

IRON AND STEEL SLAGS REDISCOVERED RESOURCES

It has been suggested that the world needs a technology revolution to reach the aspirational global greenhouse gas reduction targets needed to stabilise the level of CO₂ in the earth's atmosphere. Current energy technology has evolved over about 150 years and it has been estimated that globally, we will need to make similar progress in about 30 years.

Throughout its history, at least since European settlement, Australians have been a truly inventive people. Many innovations have addressed the particular harshness of this continent from isolation and drought to flood have found their way onto the world stage. It is clear that the early inventiveness that first was aimed at survival of the colony continues to thrive today and should place Australian initiative at the forefront of meeting the world's environmental challenges. Australian-developed solar and water conservation / purification technologies are being taken

to larger pilot and production stages internationally.

The Federal Government has taken the lead in setting the aspirational 60% greenhouse gas reduction target for 2050. This together with the Cap and Trade approach to securing reductions will no doubt test our inventiveness as a nation. Processes such as dry granulation of slag hold out the distinct possibility of trapping significant quantities of currently untapped heat sources for energy without incurring additional generation of CO₂.

60% greenhouse gas reduction target for 2050

Currently the use of Ground Granulated Iron Blast Furnace Slag (GGBFS) saves around 500,000 tonne of Greenhouse Gas per year in Australia and has been doing so for

quite a number of years. Projects such as Sydney's Desalination Plant, the immersed tube sections of the Sydney Harbour Tunnel and many other applications across Australia over many years also demonstrate GGBFS' role in improving durability of structures. Eco-concrete may well be a new chapter in Australian innovation and the use of iron blast furnace slag products.

The iron and steel slag industry owes its success to many people in Australia over many decades. It is only fitting that we acknowledge with gratitude the role played by the late John Button in launching the Association in 1990 and for his strong support.

Association technical meeting focusing on new developments.

Story P2



Dr Sharif Jahanshahi, Michael Hitchens with ASA President Andrew Wilson at the November 2007 Technical Committee meeting.

Association pays tribute to Late Senator John Button

The association pays tribute to the memory of the late John Button. He was a great friend to the Association, assisting it in its early days as a new Industry advocacy group. In the midst of a very busy schedule as Industry Minister in 1990, he took time out to formally launch the Association at the North Ryde Campus of the CSIRO in Sydney.

Support of the Australasian Slag Association was a logical extension, having championed the significant and successful Steel Industry Plan, for the then Labor Government. Success of both the Steel and Slag industries today is a fitting tribute to the strategic intent of John Button and his leadership at an important time in history.

RIGHT: John Button with Association foundation Executive Officer Doug Prosser at the Association's launch in 1990.



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CONNECTIONS EDITORIAL TEAM

Connections is published by ASA

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Publisher: ASA inc. Executive Director: Craig Heidrich Editor: David E. Jones

Design & Print: 101 Design Pty Ltd

Connections is a quarterly publication with a print on online circulation >2,000 copies

Emissions Trading 101 (AETS)

Members of the ASA Technical Committee were given an overview appreciation of where the emissions trading debate was up to prior to the November 2007 General Election. Michael Hitchens outlined the "current policy debate/development process" In particular; he projected some of the likely implications/benefits within the context of our industry offerings, for effective recovery and use of ISS (iron & steel slag). Speaking to the topic of Emissions Trading 101, Michael defined Cap and Trade processes, with the Cap setting the supply side being the total emissions permits on offer in line with the Governments reduction strategy. The demand side of the equation is driven by the level of economic activity and the availability and uptake of options to reduce emissions.

The potential Australian system is different, where each year a producer must hold the number of permits equal to the emissions. Michael explained the proposed Cap and Trade model comparing it with the European Union Emissions Trading Scheme (EU-ETS). Total emissions will be capped in line with the Government's reduction targets with impacts relative to greenhouse gas generation. One impact could be a potential reduction in the price of coal because the cost of using it will increase because of the need to hold additional permits. Conversely, the price of slag for cement could rise given down stream users will need to hold fewer permits to support its use.

The aspirational goal of a 60% reduction by 2050 will be supported by firm goals in 5 year increments to give forward price signals. Initially it is proposed there will be a free issue of permits to trade exposed emissions intensive industries and to non trade exposed emissions intensive industries. Permits will be issued with a range of expiry dates up to 20 years, 1 permit = 1 tonne CO₂-e. These permits will cover the greater percentage of emissions in year 1, with an auction for the balance. In subsequent years the initial free issue permits will decrease with new permits having to be purchased from the auction pool. The intersection between supply and demand will set the permit price. New production will have to fit within the overall cap. Although there are current negotiations with New

Zealand, it is not anticipated that there will be other international purchases or trading for the first five years.



