



FOCUS

NUMBER 162
JUNE 2010



INNOVATION & COMMERCIALISATION

R&D, INNOVATION & PRODUCTIVITY

Contributors from the world of R&D, innovation and productivity policy and practice tackle some of the key issues the nation confronts – and we showcase the best of Australia's technology commercialisation

Arup

Innovation and a fresh perspective

We are an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Through our work, we make a positive difference in the world.

Outstanding design, innovation and value characterise our work. Arup looks at every project, big or small, with a fresh perspective and we promote in our people a willingness to think laterally and creatively in order to deliver the best solutions.

Arup's commitment to sustainability is at the heart of every project. The firm is acutely aware of the responsibility it has in designing and influencing the built environment, to do the best possible work for current and future generations.

AAMI Park Stadium, Melbourne
©John Gollings

5

R&D realities underpin commercialisation in Australasia

By Leonie Walsh and Greg Smith

7

Lean and agile innovation means removing waste

By Richard Paynting

11

Innovation rests on engaging multiple stakeholders across the value chain

By John Kapeleris



Front cover: Innovation is everywhere.
Photo: iStockphoto



Arthur Lowery, from Ofidium, a recipient in Commercialisation Australia's first round of funding (see page 27).

- 14 Sustaining growth through productivity
- 17 Navigating public policies to improve innovation performance
- 21 Australia celebrates innovation
- 22 ATSE Clunies Ross Awards recognise Australia's visionary innovators
- 29 Students really go 'hands on' at Extreme Science Experience
- 30 Academies call for better fix on public attitudes to new technologies
- 32 Economic cost a danger in reducing international research collaboration
- 32 Academy joins Korea in Green Growth workshop
- 33 ATSE wins two new LASP grants
- 46 ATSE in *Focus*

FOCUS

ATSE *Focus* is produced to stimulate discussion and public policy initiatives on key topics of interest to the Academy and the nation. Many articles are contributed by ATSE Fellows with expertise in these areas. Opinion pieces on topics of national interest, particularly the Academy's key interest areas – climate change impact, water, energy and education – will be considered for publication. Items between 800 and 1500 words are preferred. Please address comments, suggested topics and article for publication to editor@atse.org.au.

Deadline for the receipt of copy for next edition of *Focus* is **16 July 2010**.

ATSE is an independent body of eminent Australian engineers and scientists established to promote the application of scientific and engineering knowledge to practical purposes. ATSE *Focus* is produced to serve this goal.

Opinions expressed in this publication are those of the authors, and do not necessarily reflect the views of ATSE. Material published in *Focus* may be reproduced provided appropriate acknowledgement is given to the author and the Academy.

CEO: Dr Margaret Hartley

Editor: Bill Mackey

Technical Consultant: Dr Vaughan Beck FTSE

AUSTRALIAN ACADEMY OF TECHNOLOGICAL SCIENCES AND ENGINEERING (ATSE)

Address: Level 1, 1 Bowen Crescent, Melbourne

Postal Address: GPO Box 4055, Melbourne, Victoria 3001

Telephone: 03 9864 0900

Facsimile: 03 9864 0930

Email: editor@atse.org.au

ACN 008 520 394

ABN 58 008 520 394

Print Post Publication No 341403/0025

ISSN 1326-8708

Design and production: Coretext 03 9670 1168 www.coretext.com.au



Achieve

international research excellence.

Join us.



If you want to achieve world-class results and work with researchers who are already doing just that, we invite you to join The University of Western Australia. As a member of Australia's Group of Eight research-intensive universities, our focus is on working with the brightest and the best. We continue to attract international award-winning teachers, researchers and students whose individual reputations have helped to build ours. To explore the exciting opportunities available visit www.uwa.edu.au



**THE UNIVERSITY OF
WESTERN AUSTRALIA**
Achieve International Excellence

R&D realities underpin commercialisation in Australasia

Industrial R&D managers have become even more focused on R&D productivity – including tighter priority setting, increased leveraging of scarce R&D funds and greater collaboration.



By Leonie Walsh and Greg Smith

leoniewalsh@me.com greg.smith@sciventures.com.au

All research and innovation managers across Australia and New Zealand are trying to be more innovative about how they perform their management function. Both in large and small industrial companies, and in the publicly funded research sector, they are all leveraging resources through increased collaboration. They are placing greater emphasis on working on the right problems, but also considering earlier what may be the best path to adoption and impact. In this process, they are seeking earlier involvement from prospective value-chain partners to move their research outcomes into the market.

These were key aspects in presentations and discussions at the 2010 Australasian Industrial Research Group conference, titled 'How can R&D managers influence and improve the future of Australasian research and innovation?'

The conference noted dramatic recent changes in industrial R&D in Australia and New Zealand, including:

- closures or retrenchment at important corporate R&D installations;
- major innovation reviews in both countries;
- financial challenges for new ventures with Commercial Ready's demise in Australia; and
- significant recessionary pressures changing the priorities of governmental, corporate and consumer investment in R&D and innovation.

In Australia, business expenditure on R&D grew to a record \$14.4 billion in 2007-08, making Australia 14th in the OECD ranking at 1.2 per cent of GDP – but large Australian firms were noted to be last in 'New Products to Market', compared to all other OECD countries, while the nation's smaller firms performed only marginally better.

Since 2007-08, however, financial crisis impacts have lowered activity from this level and governments have sig-

nificantly lowered historic investment levels in R&D and innovation. As a result, industrial R&D managers have become even more focused on R&D productivity – including tighter priority setting, increased leveraging of scarce R&D funds and greater collaboration through open innovation, including increased efforts to integrate public sector researchers into industrial technology developments.

Although the Government has somewhat altered the emphasis of Australia's long-cherished Cooperative Research Centre (CRC) program recently, major industrial companies are still working very closely with key CRCs to achieve program leverage, especially for longer-term, higher-risk research targets.

However, it has been a tough time at the smaller end of business, with the focus of SMEs now on balance sheet repair and consequential cuts to their more prospective R&D and innovative developments.

The cultural mismatch between academia and industry continues to be felt in both Australia and New Zealand, speakers noted, although with different pressure points perceived in the two countries. Meanwhile, university researchers have received conflicting messages concerning where to place their emphasis to best attract continued funding in future.

New Zealand

In New Zealand, improvements have continued, although the government recognised these have grown from a relatively low base. The Crown Research Institutes (CRI) were established during radical reforms between 1989–92. While all of the CRIs are government-owned, they have operated as independent, competing companies, each seeking its own integrated role across the spectrum from discovery research to commercialisation.

Contributions are welcome

Opinion pieces on topics of national interest will be considered for publication in *ATSE Focus*. Items between 800 and 1500 words are preferred. They must list full name, title/role, organisation (if relevant), city of residence and email address for publication. Please address to editor@atse.org.au

One unfortunate consequence has been considerable emphasis on process and on competition. It is now recognised that CRI funding and productivity, compared to a benchmark such as Denmark, are low, with funding basically flat over the past 10 years.

The proliferation of agencies for research and funding has created unnecessary complexity and overhead, leading to a new 10-point Science Manifesto. A CRI taskforce is now identifying how to turn these issues around for New Zealand's public sector R&D.

Australia

Meanwhile in Australia, CSIRO has considered how the context of a viable institutional research approach may have altered as a result of the evolving complexities of the global economic environment. While CSIRO's focus in recent decades was on productivity, transparency, accountability and responsiveness, now the identified challenges involve large and complex targets such as environmental, social and economic pressures – all global issues.

While CSIRO views its scale, breadth and depth as advantages in this environment, it understands that success requires strong management if it is to draw out the full value of its endeavours.

Australasian industrial R&D managers clearly recognise that they exist in a global marketplace for competitive research and innovation acquisition. Cost, productivity and quality are watchwords. Sourcing technology – not just externally in Australasia, but globally – is a key ingredient for any technology program, especially within Australasia's larger companies.

For Australasian public sector research organisations, their traditional emphasis on a national responsibility and return, relative to the competitive global market for quality research, is increasingly a pressure point. One positive perspective, in this regard, is that CSIRO now seeks to ensure Australia always has a seat at the important international science tables.

Key issues

Speakers identified the many challenges in 'Innovation Measurement' – a relatively young science, crowded by complexity and still evolving. Therefore, international comparisons can be difficult, with disparate input and outcome measures still in development. Key ingredients were identified in a recent international study, including:

- a culture of innovation is critical to success;
- access to (rather than ownership of) the best global R&D centres is critical;
- it is all about accessing skills and expertise;
- location barriers may be more about the availability of

working visas than tax credits; and

- quality – not cost – is paramount: the best will only work with the best.

Key points made in conference discussions included:

- operating in a global versus national framework requires everyone to understand the strategic framework of a project (not just the technical aspects). Value decisions depend on this understanding – and on asking good questions;
- the key issue has become the management of a total innovation process, rather than just of the technology or a laboratory;
- globalisation is yet to become a two-way street for Australasian R&D – usually it is those 'Down Under' on the late-night-end of international teleconferences;
- while research departments might previously have been distributed globally (but bringing people together as needed), today's dispersed technology networks often operate across open innovation environments. Now key players in any network may not all be from the one company;
- having the best people available is crucial but, with reducing R&D investment in Australasia (relative to some other countries), there may be reduced opportunity to continue developing good people. Placing the right people in the right roles was widely acknowledged. Today, some industry managers view a PhD as still very oriented towards an academic research career, with training elements not well aligned with the required experience for a successful industrial career;
- in one outsourced R&D program, the failure to negotiate a satisfactory IP ownership agreement was noted to be a sufficient reason to drive R&D offshore; and
- return-on-investment evaluation of ongoing programs continues to be very challenging, especially in terms of how to present a convincing assessment to the senior management committee. ◀

MS LEONIE WALSH is an Associate with Capstone Partners

specialising in activities related to technology commercialisation and new ventures. She has a BSc and MSc from Swinburne University, and an MBA (Exec) from the Australian Graduate School of Management. She has more than 20 years of technology and business leadership experience across a range of industries, locally and internationally.

DR GREG SMITH is a Co-Founder and Director of Melbourne-based venture capital company SciVentures Investments. Before returning to Australia, he worked as Director of the Alcoa Technical Centre in Pittsburgh and, previously, as Vice-President of AlliedSignal's Corporate Research & Technology New Jersey and Illinois-based laboratories. His technology innovation management experience began with Exxon Chemical, working in Australia, the US and Belgium.

Lean and agile innovation means removing waste

Ideally, you have to be the competitor who consistently, reliably and profitably provides the greatest value to the customer first.



Richard Paynting

richard.paynting@rapidinvention.com

Lean development is not about trying to do R&D on the cheap. It is about removing the waste that is intrinsic in our R&D processes – primarily due to poor requirements development and ineffective risk management.

