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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.

BY THE TIME you receive this, my term as President of CGCA will be nearing its end. This I find amazing. I'm convinced that, when you reach the age of 60, time passes much more quickly. I think it has something to do with relativity; not the Einstein version, but simply that one week is only 0.03% of one's life at age sixty, whereas it is nearly 0.1% thereof on graduation. I am sure our friends from the Physics Department would come up with a more erudite explanation.

These musings fit neatly with the sustainability theme of this edition of IE. During my year in office I have been preoccupied with the sustainability of the City and Guilds College Association. I am convinced that this hinges upon striking the right balance between the proud traditions of the City and Guilds College and the interests and aspirations of current engineering students at Imperial. These, as well as the College itself, have changed radically in recent years. I think it unlikely that any recent or current engineering graduates will spend their entire professional career with one employer, as I have done, or indeed that many of them will end up as practising Engineers. It is essential that CGCA fully understands and responds positively to these changes.

With this objective in mind, I think we have struck a rich vein in our recent opening, at the recommendation of the Students Union, of a dialogue with the student departmental societies. These are dynamic bodies and appear keen to work with CGCA to ensure that it is sustainable. They have come up with constructive suggestions as to how this might be done and the ball is now in our court. Our ability to build on these suggestions will depend on the willingness of our younger alumni members to devote a little time and effort to working in various ways with current students.

I shall hand over to Dame Julia Higgins in the confident expectation that CGCA is good for another century, at least!



Peter Garratt

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 RSM committee information that will enable it to channel its finite resources to best serve RSM alums and RSM members. It is critical that the wider body of RSM alums respond 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 RSM had a splendidly successful November annual dinner at which Stef Loader, Rio Tinto exploration executive, gave a fascinating insight into geological 'discovery'. John Bramley was the first recipient of the Peter Harding 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 Sharpley 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. What 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.justgiving.com/pamelamurphy1 or www.justgiving.com/kurt2008. Thank you.

£15

ATTENTION! Some of you have missed the fact that CGCA and RSM subscriptions have increased. Please amend your standing orders TODAY to £15! PLEASE get a form from the office or the website

IN BRIEF

Walk on?

SINCE David Hattersley has reluctantly given up organising 'walks with a past president', he's suggested that reunion secretaries could take over.

'Why not get your groups to meet more regularly and see the sights of the City of London at the same time', says David. 'Start a walk group!' David has the know-how and the City guide. Call him on 020 8504 8263.

Environmentalist MP hosts evening

IN OCTOBER, Conservative MP John Gummer hosted a reception for 80 C&G alumni and guests in the House of Commons. Environment Secretary in Margaret Thatcher's government, he has earned worldwide respect in the business community and among environmentalists. John gave a thought-provoking talk, 'Education and Climate Change' which generated a lively discussion.

Fair attendance

AUTUMN'S Engineering Careers Fair gave undergraduates a great opportunity to discuss possible career options with engineering companies. Given the larger venue, the marquee on Queen's Lawn, a record 60 companies attended with many stands staffed by alumni. Nearly 2000 engineering students, as well as others, attended. There was a general consensus that it was excellent to have an 'engineering-only' fair.

Online reading

Once again, high levels of contributions mean that some articles have had to be abbreviated. If specified go to www.imperial.ac.uk/engineering/about/alumni/imperial_engineer_to_read_them_in_full.

Agreement makes students industry-ready

IMPERIAL College has signed a ground-breaking memorandum of understanding with Nexia Solutions to help engineering graduates to be 'industry-ready'. It will see the two pooling their expertise to develop new research initiatives and prepare the next generation of UK scientists for industry.

Imperial students studying materials science, mechanical engineering, chemical engineer-

ing and natural sciences will be offered vocational placements at Nexia Solutions, one of the UK's largest employers in nuclear science and technology.

Staff secondments from both organisations will foster joint research projects covering areas such as applied modelling; advanced reactor technology and fuel cycles (including reactor systems and materials); engineering nuclear

facilities; waste management, and nuclear waste disposal.

Nexia Solutions will be at the forefront of the government's strategy to develop the UK's nuclear science and research capability. By working with Imperial on research projects it will provide valuable industry experience for some of our country's brightest graduates, commented Engineering principal John Wood.

John follows Pete's footsteps

THE FIRST award of the Peter Harding Memorial prize was made to John Bramley (right), a graduate of mineral technology in 1956, who added a PhD in 1959. John has been a loyal servant to the RSM, and served as the RSMA hon sec for many years.

In that time he was editor of RSMA's newsletter, *Update*, and was one of those behind the concept of the joint magazine with CGCA, *Imperial Engineer*.

'No one would ever be able to match Pete's (Metallurgy 47) contribution', said John. He inspired the award

by his 'sustained commitment and outstanding contribution to the RSM, Faculty of Engineering or Imperial communities.

'As with Pete, through my student days and as an alumnus, John is one of those recognisable faces you see at RSM events', said RSMA president Kurt Budge. John has always had the best interests of the RSM at heart and hard for them.

John has donated the £150 cheque that went with the medal to the Sakhelwe Trust (www.sakhelwe.org.uk) which is led by his sister. It supports work to prevent the spread and care for the victims of HIV/AIDS in rural



Mpumalanga, South Africa. The Trust is currently establishing a hospice there.

Share in Nobel Prize

WORK by John Woods of Earth Science and Energy was honoured when the Intergovernmental Panel on Climate Change (IPCC) and Al Gore shared the 2007 Nobel Peace Prize.

Professor Woods recogni-

tion stems from his leading role in the first scientific assessment by the IPCC in 1989. It surveyed the world's ocean currents to assess what could then be safely said about the effects of CO₂ in climate change.

John said: 'The first scientific assessment was a landmark in science; there was no precedent in any other scientific discipline. Nobody knew what a global assessment was. I'm proud to say that we taught ourselves how to do it and we seemed to have got it right'.

BA SENIOR first officer John Coward (below), who hit the headlines when he successfully landed flight BA038 a few hundred metres clear of the busy



Alumni averts disaster

A30 when its engines failed, studied mechanical engineering at Guilds. He is also a member of CGCA!

John, 41, who decided, while at college from 1985-88, to pursue a commercial rather than a military career, subsequently applied to the BA Cadet Pilot Training Scheme. He played rugby for C&G Rugby Club and was a member of London University Air Squadron.

Starting with the Boeing

737 fleet at Manchester, he moved on to fly 777s in 1997.

John lives in France with his wife and three children. When not flying around the world for BA, he enjoys mountaineering and cycling.

Digging around in the archives, CGCA hon sec Chris Lumb has discovered around 15 members of BA staff. They include several first officers and senior first officers, two captains and one training captain!

Climate expert heads new £10m centre

THIS 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 assess-



Professor Sir Brian Hoskins (left) with Hannelore and Jeremy Grantham

ment team recently awarded the Nobel Peace Prize.

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

cant changes to UK weather.

The Grantham Institute for Climate Change was established, following a £12 million donation from Jeremy and Hannelore Grantham, through the Grantham Foundation for the Protection of the Environment.

The Institute is focused on understanding the radical climate changes occurring on earth, how they affect human welfare and ecosystems and on developing the technological, market and policy solutions needed to mitigate and adapt to change at both a global and local level.

