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COVER PICTURE: Decking is completed on a bridge across the North Rukuru river in Malawi, in a project run by Imperial engineering students.

Imperial ENGINEER

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COPY DEADLINE FOR THE NEXT ISSUE IS MONDAY AUGUST 4 2008
The editorial board of Imperial Engineer reserves the right to edit copy for style and length.

PRESIDENTS REPORT

Almost one year into my presidency and still so much to do. RSM alums will shortly receive, if they haven’t already, a survey questionnaire intended to give the RSMA committee information that will enable it to channel its finite resources to best serve RSM alums and RSMA members. It is critical that the wider body of RSM alums responds to this initiative and that you let us know what you need. This is a presidential plea!

Many alums, we feel, may have lost touch with the RSM in the years before common usage of the internet and email and we need you to get back in touch. Others may want to break the connection with the RSM and be taken off the database. We need to know who you are, as well. These days questionnaires come from all directions, but we really do need you as alums to engage on this one; if we are to be a proactive and meaningful association committee.

Other important news since last reporting: the RSMA had a splendidly successful November annual dinner at which Stu Loader, Rio Tinto exploration executive, gave a fascinating insight into geological ‘discovery’. John Brumley was the first recipient of the Peter Hardinge Memorial Prize for demonstrating a sustained commitment and outstanding contribution to The Royal School of Mines and Imperial College communities. The RSM rugby team won back the Bottle and hockey won the Sharpey Cup in February. Congratulations are due to the cohort of RSM students who took part in playing and supporting the weekend’s sports.

Looking forward, we have replaced the Final Year dinner with a barbecue for our graduating students to be held on June 26. We hope many RSM alums will attend. We hope to have sourced beer from the Ramsgate Brewery, whose proprietor is Eddie Gadd, an RSM alum and contemporary of mine. Whet your lips, you real ale fans! We will also continue our search for an alum with a vineyard or who’s now a wine merchant. Any leads?

Finally your president ran his fourth London Marathon in 3 hours 54 minutes in April raising funds for Headway - the brain injury association which has supported two RSM alums in recent years, Charles Hutson (Min Eng 78) and Pamela Murphy. Pamela also ran this year. She has now raised a tremendous total of over £5k, and I have raised over £3.5k. There’s still time to support Headway by donating at either www.joingiving.com/pamelmurphy1 or www.joingiving.com/kurt2008. Thank you.

Peter Garrett

Peter

Kurt Budge

£15

ATTENTION! Some of you have missed the fact that CGCA and RSMA subscriptions have increased. Please amend your standing orders TODAY to £15! PLEASE get a form from the office or the website.
Climate expert heads new £10m centre

THIJS January saw the appointment of Professor Sir Brian Hoskins as the first director of Imperial’s Grantham Institute for Climate Change, set up in 2007. Sir Brian is a world-leading authority on climate issues and global weather patterns, who uses mathematical models to understand weather systems in different parts of the world and how they interact. He has built one of the world’s foremost meteorology departments at the University of Reading. From January 1, he has shared his time as a Royal Society Research Professor between Imperial and Reading.

Committed to ensuring that climate research is used to advise governments and influence policy, Sir Brian was a member of the Royal Commission that proposed a 60% target for reduction of UK CO2 emissions by 2050. He was also scientific advisor to the Stern Review, which was credited with pushing the issue of climate change to the centre of the UK political agenda, and a member of the IPCC assessment team recently awarded the Nobel Peace Prize.

His scientific achievements include the establishment of a link between unusual weather events in the tropics and signif-

Imperial helps tackle Chinese emissions

DR JON GIBBINS and Ms Ji Li from Mechanical Engineering and Dr Tim Cockburn from the Centre for Environmental Policy are working with Chinese and UK academic and industrial experts on two new projects to tackle CO2 emissions from Chinese coal using carbon capture and storage (CCS).

In the DEFRA-funded UK-China Zero Emissions Coal (NZEC) project (www.nzec.info), Imperial is the UK coordinator for a study of ways in which CO2 can be captured from coal plants before it enters the atmosphere. After it is compressed to 100 atmospheres, the dense liquid CO2 can be injected a kilometre or more underground, into porous rock layers with solid rock ‘caps’ that will seal the CO2 securely.

Imperial is also leading a project supported by the government, with Cambridge University and Harmin Institute of Technology, to look at ways that power plants being built now in China can be designed to make adding CO2 capture easier.

The Chinese Advanced Power Plant Carbon Capture Options (CAPPCCO) project builds on a five-year programme of work at Imperial to analyse how new power plants ‘capture ready’. New UK power plants have to be capture-ready to get government approval. Transferring this approach to China as quickly as possible could avoid hundreds of power plants there from being locked into emitting CO2 throughout their operating lifetimes.

Any Imperial alumni working in this area are interested in finding out about making plants capture-ready contact j.gibbins@imperial.ac.uk.

Alumni invited to share work experiences

FOLLOWING Imperial’s careers fair on October 23, the Engineering Chapter is hosting a networking event for experienced and penultimate year engineering students and alumni.

This event, sponsored by Npower and CGCA, aims to provide an informal social envi-

ment in which students can meet alumni and gain from their career experiences and insights.

Principal John Wood will open the evening with a brief address to attending alumni to let them know about current developments at Imperial. If you are interested in participating and giving your current engineering students the benefit of your experiences, please contact either t.sergot@imperial.ac.uk or rosemary.ste-

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Ceramic Centre works on strength

SOME of the strongest, most durable and heat-resistant materials on earth are being developed by a joint project between Materi- als and Mechanical Engineering researchers.

The £6 million Imperial College Structural Ceramic Centre (ICSCC) is being funded over the next two years by both the Engineering and Physical Sciences Research Council (EPSRC) Science and Innovation Award.

The new centre aims to improve dramati-
cally the strength and durability of structural ceramics, made of inorganic materials like oxides and carbides, to meet indu-
trial demand for materials that can withstand extreme environments.

Projects will include collaborations with aerospace organisations like NASA to develop the next generation of reusable spacecraft, which require new materials for tiles that can withstand both the freezing conditions of space and the scorching heat of take-off and re-entry.

Another focus of the ICSCC will be on improving composite layers of ceramics for body and vehicle armour for troops and security personnel that can absorb and deflect explosive high-impact shats.

Cleaner and greener energy alternatives will also be explored, with potential applications in power generation including pebble-bed nuclear reactors. This new development could be used in the manufacture of ceramic pebbles, to heat water, create steam and generate electricity.

Spiral makes research available to all

IT IS a must to be involved in Spiral. It’s an easy procedure for academics to upload their work and it will maximise their research and increase expo-
sure. Engineering’s John Wood was speaking about the recently
launched digital repository at Imperial.

Spiral is the result of many months’ planning by a team in the Library, working closely with ICT, and managed by Fereshteh Afshari. ‘The online repository can be used immediately and will allow all published papers to be stored and accessed by people all over the world, rais-
ing the profile of our academics’, she said.

Research elsewhere has shown that depositing a paper in an institutional repository like Spiral increases the visibility of research on the web and can increase citations which may, in turn, lead to future funding. Spiral also brings Imperial in line with most funding bodies, which require publicly-funded research to be made freely available to the public.

Access Spiral online at http://spiral.imperial.ac.uk

Life from beyond earth

RESEARCH by Zita Martins and her team in Earth Science and Engineering, on two meteorites found in the Antarctic, are providing new insights into the chemistry of the early solar system and the resources avail-
able for early life.

The research team believes that the presence of amino ac-
s, the building blocks of all biological life, provide clear evidence that the early solar system was richer in life’s raw materials than thought. These materials may have helped to kick-start life on earth.