These sources of waste cause most of our cost overruns and delays, resulting in late market entry, low margins or filing IP too late to benefit from it.

Value is usually considered to be to be 'Quality + Performance/Price'. But taking into account the premium paid to the lone supplier of a great innovation or the first to file IP, value to the innovator may be better represented as 'Quality + Performance/Price ÷ Number of Competitors'.

In the global market, being competitive on quality, price and performance merely gets you into the game. Given this, the rank order of your entry into the market determines how well you will be rewarded. Time-to-market matters and speed relate to not wasting time on non-valued activities.

Projects regularly run between 125 to 200 per cent over budget and/or time. Problems usually do not lie in the quality of our staff, ideas, technology or financing. The most significant causes of cost overruns and delays are found in the areas of productivity and product definition.

Reviewing the best available models for managing our innovation process led to implementing a variation of John Boyd's OODA principles (see Figure 1).

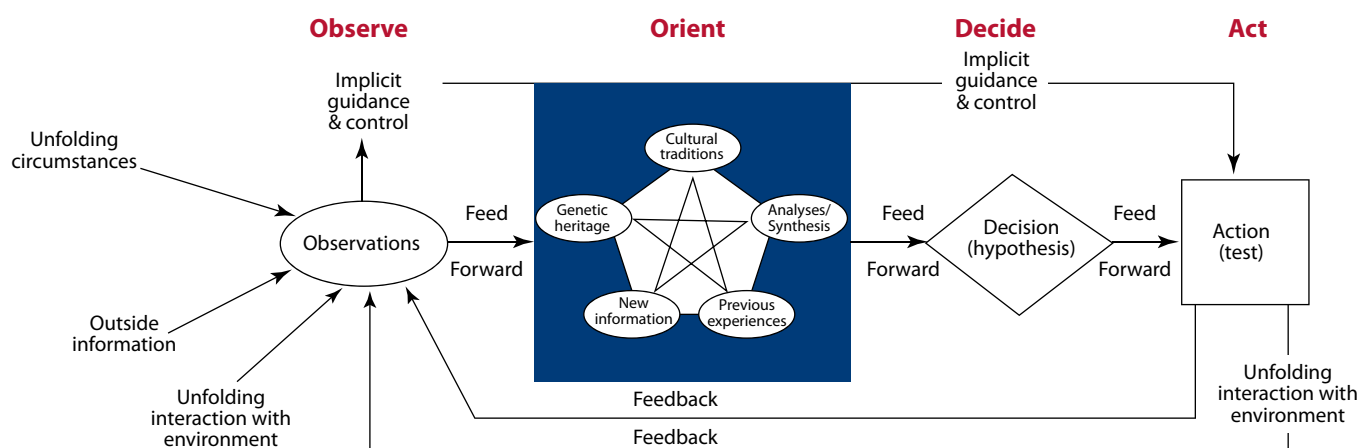
The OODA loop was originally designed to increase the success and survival of fighter pilots.

- **Observation:** this phase is about intimately understanding your customers' and stakeholders' purchase and business decision-making process.
- **Orientation:** here you make sense of what you have observed and develop scenarios of how the customer and market think and work.
- **Decision:** in this phase you formulate strategies for action and then select the one that best meets your requirement metrics.
- **Action:** this phase is the execution of the strategy – the goal is to execute better and faster than your competition.

For fighter pilots, slow or indecisive progress through the OODA cycle is very Darwinian – you're dead. In business, death is slower but inevitable. Being the fastest through the loop forces your competition into a state of continually reacting to you, it becomes business by Blitzkrieg.

Agility beats a crystal ball most of the time. If we had the ability to act instantly on real-time information we would not need to rely on crystal balls, predictions or es-

Figure 1 John Boyd's OODA loop





Waste not, want not.

As global fresh water becomes scarcer, supply is increasingly reliant on desalination. Desalination however, is not only costly but concentrated brine discharges pose ecological concerns and disposal challenges. ITEK, the Technology Transfer Company of the University of South Australia, has established a joint venture to commercialise a revolutionary technology which promises to convert desalination waste products into a saleable commodity.

UniSA's Associate Professor Linda Zou at the SA Water Centre for Water Management and Reuse developed the innovative process which converts salt from brine – a by-product of desalination processes – and carbon dioxide and waste gases from combustion sources, into fresh water and soda ash.

Soda ash is used primarily in the manufacture of glass and also soap, detergents, water treatment chemicals, pulp and paper. It is currently produced using the Solvay process which is highly energy intensive and emits greenhouse gases including carbon dioxide and other waste products into the environment.

ITEK has supported the technology's development since 2008 through its Catalyst Funding Program and a patent application is pending. The new company, Lased Technologies Pty Ltd, was incorporated in March 2010 and is a joint venture between ITEK (UniSA), Desal Systems Pty Ltd and Gambit Technologies. The industry partners bring significant related engineering and capital raising experience as well as a strong industry network to the joint venture.

This synergy of innovation, strong commercial expertise and industry networks, again demonstrates why UniSA is fast earning a reputation for quality research which is making a real difference to our world and its future.

To find out more about research or technology transfer at UniSA, visit unisa.edu.au/research
itek.com.au



New technology is helping to convert desalination waste products into useful products such as soda ash. The cheaper and less energy intensive method also benefits the environment through a reduction of greenhouse gas emissions into the atmosphere.



Advancing knowledge
through innovation



timates. It is easier to operate closer to real time than it is to produce accurate long-term projections. Predictions are useful for developing trends and general direction, but specifics should be derived from near-real-time information.

Agility requires constant interaction with the business cycle and the business ecosystem. Agile businesses are organised to respond to the learning and discovery provided by a good customer-development process.

To quote Ari de Geus: “The only sustainable competitive advantage is to outlearn your competitors.”

Figure 2 shows the knowledge development and flexibility curves for a typical project. The problem is that without rapid learning you learn what you need to know about the time it becomes very difficult and expensive to act on it.

The red curve depicts the relative freedom of choices you have versus time. Flexibility decreases as you become more committed to directions that have already been taken. The solid blue curve depicts the rate of knowledge acquisition as the project progresses. The dotted curve represents using an accelerated learning process to move the elevated state of knowledge to a point where high flexibility is still available; hence maximising the ability to innovate with lowest possible cost and delay.

OODA and its supporting tool set provide the framework for this accelerated learning:

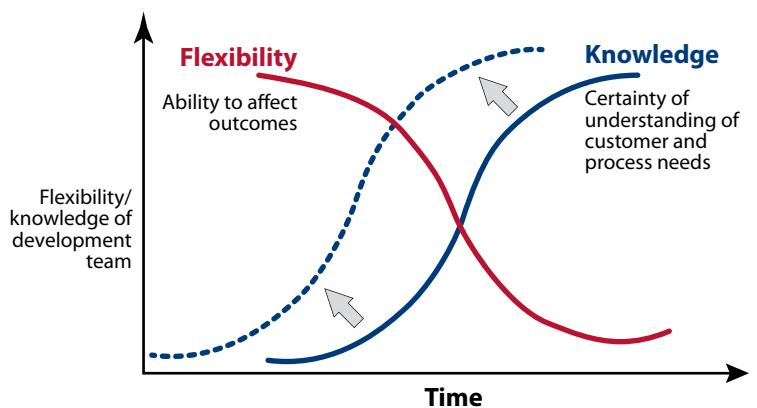
1 Initial planning and framing

The initial planning phase (Observation and Orientation) engages team members from each of the functions required to deliver the product, service or innovation with customers and other stakeholders. The purpose in the observation phase is to turn team members into near-perfect proxies for the customer, with intimate understanding of the customer’s real needs and their context of use. This activity also increases cross-functional interaction, understanding and respect. It is also the foundation for rapid learning.

Therefore it is imperative to have a solid observation and customer development processes which allows team members to accurately define and interpret requirements. They also concurrently develop the insight necessary to make the thousands of decisions that occur in the development process in a way that the customer values most. It is about translating and building into the design what the customer really values.

Customer development should not be outsourced. Any person or process that isolates the team from the customer reduces insight, empathy and effectiveness. However, professional facilitation of this activity greatly improves its quality.

Figure 2 Required change in learning rate



2 Risk mitigation

Risk analysis and mitigation predominantly occurs during the orientation and the decision-making phases of the business operating system. Most of the delays and cost overruns are traceable to poor risk management and contingency planning. The basic components of risk are:

■ Business risk – customer targeting and development.

The first order of risk reduction is through accurate requirements and metrics generation, ensuring that you work only on what customers and other stakeholders value most. All customer requirements should be qualified by the customer development process.

■ Technical risk.

Risk management reviews must evaluate the technical direction for feasibility and implementability within the prescribed time and budget. It also reviews whether or not supporting technologies are available.

■ Structural risk – avoidable risks built into the project during planning.

Key to effective risk management is a system for revealing hidden risks particularly those that were built into the project plan as it was developed. Some structural risk is related only to poor sequencing of workflow. Other structural risk is related to basing the project on unsubstantiated assumptions. These built-in structural risks form a large percentage of what appears to be unforeseen risk. However, with design structure modelling (DSM), these risks can be identified and eliminated before the project commences.

■ Unforeseen risk.

This is the unavoidable incidents which impact negatively on project cost and delivery. To manage these risks you need to be able to run real-time cost and time contingency plans. Through the use of appropriate tools once again DSM is a very useful tool.

3 Implementing opportunities without incurring added risk

Changes in a plan either occur because of problems related to risk or through opportunities that become available from tech-

nical innovation and the customer development process. Like risk mitigation, opportunity management requires developing contingency plans that are efficient and effective and which don't have the negative effects of unintended consequences.

4 Operational excellence

Operational excellence is based on several factors. First is excellent technical capability; second is an operating plan that is designed for optimal efficiency, effectiveness and visibility to all stakeholders; and third is excellent control of workflow.

Key tools and processes

Many well-known tools are used to support the OODA process. The following three tools are less well known, but have been used by industry leaders in aircraft, automotive and construction.

- Customer development is the initial and continuing interaction of the design team with the end customer and delivery chain to initially qualify and then continually update the complete value proposition.
- Minimum Viable Product is the use of very minimal prototypes to expose design intent to all stakeholders in order to engage them in an ongoing

value optimisation process.

- Design structure modelling (DSM) is one of the most significant additions to the project manager's toolbox in many years. Traditional tools have only exposed about 50 per cent of the total interactions within the project, missing almost completely the domain where greatest risks reside. DSM's ability to optimise projects for efficiency and effectiveness is unsurpassed. ◀

More information

For more on OODA visit www.fastcompany.com/magazine/59/pilot.html. For an overview and tutorials of the DSM method and its risk and complexity management capabilities visit www.dsmweb.org and www.projectdsm.com.