Commenting on his appointment, Sir Brian said: 'The range and depth of the combined Imperial and Reading expertise is phenomenal. Specialists work in areas as diverse as public health, agriculture, engineering, climate and weather science, biodiversity, earth science, energy technologies and risk'.

Far East enjoys Centenary

DURING its Centenary, strong links between Imperial and Asia were celebrated with a special graduation ceremony at Singapore's National University.

Attending the Asia Convocation were 61 graduates with their guests from around the world including Australia, Ghana, Greece, Hong Kong, Indonesia, Netherlands, Thailand, UK and Singapore. Five honorary degrees were also awarded to key Asian figures

The ceremony was part of a 10-day tour of Asia, led by Imperial's rector Sir Richard Sykes.

Imperial helps tackle Chinese emissions

DR JON GIBBINS and Ms Jia Li from Mechanical Engineering and Dr Tim Cockerill 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 Near Zero Emissions

Coal (NZECC) project (www.nzccc.info), Imperial is the UK coordinator for a study of ways in which CO₂ can be captured from coal power 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 hold the CO₂ securely.

Imperial is also leading a

project supported by the government, with Cambridge University and Harbin 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 on how to make 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.

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



Jon Gibbins (centre) and Jia Li (second from right) with NZEC CO₂ capture colleagues in Beijing.

Alumni invited to share work experiences

FOLLOWING Engineering's careers fair on October 23, the Engineering Chapter is hosting a networking reception for final and penultimate year engineering students and alumni.

This event, sponsored by Npower and CGCA, aims to

provide an informal social environment in which students can meet alumni and gain from their career experience 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 current engineering students the benefit of your experiences, please contact either t.sergot@imperial.ac.uk or rosemary.tipples@imperial.ac.uk

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Transatlantic link shares ideas and equipment

FOLLOWING the official launch of the Global Lab at Imperial last autumn, scientists in London have been able to use, in real-time, leading multi-million dollar scientific instruments and technology in the USA.

The Global Lab has been established as part of the AtlanTICC Alliance, a sustainable energy research consortium comprising Imperial, Georgia Institute of Technology, Atlanta, and the Oak Ridge National Laboratory, Tennessee, USA. The AtlanTICC Alliance was established four years ago as part of a £1.5m grant to support collaborations between Imperial and US research organisations on energy sources and the treatment of cancer.

Laboratories in the UK and the US are linked across the Atlantic seabed by a high-bandwidth/low-latency network, the Lambda Rail. It can move vast amounts of data virtually instantaneously. Scientists have already shown that they can simultaneously manipulate complex equipment in the US, such as the world's leading electron microscopes at Oak Ridge, and

talk to each other via video link-up, without the time-delay and low resolution usually associated with such long-range communications. All three institutions involved are now exploring how to use this data-rich, high-speed communications tool to share ideas and research.

There is only a small number of electron microscopes worldwide providing scientists with true atomic-scale resolution. Imperial can now use it to research alternatives to fossil fuels - such as the next generation of low-cost solar power cells, advanced fuel cells and innovative biofuels - in collaboration with US colleagues.

Research in the Faculty of Engineering has gone from strength to strength in this academic year, attracting a number of generous grants...

EU grants back Imperial projects

A TOTAL of 6.5 million euros has been awarded to the Faculty of Engineering by the European Research Council (ERC). Engineering won four out of 275 awards made across the EU in ERC's inaugural 'Starting Independent Research' competition.

Three projects from Computing were awarded funds for research into new technologies to analyse human behaviour; improve robotic vision, and

develop models for complex software systems.

Materials and the Institute for Biomedical Engineering received funds for potentially life-saving research into new techniques for growing human tissue and improving the quality of life for cancer patients.

The focus will be on bone and cartilage, but findings can be applied to the regeneration of many other types of body tissue, such as the heart and liver.



Robotic surgery gets new backing

HAVING led the use of robots in medical care, further developments at Imperial have been given a boost by the setting up, in March, of the Hamlyn Centre for Robotic Surgery.

This new centre has been made possible by the support, totalling £10m, from the Helen Hamlyn Trust and Lady Hamlyn personally. It is to be co-directed by two UK pioneers in medical robotics, Professor Lord Ara Darzi, who holds the Paul Hamlyn Chair of Surgery at

Imperial, and Professor Guang-Zhong Yang, director of Medical Imaging, supported by an interdisciplinary team of engineering and clinical scientists.

The Centre will draw together under one roof world-leading experts in a range of disciplines, with the aim of creating a national resource in medical robotics that will benefit other UK research groups and industry.

Professor Guang-Zhong Yang, who will be directing the

basic sciences and engineering research of the new Centre, commented: 'The need to perform delicate surgical procedures safely in tight spaces, where the surgeon cannot see directly, has created a growing demand for devices that act as extensions of the surgeon's eyes and hands. This creates a unique opportunity for developing new robotic devices that build on the latest developments in imaging, sensing, mechatronics and machine vision.'

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

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 Materials and Mechanical Engineering.

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

The new centre aims to improve dramatically the strength and durability of structural ceramics, made of inorganic materials like oxides, carbides and nitrides, to meet industrial 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 shells.

Cleaner and greener energy alternatives will also be explored, with potential applications in power generation including pebble-bed nuclear reactors. This new technology encases uranium dioxide in ceramic pebbles, to heat water, create steam and generate electricity.

Joint benefit from Saudi agreement

IMPERIAL has signed an 'academic excellence alliance partnership' with the King Abdullah University of Science and Technology (KAUST). It will open in Saudi Arabia in 2009.

The \$50 million agreement will see joint collaborations in research, curriculum development and academic recruitment. It will enable the new international, post-graduate research university to build up its academic staff and curriculum in materials science and chemical engineering in its first years.

It will also push forward research in areas such as carbon capture, hydrogen-rich fuels, membranes, materials for high stress environments, structural ceramics (including fuel cell materials), energy engineering, process systems engineering, materials for clean power generation, fluid mechanics and biomaterials.

Partnering Imperial College will help to establish a strong relationship between KAUST and similar departments and institutions around the world.

'KAUST's decision to enter into an academic alliance with the Chemical Engineering and Materials departments is based on its pre-eminent global reputation, built on the long-term scientific achievements of its faculty', said Nadhmi Al-Nasr, KAUST's interim president.

Spiral makes research available to all

'IT ISA must be involved in Spiral. It's an easy procedure for academics to upload their work and it will maximise their research and increase exposure.' 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, raising 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 available for early life.

The research team believes that the presence of amino acids, 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 approximately 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 knowledge about how life came into being. Our work has shown that it may have been meteoritic amino acids and other biologically useful compounds that spurred life into existence.'

Researchers find blue is the colour for processing

MAGNETIC properties of a commonly used blue dye, metal phthalocyanine (MPC), could revolutionise computer processing power, according to Materials' Sandrine Heutz and scientists from the London Centre for Nanotechnology,

Dr Heutz made a scientific breakthrough when she found that she could control

how the metal centres of MPC spin in relation to one another.

The secret to controlling this spin lies in the way Dr Heutz grew stacks of MPC in crystal structures on plastic surfaces and then experimented with the preparation conditions. She grew them at room temperature; applied heat; chemically altered the plastic surfaces that the crystals grew on; and changed the way

the crystals grew. All these different elements altered the way the metal centres interacted with each other.