‘We know that approxi-
mately 3.8 to 4.5 billion years ago the earth underwent heavy bombardment from meteorites which brought molecules to our planet, just before life emerged. However, there is a gap in knowl-
edge about how life came into being. Our work has shown that it may have been meteoritic ami-
no acids and other biologically useful compounds that spawned life to existance.’

Researchers find blue is the colour for processing

MAGNETIC properties of a commonly used blue dye, which could be used to revolutionise computer processing power, accord-
ing to Materials’ Sandrine Huez and scientists from the London Centre for Na-
notechnology.

Dr Huez made a scient-
ific breakthrough when she found that she could control how the metal centres of MPP spin in relation to one another. This secret to controlling this spin lies in the way Dr Huez grew seeds of MPP in crystal structures on plastic surfaces and then experimented with the preparation conditions. She grew them at room temperature, ap-
plied heat, chemically altered the plastic surfaces that the crystals grew on, and changed the way the crystals grew. All these differ-
ent elements altered the way the metal centres interacted with each other.

After three years’ experi-
mentation, the team can control a set of magnetic interactions between the molecules. So far the team can switch the interaction ‘on’ and ‘off’ and change the state of the interac-
tion from ‘on’ to ‘a different type of’ on.’ They are still experi-
menting with ways to turn the interaction off.

When they find this last interaction, Dr Huez believes she will have a superior set of molecular signals for in-
formation processing and storage. Dr Huez says it could be possible to practically apply this technology.
**A family affair at RSMA dinner**

Food with a family flavour and a great family feeling set the scene for RSMA’s annual dinner at the Polish Club. Once again all student guests were sponsored by alumni. Among the events of the evening was a very entertaining talk given by guest speaker, Stefan Loader (right), executive, Rio Tinto Exploration, on the importance of geologists. President Kurt Budge paid tribute to his predecessors in his toast to the RSMA. They had been inspired to push the Association forward. Responding to Coen Louwrens’ toast to guest, RSMCSC president Dan Hill said that they are known as the most active family union at Imperial. To prove the point, he revived a tradition and led the gathering in a rendering of thezmare, the people’s hymn song.

**LEFT:** Elly Joy with chairman of the RSMA Trust Rees Rawlings. He presented her with the medal for combining academic prowess and social involvement in the RSMCSC.

**CGCA traditions alive at Ironmongers’ Hall**

TRADITION ran as a theme through the evening and speeches at CGCA’s March annual dinner, starting with the procession of the President’s party into the glittering dining room, through to the traditional Boonmalaka. It was called for by CGCU president Tristan Sherliker. Guest speaker, Lord Garel-Jones, a supporter of the EU and Rule Britannia, is a thing of the past and has been replaced by ‘Cool Britannia’. He feels that Euro-sceptics’ values need to change as we must share sovereignty around the globe. If Britain holds back, it may be dubbed ‘fool Britannia’.

In thanking Lord Garel-Jones, president Peter Garrett also thanked the guests, including officials of the RSMA and RCSC. Rayling Engineering principal John Wood commented that EU member states needed to cooperate but at the same time, conserve their individuality. He also commented on the excellence of the wine and port – a Chateau Talbot 1996 and a 1970 Warre.

Peter thanked the team whose eye to detail had made the evening so enjoyable. He completed it by giving his own award, an old horn, to Bo driver Henry Weaver. Henry also received the Peter Moore Memorial tankard.

**GUILDS ALIVE!**

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Our major events are now behind us. A successful freshers’ week was followed by the legendary Freshers’ Dinner. Over 150 guests welcomed the new students to the traditions of the RSM. The Christmas Dinner, generously sponsored by Rio Tinto, was as successful. It was a more formal black-tie affair where a number of academic teaching staff joined us students.

More recently, the 186th Bottle Match was held at Cambridge. I’m delighted to say the Bottle has returned home and from the beginning of the year, the CGCU has been as active as ever, and a group of sterling officers are making this a fabulous year for Guilds. Freshers were introduced to the Guilds straight away, with every one attending an introductory talk. There was also a series of events throughout the term – from bar nights and cinema nights to our Lord Mayor’s Show float on national TV. After the introductions, we had our traditional begining of year dinner – this year breaking with tradition somewhat and extending the invitation to all students, not just freshers. Held in the very centre of campus, in the Queen’s Lawn Marquee, there was a good turnout and the speaker, Professor Mike Kelly FREng, gave an uplifting speech to all aspiring engineers. The casino, live jazz and dancing continued late into the night.

The Lord Mayor’s Show was a great experience for all involved, though the work was hard and very dedicated people to get everything ready!

We were generously sponsored by BP who were pleased to have their banner on prime-time BBC national television. The float this year was a mechanism to convey the idea of engineering used in sport. It was comically themed as a huge horse scoring a goal before the ball was returned through a system of pulleys and chains.

CGCU members have been instrumental this year in restoring people’s attention to traditional values, especially through union mascotry. At one point in the year we had our hands on every college mascot – our own Spanner and Bolt (you may have seen them recently at the CGCA annual dinner), as well as the RSCU’s Theta the Thermometer, the RSMA’s Davey the Davy lamp and the RAG’s three-foot christening collecting tin.

We raised money for charity and reminded the unions they are there for more than just their year-on-year activities – to represent past and present students in the history of Imperial College.

This term activities have progressed as normal, with the small events and the major ones – such as the RAG slave auction, where we raised almost £1000 for charities and persuaded the ICU president to do some very unbecoming things for charity! Students – more than ever – before enjoyed the CGCU annual dinner and, with our new alumni officer and a new CGCU student award in the pipeline, we’ll be working hard next term to bring the CGCA to the student body’s attention.

**Oh RSM! Oh RSM is wonderful!**

is back behind the Union Bar. An intense rugby match finished 13-10 to RSM. The Men’s hockey team also excelled, winning 4-3. The Starypie Cup is now on display in the RSM office.

All our clubs and societies have had a successful year! The De La Beche Club has done a superb job of promoting an interest in geology outside the academic arena. With a number of talks followed by Gooma Loomas, an over-subscribed fieldtrip to the Isle of Wight and the symposium moved to early June due to timetable changes in the EEE department – the DLB has assured that it is a club that’s worth being involved with.

The Hockey Club has excelled this year – with a record high number of members and two semi-final UULC cup appearances (men’s & women’s).

To the future... The RSM has a full committee next year with a large number of officer positions being contested by freshers. Under the leadership of president-elect, Adam Baldwin, I’m certain they will continue the hard work and effort of this year’s committee. The official handover takes place at the Final Finale in June.

Finally, the RSM has kept up a strong relationship with the Clubs. We are extremely grateful for all the generous donations.

**WE NEED YOUR NEWS**

Let us know your news and stories. Or have you an idea for a feature? Editorial assistance is available.

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**RSMA dinner**

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Hydropower still has great potential

FOLLOWING the CGCA committee meeting in November, we were treated by Chris Head (formerly lecturer in hydrology) to an informative talk on remote hydropower projects. Chris is a consultant specialising in hydro projects in developing countries. He entertained us with several intriguing facts: for example, hydropower accounts for almost 20% of global electricity generation!

However, 70% of the world's hydropower remains untapped. Environmental constraints and economic concerns must be overcome if we are to continue to develop non-carbon dependent energy sources. Chris mooted the possibility of using remote hydro to produce hydrogen as a transport fuel. Bill McAuley

Collaboration need stressed

'COLLABORATION without borders – the future of European research in a global context' was the theme of Engineering Faculty principal John's annual alumni lecture.