Michael Hitchens

Each year liable firms will need to account for their direct emissions, acquitting those emissions with a permit. Where a firm has surplus permits, they can sell them. If they lower emissions, this will lower the number of permits required for a particular year. Measurement of direct emissions will be at the enterprise level rather than at the individual site, providing flexibility in forward capital decisions in line with reduction targets. Some firms may also be liable to acquit for indirect emissions (e.g. petroleum wholesalers and petrol). In this way, individual consumers and small producers will pay for the costs through costs such as energy used with costs passed

on in this way bringing them into the overall reduction program by the choices they make.

The Government's aspirational target and the permit system will have important implications for RD&D. It has been suggested that the world needs a technology revolution to reach the global reduction targets needed. Current energy technology has evolved over about 150 years and it has been estimated that globally, we will need to make similar progress in about 30 years. Governments will also need to put significant funding into R&D as part of this program.

Michael Hitchens is a Senior Economist at ACIL Tasman and has worked on economic issues for over 25 years. Michael provides economic, policy and strategic analysis and advice to corporate and government clients on issues relevant to the energy and resources sectors.

Michael is also the Chief Executive Officer of AIGN (Australian Industry Greenhouse Network) being a network of industry associations [including ASA] and individual businesses which contribute to the climate change policy debate through joint industry action on climate change policy issues in order to promote sustainable industry development.

Association technical meeting focusing on new developments

Technical meetings of the Association have always been a member forum for sharing technical advances, discussing common matters and undertaking common research. From its work has come the various technical guides and bulletins as well as research papers most of which are available through the Association's website. Research under its auspices has been conducted through Universities and research organisations in Australia and New Zealand. There has also been cooperation with overseas Associations in the iron and steel slag network. The Association's current membership and affiliations are listed in the Insider section of this issue of Connections.

Although there has been significant applied and pure research and development over the past 200 years across the globe, there are always new opportunities and challenges to be met. Clearly our Sustainability conference in May last year struck a cord as being most timely and focusing on current community concern.

For the Technical meetings in November 2007 and February 2008, we have had presentations from eminent researchers and consultants that will undoubtedly help to shape our forward research and development work for some time to come. At our November 2007 meeting, we had presentations from Michael Hitchens – Senior Economist with ACIL Tasman on Emissions Trading 101. Dr Sharif Jahanshahi the Theme Leader - Sustainable Processing CSIRO Minerals gave a presentation on Dry Granulation, A New Approach to Slag Processing. In February 2008, Alessandra Mendes from Monash University School of Engineering gave a presentation on Fire Resistance of Concrete Made with Slag Blended Cements.



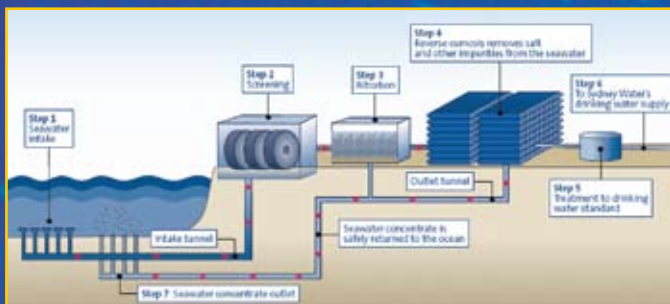
Dr Sharif Jahanshahi

In this issue, the November 2007 presentations are previewed. Look for the February presentation in a later issue of Connections.

Slag Cement for Sydney's Desalination Plant

Sydney's Desalination Plant will be built on 45 hectares of industrial land at Kurnell, and will be powered by 100% renewable energy. When complete it will be able to produce 250 million litres a day, which can be increased to 500 million litres a day in the future if needed. A new pipeline will carry the water from Kurnell across Botany Bay to the city's main water supply.

The plant will use a process called reverse osmosis to remove salt and other solids from seawater to produce drinking water. Seawater will be forced through a membrane under high pressure, the membrane acts like a strainer to separate the drinking water from salt and other solids in the seawater.



“will produce
250 million
litres a day.....”