After three years' experimentation, the team can control a set of microscopic interactions between the molecules.

So far the team can switch the interactions from 'on/off' and change the state of the interaction from 'on' to a different type

of 'on'. They are still experimenting with ways to turn the interaction 'off/on'.

When they find this last interaction, Dr Heutz believes she will have a superior set of molecular signals for information processing and storage. Dr Heutz says it could take another five years to practically apply this technology.

The source of some of these articles and some of the words come from Reporter, newspaper of Imperial College.

DIARY DATES

Wednesday May 28
CGCA's AGM & President's Evening, Read Lecture Theatre 17:30, 170 Queen's Gate 19:30

Monday June 16
Faculty of Engineering: Teaching Awards Ceremony and Reception, ME220 and Mech Eng Concourse 18:00

Saturday June 21
Student Union/ Office of Alumni & Development: Summer Ball, South Kensington Campus

Thursday June 26
RSMA's AGM & Final Year barbecue Main Dining Hall, Sheffield Building, 18:30 for 19:00

Saturday September 20
Office of Alumni & Development/Chapter Imperial College: Alumni: Decade Reunion South Kensington Campus

Thursday October 23
Careers Advisory Service/ Chapter: Engineering Careers Fair, Queen's Lawn Marquee, 11:00. Networking Reception ME220 and Mech Eng Concourse 18:00

Friday, November 21
RSMA's Annual Dinner, Polish Club. 19:00 for 19:30

Saturday, November 22
CGCA's Christmas Anniversary Lunch, Polish Club. 12:00

Thursday, December 11
CGCA's Christmas Lunchtime Seminar, 170 Queen's Gate, 12:00

For more information and booking for any of these events, contact
Teresa Sergot
t.sergot@imperial.ac.uk
or phone
020 7594 1184

A family affair at RSMA dinner

FOOD with an international 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, Stefanie Loader (right), exploration 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 Louwarts' 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 the more repeatable verses of the Mines song.



LEFT: Elly Jay 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 Boomalaka. It was called for by CGCU president Tristan Sherliker.

Guest speaker, Lord Garel-Jones, a supporter of the EU, said '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 Garratt also toasted the guests, including officers of the RSMA and RCSA. Replying, 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, of an old horn, to Bo driver Henry Weaver. Henry also received the Peter Moore Memorial tankard.



TOP: Joseph Sanders receives the Holbein Memorial award for being 'a sportsman in the widest sense' from Prof Chris Hankin. LEFT: Lord Garel-Jones and, RIGHT, Peter Garratt.

WE NEED YOUR NEWS

Let us know your news and stories. Or have you an idea for a feature? Editorial assistance is available!
Contact is Teresa Sergot (address on page two).

COPY DEADLINE FOR NEXT ISSUE IS MONDAY AUGUST 4 2008

Any pieces not published in this issue will be published next time

FIRSTLY, I have to say what a great year it's been. The RSM goes from strength to strength. With a fantastic influx of dedicated freshers this year, we've seen record high turnouts to events and our clubs and societies thrive! It has been an honour to look after the RSM this year and very enjoyable – I'm certain the memories from the year will stay with me.

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 106th Bottle Match was held at Camborne. 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,



Mark Mearing-Smith and Andrew Jasudasan display the CGCU Spanner and Bolt at this year's CGCA dinner.

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 Sharpley 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, a over-subscribed fieldtrip to the Isle of Wight and the symposium moved to early June due to timetable changes in the ESE 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 ULU cup appear-

ances (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 RSMA this year. We are extremely grateful for all the generous donations.

we had our traditional beginning 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 FEng, 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 took 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 foot scoring a goal, before the ball was returned through a system of pulleys and chutes.

CGCU members have been instrumental this year in restoring people's attention to traditional values, especially



RSM reclaimed the Bottle from Camborne, winning 13-10! For full Bottle story, see www.rsmonline.co.uk/bottle

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 RCSU's Theta the Thermometer, the RSM's Davey the Davy lamp and RAG's three-foot charity collecting tin.

We've raised money for charity and reminded the unions that 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 CGCA annual dinner and, with our new alumni officer and a new CGCA student award in the pipeline, we'll be working hard next term to bring the CGCA to the student body's attention.

COLLEGE COMMENT...

...on sustainability and climate

North Atlantic influence
'Britain has warmed almost twice as fast as the world as a whole over the past 25 years. Our climate is very strongly influenced by the North Atlantic. Now, because of this, many projections show less warming for Britain than for continental Europe, Asia and North America.' **Sir Brian Hoskins (Grantham Institute for Climate Change)**

Nuclear waste planning
'One of the serious differences we have now, in terms of the way we think about things, is that in the old days nuclear waste was something that resulted from a reactor and was considered in isolation from the reactor itself. Now the issue of what happens to the waste is an integral part of the whole project.' **Professor Robin Grimes (Engineering)**

Nowhere to go
'...human beings are realising that they can't be besotted with always using more. You can't always lay waste to the place you've been and move on to somewhere else - there isn't anywhere else.' **Sir Brian Hoskins**

Sun not to blame
'Claims that the world's rising temperature is caused not by greenhouse gases but by a combination of solar activity and cosmic rays are wrong. My investigations into the sun's ultraviolet output shows it may raise temperature on earth by a maximum of half to 1°C in certain regions. In terms of an impact on the global average temperature, it's small - maybe about 0.2°C.' **Dr Joanna Haig (Natural Sciences)**

Sustainable biofuels
'The challenge we must embrace is to develop crops, agricultural practices and processes that will supply food, energy, materials and chemicals in an economically, environmentally and socially sustainable manner. This will be the 21st century's agricultural revolution.'
Professor Richard Templer (Chemistry) and Dr Jeremy Woods

LECTURE ROUNDUP

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 Wood's talk for the 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 Hattersley**

For a full report of the lecture, use the following - link www3.imperial.ac.uk/newsand-events/pgpr/imperialcollege/alumni/pastevents/



How important was Tizard's Box of Tricks?

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 Schroter**

Gaia needs human beings to change

THE GAIA system is suffering from human impact, Huxley'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.

This *Imperial Engineer's* features are an eclectic mix, continuing our sustainability and resource development theme. In the following 13 pages, we address developed and developing country issues and show that both the challenges are becoming the same.

China leads the way?



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 (SIIC) 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 civilisation.

SIIC 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

by Peter Head
head of Global Planning,
Arup

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 interconnecting aspects:

- 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 this part of Chongming 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)



Peter Head, OBE FREng FRSA, (Civil 69) is project director for planning and development of Dongtan as well as other eco-city developments in China

for SIIC. He is a recognised world-leader in major bridges, advanced composite technology and now in sustainable development in cities. He has won many awards for his work. (See page 24.)

INITIATIVES in recent years suggest the mining sector is turning its sometimes-dubious environmental and social track record on its head to learn from its mistakes, and lead the extractive industries in the drive towards sustainability and better accountability in business practices.

By adopting proactive consultation techniques, more companies are drawing from the value systems of a range of stakeholders at different stages in the mine development cycle. They are harnessing local and expert knowledge to reduce their impacts, strengthen their community relationships and facilitate the shift towards more socially and environmentally responsible mining.