He took us from his time at Cambridge to his lecturing at the Open University, a period in Japan before his settling down in the Materials Department at Sheffield and time as chairman of the European Research Forum.

John’s passion for both research and Europe was soon evident as he took his audience from establishment to establishment, describing each country’s contribution and why a particular laboratory had been located there. He mentioned the importance of the Lisbon Agenda and stressed the focus of the research programme, which must embrace the 27 states, if it is to become a truly competitive and knowledge-based economy.

Within this there has to be the freedom to move, share, optimise and above all, circulate knowledge learned so that everyone can use it. David Hatterey

For a full report of the lecture, see the following – link www.imperial.ac.uk/newsandevents/pgrp/imperialcollege/alumni/pastukevents/

How important was Tizard's Box of Tricks?

THAT WAS the question answered by Sir Brian Hoskins, Grantham Institute for Climate Change

Lecture in April. With its associated reception and dinner, it has been established with part of the enormously generous legacy from Peter Lindsay to the Old Centralians’ Trust.

Contained in Tizard’s Box in 1940 were Britain’s most secret scientific and technological advances. They were taken secretly to the USA by a team led by Sir Henry Tizard – then rector of Imperial College – to bargain for scientific help. This was before America joined the conflict and at a time of considerable scientific distrust.

Among these advances was one item that affected not only the outcome of the war, but much of modern life – a prototype of the cavity magnetron. This tiny device was able to generate microwave radiation, enabling the new but bulky ‘radar’ equipment to be made small enough to be mounted in aircraft. It greatly enhancing the effectiveness of our air force. Today it is at the core of so many useful devices – from mobile phones to microwave ovens.

Professor Peter Lindsay, a lifelong member of CGCA who died in 2006, studied in the EEE department during the war and later worked at GEC Wembley on later versions of the magnetron. Following the main lecture, Peter’s career and love of life were described to the audience by Alan Reddish, with whom he worked at GEC. Alan also explained to an audience, largely ignorant of such science, just how the device worked! Bob Schrotter

Gaia needs humans to change

THE GAIA system is suffering from human impact, Huuxley’s great grandson, Sir Crispin Tickell claimed as he gave the inaugural TH Huxley lecture in the autumn. Sir Crispin is director of the Policy Foresight Programme at the James Martin Institute for Science and Civilisation, Oxford University.

Sir Crispin talked about human impacts since the industrial revolution on the Gaia hypothesis. This says that living and non-living parts of the earth are a complex interacting system that can be thought of as a single organism. He stressed that societal changes need to be made in order to address this environmental imbalance.

A COMPLEX set of drivers around the world are pushing governments and businesses to invest in the built environment in a way that dramatically improves resource efficiency. Cities are at the forefront of this transition as they consume 75% of resources and house over 50% of population.

In China, it is estimated that 600 million people will have moved from rural areas to the cities by 2050. The Chinese government argues that the current urban development paradigm is ecologically unsustainable and will be irreversible unless a new one is found.

A new direction is being explored in the design of the Dongtan eco-city in China which see the principals of biomimicry harnessed to illustrate the efficiency gains that are achievable against a range of targets for a new city.

Arup was appointed to carry out the planning of Dongtan by the developers Shanghai Industrial Investment Corporation (SIOC) in August 2005. The aim of Dongtan is to create a demonstration of this new paradigm of urban development and a first tentative step towards the ecological civilization.

SIOC has set ambitious targets for Dongtan. They intend to create a city that has an ecological footprint close to 2.2 hectares per person, meaning that it would take 2.2 hectares of land and sea to supply the resources each person in Dongtan would need to live each year. To put this into context, Beijing is currently four hectares per person, London 6.6, while the average for US cities is 18 hectares per head.

A critical starting point for planning Dongtan was to build in the drivers and components of successful sustainable development or ‘integrated urbanism’ in order to control the social and economic outcomes in line with such a radical environmental agenda for change. The approach used was based on the following interconnects:

- Human and Environmental Health
- Economic Vitality and Individual Prosperity
- Energy

An artist’s impression of the harbour area of Dongtan. Work is expected to start soon on the island of Chushan Island – the largest alluvial island in the world. Picture by Arup.

Housing
Nutrition and Urban Rural Linkages
Mobility and Access
Communications
Education and Culture
Governance and Civic Engagement
Water
Materials and Waste
Ecological Footprint

While much of the technology to make Dongtan possible is available now.

(Continued on page 16)
Towards responsible exploitation?

An unsustainable necessity? The mining industry has traditionally been associated with environmental degradation and social upheaval and is renowned for its sometimes irreversible impacts – perhaps more so than any other heavy industry.

Mining involves the large-scale depletion of finite and non-renewable resources in increasingly remote, ecologically fragile and often politically unstable regions. It can result in the redistribution of mineral wealth from the poorest and most disempowered regions to the world’s fastest growing economies.

The hole a mine creates at the end of its productive life is not only physiologically but also social and economic and can be a permanent scar unless closure is thoroughly and sensitively planned. The duration and physical scale of a mine footprint often makes rehabilitation, resettlement and reinstatement processes hugely complex and costly.

Economic lynchpin

The exploitation of natural resources, particularly minerals and metals is an economic lynchpin of modern industrial development. The growth of our societies and economies cannot be supported without the essential resources and commodities the mining industry provides us with, such as iron for steel.

The huge challenge for the mining sector today, in a world highly sensitised by the corporate governance agenda, change debates and a now-ubiquitous human rights discourse, is to engage in what is often perceived as an intrinsically unsustainable activity to yield profit and development benefits, in an ethical and responsible way.

A social license to operate

The mining sector is changing its behaviour and demonstrating transparency and accountability more effectively than ever, through proactive consultation and engagement with the community.

Economically, mining companies are consulting up front to identify challenges and opportunities by working with their stakeholders (both friends and foes) to mitigate or to manage potential conflicts. By publicising and documenting the stakeholder views, and transparently addressing them through a feedback loop, the company can manage expectations and create an even playing field upon which to negotiate design and development solutions which best address the priorities of the majority.

Regular engagement can also act as an early warning system: helping to eliminate sources of future conflict, or unexpected negative media coverage from disgruntled, or ill-informed, affected groups.

Key drivers

Key drivers behind adopting integrated multi-stakeholder engagement processes in the mining industry include –

- Regulation – legal requirements in many jurisdictions call for public participation in industrial development projects often under Environmental Permitting law. The Public Consultation and Disclosure programme is a central mechanism in the Environmental Impact Assessment (ESIA) process.

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Benefits

Consultation and engagement takes many forms and provides benefits at all stages in the mining/project development cycle. At the exploration and discovery stage, GeoESIA imaging and screening helps to focus stakeholder consultation groups at the local, regional and international level. Due diligence of the proposed project and risk assessment of alternatives enables a strategy to address stakeholder concerns, to be developed to reduce shareholder uncertainty.

During construction and operation, public concerns can be taken into account in mine design and a structured land acquisition and resettlement process enacted with representation from indigenous peoples incorporating transparent compensation policy. By undertaking formal public disclosure, the project is able to attract debt financiers more readily, plan construction and obtain operating permits providing greater surety to investors.

As environmental and social considerations have been considered up front, liabilities and provisions for closure can be managed to protect shareholder interest and mitigate any adverse social and environmental legacy.

TOBY UPPINGTON (Civil, MSc/DIC 97, below) is senior social responsibility consultant, URS Corporation, Belinda Riley, write about multi-stakeholder consultation in the mining industry

Toby Uppington and colleague at URS Corporation, Belinda Riley, write about multi-stakeholder consultation in the mining industry

10 Principles of sustainable development:


10 Principles of Sustainable Development:


- Operational Risk Management and Impact Mitigation – for example, Anglo American’s Socio Economic Assessment Toolkit. This uses structured consultation with local communities to shape the design of appropriate, locally effective environmental and social management systems and identify community investment opportunities across Anglo American’s operations.