MR RICHARD PAYNTING served as CTO with Klipsch Audio Technologies, where he was responsible for product innovation and design engineering for all Klipsch market segments until his retirement mid-2008. Before that he was CTO for Helix Technologies for three years, director of new product concepts at Bose Corp for nine years, where his team developed the LifeStyle music and Wave Radio systems and managed product development and operations groups in Europe and Asia for several original design manufacturers. He moved from the US to Australia in 2008 and now lives in Bendigo.

Excellence in delivering information

- Professionally written and produced publications
- Information products that showcase R&D at work
- Our passion is creating content that matters

Coretext specialises in developing publications for organisations devoted to knowledge-raising through science, education, research & development. We provide communication strategies, editorial, design, production and publication distribution for a broad range of clients and audiences.



coretext
CONTENT MATTERS

Innovation rests on engaging multiple stakeholders across the value chain

Problems and opportunities drive innovation, not just technological developments – addressing these topics should be the antecedent of any economic development initiative.



By John Kapeleris

john.kapeleris@ausicom.com

It is well recognised that businesses, particularly small to medium enterprises (SMEs), are the engine room of the Australian economy. For SMEs to grow their profitability and create a sustainable competitive advantage in the global market they need to access or adopt business innovation capability.

The Australian Institute for Commercialisation (AIC), a leading service organisation assisting innovators to take their ideas to market, argues that although Australia can continue to focus its funding, support and development programs at the individual entrepreneur or firm, considerable impact can occur by targeting development programs at the industry level – to build and strengthen value chains, enhance collaboration and increase business innovation – where Australia can achieve a global comparative advantage.

The AIC has supported and assisted thousands of businesses and the two main topics that businesses generally have at the top of their agendas are:

- The issues/problems they are trying to address.
- The new opportunities they are trying to capitalise.

Problems and opportunities drive innovation in firms, not just technological developments. Therefore, addressing these two topics should be the antecedent of any economic development initiative. However, not all businesses are the same.

From the AIC's experience, businesses can generally be segmented into three broad categories, as shown in Figure 1:

- the new entrants or low innovators (status quo businesses);
- medium innovators or 'Rising Stars' which are innovating but lack a particular capability or resource; and
- the high innovators or 'Stars' which are successfully innovating and creating a competitive advantage.

Consequently, assistance, support, funding and incentive programs should be segmented accordingly to create the greatest impact for the particular business segment (Figure 1).

Moreover, the new entrants or status quo businesses

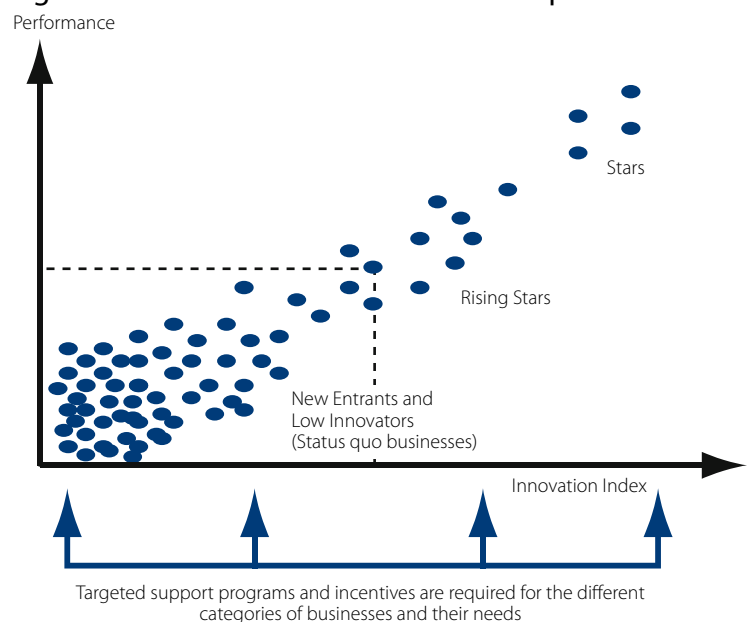
– which may be under-resourced and struggling – place a considerable burden on the innovation ecosystem of an economy. A number of factors contribute to their predicament, including lack of early-stage risk funding or follow-on funding, operating in competitive market segments, inability to access or attract experienced human resources, or lack of operating infrastructure.

For many of these businesses "fast failure" or considerable business model transformation would be the only options available.

The AIC – through its delivery of a number of innovation programs on behalf of the Australian and state governments, and its own innovation and commercialisation programs that are focused on addressing immediate issues and opportunities facing businesses – is advocating a new approach for 'status quo' businesses to access and adopt new knowledge, improve collaboration and enhance business innovation capability.

The new approach suggested is the 'AIC Industry In-

Figure 1 Level of firm innovation vs firm performance





When **science is in the headlines** the Australian Science Media Centre is there to make sure the media get the message straight. Independent and not-for-profit, the Centre aims to inform public debate by encouraging scientists to better engage with the media. With a growing database of over 2000 experts and 500 registered journalists you can't afford not to know about us! To find out more, visit our website at www.aussmc.org

ausSMC
| **australian science media centre**

Figure 2 AIC Industry Innovation Framework

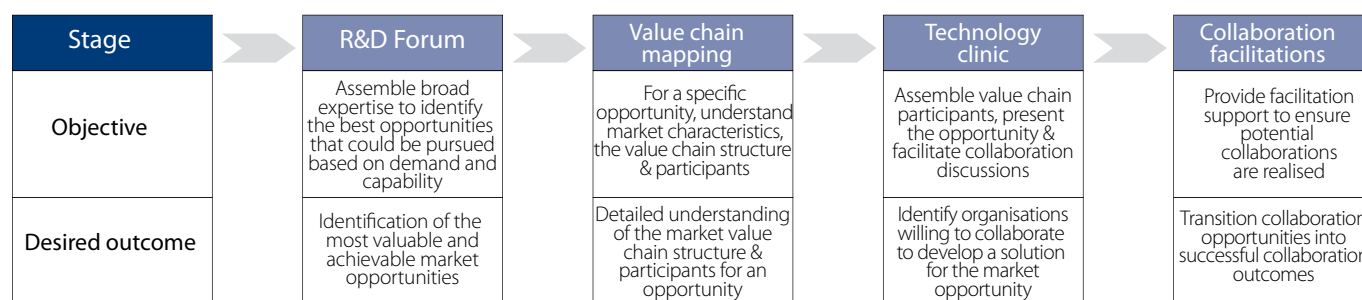
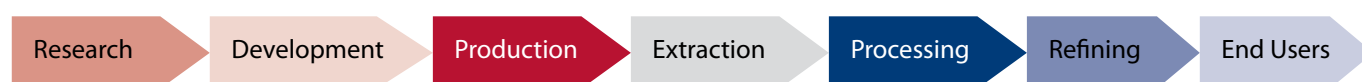


Figure 3 Algae-based biofuels industry value chain



novation Framework’ (Figure 2), which drives innovation and collaboration in industry, and is focused on development at the industry level.

The AIC Industry Innovation Framework engages multiple stakeholders across the value chain to develop specific industry sectors that can strengthen the nation’s economy by:

- adopting new knowledge or technology;
- enhancing collaboration activities;
- building value chains; and
- increasing innovation capability.

The core components of the Industry Innovation Framework are the Value Chain Mapping and the Technology Clinics (or TechClinic™).

Value chain mapping determines the activities and capabilities that a particular industry needs to develop so that it can build industry sectors.

For example, in order to establish a viable algae-based biofuels industry in Australia a large-scale algae production and oil extraction capability needs to be established. Australia currently has the research, development, processing, refining and end-user capability for this industry sector, but lacks adequate scale in algae production and oil extraction.

However, algae production and extraction integrate between the development and processing activities of the value chain (Figure 3) and therefore are integral to the building of a viable algae based biofuels industry in Australia.

The TechClinic™ is a forum that brings together multiple stakeholders (research organisations, industry, government and end users) across the value chain to interact and engage in collaborative activities. The TechClinic™ strengthens an industry sector that is fragmented and dispersed, and allows organisations and firms to identify the opportunities and overcome issues.

Government stakeholders who participate in the Tech-

Clinic™ forums are informed of the issues and opportunities, but also the specific needs required to build industry level capability in established or emerging economic sectors.

The TechClinic™ facilitates and encourages low innovating firms (status quo businesses), but also innovating firms, to collaborate with other stakeholders across the value chain to promote awareness of solutions available, provide networking opportunities with end-users and larger corporations, facilitate collaborative opportunities with researchers and other firms, improve uptake of technology, and increase industry and innovation capability.

To remain competitive in specific industry sectors, Australia must change its mindset, assume new paradigms of thinking and adopt novel globally leading programs to develop its industry capabilities.

Government funding, support and incentive programs must be aligned with the needs of industry sectors to build value chains and strengthen the organisations that operate across these value chains, in addition to specifically targeting the different categories of businesses and their needs.

Ultimately, it is the aim of the AIC’s novel Industry Innovation Framework to build value chains and develop industry sectors where individual entrepreneurs and firms can flourish and drive economic development for the benefit of the nation. ◀

DR JOHN KAPELERIS started his career in medical diagnostics, specialising in exotic infectious diseases, and spent 17 years in the biotechnology industry in diverse senior roles. His current role as Deputy CEO and Director of Commercialisation at the AIC allows him to use his lateral thinking skills to help clients take their innovative ideas to market. He has assisted numerous individuals, small businesses, universities, government agencies and large corporates to implement successful strategies and innovations. He has an MBA and is a Doctor of Biotechnology (UQ), where he currently holds an adjunct Associate Professorship.

Sustaining growth through productivity

Until now, reliable evidence on the quality of Australian management, and its link with productivity at the enterprise level, has been sparse.



By Roy Green

roy.green@uts.edu.au

Earlier this year, a new OECD report noted that “Australia needs to boost productivity to return to long-term sustained growth...”

The report highlighted the role of regulatory reform, infrastructure investment and workforce skills, but said little about the capability of Australian management to drive the productivity agenda.

The national accounts data has by now dispelled doubts as to the effectiveness of the government’s fiscal stimulus package, which we can see in retrospect was well-timed and calibrated. Treasury economists may not have an unblemished record in forecasting the future, but they understood the lessons of the past. Consequently, Australia is one of only three advanced economies in the world to record positive growth in the past year.

However, with the winding back of the stimulus, future growth and competitiveness are jeopardised by a legacy of poor productivity performance.

From being a leading performer in the late 1990s, following the last Labor government’s microeconomic reforms, Australia slipped back to be one of the laggards by the mid-2000s, despite the enhanced opportunities for investment in research and innovation afforded by the commodities boom.

Regrettably, the Howard Government not only failed to exploit the windfall gains associated with the boom to build on these reforms, but allowed it to mask a serious structural deterioration in the Australian economy.