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 physical but also social and economic and can be a permanent scar unless closure is thoroughly and sensitively planned for. 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, climate change debates and a now-ubiquitous human rights discourse, is to engage in what is often

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

Towards responsible exploitation?

perceived as an intrinsically unsustainable activity to yield profit and development benefits, in an ethical and responsible way.

A social licence to operate

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

Historically, mining had a reputation for denying the likelihood of its impacts, or defending them as unavoidable consequences, later incurring costs of the resulting conflicts or local resistance.

Increasingly, mining companies are consulting up front to identify challenges and opportunities by working with their stakeholders (both friends and foes!). They are, often voluntarily, using early, open engagement to fully address the negative impacts of their operations by designing tailored and locally effective measures to mitigate and offset them.

Effective consultation and stakeholder engagement is now recognised as a critical risk management tool needed to gain an accurate picture of a mining project's operating environ-

ment at its outset and integrate and build trust at all levels of the host community – to earn the 'social licence to operate' that is essential to the long-term success of a project.

The earlier dialogue begins and an enabling relationship is secured,



the more efficiently the company can identify and manage risks and focus on maximising the economic benefits of its presence for all parties. Experience is demonstrating that, if properly implemented, multi-stakeholder consultation yields better informed and more accurate impact assessments, fewer start-up delays, reduced transaction costs, properly planned closure and ultimately an increase in long-term shareholder value.

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 domain 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 different values with a view to pre-empt and manage potential conflict. By publicly listening to, and documenting the stakeholder views, and transparently addressing them through a feedback loop, the company can manage expectations and create an even playingfield 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 confrontation 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, Social and Health Impact Assessment (ESHIA) process.

▣ **International Financing Institu-**

tions Standards – namely, the World Bank and IFC Performance Standards and associated Equator Principles. The requirement for consultation is enshrined by these standards in the principle of *Free Prior Informed Consent*. 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) 10 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.

▣ **Operational Risk Management and Impact Mitigation** – for example, Anglo American's Socio Economic Assessment Toolbox. 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.

▣ **Corporate Reputation Risk Management** – managing investor and public relations and providing assurance on social and environmental reporting. Companies are becoming more proactively accountable about their activities, under scrutiny of increasingly inquisitive and well-informed shareholders, stakeholders and public. Cultivating transparency *very early* on in communication with key stakeholders is critical. Xstrata for example used a panel of independent stakeholder experts, including NGOs, potential investors and environmental experts, to assess potential social and environmental risks associated with a project still at early exploration phase (Las Bambas in Peru).

Benefits

Consultation and engagement takes many forms and provides benefits at all stages in the mining/project development cycle. At the exploration and development stage, ESHIA scoping 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 a transparent compensation policy. By undertaking formal public disclosure, the project is able to attract debt financing 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 provisioning 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 managing principal – environmental consultant at URS Corporation



Ltd, where he works with Belinda Riley. She is senior social responsibility consultant, sustainable solutions.



WITH CO₂ emissions from vehicles growing rapidly worldwide, it is imperative that measures be taken to prepare for extensive decarbonisation of this sector in the next few decades. Choices are limited. Due to likely constraints on biofuel production, decarbonisation will have to rely on a combination of low-carbon hydrogen and electricity.¹

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 both hydrogen and 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.² 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

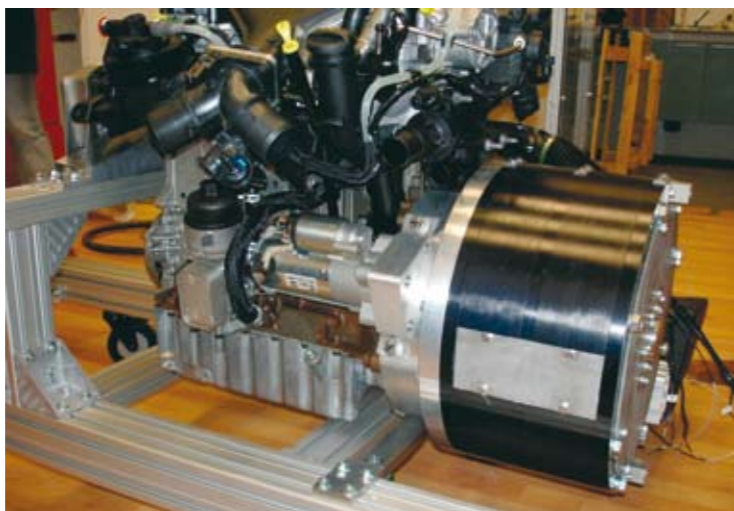
Recent policy and economic research at Imperial College has found that BEVs offer a more promising option for decarbonisation, not because of any intrinsic technical or economic advantage, but because they are a better fit to existing infrastructures and evolutionary trends in technology. In other words, the *pathway* to decarbonised future automobile system appears to be more feasible with electricity and some form of storage than 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 link up with niche markets, as 'springboards' to mainstream markets, and when possible with existing infrastructures, ca-

pabilities 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.³ 'Piggybacking' 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.⁴ 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

by *Alexandre Beaudet
and Jon Gibbins*

premium niches and/or by 'hybridising' with existing technologies and infrastructures.⁵ 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 markets involve fuel cell types other than automotive (PEM) fuel cells.⁶ There is even less scope for early markets for advanced hydrogen storage tanks. As for hydrogen fuel supply, there is some scope to utilise existing 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 sta-



ABOVE: A novel generator for hybrid electric vehicles, developed by Dr Mike Lamperth's group in Mechanical Engineering, is tested coupled to a high-efficiency diesel engine.

RIGHT: Dr Shaun Crofton, senior tutor in Mechanical Engineering, 'fills up' his G-Wiz electric car at the charging point on the South Ken campus.

The route to decarbonising road transport: hydrogen or electricity?

tions 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 hard 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, as well as benefiting from the ubiquity of electric power infrastructures. The first trend to note is the progress in lithium batteries, driven almost entirely by consumer trends in electronics. Lithium-ion and other lithium-based batteries offer a promising route to commercially attractive BEVs.⁷

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, the hybrid vehicle points the way to an alternative to the 'pure' BEV: the plug-in (rechargeable) hybrid (PHEV), which combines the benefits of petroleum (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' conversions of 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 (eg 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' for 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 petrol or 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.⁸ 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 alternatives, perhaps through a combination 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 'build-up' 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.

Well financed

More aggressive governments might consider subsidising investments in fast-charging stations (possibly coupled with electricity storage for benefiting from off-peak pricing), smart meters that enable BEVs to put electricity back into the grid

(Continued on page 22)

China leads the way?

(Continued from page 11)

the great innovation lies in bringing it all together and designing the city with sustainability as an all-encompassing integrating and guiding principle.

To ensure Dongtan uses the best proven and most reliable technology, various sites all over the world have been visited to see the latest technologies for water, energy and waste processing and management.

Integration

The decision was taken that the innovation in the first stage development would be focussed mainly on the integration of existing technologies and in the spatial planning. Later phases of development can incorporate emerging technologies.

Management structures for driving 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 aspects and then incorporates the main physical components of city life such as transport, the built environment, social services and utilities.

Sustainability driver

The starting point 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 environmental performance.

Planning an eco-city is an unknown, and undoubtedly the process that Arup has started with Dongtan will be improved on 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 might just determine for the entire 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.

