victoria's world-scale brown coal resource and acknowledged potential for geological storage of CO₂, mean that the State is well placed to generate significant returns on public investment to foster growth in innovation and low-emissions utilisation of brown coal.

BCIA's innovation support spans three key spectrums:

- R&D in low-emissions, low-cost, coal technologies and novel, high-value products derived from brown coal
- Skills development and new training opportunities to secure scientific, engineering and trades expertise
- Linkages and networks to foster international collaboration in innovation and low-emissions technologies

BCIA 2011 FUNDING ROUND FOCUS AREAS

BCIA identified cost and risk reduction as focus areas for the organisation's inaugural funding round. Successful grant applications were required to demonstrate how they would make a significant contribution to the following cost reduction targets:

COST REDUCTION

- \$100/200/2020 – a levelised production cost target for electricity generation from brown coal of \$100 per MWh (sent out) at a CO₂ emission level of not more than 200 kg per MWh in commercial-scale demonstration by 2020
- 50%/100/2020 – a levelised production cost target for non-power generation products derived from brown coal (including novel, high-value products) that is at least 50 per cent lower than those from conventional sources, at a CO₂ emission level of not more than 100 kg per MWh in commercial-scale demonstration by 2020.

RISK REDUCTION

Risk reduction projects were required to demonstrate how they would contribute to reducing the risks likely to affect the success over the next five to seven years of proposed large-scale demonstration and/or early-deployment projects for low-emissions power generation from brown coal.

BCIA 2011 FUNDING ROUND PROCESS

The BCIA R&D funding round was undertaken in two stages: a call for Expressions of Interest, followed by an invitation for shortlisted applicants to submit full proposals. The BCIA Research Advisory Committee (RAC) assessed both EOIs and full proposals and provided advice to the BCIA Board.

The BCIA RAC assessed the merits of the EOIs against the following high-level selection criteria:

- The project: The strategic, technical, competitiveness, budgetary and 'value for money' merit of the proposed project. BCIA seeks projects that offer high value for our contribution to the total cost of the project. A minimum 1:1 funding criterion is required for R&D projects.
- The people and collaborations: The quality of the key people, including their capability and capacity to achieve the objectives of the project, together with the synergies in proposed collaborations to produce genuine, collaborative outcomes.
- The contribution to BCIA's research investment objectives and priorities.

The BCIA Board considered all submitted EOIs and full proposals; only project applications of the highest merit were selected. In all areas, industry and government partnerships that increased project funding leverage beyond the matched funding criteria and reduced commercialisation risk were viewed favourably.

The amount of funding released and the funding allocations against each focus area were at the discretion of the BCIA Board. All approved projects will be stage-gated to ensure continuing support only on the basis of demonstrable achievement of clearly-defined milestones.

BCIA RESEARCH AND DEVELOPMENT PROJECT GRANTS

\$1,500,000 funding for '*CO2CRC's Solvent-Based Carbon Capture Technology in Brown Coal Fired Power Plants – (CSCCT-BCFPP) Capture Demonstration for Cost Reduction*'; submitted by CO2CRC Limited in association with International Power Hazelwood; CO2CRC partners and Process Group.

This project will identify the best-performing and most cost-effective solvent absorbent technologies for the capture of CO₂ emissions from brown coal through modification of two existing pilot-scale facilities in Victoria. Recent research trials have demonstrated a range of benefits from the use of solvent potassium carbonate including negating the need for separate flue gas desulphurisation facilities. An experimental program and simulation studies will be used to further improve the performance of the potassium carbonate process for CO₂ removal. The project will also examine CO2CRC's precipitating potassium carbonate process including the removal of sulphur and nitrogen oxide impurities; a valuable by-product which could be further processed as fertilisers. Additionally, a modified pre-combustion solvent-based capture plant will undertake world-first trials of state-of-the-art WES absorber technology. Research results will enable international benchmarking of solvent absorbent technologies against current CO₂ capture techniques, develop clear directions for large-scale deployment and create the necessary competitive tension to drive down CO₂ capture costs.

\$605,000 funding for '*Development of chemical looping process for fuels production and CO₂ capture from Victorian brown coals*'; submitted by Monash University in association with TRUenergy; CSIRO Process Science and Engineering and leading European universities engaged in chemical looping research - Chalmers University of Technology Gothenburg, Sweden and Technical University of Darmstadt, Germany.