Now the urgency of a coherent, coordinated approach to improving Australia’s productivity performance has been sharpened by the prospect of a new resources boom, bringing with it the familiar ‘Dutch disease’ associated with the North Sea gas discoveries of the 1960s and 1970s. Already we are seeing a higher exchange rate increasing pressure on trade-exposed industries and services beyond anything experienced in the terms-of-trade crisis of the 1980s.

This is why the US economist Paul Krugman remarked that “productivity isn’t everything, but in the long run it

is almost everything”. He also pointed out that the recent productivity spike in the US had more to do with short-term cost-cutting based on labour shedding than with the longer-term dynamic efficiency gains sought by northern European countries through schemes to retain and upgrade skills during the downturn.

Certainly, the international evidence suggests that workforce skills and capabilities are a key factor in the creation of a high-productivity, high-wage economy, as well as contributing to social inclusion. While this has resonance in the government’s “education revolution”, particularly the role of Skills Australia, it is also important to understand skills development in the broader context of knowledge and innovation as an ‘unexplained residual’ in the measurement of productivity.

Last year’s innovation White Paper *Powering Ideas: An Innovation Agenda for the 21st Century* not only lifted our sights with a 10-year program for public research and business innovation, but also recognised that innovation is more than science and technology – important though these are – and increasingly encompasses ‘organisational innovation’, including new business models, systems integration and high-performance work systems.

The White Paper made it clear that a future focus of the government’s industry and innovation policies will be on “building innovation capacity and performance at the enterprise level ... Making innovation work requires a workforce with sophisticated skills of all kinds, including leadership and management skills.”

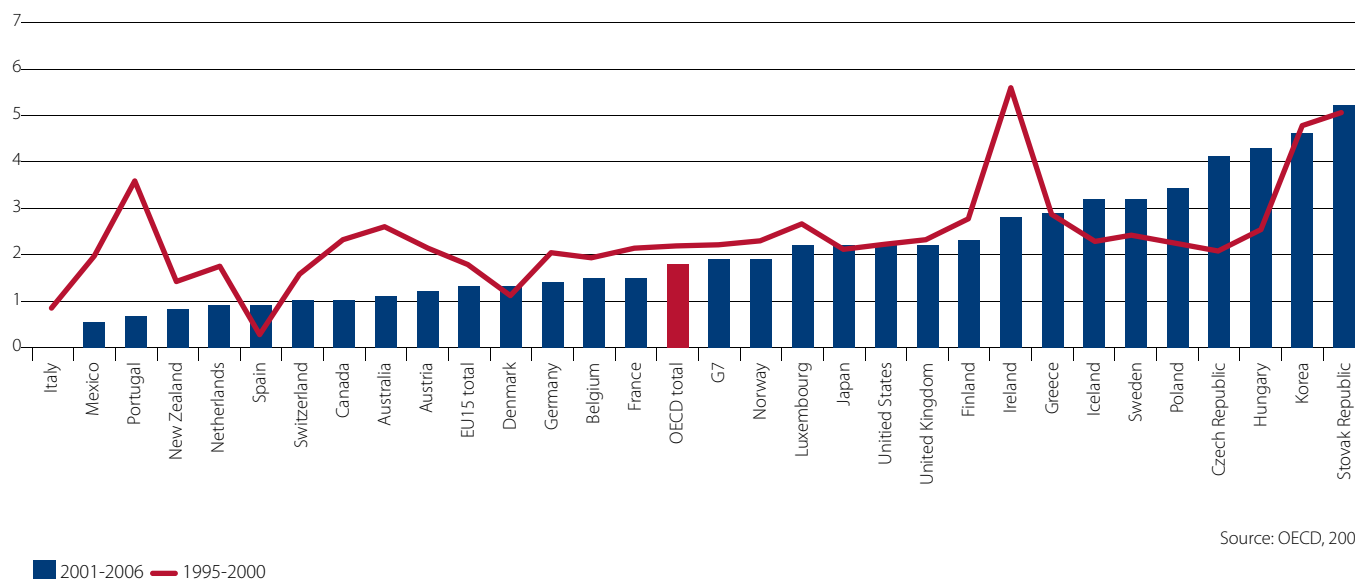
But how important is management to our performance in innovation and productivity?

Until now, reliable evidence on the quality of Australian management, and its link with productivity at the enterprise level, has been sparse – the last significant study being the 1995 David Karpin report on leadership and management skills, *Enterprising Nation*.

With this in mind, the Department of Innovation, Industry, Science and Research commissioned a new study

Figure 1 Labour productivity growth, 1995-2006

GDP per hour



Source: OECD, 2008

Management Matters in Australia: Just How Productive are We? as part of a global 16-country project led by the London School of Economics (LSE) and McKinsey & Co. The Australian component of the study was carried out by a multi-university team, which included the University of Technology, Sydney.

The purpose of the study was to inform the evolving design of the government's Enterprise Connect advisory services for small to medium firms, mainly (though not exclusively) in the manufacturing sector. Enterprise Connect is an unsung public policy success story of the current Government, with monitored results for more than 2000 clients in its two years of operation. As the LSE authors of the global project noted: "Governments can play their part in encouraging the take-up of good management behaviour. Doing so may be the single most cost-effective way of improving the performance of their economies."

A key finding of the Australian study, applying the LSE/McKinsey methodology, was that our managers, measured against 18 dimensions of management practice, rated about average for the countries surveyed but considerably worse in people management, particularly in the area of "instilling a talent mindset", which may be treated as a proxy for the innovative capability of organisations.

While managers of large international corporations rated highly across the sample, the differences among countries reflected to a great degree the length of the tail – a "tail of mediocrity" – among small and medium firms.

Nor was it surprising that the study also found a statistically significant relationship between productivity performance and the quality of management, which in turn was closely related to level of education. Australia fared

worse than most countries in this area, with only 44 per cent of managers holding a tertiary qualification. Yet the data also showed that many managers grossly overrated their own capabilities and performance, which raises questions about how a message about the need for change can most effectively be disseminated, let alone implemented.

Education may not be everything but, to paraphrase Krugman, it is almost everything when it comes to productivity improvement. For Australia's growth momentum to become self-sustaining, the next stage of reform must be ambitious and it must integrate the innovation agenda with the education revolution to promote a transformation of management and workplace performance.

Clearly, this is not a simple or straightforward task but it is an important one, and it will provide our firms and organisations with the best opportunity to generate new ideas and translate them into market success. ◀

** Professor Roy Green and Dr Renu Agarwal at the University of Technology, Sydney, led the Management Matters in Australia project, with the Macquarie Graduate School of Management and Society for Knowledge Economics.*

PROFESSOR ROY GREEN is Dean of the Faculty of Business at the University of Technology, Sydney. He is a graduate of the University of Adelaide, with a PhD in economics from the University of Cambridge. He has published widely on innovation policy and management and has worked with universities, business and government in Australia and overseas. He is chair of the Federal Government's Innovative Regions Centre, CSIRO Manufacturing Sector Advisory Council and NSW Manufacturing Council and a member of the Enterprise Connect Advisory Council.

Building on STELR success

The STELR Stage One Project 2010 is running in more than 180 schools across the country

During March, 370 teachers from schools in all states and territories attended STELR professional learning seminars in Melbourne, Brisbane, Sydney and Perth.

The STELR Project has been enthusiastically received by teachers and students alike.

THE STELR PROJECT:

- STELR is an exciting new curriculum program that aims to reverse the low level of interest among students in science courses and careers.
- STELR targets students in Years 9 or 10 – and their science teachers – and will be provided free of charge to more secondary schools from across Australia in 2011.
- STELR is a 6-to-10 week package involving inquiry-based activities. It engages students through investigations into global warming, climate change and renewable energy resources.
- STELR operates within the curriculum. It is intended for delivery to all students in the year level.

PARTICIPATING SCHOOLS RECEIVE:

- a comprehensive set of curriculum materials, including teacher resources and student activity booklets;
- class sets of solar and wind laboratory equipment (yours to keep);
- free attendance for two teachers at a two-day professional development seminar to be held in major centres in March 2011;
- teacher release funds, air fares and accommodation, where appropriate, for teachers to attend the professional development seminar; and
- on-going support throughout the year.

Don't miss this chance to take STELR to your students. Register an expression of interest for your school on-line today at www.stelr.org.au

Find out more about STELR by visiting the web site or contact the STELR Project Manager Peter Pentland (03) 9864 0906 or peter.pentland@atse.org.au

The STELR Stage One Project 2009-2010 is supported by the Australian Government.



"The enthusiasm for the program expressed by the teachers, as well as the highly topical contexts around which the program was developed, makes it highly likely that the students will also find the program engaging. In fact, we believe that the provision of more units along similar lines to the current STELR program would go a long way towards ensuring that high quality science curricula, in line with the National Curriculum and utilising appropriate pedagogies, would be implemented across the country."

– Mark Darrell, Assistant Principal, Mathematics and Science, Hallett Cove School R-12
President, Mathematics Association of South Australia

 **ATSE**
STELR

Navigating public policies to improve innovation performance

Government intervention in innovation is still hotly debated because it is regarded as principally the responsibility of the private sector.



By Amanda Caples

amanda.caples@iird.vic.gov.au

For at least a decade, innovation has been at the centre of economic policy development by governments around the world – because innovation is strongly linked to business growth across sectors.

Industry largely recognises the importance of innovation and industry leaders generally welcome government assistance to help mitigate the inherent risks of innovative activities. If this is true, why is Australia still behind its OECD peers on a range of innovation indicators? And how can industry R&D managers better navigate public innovation policies to help improve their own innovation performance?

It starts with a better understanding of government: where government has a role, what government needs to make investment decisions, and what outcomes governments seek.

Generating economic activity

To begin to understand the role of government, it is important to first differentiate between research and innovation. The two terms are often used interchangeably but there is an important difference, especially from a policy perspective. Research is about creating new knowledge, whereas innovation is about converting that knowledge into value by the generation of economic activity.

Government's role in the former is generally well accepted by policymakers as a public good and, in Australia, research is supported primarily through Federal programs such as those available through the Australian Research Council. On the other hand, government intervention in innovation is still hotly debated because it is regarded as principally the responsibility of the private sector.

Framework conditions

At a state level, Victoria's science, technology and innovation policy has aimed to transform Victoria into a knowledge-based economy. Successive Victorian innovation statements have focused on the support of framework conditions – infrastructure, skills, regulation and information diffusion.

There have been several concurrent aspects to this poli-



The beamline at the Australian Synchrotron in Melbourne.

cy's implementation. We have built research infrastructure, such as the Bio21 Institute and the Australian Synchrotron, thereby enabling greater competitiveness of Victorian industry by allowing firms access to highly competent research and world-class facilities.

We established competitive Science Technology and Innovation (STI) Initiative grant rounds, which have helped to fund collaborative research-industry partnerships.