- The requirement for consultation is enshrined by these standards in the principle of Free Prior Informed Consent. The ‘Free’ is widely adopted by international and intergovernmental development organisations such as the UN and International Labour Organisation (ILO), this relates mainly to landowners and indigenous people. It states that individuals and communities should be informed – in a timely way and in an appropriate, accessible language – about projects that might take place on their land. It also guarantees that they are given the opportunity to give, withhold or negotiate land use and related issues.

- Industry Best Practice – consultation is a central tenet and core principle of mining industry best practice, sustainability initiatives and frameworks. For example, the International Council on Mining and Metals (ICMM) and its ten Principles of Sustainable Development. The global Extractive Industries Transparency Initiative (EITI) aims to strengthen governance by working with both governments and companies to improve transparency and accountability in the extractives sector. The core commitment made by EITI candidate countries is to work with all interest parties through a multi-stakeholder committee and engagement processes.

- Multi-stakeholder engagement

Multi-stakeholder engagement

Multi-stakeholder engagement methods derive from the theory of good governance by which the business of a corporation not only addresses the interests and concerns of its directly impacted employees, suppliers, customers and shareholders but also of a wider range of groups and individuals – defined as a stakeholder, or any person or group that has a legitimate interest in or ability to influence a project or business. This may include non-governmental organisations (NGO), labour unions, governments, political lobbying groups, communities or the public at large.

Stakeholder engagement and consultation creates a forum for the controlled airing of multiple interests and differences with a view to pre-empt and manage potential conflict. By publicising and documenting the stakeholder views, and transparently addressing them through a feedback loop, the company can manage expectations and create an even playing field upon which to negotiate design and development solutions which best address the priorities of the majority.

Regular engagement can also act as an early warning system: helping to eliminate sources of future conflict, or unexpected negative media coverage from disgruntled, or ill-informed, affected groups.

- Environmental Impact Assessment – namely, the World Bank and IFRC Performance Standards and associated Equator Principles.


- Operational Risk Management and Impact Mitigation – for example, Anglo American’s Socio Economic Assessment Toolkit. This uses structured consultation with local communities to shape the design of appropriate, locally effective environmental and social management systems and identify community investment opportunities across Anglo American’s operations.

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Regular engagement can also act as an early warning system: helping to eliminate sources of future conflict, or unexpected negative media coverage from disgruntled, or ill-informed, affected groups.
WITH CO₂ emissions from vehicles growing rapidly worldwide, it is imperative that measures be taken to promote decarbonisation of this sector in the next few decades. Choices are limited. Due to likely constraints on biofuel production, decarbonisation will rely heavily on a combination of low-carbon hydrogen and electricity.

There are several issues to consider when comparing these energy vectors. Generally speaking, electricity-powered battery-electric vehicles (BEVs) consume less energy and emit less CO₂ than other hydrogen-fueled biofuels. However, this depends on specific assumptions regarding the mix of primary energy sources used to generate the input power, vehicle weight (and hence driving range), which in BEVs is tied to battery capacity and other parameters. Costs and driving range are another story. Some studies suggest hydrogen and fuel cell vehicles (FCVs) may be more promising in this regard. Though there is increasing interest in BEVs, many carmakers, oil companies and governments (including the EU) continue to see FCVs and hydrogen as the ‘ultimate’ solution for transport.

BEVs promising

Recent policy and economic research at Imperial College has found that BEVs offer a more promising option for decarbonisation, not because of any intrinsic technical or economic advantage, but because they are a better fit to existing infrastructures and evolutionary trends in technology. In other words, the pathway to decarbonised future automobile transport appears to be more feasible with electric vehicles than with some form of storage or hydrogen (or biofuel) based pathways. Although there has been much enthusiasm about what a hydrogen/FCV (or BEV) future might look like, the question of how society could make the transition to such an outcome has been neglected.

Evolutionary approaches to economics and technology studies may offer critical insights in this regard. In particular, they point to the need for emerging technologies to line up with niche markets, as ‘springboards to mainstream markets, and when possible with existing infrastructures, capabilities and institutions (including those of the incumbent technological system). Niche markets provide crucial opportunities for learning-by-doing in manufacturing and other areas, and for getting feedback from users, suppliers and partners. ‘Piggy-backing’ of existing infrastructures is an obvious means to minimising capital investments and, crucially, to allow for an incremental scaling up of infrastructures in line with demand, thus avoiding the classic ‘chicken or egg’ problem. If history offers any lesson in this regard, it is that most of the large-scale technological transitions of the past (and in particular those in transport) occurred incrementally, starting in premium niches and/or by ‘hybridising’ with existing technologies and infrastructures.

As it happens, FCVs and hydrogen are highly deficient in both of these areas. Niche applications for fuel cells have been much discussed but progress has been slow; moreover, much of the early market involves fuel cell types other than automotive (PEM) fuel cells. There is even less scope for early markets for advanced hydrogen storage tanks. As for hydrogen fuel supply, there is some scope to utilise small industrial infrastructures and especially capabilities within the industrial gas and oil industries. However, it is difficult to imagine how FCVs could be popularised before a significant number of hydrogen refuelling stations are built, which in turn will require a high level of confidence in the success of FCVs. As a result, FCVs for niche applications are held to position, only buses and other centrally fuelled vehicles can avoid the infrastructure issue.

In contrast, the BEV appears to be solidly connected to a number of strong, market-driven trends relating to battery development and niche vehicles, and as benefitting from the ubiquity of electric power sources. The first trend to note is the progress in lithium batteries, driven almost entirely by consumer trends in electronics. Lithium-ion and other forms of lithium-based battery offer a promising route to commercially attractive BEVs. Though costs and weight remain far above what would be required for mass-market adoption today, there is considerable scope for improvement. Second, the success of hybrids has enabled large improvements in other electric powertrain components (though these developments also help FCVs). More importantly, electric vehicles point the way to an alternative to the ‘pure’ BEV the plug-in (rechargeable) hybrid (PHEV), which combines the benefits of petrol (high energy density) for long-distance trips with those of electricity (low energy cost and potentially very low carbon intensity) for short trips.

Although the technical challenges of making affordable plug-in hybrids are not trivial, both GM and Toyota are working on advanced prototypes while a few companies already offer third party conversion kits for existing hybrids. A third point is that niche BEVs, such as those offered by Reva/G-Wiz and Tesla Motors, are enjoying a surge of consumer interest. Other models should soon be on offer by companies such as Think, with many aiming for the London market. This suggests that there is a market for BEVs. Finally, more established players are getting ready. Nissan, Subaru and Mitsubishi Motors all have prototypes as well as lithium battery joint ventures while it is true that niche markets for BEVs have long existed (e.g. golf cars, milk floats), this is the first time that BEVs could penetrate consumer markets.

A more traditional advantage of BEVs over rival alternative fuels is the possibility to use existing electricity infrastructures. Many utilities can accommodate significant numbers of BEVs or PHEVs without the need for new generating or transmission capacity, provided the vehicles are charged during off-peak hours.

More attractive

Emissions from natural gas and especially coal-fired power plants can be significant, but the hope is that the electrified vehicles will become greener and greener as electricity itself is decarbonised through various pathways. This will make BEVs and PHEVs even more attractive. An interesting point is that, similarly to the development of lithium batteries, this decarbonisation trend is not tied to the future of the automobile.