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 atmosphere 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-engineering 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 greenhouse gas emissions (mitigation). During 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 geo-engineering techniques attack the root of the problem, carbon dioxide, head on. Artificial trees which, like real trees, can absorb carbon dioxide 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 aquifers 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 energy needed to process and transport

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 Sherborne School?

I want to study chemical engineering in Cambridge. Then I want to develop

new technologies to reduce pollutants in industrial emissions. I also want to become a university lecturer. *Why do you think young people around the world should learn about science?*

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 is congratulated by Lord Robert Winston, one of the judges and Imperial's professor of science and society.

water into the atmosphere to promote the formation of clouds, thus increasing earth's reflectivity (albedo). This process is eco-friendly and could be stopped at any time. Perhaps the only impediment is the unknown effects of this process on rainfall patterns.

Methods which involve using space lenses or mirrors to deflect sunlight were also suggested. Not only do these methods cost a lot, but they also could go wrong at any stage. What would happen if we lost control and ended up with a lack of sunlight? If we decided to destroy the lenses, the debris may scatter sunlight and cause more problems.

It is worth noting that methods that target sunlight have no effect on carbon dioxide. Therefore, the new planetary conditions (low sunlight and high carbon) might have unknown consequences.

Another aspect to consider is the ethical aspect. Do we have the right to mess with our planet in that way? Personally, I think we do. Whether you believe that a divine power created this planet, or another cause, the case is one: we have already, and by our own actions, messed up our atmosphere. 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 decision for all earth inhabitants on which remedial action to take? It is unwise to allow private companies to act erratically on their own; we need an international legal and political framework and a global committee of scientists to make such critical decisions.

In short, geoengineering techniques should not be regarded as ideal solutions for global warming, due to the uncertainty surrounding their consequences. However, if we failed to reduce our carbon emissions to safe levels within the next few years, it would make a huge difference if we had powerful backup. 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 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-engineering the solution to the climate change problem?' Apart from writing the essay, Hassan was among six school finalist and six Imperial 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 boarding school to encourage more pure scientists in the country.

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 phytoplanktons, microscopic organisms that form the base of the marine food chain. An advantage of this process is that it can be controlled easily; phytoplanktons would not last for so long after the urea supply had been stopped. If to succeed, 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

about this method is that meddling with the equilibrium of an ecosystem has, on many occasions, yielded devastating consequences.

Other geoengineering techniques aim at cooling the earth by reducing the amount of sunlight that reaches it. Volcanic eruptions cause the temperature of the earth to cool down because of the massive amounts of sulphates released, which have the ability to reflect sunlight. Therefore, using rockets to release sulphates into the stratosphere has been proposed. Nevertheless, this process could damage the ozone layer. Moreover, if released in low altitudes, sulphates may cause acid rain and respiratory diseases.

A less risky method would be cloud seeding. Special yachts could be used to spray tiny droplets of sea

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 4.4m 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 cement 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 for 1.6m 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-Teck Lau and Jumana Al-Zubaidi completed the team.

In the previous year, meetings con-

firmed 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's relief 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

then finally concreted into place.

With the bridge out of bounds while the concrete set, work concentrated on clearing the river channel from low branches, protecting the bank in front of the towers and building up the earth embankments behind the towers. The large felled branches were sectioned and manhandled upstream where they were held in place on the east bank by stakes. The area behind each log was then backfilled with large



from the community to assist with the completion of the bridge. They were mainly given the task of collecting materials which were sourced locally where possible. Vast quantities of earth were shifted to build embankments on the approach to each tower. A soft engineering approach was used to build retaining walls for this earth. This involved filling woven sacks with earth and staking them with metal rods into the ground. Meanwhile sand and gravel were gathered for concreting and boulders were used for armouring the bank and towers.

The whole workforce helped to unroll the UK-sourced cables and carry them across difficult terrain to the site. A great deal of manpower was again required to haul the cables across the river. Once raised into place using a sequence of pulleys and grips, the cables were fastened. Members of the expedition team used specialist high ropes equipment to fasten adjoining cables and lay the decking. These were made in simple 0.7m wide units from termite-resistant blue-gum wood from the National Park's saw mill at Chelinda.

The bridge was left to settle under its own weight before the final adjustments were made. The cables were

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 cliff by 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. 25 The chief of Uledi and the senior National Park officer from Chelinda spoke to a large 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 everyone 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



TOP: Building one of the towers. ABOVE: Retaining walls and shuttering for earth embankments leading up to the bridge. TOP RIGHT: A human chain passes bricks across the river.

Undergraduate engineers have traditionally gained experience working on real-life projects during vacations. Including funding from The Old Centralians Trust, these two have been carried out over the last few summers.



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 homeless 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 landslips damaged buildings and roads 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 2002, problems encountered included safety on site awareness, land ownership disputes and lack of enthusiasm amongst community member: 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 castillas* 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 before. The students also funded 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!

REDES was formed in September 1989 to work with refugees and displaced people resulting from the civil war. It provided them with vocational training in agriculture and fisheries and facilitated the legalisation of properties in areas affected by the armed conflict. It has developed to work in farm development, social infrastructure and housing, risk management, micro credit schemes, social development projects, diversity development, social development in health and education, women's issues, social security and municipal planning.

REDES gained funding to build a number of houses from charities such as the Catholic Agency For Overseas Development (CAFOD) and the United Nations. However, to gain volunteers to lead projects, it works with national and international educational institutions which involves students from social sciences, engineering and architecture in development projects. Experienced personnel work with the students on live assign-

Why Boanerges?

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

INA 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 32), 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 (Civl 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 WWII, 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 removed because she climbed onto the bonnet and, in a squatting position, solved the problem!

Contact Eric at arnot@global.co.za.



Bo at the recent CGCA dinner with driver and co-driver, Henry Weaver and David Hankin and their girlfriends.



MEET THE EDITORIAL BOARD

THE MERRY gang above makes up the board responsible for the publication of Imperial Engineer. The men, from left, are managing editor Bill McAuley, CGCA hon sec Chris Lumb and RSMA hon sec Paul Holmes. In yellow is production editor Lynn Penfold, with pink scarf Rosie Tipples, in purple Colleen Shilstone and, on right, Teresa Sergot.

Bill's (Chem Eng 60-65, MBA in USA) CV talks about his ability to build a team within big business and he's done a good job since taking over as managing editor of Imperial Engineer after its first issue. That was masterminded by John Bramley of RSMA, Colleen and Lynn. John had been editor of RSMA's Update which had been produced by Lynn for 10 years. Colleen (Elec Eng '46) was editor of CGCA's Imperial College Engineer for seven years.

Lynn has worked on a local newspaper, been a wine and food writer and produced company newspapers. With Bill she pulls all the stories together and produces finished pages on computer for the board to check.

Key to gathering stories are readers' submissions, most via the internet, and the newshound abilities of the others. CGCA's hon sec Chris Lumb (Elect Eng 61), with his eye for detail, noses out interesting facts, as does RSMA's hon sec Paul Holmes (MSc 94 - mining engineering and rock mechanics). He is head of national accounts at Tarmac.