We have built commercialisation capability through Technology Commercialisation Programs that leverage similar Australian Government programs and we recently introduced the Smart SMEs program that recognises innovation demand.

Victoria's policy position has been successful and, according to a recent evaluation, the STI Initiative generated an increase in Gross State Product equivalent to between \$2.40 and \$3.56 for every dollar of Victorian Government funding provided.

Making investment decisions

Specific selection criteria differ slightly from program to program but, generally, Victoria makes innovation invest-

ment decisions according to four overarching principles:

- What is the nature of the problem – what are its effects?
- What are the available strategic interventions – the lever (skills, infrastructure, regulation) that we can pull?
- What are the benefits – the value we can create?
- What is the solution – the changes required to deliver the benefit?

These principles sit at the centre of government's own decision-making on public-sector investments, whether in education, health or transport. The four principles are also familiar to industry because investment choices are made at board-tables around Australia on a similar basis.

It means that between the public sector and industry there is a common understanding and process for making investment decisions. The language may appear different at first, with government seeking interventions that drive long-term capability development, such as skills and infrastructure, rather than a subsidy.

But in terms of outcomes, the "benefits" that government seeks are broadly the same as industry – the generation of value, growth and economic activity. Governments

also look specifically for investment, jobs and exports at an economy-wide level.

Clarity against the four overarching principles is essential for success. Accordingly, we have started using the 'Investment Logic Mapping' (ILM) process (see Figure 1) in an increasingly explicit way with stakeholders.

As a result, applicants in our grant programs find it simpler to deliver a better product – including identifying solutions they would not necessarily otherwise have considered. It also helps to make sure we, as public servants and facilitators of innovation, receive proposals we can respond to more efficiently.

Coordination and sector impact

While the ILM process is a useful tool to make a particular investment case, it is not always sufficient.

Unlike the private sector, government is accountable to a broader range of stakeholder interests. Government also has additional policy interests such as maximising spill-over benefits. These result in an additional layer of consideration when assessing investment proposals for govern-

Innovation System Report 2010

The *Australian Innovation System Report 2010*, the first of a new annual series of reports on the performance of Australia's national innovation system, delivers the Australian Government's commitment in *Powering Ideas: An Innovation Agenda for the 21st Century* to produce an annual report on innovation.

The report – launched by Innovation Minister Senator Kim Carr at the opening of 'Collaborating for Success', the inaugural conference of the government's innovation advisory bodies – outlines:

- metrics and baseline indicators which compare Australia's innovation performance to other OECD countries and tracks progress against the government's innovation priorities and targets – these metrics are presented under the four policy themes identified in *Powering Ideas*: skills and research capacity, business innovation, links and collaboration and public sector innovation;
- features and trends of the Australian innovation system and performance as a whole, including Australia's performance on Gross Expenditure on Research and Development (GERD), investment in

knowledge, proportion of innovating businesses, collaboration and networking, skills used and shortages and trends in Multi-Factor Productivity (MFP) growth; and

- actions, achievements and forward plans of various participants in the national innovation system, including governments, public sector researchers, and industry.

Senator Carr said the *Australian Innovation System Report 2010* showed that business expenditure on R&D had almost doubled over the past decade, rising from a low of 0.67 per cent of GDP in 1998-99 to 1.27 per cent of GDP in 2007-08.

Importantly, he said, the report sets a baseline against which Australia's future innovation performance could be assessed, allowing concrete measurements of progress on the targets and ambitions outlined in the government's innovation statement.

It also described strategic measures taken by governments, businesses and research



institutions to boost Australia's innovation performance.

"Putting money into R&D will lift Australia's productivity and create new high-skilled jobs," Senator Carr said. "While the increase in private sector R&D spending is pleasing to see, much more work remains to be done by both industry and government."

"If Australia's productivity is to grow, we need to make sure that all stakeholders – industry, the research workforce, the community and governments – are working together."

"This includes working closely with our international partners so Australia can benefit from the vast amounts of knowledge created offshore," he added.

ment funding than might otherwise occur in industry.

Consequently, we have additional questions we must ask, in addition to the triple-bottom-line questions of social and environmental impacts:

- Is there industry support more broadly for this initiative?
- What are the spill-over benefits?
- In a crowded and complex market, does the provision of government support give rise to disadvantage to another player (that is to say, is the proposal competitively neutral)?

These considerations are highlighted because industry coordination is not usual in the private sector – where focusing on core business and growing market share are priorities. As such, coordination is often overlooked by industry in applications to government funding programs.

But, in highly competitive government programs, coordination can make all the difference. It sends a message that this problem is of broad importance. As with any investor in a constrained funding environment, government is going to prioritise projects that maximise returns, for all.

The ILM tool can be used for sector engagement and coordination and in Victoria we have started to use it in this way. For example, in Victoria's current Science Agenda Strategic Projects Fund (which seeks to build technology capability), all short-listed project consortia were invited to participate in an ILM workshop to sharpen their thinking before commencing the detailed business planning process.

Stakeholder feedback has been positive, business plans have improved and benefits are more likely to be realised.

Measuring outcomes

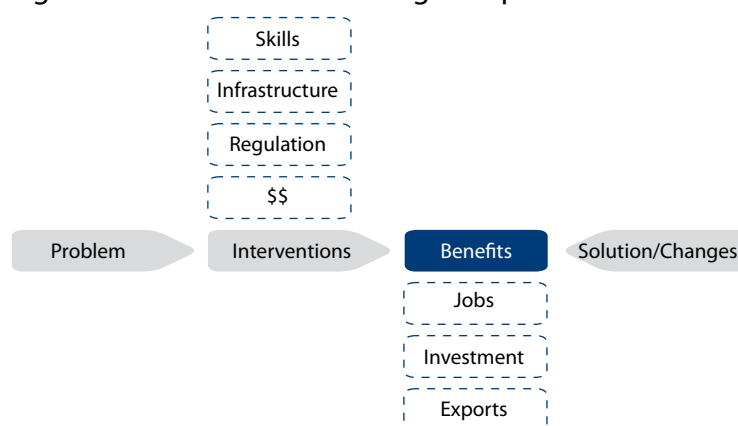
Innovation is a long-term endeavour. The relationship between activity and outcomes is non-linear and the lag between investment and benefits realisation is seven to 10 years. There is an urgent need for good measures of innovation – to inform better policy and to maintain government's commitment to the field. More than ever, we are coping with ever-increasing budget pressures to deal with the 'here and now' at the expense of the future.

The Victorian Government recognises the importance of monitoring and evaluation. Eight years ago we developed an outcome-monitoring tool, which has been applied from commencement of many of our STI grants.

We apply this tool on an annual basis and capture data related to five outcome areas: collaboration, skills, science awareness, commercial and research outcomes. This enables us to generate qualitative and quantitative data to estimate the contribution of innovation to broad economic performance, thereby attempting to close the investment/benefits loop.

We formally evaluate the STI program every few years, with the most recent evaluation reported late last year.

Figure 1 DIIRD's investment logic map structure



While the full benefit realisation of the STI program is just starting to be observed, to date the program has attracted 528 researchers from interstate and overseas and supported more than 2400 collaborations between research and industry. This increased activity is estimated to add \$1.7 billion to gross state product and more than 7000 new jobs.

Innovation partners

The Victorian experience is that innovation policy brings industry and government together, as partners, in a way not experienced to date.

Tools such as the ILM provide a framework around which solutions can be developed to our common problems.

Industry R&D managers have a pivotal role in this process. Greater understanding of government's role and broader consideration of the changes required to deliver value for all will drive Australia's innovation performance. ◀

More information

- *Impact Assessment of the Science, Technology and Innovation Initiative*, October 2009, www.business.vic.gov.au.
- For further information on ILMs contact the Investment Management Unit, InvestmentManagement@dtf.vic.gov.au.

DR AMANDA CAPLES is the Director of Biotechnology and Science & Technology Programs in the Victorian Department of Innovation, Industry and Regional Development (DIIRD). She joined the Victorian Public Service in 2002 after a successful 15-year career in the private sector developing and commercialising pharmaceutical and biotechnology products. Dr Caples has led the development of successive Biotechnology Strategic Development Plans and related policy statements. She has had a significant role in major research capital initiatives and has been responsible for regulatory reforms including stem cell legislative reform and the establishment of a single ethical review process for multi-site clinical trials in Victoria.



Dr David Nisbet, Materials Engineering

Engineering a healthier future

Monash researchers from engineering, science and medicine are collaborating to help solve health challenges of the 21st century. The combination of technical and scientific expertise is leading to holistic outcomes that will change lives.

Current ground breaking projects:

- Tissue engineering research to develop replacement nerve tissue
- Re-engineering polymer-based biodegradable fibres, 100 times smaller than a human hair, to create a 3D scaffold that may enable stem cells to repair damaged nerves more quickly and effectively
- A needless drug delivery technology, Respire, which dispenses with the need for painful injections
- The Bionic Eye project team is developing a device that is implanted in the brain providing treatment for the majority of forms of blindness
- Developing artificial vision with the use of intelligent robotics

For more information email: james.friend@eng.monash.edu.au

www.monash.edu/research



MONASH University

Australia celebrates innovation

Each year, innovation and entrepreneurship are showcased during the Australian Innovation Festival (AIF). This year, the festival – the ninth – ran from 26 April (World IP Day) to 30 May, in all Australian States and Territories.

This year's festival theme, 'Building Sustainable Businesses', highlighted the importance of innovation during this period of regeneration after last year's global economic uncertainty.

"Australia has come through the global recession in remarkable shape but we should not underestimate the challenges that our businesses face in these changing and still difficult times," Innovation Minister and Festival Co-Chair Senator Kim Carr said, launching the festival. "Businesses must embrace new ideas and new ways of operating."

"Research and innovation are the keys to success in a highly competitive environment. They are not a luxury to be cast aside in difficult times," he said.

AIF was established in 2002 as a not-for-profit initiative to celebrate and showcase the best in Australian innovation. Its mission is to increase public awareness of the importance of innovation and entrepreneurship through a renewed emphasis on the three pillars of future economic growth – excellence in research, development and commercialisation. The AIF is the largest Australian industry festival.

AIF says it has national importance because Australians increasingly realise that innovation is the lifeblood of today's companies and the key to national economic success. "Those that fail to innovate are, at best, standing still, while those receptive to new ideas, realistic to challenges and prepared to make things happen will be successful," AIF says.

AIF is supported by an Advisory Council, of which ATSE Vice-President Mr Peter Laver AM FTSE is a member.

AIF has five key objectives, to:

- demonstrate the value of research, development and commercialisation;
- profile Australia's intellectual capital;
- reinforce the innovation and entrepreneurial process, from idea to market;
- facilitate networking between innovators and investors; and
- collaborate nationally and with each Australian state and territory.