In contrast, the economics of hydrogen production and the lack of mature alternatives suggest that hydrogen will be produced predominantly from the steam reforming of natural gas for some time. With electricity infrastructures already in place, the market is open to two complementary pathways to electrified transport. One starts with small BEVs for niche markets (such as small limited-range commuter cars) powered by conventional lead-acid or other low-cost batteries, and high-end performance cars powered by lithium batteries. The other aims for mainstream markets by relying on hybrid configurations of diesel with electricity, with a progressively increasing share of electricity as the energy source as battery economics improve. Although these pathways can start contributing to lowering CO₂ emissions immediately, their main value is as bridges to fully decarbonised transport. These two pathways thus provide the basis for a largely market-driven ‘incrementalist’ strategy for decarbonisation, one that starts small rather than attempt to revolutionise transport with radically new energy systems. The end-point vision of a decarbonised and electrified automobile system may be as radical as the ‘hydrogen economy’, but the route to get there is much less abrupt and does not require heavy-handed support from governments.

It is possible to imagine scenarios where hydrogen would win out over all alternatives, perhaps as the result of technical breakthroughs in hydrogen storage and aggressive support from large corporations and governments. But it is more difficult to imagine how R&D and policy could drive the technological, infrastructural and institutional ‘builds’ for a transition of the magnitude envisioned by hydrogen proponents.

Incentives needed

Of course, BEVs will also face major barriers: cheap oil and dear batteries may slow the current surge of interest in BEVs and PHEVs. In a business-as-usual environment, car manufacturers may prefer to focus on incremental changes to internal combustion engines while oil companies will continue to push biofuels. To avoid this, governments need to push for incentives, such as tax credits for vehicle buyers and rewards for suppliers of decarbonised electricity (perhaps as part of the ‘Renewable Transport Fuel Obligation’ or related schemes). Infrastructure investments would also be helpful. Installing small-scale, low-cost charging posts areas around London would enable the many car owners without private garages to charge at night.

(Continued on page 22)
China leads the way?

(Continued from page 11)

the way?

improved on in future. One city on its
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pects and then incorporates the main
social, economic and environmental as
approach of London which cross cuts
management structures for driv-
ing sustainable development in cities
development can incorporate emerg-
and society.

Sustainability driver

The driving force for the work in
Dongtan was a process of evolving,
agreeing and defining sustainable
development objectives for the project
that would drive the masterplan design
and in particular the radical environ-
mental changes.

Planning an eco-city is an unknown,
and undoubtedly the process that
Arup has started with Dongtan will be
improved upon in future. One city on its
own cannot solve China’s, or indeed the
world’s, environmental problems.

However, evolution is most rapid
where the pressure of circumstances is
the greatest. China is an incubator that
has been good for the human race
whether sustainability is
more than just a word. And who knows – once Dongtan is built, the eco-city
may turn out to be one of China’s most
successful exports.

Integration

The decision was taken that the inno-
vation in the first stage development
would be focussed mainly on the inte-
gration of existing technologies and in
the spatial planning. Later phases of
development can incorporate emerg-
ning technologies.

Management structures for driv-
ing sustainable development in cities
are emerging around the world and
interestingly, London leads the way
in many respects. The structure used
for planning Dongtan uses the matrix
approach of London which cross cuts
social, economic and environmental as-
pects and then incorporates the main
physical components of city life such as
transport, the built environment, social
services and utilities.

Geo-engineering – the solution to the climate change problem?

By Hassan Al Halwachi

Geo-engineering is a relatively new approach which has received more attention of late. It tackles global warming by targeting either the carbon dioxide in the atmos-
phere or the sunlight reaching the earth. Many methods have been proposed but
none of them has been implemented on a large scale yet. This is mainly because of
the unknown consequences of meddling with the earth's environment, as well as the
absence of international regulation for such methods. The best role that geo-engi-
neering could play in the global warming combat would be to work alongside the
reduction of greenhouse gas emissions in order to buy us more time.

FOR YEARS, we have been tackling
global warming by trying to increase
energy efficiency and reduce green-
house gas emissions (mitigation). Dur-
ing that time, another approach, which
involves modifying earth’s environment,
has been simmering on the back
burner. Could ‘geo-engineering’ make
any difference in our combat against
global warming?

Some geoengineering techniques
attack the root of the problem, carbon
dioxide, head on. Artificial trees, which
are real trees, can absorb carbon diox-
ide from the atmosphere are an option.
A solution of sodium hydroxide flows
through the trees and absorbs carbon
dioxide forming sodium carbonate.
However, in order to release carbon
dioxide, the carbonate must be heated,
which, unless a green energy source
is used, would undo the effort made
to collect the gas in the first place.
Storing the gas is another problem.
Although injecting the gas into some
geological formations, like saline aqui-
ifers and depleted oil fields, is claimed
to be a safe manageable option, the
long term effects of the process are
unknown.

Sequestration, storing carbon
dioxide in solid minerals, is a similar
method. For example, serpentine is
a type of rock found in quantities
sufficient to store the carbon dioxide
produced by the world’s entire known
fossil fuel reserves. The absorption of
the gas by the rock yields magnesite,
which can be used in bricks. The en-
ergy needed to process and transport
the rocks, however, could take us back
to square one.

Instead of imitating photosynthesis,
the real process can be utilised. This
is the principle of the next method, which
is to pump urea into the ocean
to promote the growth of phytoplank-
tons, microscopic organisms that form
the base of the marine food chain.
An advantage of this process is that it
can be controlled easily. Phytoplank-
tons would not last for so long after
the urea supply had been stopped.
If it succeeded, however, this process
should be done only in areas which
already lack phytoplanktons. This
is because the death of these organisms
stimulates the growth of decomposing
bacteria, which causes a shortage of
oxygen in the system, affecting other
marine organisms. The major concern

HASSAN TALKS ABOUT HIS WIN AND THE FUTURE

Why you chose the question about
geoengineering?
I’ve always been concerned with
the issue of climate change and have
always been keen on reading about
possible technological solutions for
the problem. Although I had come
across some ways to absorb carbon
dioxide from the atmosphere before;
I didn’t know anything about the term
‘geoengineering’.

What do you want to do after Sher-
borne School?
I want to study chemical engineering
in Cambridge. Then I want to develop
new technologies to reduce pollut-
ants in industrial emissions. I also
want to become a university lecturer.

Why do you think you deserve the prize?
Science enables us to understand
and appreciate the perfect balance
that governs our universe. It is also
the tool with which we can improve
the way we live. Learning science
challenges your mind and opens new
horizons. Without science, we won’t
be able to move a step further or see
how beautiful life is.

HASSAN AL HALWACHI, 18, was the school winner of Science Challenge 2008, the annual essay competition organised by Imperial and sponsored by Shell. Entrants in two categories – schools and Imperial students – had to choose from one of six topics suggested by the panel of judges.

Hassan chose the one suggested by Sir Brian Hoskins, director of Imperial’s new Grantham Centre – ‘To what extent is geo-engi-
neering the solution to the climate change problem?’ Apart from
writing the essay, Hassan was among six school finalists and six
Im-
perial students also gave a short talk about their essays at the final
in the Science Museum.

Hassan, from Bahrain, attends Sherborne School. He is one of
the top science students in his country and, as the Crown Prince
of Bahrain’s Scholar, was elected to study sciences in an English board-
school to encourage more pure scientists in the country.