Contacts within the Engineering Faculty are Teresa and Rosie, whose jobs involve supporting the alumni associations and student unions. After a chemistry degree from Imperial and PhD in analytical chemistry, Teresa worked in industry before having four children. She returned to Imperial in 1995 and is now academic and alumni relations manager. Rosie, from Canterbury NZ, has a degree in linguistics and political science and an MA in EU studies. She's worked at Imperial for some time and is now with Teresa as alumni and communications officer.

Having proof-read the final version before publication, the board gathers round Lynn's kitchen table to combine their findings, stopping only for a friendly lunch.

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 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,



Greenhouse debate hots up in Victoria

as described above, comprises (as at March 10 2008) -

- Petroleum, including road and air transport: 28%
- Gas, domestic and peak power generation: 9%
- Base load power generation: 63% (50% from Lignite)

Obviously, to make inroads into excessive emissions, the major emitting areas of petroleum and power generation would be the first to be addressed, -but how?

Australia 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 +3.5L engine - mainly 6 cylinder, where the best consumption achieved is 10-12L per 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

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

adequately taxed to reflect this high-level of damage.

Improvements 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 (2050) aim.

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 A\$1.40 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 63 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

(Continued over page)

potential geosequestration zones are up to 300km from the generating sites, some are even offshore in Bass Strait, thus making it inevitable costly.

Technical sources provide data for the comparative levels of unit CO₂ generation⁽¹⁾⁽²⁾ by fuel source.

These are -

- lignite 1.15 kg CO₂ /kWh
- anthracite 0.85
- natural gas or LPG 0.6

This clearly illustrates a potential short- to 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 terminal 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 strategy could be easily implemented, as Australia has significant reserves of offshore natural gas, for short to medium term use, close to the Victorian coastline.

For a longer-term solution, Australia's governments have to reconsider nuclear power (as it has almost no CO₂ footprint) 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.

It is expected that the trading scheme will force emitters to rectify their processes to remain within their emission limits or be forced to buy additional credits on the open market. These schemes will inevitably increase



Michael Walton (RSM 70) is an independent consulting engineer, based in Melbourne, Victoria. refmet@jprimu.com.au, www.refmet.net

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

- higher costs of production of goods, services and energy generally, and
- forced introduction of new capital-intensive technology or
- shut down of 'inefficient' or cost-sensitive industries. (To be replaced by imports from third world countries, not covered by Kyoto?)

Summary

Australia has committed to significant reductions of its greenhouse gas emission, 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.

Technical issues are fairly straightforward and costings 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.

FOOTNOTES

¹ Potential Greenhouse Gas emissions reduction from future Lignite-fired Power stations in Victoria and S Australia, *Brookway & Simpson, 1999*

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

Hydrogen or electricity?

(Continued from page 15)

more certain and affordable way to decarbonise the automobile. It is thus important that at the very least, BEVs are not treated less favourably than biofuels or hydrogen vehicles in policy and incentive design.⁹

FOOTNOTES

¹ J King 2007. *The King Review of low-carbon cars. Part I: the potential for CO2 reduction*. HM Treasury: London.

² J Gibbins *et al* (forthcoming), *Electric Vehicles for Low-carbon Transport*, Energy - Proceedings of the Institution of Civil Engineers, accepted December.

³ International Energy Agency. 2000. *Experience Curves for Energy Technology Policy*. Paris: OECD/IEA.

⁴ National Academy of Sciences 2004. *The Hydrogen Economy: Opportunities, Costs, Barriers and R&D Needs*. Washington DC: National Academies Press.

⁵ See for example A Grübler 1990. *The Rise and Fall of Infrastructures. Dynamics of Evolution and Technological Change in Transport*. Heidelberg: Physica-Verlag, and R. Raven.

⁶ See for example P. Agnolucci, *et al*. 2007. *Technological change in niches: Auxiliary Power Units and the hydrogen economy*. Technological Forecasting and Social Change.

⁷ FR Kalhammer, *et al*. 2007. *Status and Prospects for Zero Emissions: Report of the ARB Independent Expert Panel*. State of California Air Resources Board, Sacramento.

⁸ On 'incrementalism', see D Collingridge. 1992. *The Management of Scale. Big Organisations, Big Decisions, Big Mistakes*. London: Routledge.



ALEX BEAUDET, PhD candidate at Imperial's Centre for Environmental Policy, is researching transition pathways

toward low-carbon vehicles and associated infrastructures. He also consults for a number of companies and governmental bodies on strategies and policies relating to low-carbon technologies. JON GIBBINS is senior lecturer in the Energy Technology for Sustainable Development Group within Mechanical Engineering. He is a leading exponent of carbon capture and storage (CCS) as part of a more sustainable energy supply.



Mining can be for everyone

ALTHOUGH initially interested in languages, a geology field course was the turning point for Cynthia Carroll and she was captured by the subject. Applying her training in oil and gas exploration for Amoco, she later moved away from the actual science and into management. After Harvard, Cynthia joined Alcan Aluminium, in its packaging business, later becoming chief executive of the core metals business. PAUL: From your experience, and as CEO of Anglo American, how do you get school children 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, 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 encouraging people to take maths and science. In the UK, we give students small taster sessions and in Australia we have a big programme where the local schools are vital to the local mine. We have open days where children are encouraged to come and touch. That can make a child, who is just looking at a rock, say 'just imagine there's all that stuff in that rock and this is where it goes'. Kids can be turned on which is why we are supporting maths and science education. In South Africa, our chairman's fund is looking at spending \$4m sending teachers and university lecturers into schools to upgrade maths and science.

PAUL: Do you think the mining sector has an historical publicity problem and should it be doing more to show the realities of a modern industry? CYNTHIA: *I really do think that. We have to change the old image - male-dominated, underground, dirty and unsafe. This can be done by early education but also by about talking about sustainable development and all the good that comes out of mining, whether its from an environmental, safety or community development standpoint. We need to get those messages out. If there's any company in the*

industry that can do that successfully, Anglo should be able to.

PAUL: What is Anglo's main point of engagement with universities?

CYNTHIA: *We work with them quite closely and sponsor a number of chairs in mining. Chile is a wonderful example. Despite opening five new mining schools in the last five or six years, there are more kids than they've got space for, so they're coming to Europe*



Anglo American's new CEO Cynthia Carroll talks to Paul Holmes (RSMA hon sec) about how her company engages with schools and helps attract the best graduates into the mining industry.

to study. We're sponsoring a couple. Our work experience programme is essential. We're doing the right thing in terms of engagement and giving them a good experience. They go all over the world and see different countries and if they don't like doing that then they shouldn't be in mining actually.

PAUL: Has Anglo struggled with a shortage of skilled people in mining?

CYNTHIA: Yes and no. People are knocking at our door, saying 'what about me, would you think of me?' That's only a recent development. We're experiencing a bi-modal hump from when the industry had a bit of a slump. Mining companies were cutting back and you could get a ready-made engineer rather than develop graduates. We've got more than enough youngsters coming in but the middle levellers are a lost genera-

tion. It's exciting because youngsters 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 been converting geologists to move closer to engineering topics and do masters. Quite a lot of civil engineers have crossed. We provide a support for people who want to. There are some constraints, particularly safety related, where in some countries you have to have done the right sort of things in the right order.*

PAUL: What is typical career progress 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 industry, more than one condition and more than one country.*

Varied careers

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 teams. Anglo has very diverse products and geographical activities, so you could still have a whole career with us and could do many different jobs., unlike most mining companies..*

PAUL: What is the most important skill that university didn't 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 know where you teach that! Students come out and expect life to be predictable and they're horrified when it's not. You have to be willing to give and take in life and be open and consider many different things. You have to be flexible, creative and be open to differences, whether it's different countries, different businesses or different problems.*

Mining courses publicised on website

SINCE John Bramley's (Mining 56) retirement from the RSMA committee, he's devoted considerable time to Ecton Mine Educational Trust. It now has a website: www.ectonmine.org

Volunteers at this old copper mine are reviving courses there to attract school leavers into the minerals industry.