Some 400,000 participants engaged in the 500-plus events this year, which opened with launch events in each state and territory capital. ◀



Queensland Innovation Festival 2010 launch attendees with Master of Ceremonies Carrie Hillyard FTSE. (Below) Attending the Queensland Innovation Festival 2010 launch (from left) John McTaggart, Rowan Gilmore, Trevor Neville and Scott Stewart.



Queensland AIF launch

The Academy and the Australian Institute for Commercialisation (AIC) hosted the launch event of the 2010 Australian Innovation Festival (AIF) in Queensland.

The launch event, titled 'Research Commercialisation – Are we there yet?', was attended by more than 60 people, including ATSE Fellows and members of a range of government and academic organisations.

The event was chaired by Dr Carrie Hillyard FTSE and commenced with presentations from Dr Rowan Gilmore FTSE, AIC CEO, David Henderson, CEO of Uniquist, and Anne-Marie Birkill, CEO of i.Lab, who provided their insights on the current state of commercialisation as it relates to the development of new products or services from university research.

Each speaker gave a presentation on commercialisation from their perspective and then engaged in a panel discussion on the pitfalls, recipes for success (or failure) and what could be done to enhance commercialisation processes.

Questions to the panel included the following.

- What do we need to do more of to achieve commercialisation?
- Are there particular patterns regarding the type of commercialisation projects being implemented?
- What are the gaps preventing us from achieving research commercialisation?
- How long will it take for Australia to achieve commercialisation equivalent to the US?
- Could Australia change its research commercialisation culture by providing tax incentives for investors?

The event was held in the Conference Centre at the Brisbane Technology Park.

ATSE Clunies Ross Awards recognise Australia's visionary innovators

Winners of the prestigious 2010 ATSE Clunies Ross Awards for excellence in the application of science and technology were announced at a gala dinner in Melbourne in May – including four ATSE Fellows.

The 11 winners' areas of endeavour – covered by six awards – included science, communications, health/medicine, nuclear science, microelectronics and mining.

The Award winners were:

- Dr John Boldeman FTSE (Lifetime Achievement Award);
- Mr Andrew Jessett;
- Dr John O'Sullivan, Mr Graham Daniels, Dr Terence Percival, Mr Diethelm Ostry and Mr John Deane;
- Dr John Parker FTSE;
- Dr David Skellern FTSE and Dr Neil Weste FTSE; and
- Professor Tim St Pierre.

The Awards once again recognised Australia's pre-eminent scientists and technologists who have bridged the gap between research and the marketplace.

The ATSE Clunies Ross Awards are made annually to people who have persisted with their ideas, often against the odds, to the point that their innovations are making a real difference to the economic, social or environmental benefit of Australia.

ATSE Clunies Ross Award Winners for 2010 follow in the footsteps of past winners such as Professor Ian Frazer FAA FTSE, inventor of the cervical cancer vaccine; Professor Graeme Clark AC FRS FAA FTSE, inventor of the bionic ear; Nobel laureate Dr Barry Marshall, who, jointly with Mr Robin Warren, discovered the bacteria that cause stomach ulcers; Dr David Boger FRS FAA FTSE, a giant in the world of fluid behavior; Dr Fiona Wood, inventor of spray-on skin; and Professors Martin Green FTSE and Stuart Wenham FTSE, international leaders in silicon cell technology.

The black-tie dinner in the Melbourne Town Hall, attended by more than 400 people, was addressed by Professor Alan Trounson,



John Boldeman

world-renowned IVF pioneer and stem cell biologist, who is now heading the world's wealthiest embryonic stem cell research group in the US. His address was titled 'Creativity in Biomedicine and Conversion to Benefits'.

Dr John Boldeman, Professor, Institute of Nuclear Science, University of Sydney, and Researcher/Designer, Australian Nuclear Science and Technology Organisation (ANSTO), won the Lifetime Contribution Award.

His career is a story of single-minded scientific brilliance combined with exceptional personal commitment to his goals – particularly in the establishment of two national icon projects: the ANTARES Tandem Accelerator and the Australian Synchrotron.

Both are extraordinary examples of commitment and determination of the highest order. He is the epitome of the quiet but persistent achiever. He has done more than most to elevate cutting-edge Australian science and engineering to world status.

Dr Boldeman's contribution to the establishment at ANSTO (Lucas Heights, NSW) of the ANTARES Tandem Accelerator is a story of singular personal dedication.

After five years of advocacy for a dedicated tandem accelerator in Australia, Dr Boldeman

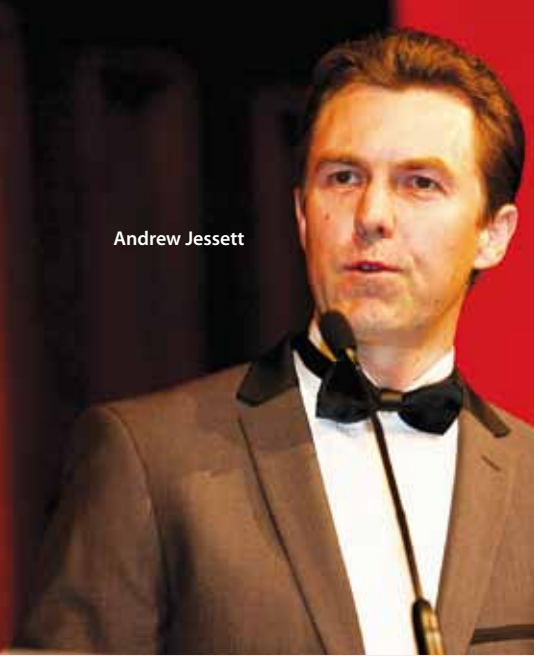
in 1989 got funding from ANSTO to recover and rebuild a tandem accelerator from the US. It was buried under 2.5 metres of concrete, but the ANSTO team removed all the equipment and packaged the entire 100-ton facility and associated plant in six weeks.

The Accelerator was in very poor condition and all equipment had to be refurbished, system optics completely redesigned and computer control systems designed and built from scratch by the staff of the Physics Division of ANSTO, led by Dr Boldeman.

He was also a key figure in the development of the Australian Synchrotron. He prepared the successful 1995 proposal for the Australian Synchrotron Research Program (ASRP) which received \$12 million funding. Dr Boldeman was appointed Facility Director at ASRP and its success saw the Australian synchrotron research community expanded to more than 300 by the time he left in 2001.

In July 2001 the Victorian Government announced it would build a national facility at Clayton and Dr Boldeman became the Foundation Technical Director and continued in this role until the end of 2002. He subsequently monitored its construction as Principal Scientific Advisor to the Victorian Department of Innovation and Industrial Development.

Andrew Jessett



Mr Andrew Jessett, Chief Executive Officer of MineWare Pty Ltd in Brisbane, was recognised for his development of mining technology.

As MineWare founder, CEO and inventor of the world-leading dragline monitoring technology Pegasys, Mr Jessett has made an outstanding contribution to the application of science and technology in Australia. His unwavering commitment, performance, persistence and dedication to exceed beyond expectations has been exemplary, establishing one of Australia's leading mining technology organisations with a range of the most technologically advanced, commercially successful mine-monitoring systems and intelligence solutions.

He has spearheaded the company's growth in new markets and extended its product range. This has contributed to the Australian economy and added significant value to the mining and technology industries – stimulating new product innovation, entrepreneurship, new export opportunities and the Australian mining technology sector on the world stage.

Mr Jessett was just 29 when he first developed Pegasys – a superior dragline monitor system and the first of its kind to employ the latest computing, electrical, communications, and GPS technologies. Since establishing MineWare in 2005, its Pegasys system now has almost 40 per cent of the Australian market, has also secured the company's first international sale in South Africa and continues discussions with a number of international mine operators in North America and India.



(From left) Monash University Vice Chancellor Professor Ed Byrne, with the WLAN Team: John O'Sullivan, John Deane, Graham Daniels and Diethelm Ostry.

The team behind a wireless technology that changed the world also won an award – for their work in inventing, patenting and demonstrating the wireless local area network (WLAN) technology that underpins the wireless communication system installed in almost every laptop computer and wireless device produced today.

The team of **Dr John O'Sullivan**, **Mr Graham Daniels**, **Mr Diethelm Ostry** and **Mr John Deane** (retired) – all from CSIRO – and **Dr Terence Percival** (NICTA) found a solution that had eluded some 20 major research groups, including those in companies such as Motorola, Lucent and Hewlett Packard.

As computers got faster, demand for technology that would allow large amounts of data to be sent over a wireless connection was clearly going to grow. This team foresaw that that a new generation of WLANs capable of transmitting data at 50 megabits per second (Mbps) would be needed.

Achieving it required a practical solution to a major indoor radio communication problem – the high frequencies at which fast, large data rate wireless systems work cause problems indoors because the signals bounce off surfaces, causing multipath interference, similar to the way the picture on an analog television can 'ghost'.

In beating these problems this team has shown budding Australian scientists and engineers what can be achieved through the combination of scientific excellence and commercial foresight.

Dr John Parker FTSE, Chief Technology Officer, Implant Technologies at National ICT Australia Ltd (NICTA) in Sydney, was awarded for his outstanding implant technologies research.

The hearing implant technologies developed under the direction of Dr Parker and his team at Cochlear Ltd have improved the quality of life of tens of thousands of recipients around the world and generated considerable social and economic benefit to Australia.

Dr Parker's career spans both academic research and commercial R&D, with his achievements winning recognition in both academic and commercial spheres.

After a successful academic research career, which included work on micro emulsions, biometric membranes, membrane biophysics and hydrophobic reactions, he moved in 1994 to Cochlear, the world's dominant supplier of hearing implant technology.

In a 14-year commitment to R&D in the field of implant technologies, he undertook a number of roles at Cochlear – GM Manufacturing, GM Design and Development, Chief of Operations and, finally, Executive Director and CTO. He contributed to 60 published patents at Cochlear and contributed to all areas of cochlear implant science, including new treatment modalities, new manufacturing techniques and new signal processing strategies.

In 2008 he joined NICTA, Australia's biggest ICT research organisation, and he and his team are focused on development of next generation technologies for active medical devices.



The answers to some of the world's most challenging problems lie in cross-disciplinary research.

World-class expertise and knowledge - all in the one place.

Our Research Institutes are taking new directions, applying new ways of thinking, and bringing together the best minds from over 50 disciplines. From energy and sustainability, to biotechnology and neuroscience, we're all working together to make a positive contribution to the world and provide cutting-edge opportunities for the next generation of researchers.



Research Institutes

A Global Research Powerhouse

researchinstitutes.melbourne.edu

Dr David Skellern FTSE, CEO of National ICT Australia (NICTA) and **Dr Neil Weste FTSE**, Director and Founder, NHEW R&D, became world leaders in microelectronics, leading to their Award.