Another aspect to consider is the ethical aspect. Do we have the right
to mess with our planet in that way? Personally, I think not. Neither you
believe that a divine power created this planet, or another cause, the case
is: we have already, and by our own actions, messed up our atmos-
phere. Therefore, it is our responsibility to remedy what we have done by
any means possible. Another issue would be, who has the right to make a deci-
sion for all earth inhabitants on which remedial action to take? It is unwise
to allow private companies to act erran-
neously on their own. We need an inter-
national legal and political framework
and a global committee of scientists to
make such critical decisions.

In short, geoengineering tech-
niques should not be regarded as ideal
solutions for global warming, due to
the uncertainty surrounding their con-
sequences. However, if we failed to reduce our carbon emissions
to safe levels within the next few
years, it would make a huge differ-
ence. If we did, there would be a greater
demand for reduced carbon emissions.
These techniques should be tested
and developed to make them viable
to play that role when needed, but
they should not replace the current goal
of reducing greenhouse gas emissions.

Hassan is congratulated by Lord
Robert Winston, one of the judges
and Imperial’s professor of science
and society.
Students’ bridge makes link for Malawi village

The work to complete the construction of a footbridge across the North Rukuru river at Uledi, on the north-western corner of Nyika National Park, Malawi, followed on from the 2006 expedition. At that time, two 4.6m high mixed masonry-reinforced concrete towers, with 1m deep foundations were built together with two anchor blocks each made from 6m³ of bulk fill reinforced concrete to take a free span of 36.7m. The team achieved their aim and there is now a total superstructure span of some 60m while the height of the towers allows 4.6m freeboard above highest known flood levels. Now, much to the delight of the community and the National Park, who use the bridge daily to cross the river to collect firewood or patrol against poachers, life can carry on as normal during the rainy season. The community has joint ownership of the bridge with the government.

The expedition was organised by Naomi Bessey (BSc Physics) and Daniel Carrivick (PhD, Structural Geology) who were part of the 2006 team. Harriet Kirk, who acted as chief site engineer, having helped with the 2006 design, and two other civil engineering students Li-Teking Lau and Jamuna Al-Jubaidi completed the team.

In the previous year, meetings confirmed full government support for the bridge, which was emphasised as vital in order for Uledi to become a fully functional and effective anti-poaching scout camp during the rainy season.

To the team, the site was as it was left 10 months previously – just more overgrown. The wet season had brought more rain than normal, but the river had stayed within its banks and did not flood the surrounding area. Some 30 people were employed on the project for the whole workforce helped to build the embankments on the east bank by stakes. The area behind each log was then backfilled with large boulders. These were covered with a steel mesh to hold everything in place, forming a new tiered riverbank.

Meanwhile, the west bank was covered with steel mesh, weighted down with some left-over lengths of railway track and held against the river with 20 inch long metal pins driven into the earth. The mesh was designed to hold loose blocks of rock in place to prevent collapse or more bank erosion.

A last-minute rush ensured all the finishing touches were applied before the opening ceremony on July 15. The chief of Uledi and the senior National Park officer from Chelinda spoke to a local crowd before jointly declaring the bridge open. Officials then crossed the bridge one at a time, followed by the local workers and the rest of the community. Useful tools and leftover materials were handed over to the chiefs for the community to use in the future. That evening a meal was enjoyed by all and the celebrations went on long after darkness.

It was emotional to watch every one walk over the bridge for the first time, especially when you realised just how much it means to them.

By Naomi Bessey and Dan Carrivick

Seismically-resistant houses built in El Salvador

BACK in 2005, Imperial College engineering students teamed up with Westminster University and an NGO, the Foundation for the Reconstruction and Development of El Salvador (REDES), to help the homeless in El Salvador, the smallest country in Central America. Team leader was David Dalgardo. Focus of their attention were the two communities of Costa Rica and Santa Marta. They were made home- less by the massive earthquakes of 2001 which destroyed over 100,000 houses and damaged over 1.5 million others. Many adobe-construction buildings collapsed and landslides damaged roads and buildings throughout the country.

Houses destroyed in the earthquakes were initially replaced by temporary shacks, built of corrugated iron sheeting. These were unsafe, intolerably hot in summer and freezing cold in the winter. Even though work had been done, the majority of these houses still needed to be replaced.

REDES community development plan identified a number of projects for priority intervention. These included:

❑ the planning and construction of seismically-resistant housing;
❑ an educational project to reinforce the engineering and promote community involvement;
❑ actively funding and constructing an additional three houses required by both communities.

In those early years, including back to 2012, problems encountered included safety on site awareness, land ownership disputes and lack of enthusiasm amongst community members: they sometimes had to spend hours working on a neighbour’s house without being able to work on their own until the following year. In 2005, Westminster students helped with these complex issues and with the communication in Spanish between engineering students and the community.

In 2006, other teams of students, under the leadership Alice Clarke, carried on with the construction and planning of seismically-resistant adobe housing for another six weeks.

These barras de castilhas houses are basically a steel-framed, single-storey house, with reinforced concrete foundations, bamboo tied over the steel frame and mortar applied to the bamboo for walls. The roofs are made from corrugated cement fibre panels.

The community I went to had lost 49 out of 50 houses and they had all been living in temporary shacks for five years,” says David Dalgardo.

Then, in 2007, while David went on an IAESTE placement in Sierra Leone, a further group of 13 returned to El Salvador, this time led by Sebastian Kaminski.

They concentrated on building the same sort of houses but this time for a community near the Honduran border. They had lived in iron and wooden shacks since the infamous civil war 18 years ago. The students supervised local sanitation units, but did not have time to begin work on them.

On each occasion students planned the trip as well as fundraising and project managing when there and paid a third of their living expenses. In return they gained a once-in-a-lifetime learning experience of the challenges of construction and management in a developing country. This unique experience provided the students with the opportunity to put theory into practice on projects that form part of a sustainable development plan.

Eleanor Bailey is taking a team to El Salvador this summer and sponsorship is still needed!
Why Boanerges?

Eric Arnot (Civil 47) looks into how CGCA’s mascot got its name. Unless, of course, you know better!

In a 1997 issue of the Guilds Engineer it stated that the name Boanerges came from a book by Ian Hay and meant ‘son of fire’. In the next issue, Hugh Jobling (EE 52), writing from South Africa, said that Boanerges was ‘the sons of thunder’ the name given by Jesus to the disciples James and John. I then wrote on the following lines.

In 1995, I was on holiday in Knysna, in the Cape and looked up Howard Waters (Civil 24). He told me that when he was at Guilds suggestions for a name for the new mascot were sought. He found the name Boanerges in a book by Ian Hay and his suggestion was accepted!

Hugh Jobling wrote about another South African, Jack Scott, who was born in 1903 and was at City and Guilds in the early 1920s. He was twice decorated as a colonel in WWI, subsequently became a leading personality, and a rich man, in the post war expansion of the gold mining industry. When the South African branch of the Old Centralians was formed, Jack Scott became its first president.

According to Jobling, Boanerges belonged to Jack who presented her to the C&G Motor Club. In fact there were two car mascots. The first was a Rover, acquired in 1920. Evidently it was not satisfactory and, after some time, it was replaced by the present car, a 1902 James and Brown. The christening of the name Boanerges is recorded as having taken place in 1925. It may be that the Rover was the car donated by Jack Scott and that, when suggestions for a name were invited, and Howard Waters’ suggestion of Boanerges was accepted, it was to christen the newly-acquired James and Brown. In which case, the Rover may never have been called by that name.

Among Jack’s after dinner stories of those old days was the one about the night Bo’s radiator boiled on the bridge over the Serpentine. There was plenty of water in the lake, but no container. A young lady with initiative removed the radiator cap. Presumably that’s not all she did in the lake, but no container. A young lady with initiative acquired James and Brown. In which case, the Rover may never have been called by that name.