ALUMNI NEWS & REVIEWS

Four pages of who's doing what and where

'PJ'TOH (Mech Eng 2000), whose company organises holidays in Mongolia, has just completed an adventure of his own. He pushed his body to the limits on the six day race across the Atacama desert in Chile. The 250km race covered the most lunar landscape on earth which is 50 times more arid than California's Death Valley.



Green listing among equals

PETER HEAD (Civil 69), a director of ARUP, was named in a January issue of *The Guardian* as one of the '50 global green heroes who could save the planet', elected by a global peer group.

Previous awards include the Royal Academy Silver Medal, Award of Merit of IABSE and the Prince Philip Award for Polymers in the Service of Mankind.

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 subgroup of the Commission.

Meteorological forecast

KEN BIGNELL (Meteo PhD 64) is in the throes of producing a history of meteorology at Imperial College, from 1920 to 1975 when it was incorporated in the Physics depart-

ment under the new name, Atmospheric Physics Group. It will form the basis of an article in a future *Imperial Engineer*.

Ken was a lecturer and is on ken.bignell@imperial.ac.uk

Weather and bullet proof in minutes

PRODUCTION is expected to start next year of a solid concrete structure which can be set up as an emergency shelter in 40 minutes.

It is the invention of engineering graduates Peter Brewis and Will Crawford (Mech Eng 05).

Made of concrete cloth in-

spired by the material used to make plaster casts, it is made by adding water, pumping it into shape and waiting for the concrete to dry.

The shelters can withstand storms, extreme cold and even bullets. They have already been the focus of interest from aid agencies and the military.

Consumer organisation backs Climate Care

WHICH has given Mike Mason's carbon offsetting company Climate Care a good review for its reasonable charge 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

MINSOUTH (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.

ELECTRICAL ENGINEERING 1981

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 your old friends, we would be pleased to hear from you. Email Alan at alan.r.higginson@btinternet.com **BELOW: A growing gang outside the Union Bar.**



Marathon success makes headway

TRAINING year helped RSMA president Kurt Budge put in a respectable 3hrs 55mins in this year's London Marathon. It was over half an hour faster than

his time last year. Also running was Pamela Murphy (Min Geol 92) who also raised money for Headway. Her time was 6hrs 45mins 09secs.

CHEMICAL ENGINEERING 1960

IN ADDITION to its annual reunion, 1957-60 Chemical Engineers Group also enjoyed an autumn visit to the Tower of London, writes Tony Davis.

'Mike Heath kindly volunteered to organise the visit with the extra benefits of it being hosted and guided by the Yeoman Seargent (correct spelling!) Alan Kingshott. The evening visit included a tour of the Tower, followed by seeing the Ceremony of the Keys and a supper with drinks in the yeomanry club. It included very interesting commentary from Alan on the workings



Tower 'entertains' engineers

of the Tower and on some of its residents. Dave Martin brought chocolates from Belgium - much enjoyed by all including some yeomen.'

Around 12 of the group were present at the February reunion in The New Cavendish Club - the usual venue. Present for the first time was Richard

In the Tower, from the right the gentlemen are Dave Martin, Malcolm Cross, Alan Nethercott, Alan Kingshott, Mike Heath, Jim Friend, Paul Gallagher, Brian Stevens, Don Latimer and Tony Davis.

Lee who was visiting from Hong Kong. We met in the library as the Club management feared we would overwhelm the reduced size bar room.

As always the meeting was convivial and Dave Martin gifted more Belgian chocolates. Demand for chemical engineers with experience remains strong so there was plenty to discuss with those still working.

CHEMICAL ENGINEERING 1971

Where are you now?

TERRY Knott has written, trying to find a few of the lost souls of Chemical Engineering 1968-71 he's not managed to contact for the 40th anniversary reunion planned for Saturday September 27 in South Ken. 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 engineering alumni. Tony Barringer was not remembered, which Bill Bradford (MinTech 57) felt needs rectifying.

Born in 1925, Tony served in the British Army in WWII, later obtaining a BSc in economic geology at RSM and a PhD in 1954. He has made numerous contributions to mineral exploration technology. His most famous work was the development of the INPUT airborne electromagnetic system, which has been credited with the discovery of tens of billions of dollars-worth of ore deposits.

Other technical contributions to the mining industry include a laser-induced fluorescence-based system, used primarily in oil and gas exploration (FLUOROSCAN); correlation

spectrometer used to measure atmospheric dispersions of various gases (COSPEC); an infrared remote sensor for atmospheric gases which has been used by NASA to measure the worldwide atmospheric distribution of carbon dioxide (GASPEC); two airborne conductivity mapping systems using very low frequency fields (E-phase and radiophase) and several particulate analysers (COTRAN, SURTRACE, LASERTRACE and AIRTRACE). He has presented more than 80 technical papers and has been awarded more than 70 patents in Canada and elsewhere.

Tony Barringer moved to Canada and later became a US citizen. His company, Barringer Research, went public in 1967 and he officially retired in 1989. (See Wikipedia for more detail about Tony's career)

Earthquake award for Rui

RUI PINHO (Civil MSc/DIC 96, PhD 00), who obtained masters and doctoral degrees from Civil and Environmental Engineering, has received the 2007 edition of the prestigious EERI Innovation Prize (Earthquake Engineering Research Institute, California, USA).

It is 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 Engineering Seismology (the ROSE School), which is widely recognised as a leading international training centre in the field.

Rui's role as deputy coordinator of the LESSLOSS project, involving nearly 50 European partners, focused on risk mitigation for earthquakes and landslides, was also recognised, as was his position as co-founder and technical director of SeismoSoft.

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.

REGALIA FOR SALE

RSM
Regalia
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For more details
please contact
Elly Jay
eej04@ic.ac.uk



Tie Pins ~ £15
T-Shirts ~ £15



Cufflinks ~ £20
Jumpers ~ £20

Ties ~ £12-15

Early promise never faded

RICHARD Burkin, a leading academic hydrometallurgist, 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 mili-



RICHARD BURKIN

tary projects. After the war, he became a lecturer in inorganic chemistry at University College, Southampton but continued studying part-time, obtaining MSc and PhD degrees from London.

His joined the staff of the RSM in 1952 to teach chemistry in the then new degree in mineral technology, later transferring to the metallurgy department. Here he introduced a new course on hydrometallurgy into the existing extractive metallurgy degree.

See obituary by John Monhemius.

Complete versions of these obituaries can be found on www.imperial.ac.uk/engineering/about/alumni.