This is the first known study of chemical looping combustion and gasification of Victorian brown coal as an emerging alternate technology for the capture of CO₂ at a lower energy and cost penalty. Chemical looping has been widely studied for the combustion of natural gas but research into its potential application for solid fuels commenced only recently. Utilising metal oxides as a major source of oxidising agent, rather than concentrated gaseous oxygen from air separation plants, the technology removes the energy and capital costs of air separation plants. It is believed the low ash content, high reactivity and high oxygen content of Victorian brown coal is particularly suited to chemical looping and the process also has the potential to advance value-added brown coal technologies such as low-emissions hydrogen production.

\$603,028 funding for '*Development of entrained flow gasification technology with brown coal for generation of power, fuel and chemicals*'; submitted by Department of Chemical Engineering, Monash University in association with Mitsubishi Heavy Industries.

This project will model the characteristics of molten slag from Victorian brown coal under gasification to enable the future use of entrained flow gasifiers for brown coal-fired power generation. Gasification is capable of producing coal-fired electricity more efficiently and with reduced CO₂ emissions; thereby lowering generation costs. The project will develop commercially-applicable models for prediction of the slag behaviour of Victorian brown coals including slag formation, slag viscosity and trace element emissions while also making preliminary assessment of coal reactivity under entrained flow gasifier conditions. The measurement of slag viscosity under gasification will be undertaken in a state-of-the-art viscometer (one of only two operating in Australia) to be built at Monash University. The project is an international collaboration combining Monash University's expertise in brown coal gasification research and Mitsubishi Heavy Industries' experience with commercial scale coal gasifiers.

\$525,000 funding for '*Improved handling of lignite-based products*'; submitted by Monash University. Project participants include Environmental Clean Technologies Ltd; LawrieCo; Keith Engineering (Australia) Pty Ltd.

Dried or de-watered lignite (brown coal) is prone to spontaneous combustion following exposure to air, making lignite-based products notoriously difficult to handle and transport. This project has the potential to open up significant new domestic and global markets for Victorian brown coal through improved control of the composition and particle size distribution of lignite products. The first part of the project will seek to identify processing methodologies that can

significantly reduce the tendency of lignite to spontaneously combust. This will involve an investigation of the physical (structural) and chemical features of lignite which correlate with the low temperature, heat-releasing oxidation processes that result in combustion. The second part of the project will investigate and establish optimum conditions for the granulation of lignite and lignite-derived fertilisers. This research will be used to develop an integrated granulation and drying process for lignite using superheated steam.

\$500,000 funding for '*Next Generation Lower Emissions Gasification Systems R&D - Power and Products*'; submitted by HRL Technology Pty Ltd in association with Monash University; CO2CRC.

This research project will investigate options for high-efficiency, low-cost, advanced integrated drying and gasification systems for the production of power and high-value products from brown coal. Use of integrated drying and gasification technology for combined-cycle power generation has the potential for a significant improvement in plant efficiency, and consequent reduction in CO₂ emissions, compared with existing brown coal-fired power plants. Integrated drying and gasification is believed to be an economical means of producing syngas from brown coal suitable for further processing into high-value products such as liquid fuels, hydrogen, fertilisers, chemicals and advanced power systems utilising, for example, fuel-cells. The research project will investigate various existing and emerging process options that could be employed in the future. One of the key outcomes of this project will be the identification of further laboratory and pilot-scale work required to develop next generation lower emissions gasification system options utilising integrated drying and gasification technology.

\$450,000 funding for '*Coal-derived additives: a green option for improving soil carbon; soil fertility and agricultural productivity?*'; submitted by Monash University. Project participants include Clean Coal Victoria; International Power; LawrieCo; Exergen Pty Ltd; Environmental Clean Technologies.

This project will evaluate the merits of using Victorian brown coal and its derived products for improving soil health and plant yields and increasing carbon capture from the atmosphere. The study will involve glass house and field plot trials to determine the best performing brown coal derived materials, specifically humic/fulvic acid containing materials and char, for plant growth, soil health and soil carbon capture. Additionally, the project will compare char from brown coal with existing commercial char products and evaluate phosphorous fertilisers coated in a brown coal derived humate to determine improvements in soil health and associated increases in carbon uptake. The research plan will incorporate a life-cycle assessment of brown coal products for agricultural applications including all aspects of the supply chain, transport and distribution.

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