Source: Sydney Water (Not to Scale)

One critical path undertaken by the designers was the design of the concrete for the structure, the inlet and outlet areas, and also the design of the pipelines. A high performance concrete had to be designed and implemented so as to accommodate the stringent requirements. These include a 100 year design life, a concrete that would meet the stringent durability parameters set by the designers. Chlorides penetrating the concrete was also a major issue.

Peter Ney Technical Manager of Concrete producer Readymix says the answer was relatively simple. We used cement blends utilizing Ecocem. These special blends were fine tuned by our laboratory staff doing many months of trials mixes. We are using up to 60% of Ecocem in our high performance concrete, in a project that will use more than 50,000 m³ over a period of 12 months. We have no doubt we will not only meet the expectations of our clients, but exceed them”. Source ASMS

Company Members

A primary role of our Association is to bring together Slag Producers, processors, Customers & Suppliers to the Slag Industry. Our activities cover Technical Developments, Plant Operations and processes, Education and Promotion. If you would like more information on the Association and how you can become involved, just complete the information section at the end of this newsletter. Current membership is as listed below.

Australian Steel Mill Services Pty
BIS Industrial Logistics
Blue Circle Southern Cement
Bluescope Steel Ltd (Port Kembla)
Concrete Pty Ltd
HiSmelt Ltd
Holcim NZ Ltd
Hunter Mill Services Pty Ltd
Komatsu Australia Ltd
MultiServ (UK)
MultiServ Australia Pty Ltd
OneSteel Limited

Premium Tyre Service Pty Ltd
Readymix Holdings Pty Ltd
Roads & Traffic Authority of NSW
SCE (Steelstone)
Smorgan Steel (Melbourne)
Steel Cement Ltd
SteelServ Ltd (NZ)
Sunstate Cement Ltd
University of Newcastle
University of Wollongong

Personal Members

Anderson, L
Dobson, G
Gregory, G
Hanley, P (Hon.)
Heaton, B (Hon.)
Hinczak, Dr, I (Hon.)
James, W (Hon.)
Jones, D E (Hon.)
Maric, M
Prosser, S D (Hon.)
Venour, M (Hon.)

Related Associations - National Slag Association (US) | Nippon Slag Association (Japan) | European Slag Association (EU)

Ecoblends

Supporting durability and the environment

Ground Granulated (iron) Blast Furnace Slag (GGBFS) has been available and used in Australia since 1966. In the subsequent 20 years, more than a million cubic metres of concrete was placed in infrastructure from wharves to mass foundations and 'normal' civil works at the Port Kembla Steelworks. Even at this early stage benefits from using slag cements were being recognised, particularly the lower heat of hydration and resistance to sulphate attack. Also pioneered during the 1960's and 1970's, were the triple blend cements incorporating GGBFS, Fly Ash and Ordinary Portland Cements (OPC). It was during the later 1980's that the environmental benefits of using Ecoblends were beginning to be recognised, initially in terms of resource conservation and then its impact in lowering generation of CO₂ through replacement of OPC's.

Across the decades in Australia, Ground Granulated Slag has a long history and has been used in many significant structures including: the immersed tube sections of the Sydney Harbour Tunnel, off shore oil and gas platforms, Sydney's sewage ocean outfall tunnels, pile caps of the Glebe Island Bridge significant bridge and infrastructure work in Victoria and other parts of the country.

With replacements of Portland cement up to 65 per cent in concrete, Ecocements provide more than adequate compressive strength performance at 28 days and with advantages of higher later age strength when compared to Portland cement concrete at the same binder contents. GGBFS can be used by directly batching into a concrete mixer together with Portland cement and other ingredients, pre-blended in specific ratios with Portland cement, fly ash and microsilica and supplied to concrete plants as a Type GB cement (general purpose blended cement) for the production of concrete.

Projects such as the Sydney Desalination Plant, the Sydney Harbour Tunnel and the Offshore Oil and Gas platforms typically have significant design lives (to around 100 years) and are often dealing with chloride penetration as a significant risk factor. The use of GGBFS cements contribute to reducing chloride penetration and bring the additional benefit in reducing CO₂ emissions.



ABOVE: West Tuna offshore rig ballasting off Port Kembla



ABOVE: EJ Whitten Bridge



New Approach to Slag Processing (Dry Granulation)

All of the iron blast furnace used for cementitious applications in Australia is produced by the water granulation method. Dr Jahanshahi gave a presentation to the November Technical Committee meeting on laboratory to pilot scale test work on dry granulation of molten iron blast furnace slag.