BILL (SKIP) FAIRBAIRN

'IT IS with deep regret that I report that Bill (Skip) Fairbairn died on April 4, reports Alan Dickson. Skip was a contemporary, studying mining 1965 – 68, and contemporary resident at Garden Hall during Ian Merker's time. Skip and his wife Angela hosted a cocktail party for Western Australian IC alumni in 1998, shortly after moving here from

Inspiration at Heriot-Watt

PROFESSOR John Archer (PhD 69), who died on December 9, has been described by colleagues as a strong leader who could be 'challenging at times' but could also 'mesmerise with his contagious enthusiasm'.

A career as a petroleum engineer followed Imperial, before his return to take up a readership in petroleum engineering. He became professor in 1986 and went on to play an increasingly senior role, first as dean, then as pro rector and finally as deputy rector.

In his nine years as principal of Heriot-Watt University, John Archer helped raise stu-

the Pilbara and has been an attendee at many WA IC Alumni functions. He was also an attendee at many of the RSM First Friday Sundowners.

STEWART PEERLESS

STEWART PEERLESS, who died on January 30, took a degree in mechanical engineering in the 40s. He was captain of the City & Guilds College Boat Club 1950-51 and later became a member of staff in Mech Eng.

JOHN ARCHER

dent numbers by a third; instigated a dramatic restructure, and moved the institution out of a long period of financial deficit. **Melanie Newman** melanie.newman@tsleducation.com.

Organisation made Decade lunch

ADRIEN STURGEON, who died on March 1 after an extended illness following a stroke, studied civil engineering from 1953 to 56. After college he served with the Sappers in Malta, after which he joined Rendel, Palmer & Tritton, staying on in Malta for them.

Missed by all

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

Following a degree in mining engineering, Bill married his childhood sweetheart Molly and went out to India in 1935 as an underground surveyor at a mine in Mysore.

In 1938, he moved to

DAVID EASTERBROOK

RSM spirit carried him through

DAVID Easterbrook (Min Geol 73) died peacefully, on April 15, at home, following a brain haemorrhage after a long fight with the various complications associated with diabetes, which developed while he was at RSM. A celebration of his life (in true RSM style) followed the funeral on April 29.

An unassuming leader

'I WAS privileged to be a friend of Colin Edwards who, after a short illness, died on February 17', writes David Baker his contemporary in Electrical Engineering from 1951-54. Colin was an accomplished musician, singing tenor in the IC choir.

After graduating, Colin undertook research for GEC before returning to his beloved home town of Llandrindod Wells to take over the management of the family electrical, radio and TV business. He was very proud when his son Stuart was awarded a PhD in Computing from Imperial in 1993.

BILL EVERITT

Ghana with the Colonial Service to work underground in a gold mine and in 1941, he was posted to Malaya as an inspector of mines. In 1948, Bill returned to Malaya and held senior positions in until independence in 1957.

At this point, Bill's second career, as shopkeeper and teacher, began. In 1960, he sold the shop and moved to his final village, teaching in colleges and schools until retirement in 1978.

David married Glynda (née Lewis, Geol 75) after RSM and was father to Ruth (Geol 2001), Mawgan and Huw.

WILLIAM STEVENS

True son of Cornwall

HAVING served with REME in the war, Bill Stevens (Mining 50) came to RSM before his first job of mining in Cornwall, his home county. Bill died on December 18, aged 83. Apart from three years in Spain for Rio Tinto Line, his spent his long career with English China Clay.

COLIN EDWARDS



Colin at CGCA's 2004 dinner.

ADRIEN STURGEON

wright 'Coast-to-Coast' walk in 2003. In 2006, he worked very hard indeed to bring together 34 classmates and contemporaries, with 25 guests, to attend the CGCA Decade Reunion, making it one of the best ever. **Chris Lumb**

Back in England, he worked with several eminent civil engineering firms before becoming a consultant in the 80s.

Adrien was an avid motorist and keen walker. He competed in driving trials with his HRG sports car and his long walks culminating in the Wain-

Imperial's centenary spurred fascinating reminiscences. Many have been published on the website (www.imperial.ac.uk/centenary) but these are of particular interest. Where indicated, find more full versions on www.imperial.ac.uk/engineering/about/alumni.

A first year at Guilds

By Dudley Dennington (Civils 47)

MY FATHER'S telegram arrived in September 1944, just after I went back to school for the autumn term - 'leave school stop have a civil engineering place for you at City Guilds College stop'. I had not heard of Guilds!

Contrary to expectations my higher certificate results, which had awaited me, were sufficient for entry to London University. When informed, my father, a banker, found that 'Johnnie Walker the all-powerful registrar at the college was the man to see and hurried to him. There was one vacancy that could not be taken up and

he secured it for me. I was 17.

Duly, at the beginning of October 1, reported to the college entering by the Shap granite steps on Exhibition Road, above which Mr Walker, who had a grip on all aspects of college routine, had his office. I also met my colleagues for the next three years, one of whom I still meet at FCGI functions. The war was still on and for the first term we still suffered VI flying bomb attacks for which there were warnings...

Now read on! Go to www.imperial.ac.uk/engineering/about/alumni.

John pulls memories together for booklet

WHEN John Gardiner was handling the 'old student notes' John Davies (Mech Eng 48 & Chem. Eng 52) sent him some drafts of 'interesting' experiences he'd enjoyed during 40 years or so in engineering. He published a couple of edited versions back in 2004 in *The Imperial College Engineer* which seemed to be reasonably well received!

Now John's got his act

together and has pulled them together in a booklet for the amusement of his friends (or maybe to throw darts at, as he says).

A version, with stories about days with Tarmac and others in various parts of the world is available in Word and is now on the website. (See page three.) It's likely to inspire others to reminisce!

DANSE TRISTE BY THE ALBERT HALL by Laurence Pretty (Aero 58)

IMPERIAL College occupies the same niche in Britain that MIT has in the USA. In the 1950s, both schools had a comparable enrolment, specialised 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.

I entered Imperial as an 18 year old engineering student and joined approxi-

mately 4,500 males and 60 women. As the chances for romance needed a boost it was the custom each Saturday evening for various societies to take turns in organising a dance in the Student Union ballroom to which women from London's women's colleges were invited.

I became responsible for organizing one of the dances in 1958. I had taken a first step that would lead to the dance that lingers in my mind

I came for a degree and found a wife

'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 Kelland '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..'

Read about the couple (below) who've just celebrated their 41st anniversary.



A time as one of the Chaps

JIM PLATT'S (Min Geol 60) contribution to the Centenary reminiscences included his memories of 'the Big Smoke' at the end of the 50s when he arrived from Cornwall.

As he recalls: 'the heavy cloak of deference to author-

ity which had been draped on me...began to fray rather quickly when I took up my allegiance with the RSM'.

Jim's recalls the Rowing Club, the Boxing Club, readings from Eskimo Nell, invading Guilds and joining the Chaps.

half a century later.

I reserved the ballroom months in advance, interviewed several musical talent agencies and hired a dance band, planned refreshments and arranged for the printing of tickets. At last the Saturday night arrived, the band arrived and the dance was afoot. But by an hour after the start, when the room should have been full, it was occupied by about ninety men, by my count, and two women.

I had forgotten to publicise 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 most unusual event of the evening. One of my co-organisers told me the next day, one of the two women received not a single invitation to dance, despite the 90 to two ratio. It must have been one of the most poignant events in dance.

£15

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