The interwoven careers of Dr Skellern and Dr Neil Weste came together in 1997 when they co-founded Radiata Communications. This decision led to contributions to and the first implementation of a new international data communication protocol and eventually to the company being bought by Cisco Systems.

This led both to senior roles in Cisco's wireless networking business – Dr Skellern as Technology Director and Dr Weste as Engineering Director – before David moved to NICTA as CEO and Neil founded his own R&D company.

Radiata developed groundbreaking chip technology to enable very high speed communications over wireless local area networks (WLANs). The new technology would make it possible to run multiple channels of full-motion video and other multimedia traffic between PCs, hand-held computers, phones, TV sets and other devices – and compact the technology into an inexpensive Silicon Complementary Metal Oxide Semiconductor (CMOS) chip. This was a massive breakthrough in communications technology which led to Cisco's purchase of the Sydney company.

A key to their success in meeting and beating microelectronics design issues was their cooperation with other agencies, including CSIRO and international research laboratories.

Professor Tim St Pierre, from the School of Physics at the University of Western Australia, is a physicist who gave new hope to people suffering from iron toxicity.

Professor St Pierre has researched the magnetic properties of iron in biology and medicine for 25 years and has developed a non-invasive – and risk and pain-free – method of both measuring and imaging the tissue-damaging iron deposits in the human



liver caused by disease such as thalassaemia and hereditary haemochromatosis.

Measurement of liver iron concentration is especially important in patients who receive regular blood transfusions. Until recently liver iron concentration was measured by biopsy of the liver – a procedure dogged by pain and risk, which ruled it out for routine monitoring of patients.

The technology developed by Professor St Pierre and his team exploits the magnetic properties of iron and the availability of magnetic resonance imaging (MRI) scanners in major hospitals to magnetise the iron in the human body and then use radio signals to monitor the magnetic response of water molecules to the presence of iron in the tissues. From the signals emitted by the water molecules they were able to measure and image the tissue iron concentrations within the liver.

Their technology, branded FerriScan®, is now operating in 20 countries and more than 3500 patient measurements have been performed.



(From left) David Skellern, Neil Weste and Monash University Vice-Chancellor Professor Ed Byrne



Town Hall Organ a highlight

A highlight of the night was a brief exposition of the powers of the Melbourne Town Hall's mighty organ, by ATSE's President Professor Robin Batterham. An accomplished organist who has played all over the world, Professor Batterham put a great spark into the evening with a rendition of three pieces that showed off the power and style of the organ – the biggest in the Southern Hemisphere.

Nominations for the 2011 ATSE Clunies Ross Awards – which will be announced at a dinner in Brisbane in May 2011 – close on 26 July 2010. For details on nominations please call Rebecca Bone, 03 9864 0908 or email events@atse.org.au; download a nomination form at www.atse.org.au/clunies-ross-award



UNSW
THE UNIVERSITY OF NEW SOUTH WALES



CRICOS Provider No. 00098G

Leaders in Engineering and Science

- Internationally renowned for progressive research with a significant history of commercial innovation.
- Strong collaborative partnerships with industry, government and prestigious institutions worldwide.
- Success in securing funding from competitive national grants, industry and the community.
- Postgraduate students are offered highly competitive scholarships.

The Faculty of Engineering has the largest cohort of higher degree research students in Australia, addressing complex world issues including energy, health, water, infrastructure and ICT.

The Faculty of Science attracts many of the best Australian and international scientists comprising Federation Fellows, Eureka prize winners and Rhodes Scholars.

www.eng.unsw.edu.au

www.science.unsw.edu.au



Arthur Lowery inspects
fibre and amplifiers.

CA grants \$9.6 million to support 21 innovations

Commercialisation Australia's (CA) first grants totalling \$9.6 million will help 21 new Australian innovations become commercial realities, including new anti-cancer therapeutics and new technology to protect dolphins.

The Prime Minister announced the first-time funding support by Commercialisation Australia – the Government's new body to help Australian inventors, entrepreneurs and researchers turn their ideas into money-making products and services.

A diverse range of innovations from around the country won support, including treatments for disease, advanced materials, cutting-edge electronics, new online services, and a host of other innovations in agriculture, the media, manufacturing and beyond.

CA, which opened for business in January, recognises that Australians have always been creative innovators but, far too often, the rewards generated by our inventions and discoveries have been captured by others. It supports the modernisation of the Australian economy by increasing our focus on entrepreneurship, knowledge-based industries and new business growth.

Ofidium Pty Ltd, based in Victoria, was awarded \$1,543,742 to develop 100 Gbit/s optical transceiver modules, based on unique and patented optical orthogonal-frequency-division-multiplexing (OFDM) technology, for sale to telecommunications equipment manufacturers. This project involves the development, field-testing and customer validation of the design for product prototype. On completion, Ofidium will have a prototype design ready for manufacture and sale. Ofidium's optical OFDM technology delivers previously impossible levels of network performance for telecommunications carriers.

Other major grants went to the following.

- Immune System Therapeutics Ltd, NSW – \$1,858,349 to undertake a multi-dose phase II clinical trial to demonstrate efficacy of its

Ofidium's founder and Chief Technology Officer, **Professor Arthur Lowery FTSE (above)**, is a pioneer of optical OFDM and has been a leading optical innovator for more than two decades. He was awarded an ATSE Clunies Ross Award for his work in 2007. The original research for Ofidium was done by Professor Lowery and Professor Jean Armstrong in 2005–07. Professor Lowery's ATSE Clunies-Ross award was for his work founding Virtual Photonics (later VPIsystems), which was based on research on laser modelling.

Professor Lowery is also the Project Leader for the Monash Bionic Eye Project, funded by an \$8 million grant from the Australian Research Council's Research in Bionic Vision Science and Technology initiative. This is aiming for a cortical implant within three-and-a-half years, which will be suitable for up to 80 per cent of clinically blind people.

monoclonal antibody therapy in treating multiple myeloma. A successful antibody therapy for this incurable cancer would save hundreds of thousands of lives and generate substantial off-shore income for Australia. The trial is being held at one of Australia's leading blood cancer hospitals, the Alfred in Melbourne.

- EnGeneC Ltd, NSW – \$1,488,181 for the development of cGMP-compliant manufacturing of EDV-based anti-cancer therapeutics for commercial licensing. Potential commercial partners need assurance that EDV manufacturing can be scaled-up to cGMP standards, and are cost-effective, prior to agreeing licensing deals. Successful completion of the project will provide benefits to Australia nationally through the establishment of a globally unique manufacturing capability in a novel pharmaceutical delivery technology.

Crawford Fund

Annual International Conference



THE CRAWFORD FUND

*An Initiative of the Australian Academy of
Technological Sciences and Engineering*

Biodiversity and World Food Security

Nourishing the Planet and its People

Canberra

30 August – 1 September

Conserving and using biodiversity sustainably is vital if we are to feed the more than one billion malnourished people in the world. This conference will be a key event in the Australasian region related to the UN International Year of Biodiversity, and one of very few international events focusing on food security imperatives in relation to biodiversity conservation for developing nations and Australia.

The Minister for Foreign Affairs, The Hon Stephen Smith MP, has been invited to open the conference, and other keynote speakers include:

- Dr Cristián Samper, Director, National Museum of Natural History, Smithsonian Institution
- Professor Steve Hopper, Director of the Royal Botanic Gardens, Kew
- Dr Emile Frison, Director General, Bioversity International

Online registration and further information will be available at

www.crawfordfund.org

The Crawford Fund wishes to thank its supporters for the event



Students learn some mine-site technology.

Students really go 'hands on' at Extreme Science Experience

More than 350 Victorian Year 10 students and their teachers crowded into the Melbourne Town Hall in May to go 'hands on' with some of Australia's leading scientists and technology commercialisers at the Extreme Science Experience (ESE).

After presentations from the 2010 ATSE Clunies Ross Award winners, announced the previous night – and an opportunity to 'quiz the panel' of awardees before the lunch break – the students were able to get right into

some real science in a series of workshops.

The ESE event was compered by prominent science broadcaster Bernie Hobbs, with an opening address by Steve Herbert MP, the Victorian Parliamentary Secretary for Education.

The Keynote Speaker was Professor Alan Trounson, world-renowned IVF pioneer and stem cell biologist, who heads the world's wealthiest embryonic stem cell research group in the US.

Lauren Bartlett, Bronwyn Quint, Michelle Sanders and Avantika Banerjee facilitated four of the workshops for this year's Extreme Science Experience. All four work in Public Programs at Scienceworks Museum, part of Museum Victoria. They have a lot of experience in not only creating top-quality science programs for the public, but also managing student groups. Their expertise ensured that the workshops were not only well run, they were also full of fun and interest for the 300 students that took part in the day.

ESE attendees participated in one of five workshops during the afternoon, each devised with the Awardees and run by ATSE staff and facilitators from Scienceworks in Melbourne.

Workshop 1 – High speed and secure

Wireless local area network (WLAN) technology underpins the wireless communication system installed in almost every laptop computer and wireless device produced today. In this workshop students explored the factors that secure the information we all send via WLAN. Students were challenged to develop and use their own codes to send 'secure' messages most quickly and the most accurately.

Workshop 2 – When too many gigahertz is still not enough

WLAN communications can transmit data at better than 50 Megabits per second, but how well that data is sent and received depends on many factors. In this workshop students explored what optimises these factors. Students were then challenged to develop their own hardware to see who could transmit over a WLAN the best and the furthest.

Workshop 3 – Getting your insides out there

Every major hospital has a magnetic resonance imaging (MRI) scanner, and probably several computerised axial tomography (CAT) scanners. These machines have revolutionised how the diagnoses of diseases and injuries are made. Nearly all of us will have one of these scans in our lives. In this workshop students

► MORE ON PAGE 30



Compere Bernie Hobbs gets the ESE team revved up.

Academies call for better fix on public attitudes to new technologies

Australia currently lacks a mechanism to gather evidence on the formation of public attitudes to the introduction of new technologies, particularly the formation of attitudes to nuclear energy technology.

This is a limiting factor in achieving informed debate in the development of a national energy policy.

These are key findings in a research project recently completed by the National Academies Forum.

An Expert Reference Group comprising Fellows from each of the four NAF Academies was established to oversee the project. It was funded by the Australian Research Council (ARC) under the Linkage Learned Academies Special Projects.

The project was managed for NAF by ATSE, which engaged Professor Daniela Stehlik, then from Curtin University of Technology, Perth, as the study leader and author.

The project report, *Understanding the Formation of Attitudes to Nuclear Power in Australia*, was released at a CEDA function in Perth in April. The Project Manager and ATSE Executive Director – Technical, Dr Vaughan Beck FTSE, and Professor Daniela Stehlik both presented at the function.