Incidentally, it was from the same book by Ian Hay, that Hugh Jobling used the stories about the name of the mascot. Whether Jack’s story was based on the book is unknown. The author of the book was never mentioned.

Michael Walton discusses how Australia’s recent commitment to the Kyoto Protocol may be achieved in the state of Victoria and what this could mean.

PRACTICALLY every developed country in the world is struggling to find its own solution to the problem of CO2 emissions without causing irreparable harm to their existing standard of living.

In Australia, the State of Victoria is in the same situation, spurred by the federal government’s belated ratification of the Kyoto protocol.

Lignite-rich

The state has one major power generation issue which makes it unique. Over 80% of its power is generated from lignite – brown coal which is geologically ‘unfinished’ and contains up to 60% water. The net calorific value from this is low in comparison to anthracite (black coal), as used in other states of the country.

Power generation in Victoria is centred near the lignite deposits in the Latrobe valley, some 150km east of Melbourne (pictured), near the rural centre of Morwell. These deposits offer cheap power for more than 100 years.

One of the major Melbourne newspapers publishes the state’s level of emissions fortnightly, and these generally run at a level of 1.9-2.0 million tonnes of CO2, a week equivalent to an annual rate of 100 million tonnes per annum. This makes Victoria one of the highest per capita emitters in the world. First, the base level at the moment, has been reduced and work on this is ongoing. Victoria is one of the few remaining ‘car’ countries. There is no significant interstate or transcontinental rail infrastructure, distance travel is conducted by air. In recent times, the local car industry has suffered from low-cost imports of small cars.

Little change

They have not reacted significantly to the most recent oil shocks but still produce the standard Australian family saloon. This is a large car with a 5.5L engine-mainly 6 cylinder, where the best consumption achieved is 10.1L/100Km (24-28 mpg).

Without an effective national rail system, most goods are transported, both intra- and inter-state, by road, using very large trucks in excess of 20 tonnes. These are major polluters and they also cause severe road degradation. Many believe they are not adequately taxed to reflect this high-level of damage.

Impressions in fuel consumption here will be relatively slow and the answer would seem to be significant investment in rail infrastructure, something most governments have shied away from. This is a longer-term (2060) aim.

VICTORIA FACT FILE

The city of Melbourne is the capital of Victoria, a state in the south east corner of Australia. Victoria

- covers approximately 227,000 sq km;
- has around 5 million inhabitants, of whom 4 million live in metropolitan Melbourne;
- has 3% of Australia’s land area, but 25% of its population.

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The federal government has (historically) not reacted to calls to reduce petrol taxes to mitigate the impact of oil price rises, allowing local prices for fuel to reach $1.40 at a litre.

Note that due to Australia’s unique oil blend to their refineries, diesel fuel is more expensive than petrol in most states. This has inhibited the general introduction of diesel cars. Most of these decisions lie in the federal domain.

In Victoria, power generation accounts for approximately 65 million tonnes of CO2 a year largely due to the feed source for the stations, brown coal, accounting for 50MtPA. This fuel is used because it has been historically readily available and cheap. Little gas cleaning equipment is currently installed at the generating stations. The state government is now examining many ways of making this environmentally acceptable.

The main focus is on geosequestration, or pushing the CO2 underground, rather than reducing emission. The
Hydrogen or electricity? (Continued from page 15)

In the longer term, one feasible, low-cost option is to replace brown coal-fired generation in Victoria by gas, irrespective of the benefits of waste reduction and use of renewable sources. Technical issues are fairly straightforward and costs could be predicted to test the viability of most options. The potential political cost is, however, the issue stalling real action, and may do so for some years to come, especially at state level. It will largely depend on the timing of elections:

One seemingly inevitable consequence will be an increase in general energy prices, to cover the capital investment costs. This increase will depend on the choice of strategy, but gas-fired generation would seem the lowest cost option in the short-term.

The cost of emissions to industry, and will therefore lead to one or all of:

- higher costs of production
- higher costs of goods and services
- higher energy costs.

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Footnotes:
2. Carbon Dioxide emissions from the generation of electric power in the US, July 2000, Dept of Energy, Washington DC.

Michael Watson (RSM 79) is an independent consulting engineer, based in Melbourne, Victoria. www.rsme.net.au

Summary

Australia has committed to significant reductions of its greenhouse gas emissions on a 1990 basis by 2050. This will have a significant impact on current energy consumption patterns, power generation modes in particular, but also on transport infrastructure and usage.

In the shorter term, one feasible, low-cost option is to replace brown coal-fired generation in Victoria by gas, irrespective of the benefits of waste reduction and use of renewable sources.

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Footnotes
- potential geosequestration zones are up to 500km from the generating sites, some are even offshore in Bass Strait, thus making it inevitably costly.
- Technical sources provide data for the comparative levels of unit CO2 generation by fuel source:
- lignite........... 1.15 kg CO2/kWh
- anthracite........... 0.85
- natural gas or LPG.. 0.6
- This clearly illustrates a potential medium-term solution to the problem, one that could be implemented at low capital cost, using much existing generation and transmission infrastructure like gas firing!
- This could be implemented very quickly as it does not rely on new or developing technologies (such as CO2 capture or geosequestration).
- The major gas terminals in Victoria is also relatively close to Morwell, at Longford, making gas transport to existing generating facilities fairly low-cost.
- The data above shows that CO2 emissions can be cut by up to 48% from the brown coal level by direct substitution - thus meeting emission targets. This energy could be easily implemented, as Australia has significant reserves of offshore natural gas, for short to medium term use, close to the Victorian electricity grid.
- For a longer-term solution, Australia’s governments have to reconsider nuclear power (as it has almost no CO2), to at least include it in their option mix. Australia has the largest known reserves of mineable uranium ore, yet no downstream processing facilities, and only one pilot scale nuclear plant, restricted to producing medical isotopes.
- Nuclear power is making a resurgence elsewhere
- Much of the Kyoto optimism is centred on the introduction of one or more carbon trading schemes, in which the government issues limited emission licenses to industry, based on the costs of mitigating the CO2 emitted, and on large-scale introduction of renewable energy forms. At this time, the unit cost of renewable energies is about 50% above current base load levels.
- In the longer term, the trading scheme will force emitters to recalculate their processes to remain within their emission limits or be forced to buy additional credits on the open market.
- These schemes will inevitably increase

Although initially interested in language arts, a “wrong field” course was the turning point for Cynthia Carroll and she captured by the subject. Applying her training in oil and gas exploration tome later moved away from the actual science and into management. After Harvard, Cynthia joined Alcan Aluminum, in its packaging business, becoming chief executive of the core metals business.

Paul: From your experience, and as CEO of Anglo-American in mining, how do you get schools, parents and children to be interested in mining?

CYNTHIA: Having a scientific education has stood me in good stead. I don’t know if I could ask for anything more. The science, the language, the discipline and understanding of technology are really, really important.

Future investment

Anglo has over 11,000 bursaries and we spend $5m annually on secondary and tertiary education, particularly in science and engineering. We also spend money on training for schools, in order to be able to train people in mining.

Paul: What is typical career progression for a graduate joining Anglo?

CYNTHIA: There is a defined path, so they will do their technical development and start small, then join a team and work on projects. We’re also looking for people to work in more than one country, so we’re moving closer to engineering topics and do masters. Quite a lot of civil engineers have crossed. We provide a support network for people in mining.

Paul: What is your strategy for sustainability?

CYNTHIA: Anglo has a carbon capture or geosequestration program this could be easily implemented, as Australia has significant reserves of offshore natural gas, for short to medium term use, close to the Victorian electricity grid.