The presentation focused on recent advances in optimised atomisation to produce fine granulates and enhanced fast cooling to improve handling of hot granulates.

Conventional wet granulation method involves high capital costs, and consumes significant amounts of water. As one tonne of slag cools from 1 500 degrees to ambient temperature it releases more than 1.8 giga joules of high-grade waste heat.

The Australian steel industry produces more than two million tonnes of slag each year. Potentially, more than 4 peta joules of waste heat could be recovered from this slag. Recovered waste heat can then be used either in the steel plants or within other industrial processes.

Dry granulation is emerging as a very attractive alternative to water granulation. It delivers significant benefits for both industry and society, including:

- lower capital costs
- huge savings in water
- reduced air pollution
- waste heat recovery.

The new process can help reduce Australia's greenhouse gas emissions by about 1.8 million tonnes per annum, through significantly reducing emissions associated with cement production and steel production. Globally, greenhouse gas emissions could be reduced by hundreds of millions of tonnes per annum.

The CSIRO has made significant progress in overcoming some major technical challenges associated with the high-temperature process used to treat the molten slag.

The novel process is currently being tested through a prototype pilot facility. Once proven,



Molten slag pours on to a rotary disc during CSIRO's dry granulation process. Photo by Mr. Steve Sanetsis.

the process will be scaled up and plant trials conducted. The work has attracted world wide attention from industries and research institutions. The Dry Granulation project has recently gain support from Australian slag producers, OneSteel and BlueScope Steel. CSIRO are seeking additional support from Associations and members involved in slag processing and cement producers.

Dr Sharif Jahanshahi is the Theme Leader - Sustainable Processing CSIRO Minerals Down Under National Research Flagship and Research Leader, CO₂ Breakthrough Program Centre for Sustainable Resource Processing.

Source: www.csrp.com.au

Hopes build for eco-concrete

Throughout history, there has been the search for 'cement less' concrete, using some other material to bind the aggregates and sand together into a strong durable building material. Reasons for this have been many, including the availability and cost of materials to produce and even the availability of Portland Cement. There have been many projects, particularly in the former Soviet Union in the 1950's, where alkali activated slag cements were used (Brandster, J).**

An Australian project is currently under way in Melbourne aimed at transforming co - products from power stations and blast furnaces into geopolymer concrete (E-Crete). Zeobond founder Jannie van Deventer, a chemical engineer at the University of Melbourne asserts that "unlike with regular concrete the chemical reactions that form this polymer-based alternative don't give off carbon dioxide or require high temperatures, which also lead to CO₂ emissions. So it releases just 10 to 20 per cent of the greenhouse gases associated with making the standard stuff."

In the first instance, Zeobond is seeking to pilot E-Crete's use in smaller non safety critical applications. It is anticipated the product could be used initially in the construction of paths, building patios and sound attenuation walls along freeways. These applications are aimed at validating the durability of the product, exposed to the elements including the traffic induced environments in major cities. In time to come, the makers of E-Crete believe that durability criteria satisfied, the product could find application in high rise buildings

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Minister announces Greenhouse Reduction Timetable

Minister for Climate Change and Water, Senator Penny Wong announced the Australian Government's detailed timetable for the introduction of emissions trading in March 2008.

The timetable includes several important stages, including:

- March to June 2008: preliminary consultations on technical issues with industry and non-government groups;
- July 2008: public release of a Green Paper on emissions trading design, drawing on preliminary consultations;
- December 2008: public release of exposure draft legislation;
- March - Mid 2009: Bill consideration by Parliament;
- 2009: Consultation on emissions trading regulations;
- 3rd quarter 2009: Act enters into force, regulator established;
- 2010: Emissions trading scheme will commence.

"Emissions trading places a limit on the amount of emissions we will allow to be produced. This reform will not be simple, but it is the responsible course for Australia to take in reducing greenhouse emissions.

The Green Paper will canvass options and preferred approaches on issues, such as which industry sectors will be covered and how emission caps will be set. It will also include ways to address the impacts of emissions trading on Australian households, emissions-intensive trade-exposed industries and other strongly affected sectors.

The second phase of public consultation will focus on the Green Paper and will occur from early July to early September 2008. A further phase will follow the release of the emission trading legislation in December 2008.