Paul: Could a graduate trainee in Anglo American make it to chief executive?

CYNTHIA: Some of our high-potential people are gaining experience working very closely with me and the senior team. Anglo has very diverse products and geographical activities, so you could still have a technical career with us and could do many different jobs, unlike most mining companies.

Paul: What is the most important skill that you think a university student should teach you?

CYNTHIA: In a university it’s hard to capture the realities of business, it’s about exams and doing it right. Life isn’t like that. It’s about having great experiences and success and not so great success, uncertainty and taking risks. That’s not taught in universities. I don’t say where you teach that.

Paul: What is your strategy for sustainability?

CYNTHIA: We have already invested a lot of money in research and development. We’re investing in research and development. We’ve got more than enough young engineers coming in and we expect them to be very interested in mining. They have a lot of opportunity if they are really good and bright.

Paul: Is there a place for universities to offer a conversion course for people in other industries who want to change to the mining industry?

CYNTHIA: That’s a very good idea. In the UK, I know places like Camborne have a great track record. We’ve had a number of universities, there are some constraints, particularly related to mining in the UK. I think it’s too difficult for people to change to mining in the UK.

Anglo American’s new CEO Cynthia Carroll talks to Paul Holmes (RSM 70) about how her company engages with schools and helps attract the best graduates into the mining industry.
Consumer organisation backs Climate Care

WHICH has given Mike Mason’s carbon offsetting company Climate Care a good review for its reasonable charge of a tonne of CO2. Mike says it’s important to take every opportunity to show the way forward. For example, in South Africa Climate Care distributed 10,000 energy bulbs. The government followed up with more.

Min South spreads contacts

MINOUTH (London & Southern Counties branch of the Minerals Industries Institute) is anxious to spread the word of its events and other news are far and wide as is possible, writes hon sec Alan Baxter. Go to www.minsouth.org.uk to find out more about membership and, in particular, details about monthly meetings.

Alumni news & reviews

Where are you now?

TERRY Knott has written, trying to fill a gap of the last six issues of Chemical Engineering 1968–71 he’s not managed to contact for the 40th anniversary reunion planned for Saturday September 27 in South Kan. The plans have been made following the Centenary gathering. (We’ve found about 53 of our original 65 colleagues, but the rest are proving hard to locate. Please email me to establish contact and I’ll send details), says Terry. terry.knott@btconnect.com.

Tony Barringer – setting the record straight

During Centenary year a booklet was published detailing the work of foremost mining engineers, the latter enterprise dedicated to the memory of Rui Pinho (Civil and Mining Engineering), who received the (£r) Innovation Prize (Earthquake Engineering Research Institute, California, USA). In recognition of his ‘exceptional leadership qualities, problem-solving capabilities and entrepreneurship in defining and executing major programs leading to the reduction of earthquake risk’. It was awarded for his major role in development of the Centre for Post-Graduate Training and Research in Earthquake Engineering and Seismology (the ROSE School), which is widely recognized as a leading international training centre in the field. Rui’s role as co-ordinator of the LESSOSS project, including nearly 50 European partners, focused on seismological risks associated with those still working. The latter enterprise develops and distributes a free collection of structural analysis and signal processing programs that have been accessed by users in over 100 countries.

Tom Kitty – setting the record straight

Come and join the gang?

SOME of the Electrical Engineering undergraduate group of 1978 to 1981 meet in London once or twice a year, usually in September and sometimes in spring. They are growing in number and we have gained one more member per year for the last three years, writes Alan Higginson. ‘If you would like to meet old friends, we would be pleased to hear from you. Email Alan at alan.higginson@bristernet.com.’

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Green listing among equals

Peter Head (Civil 69), a director of ARUP, was named in January issue of The Guardian as one of the 50 global green heroes – worldtitres.org. Peter has considerable experience of successful global scale innovation in construction and manufacturing sectors. He was appointed in 2002 by the Mayor of London as an independent commissioner on the London Sustainable Development Commission and leads the planning and development sub-group of the Commission.

Electrical engineering 1981

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Early promise never faded

RICHTHARD BURKIN, a leading academic in hydrometallurgy, died in February aged 84. At the age of 19, Richard graduated with a chemistry degree and joined Ilford, where he worked on war-time metal sulphide projects. After the war, he became a lecturer in inorganic chemistry at University College, Southwark but continued studying part-time, obtaining MSc and PhD degrees from London.

It is reported that Bill (Skip) Fairburn died on April 4, reports Alan Dickson. Skip was a contemporary, studying mining in 1965 - 68, and contemporary resident at Garden Hall during Ian Markham’s time. Skip and his wife Angela hosted a cocktail party for Western Australian students. Skip died shortly after moving here from the Pilbara and has been an attendant at many WAIC functions. He was also an attendant at many of the RSM First Friday Sundowners.

Missed by all

BILL EVERITT (RSM 38), who died on October 31, aged 94, will be greatly missed by the residences of Butechthorn-Weston in Somerset, his many friends, including those of us in Probus, but especially his family, Brian Walker (RSM 35) writes in his obituary.

Bil was a student in mining engineering. Bil married his childhood sweetheart Molly and went out in India in 1933 as an undergraduate surveyor and a mine in Mysore.

In 1938, he moved to Ghana with the Colonial Service to work underground in a gold mine and in 1941, he was posted to Malaysia as an inspector of mines. In 1948, Bil held senior positions in until independence in 1957. At this point, Bill, second career, as shopkeeper and teacher. In 1960, he sold the shop and moved to his final village, teaching in colleges and schools until retirement in 1978.

DAVID EASTERBROOK

RSM spirit carried him through

David married Glynda (née Lewis, Geo 75) after RSM and was father to Ruth (Geo 01), M branch and I. 

WILLIAM STEVENS

True son of Cornwall

HAVING served with REME in the war, Bill Stevens (Min 39) came to RSM before his first job of mining in his home county. Bill died on December 18, aged 83. Apart from three years in the RFD and in the line, his long career spanned English China Clay.

An unassuming leader

COLIN EDWARDS

Imperial College occupies the top peak in Britain that MIT has in the USA. In the 1950s, both schools had a comparable enrollment, specialized in a science and technology, had faculties well sprinkled with winners of Nobel prizes for science, and had undergraduate populations that were overwhelmingly young males.

Back in England, he worked with several eminent civil engineering firms before becoming a consultant in the 80s. Adrien was an avowed motorist and keen walker. He competed in driving trials with his HRG sports car and his long walks culminating in the Wall.

DANSE TRISTE BY THE ALBERT HALL

by Laurence Pretty (Aero 58)

I had forgotten to publicize the dance to any women's college. Stunned by this disaster and busy with vain desperate calls to women's colleges, I did not notice the unusual event of the evening. One of my co-organisers told me that the next day, one of the two women received not a single invitation to dance, despite the 90 to 2 ratio. It must have been one of the most poignant events in dance.

£15

Don’t forget, CGCA and RSMA subscriptions have increased. Please maintain your standing orders TODAY to £15! Forms from the office or website.

A first year at Guilds

By Dudley Dennington (Civils 47)

I WAS a student at the RSM in 1962 studying for a DIC (Diploma of Imperial College) in the Department of Applied Geophysics, which could lead onto an MSc course in Geophysics, writes Nigel Kolland. “Some months after the start of my course a young lady, Julia Childs, joined the department as a technician for Professor Mason. As the only available young lady in the RSM, Julia was in even stronger demand as a female partner...”
IN PETE’S FOOTSTEPS
GRANTS BOOST
FACULTY STANDING
HYDROGEN OR ELECTRICITY?
MEET THE EDITORIAL BOARD