The design of emissions trading will also be informed by economic modeling work being undertaken by the Australian Treasury, the work of the Garnaut Review, and the work done to date at the Federal, State and Territory levels. Emissions trading is central to achieving the Government's goal of reducing Australia's greenhouse emissions by 60 per cent by 2050.

Source: Press Release Minister for Climate Change and Water March 17th 2008

Hopes build for eco-concrete CONT FROM PG 5

Producers are emphasising the potential environmental benefit of replacing Portland Cement with geopolymers citing the CO₂ generation in calcining of limestone, roasting of the clays and the energy consumed in the clinker process.

In Australia, Cement and concrete producers have made significant changes to their processes and fuels to reduce CO₂ generation. Significantly, they also use in blended and separate forms what they describe as supplementary cementitious materials. These are generally used separately and in combinations with Portland Cement depending on the properties required in the hardened concrete. Principal supplementary cementitious materials used in Australia are Ground Granulated iron Blast Furnace Slag (GGBFS), Fly Ash (a co product of coal combustion to produce electricity) and Silica Fume (a co product of silicon and alloy production).



*Based on an article by Rachel Nowak Melbourne - Page 1 of 3 Hopes build for eco-concrete - earth - 26 January 2008 - New Scientist Environment 27/01/2008 <http://environment.newscientist.com/article.ns?id=mg19726405.700&print=true>

** Brandster, J., The use of Activated Slags in Concrete in Eastern Europe - International Workshop on Granulated Blast Furnace Slag in Concrete - Toronto Canada 1987

Further information Zeobond - <http://zeobond.com>

AUSTRALASIAN

Planning underway for 2009 Conference
Following the successful Sustainability Conference in May 2007, an ASA Conference Task Group is investigating the potential for a conference in 2009. Whilst planning is in its early stages, the possibility of cooperatively increasing its international reach is being considered. More news in later issues.

Government aims for 60% Greenhouse Gas reduction by 2050
On March 17th 2008, Minister for Climate Change and Water, Senator Penny Wong announced the Government's timetable for addressing the greenhouse challenge. She again stressed the Governments stretch target commitment to reducing Australia's Greenhouse Gas Emissions by 60% by the year 2050. Further details can be found inside this issue.

AustStab Workshops
AustStab is running a series of workshops to provide practical advice on road stabilisation solutions noting the benefits and limitations of the design and construction process. This is a workshop format and questions will be encouraged during the sessions. Participants are also welcome to send questions prior to the workshop by email to inquiry@auststab.com.au. There are three remaining workshops:
May 12 - Carriage House Motor Inn, May 13 - Griffith Leagues Club and May 15th - Orange Country Comfort. Examples for road stabilisation of urban and rural roads with advice about issues to consider from planning to sealing phase for the works

For more details and session times refer to the web site at www.auststab.com.au and click on Events.

ASA Technical Presentation
Alessandra Mendes gave a presentation at the February Technical Committee Meeting

on the Fire Resistance of Concrete made with Slag Blended Cements. Alessandra is a researcher in the School of Civil Engineering - Monash University. This presentation will be reported on in a future issue of Connections

Source: info@asa-inc.org.au

New Geopolymer Concrete Plant commences
An Australian project is currently under way in Melbourne aimed at transforming co-products from power stations and blast furnaces into geopolymer concrete (E-Crete).

Source: <http://environment.newscientist.com/article.ns?id=mg19726405.700&print=true>

INTERNATIONAL

Call for Papers for the following conferences:

- Global Ash Conference, Germany, 5-6 June 2008 <http://www.propubs.com/gac>
- Global Cement Trade Conference, London, 16-17 June 2008 <http://www.propubs.com/centrader>
- 3rd Global Insulation Conference, Barcelona, 16-17 October 2008 <http://www.propubs.com/gic>
- 4th Global Slag Conference, Strasbourg, 17-18 November 2008 (TBC) <http://www.propubs.com/gsc>
- 2nd Global Refractories Conference for Cement and Lime, Cologne, 8-9 December 2008 <http://www.propubs.com/grc>

To access details of programs and call for papers, contact the address against each conference.

Footbridge 2008
The Third International Conference will be held on July 2-4, 2008, Porto, Portugal
Registration in Conference/Workshop/Technical Visit to Coimbra details can be found at www.footbridge2008.com - Elsa de Sá Caetano (Chair of Organising Committee).

Source NSA Slag Runner Feb 07 : www.nationalslag.org



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