Noting that a distinction needs to be made between ‘opinions’ and ‘attitudes’, the report highlights the crucial importance of a rigorously established base of community

attitudes for any future policy and program development and highlights the absence in Australia of such a process for gathering of this kind of evidence.

The report recommends that (with the support of the Australian Research Council) a national, high-quality, longitudinal program of research be established – similar, for example, to Eurobarometer* – to enable data collection on attitudes towards the many, disparate components relevant to energy and climate change policy.

Proposing the name ‘Ozbarometer’, the Report recommends that the program be established as a shared facility among key universities.

The Report also notes that the issue of nuclear energy – and energy technology security in general – is not front of mind with the Australian public and this current lack of salience is a barrier to the development of future energy policies.

It recommends that a program of community-based science education (along the lines of the program established by the former Centre for Low Emissions Technologies) be urgently established to support a broad and mature national dialogue.

It also notes that there is a lack of ongoing, rigorous and robust multidisciplinary dialogue and studies of the place of energy policy and energy technologies within the current debate

on national climate change and associated adaption and mitigation programs.

The Report also recommends that:

- Such a debate should be conducted in Australia, facilitated by the National Academies Forum;
- Such studies should be integrated into current developments including, for example, QUESTACON and science communication; and
- Interdisciplinary studies should be used to create awareness within science education at the primary and secondary levels as well as within the broader community.

This study sought to understand the development of Australian attitudes towards the use of nuclear energy for the large-scale generation of electricity.

In answer to the broad question – ‘How are Australian attitudes to nuclear power formed?’ – The study identified six pathways to attitude formation:

- Historical – key events were identified as having come to symbolise the points in history that have contributed to the development of people’s current attitudes to nuclear power in Australia.
- Cultural – symbolic forms (images, films, texts) drawn from popular culture continue to be used by individuals in explaining their support or opposition to nuclear power in Australia.

◀ FROM PAGE 29

Students go really ‘hands on’ at Extreme Science Experience

learned how these scanners help with making a diagnosis. They then used MRI scans to build a 3D image of the contents of their ‘patient’.

Workshop 4 – Our bionic future

Hearing implant technologies have improved the quality of life of tens of thousands of recipients around the world – and Australia has been a world leader in this field. In this

workshop students learned about these implants, how our brains filter signals and how technology such as MP3 compresses a signal. They then used software to generate signals and find out just what, and how well, they really hear.

Workshop 5 – Digging deep

Australia is incredibly rich in natural resources and the mines of Australia make

a huge contribution to the wealth of our nation. Getting minerals out of the ground on such a vast scale requires very advanced technology. In this workshop students explored this technology. Groups of students were given a ‘hands on’ challenge to see who could ‘run their mine’ the most efficiently and extract the most ore in a given time.

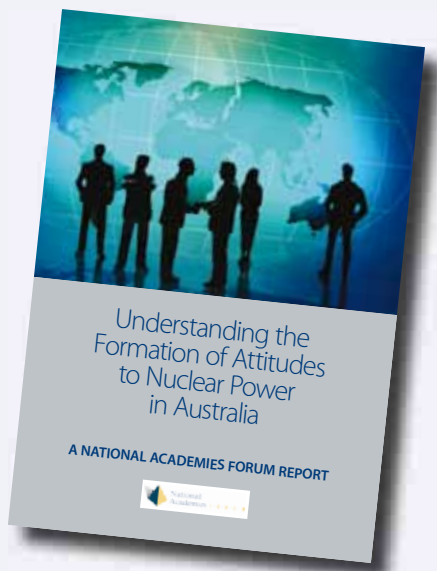


Vaughan Beck and Daniela Stehlik at the launch.

- Political – nuclear power in Australia can best be understood as a political rather than a technological, economic or resource issue.
- Media – as a mediator of cultural values and as a medium for the expression of views, attitudes and opinions, the news media act to present, interpret and re-frame events to a mass audience.
- International influences – the global climate change context has raised the issue of future contributions of nuclear power programs in countries with existing nuclear power stations. These debates are often referred to and compared with the Australian context.
- Educational – education is critical at two levels – the skills development associated with science, engineering and technology and the place of energy in society; and the history and impact of both civilian and military nuclear power.

The Report notes the topic has become more relevant as Australians are now well aware of the risks attributed to a continued dependence on fossil fuels for the nation's energy demands.

"Recently there has been a growth in public investment in the new technologies associated with low emission generation and in developing public education strategies for more efficient use of existing energy supplies. An investment in new technologies means that public acceptance of such technologies will be at the forefront of their development and long term utilisation.



"The role of science, technology and society, and what has been termed the 'social constitution of nuclear power', is reviewed in this study, as are the ways in which decision-making is affected by the perceived risks associated with the adoption of new technologies.

"This study does not include a large scale survey of current attitudes to new energy technologies or to nuclear power. It has been designed to undertake critical ground-clearing work about the debate thus far, and has been produced to enable a foundation for further, mature discussion," the Report says.

"By incorporating some very recent CSIRO Energy Transformed Flagship research and findings from community consultations, the study highlights a continued interest within

the Australian community for a low emission energy future, as well as the potential possible, within deliberative democratic processes, in facilitating the transfer of knowledge about very complex technologies.

"Finally, in regard to any future informed debate, this study has now brought together a wide range of information sources on the topic, including many multi-media sites, interviews, documentaries and articles, as well as the scholarly literature.

"Key opinion leaders have been interviewed for their views and an e-survey has been conducted of social networks, focussing on energy technologies and nuclear power.

"For anyone interested in learning more about the current state of the debate, this study now provides a base-line source of information," the Report adds.

**Eurobarometer is a series of surveys conducted regularly on behalf of the European Commission that produces reports on public opinion about issues relating to the European Union. The Eurobarometer program, running since 1973, was conceived to track and analyse public opinion and to improve the information and communication policy of European decision-makers.*

Understanding the Formation of Attitudes to Nuclear Power in Australia is at www.atse.org.au/resource-centre/National--Academies-Forum-Reports/

ECONOMIC COST A DANGER IN REDUCING INTERNATIONAL RESEARCH COLLABORATION

The Academy has warned the Government of the dangers of reduced international research collaboration and called for a significant funding boost.

International research collaboration played a key role in ensuring that Australia maximised the benefits from its investment in research and innovation, ATSE told an inquiry into Australia's international research collaboration by the House of Representatives Standing Committee on Industry, Science and Innovation.

ATSE's submission noted the Academy's unique contribution to international research collaboration in opening new, and enhancing existing, pathways for science and technology cooperation with priority countries. Its networks with research institutions and other academies had led to tangible benefits for Australian research and business.

It noted that research quality – as measured by citation impact – was three times higher for Australian researchers who collaborated internationally compared with those who did not.

ATSE acknowledged the increased investment the present Government had

made in science, technology and innovation, but noted that commitment of a new program of international research collaboration funding was one area still to be addressed.

ATSE recommended that the Government significantly increase funding for collaboration under the bilateral agreements to give these agreements critical mass – proposing overall funding for the International Science Linkages (ISL) Program should be increased to \$30 million a year.

The ATSE submission noted ISL funding, which includes support for bilateral activities and ISL Special Academies Program (ISL-SAP), had been \$94.5 million over nine years. Funding for this Program expires in the near future.

In a supplementary submission, ATSE said lack of long-term funding commitments by the Australian Government in the ISL-SAP program could jeopardise productive collaborative science and technology (S&T) relationships that had been successfully established to date.

It said the importance of international collaboration in building quality research and innovation in Australia – and its positive

contribution to Australia's economic well-being – was hard to overstate.

The ongoing support of international research collaboration was particularly needed in Australia as the nation worked to address its poor performance to date in research to 'big-business' links.

Through strategic research linkages to those countries with successful innovation investments and linkages to global big business, Australia could benefit from significant industry investment in research innovations, it said.

The submission included a number of strong statements by ATSE Fellows on the value of international collaboration, referencing a number of major Australian success stories derived from international research links. (Both submissions (63 and 63-1) are at www.aph.gov.au/house/committee/isi/intresearch/subs.htm.)

ATSE President Professor Robin Batterham AO FREng FAA FTSE told the inquiry that a key aim of the Academy was to promote Australian technological sciences and engineering globally and promote technology transfer to enhance Australia's capacity and competitiveness.

Academy joins Korea in Green Growth workshop

A 13-strong Australian delegation attended a major International Workshop on Green Growth in Seoul in April to discuss Green Growth technologies, challenges and policy implications for Australia and the Republic of Korea. The workshop was conducted jointly by ATSE and the National Academy of Engineering of Korea (NAEK) and was attended by high-level strategic/policy and research delegates from both countries. Its purpose was to inform government, industry and the research community of the potential to pursue a coordinated Green Growth policy in Australia.

The Australian delegation, led by ATSE President Professor Robin Batterham AO FREng FAA FTSE, included Mr Innes Willox, Director, International and Government Relations,

Australian Industry Group, and was supported by ATSE Executive Director – Technical, Dr Vaughan Beck FTSE and ATSE Manager, Projects and Policy, Dr Simon Potter.

Professor Batterham and Dr Beck visited Korea in January 2010 to investigate issues related to Green Growth and begin planning for the April workshop. Professor Batterham also addressed



(From left) ATSE Foreign Fellow Dr Ki Jun Lee FTSE, Honorary President of NAEK and Dean of the College of Engineering at Seoul National University Dr Jong Yong Yun, President of NAEK and ATSE President Professor Robin Batterham at the workshop welcome dinner in Seoul.

ATSE WINS TWO NEW LASP GRANTS

ATSE was awarded two new LASP grants among five projects worth \$1.4 million over three years announced by the Minister for Innovation, Industry, Science and Research, Senator Kim Carr.

The ATSE projects, awarded under the Linkage Learned Academies Special Projects scheme, have attracted funding totalling \$599,000 over three years.

The first project is titled Green Growth in Australia: examining the linkages within – and potential of – sustainable resources management to enable environmentally responsible economic growth. The project received ARC LASP funding of \$315,000 over three years.

The project will be broken into three consecutive stages, related to water, energy and climate change. Lead researchers for each stage will be Dr John Radcliffe AM FTSE, chair ATSE Water Forum, Dr Mike Sargent AM FTSE, from the ATSE Energy Forum Leadership Group, and Dr Graeme Pearman AM FAA FTSE, chair of the ATSE Climate Change Impact Forum.

The second project is titled Making Interdisciplinary Research Work – Achieving

and Sustainable Australia. The project, jointly proposed by the National Academies Forum (NAF) and ATSE, and managed by ATSE, has attracted ARC LASP funding of \$284,000 over three years. ATSE Vice President Peter Laver AM FTSE will lead the project for ATSE.

Announcing the grants, Senator Carr said the Government was committed to supporting Australian research and providing the funds and flexibility needed to get results.

"Members of the Learned Academies are esteemed scholars whose talent and unique experience allow us to tackle some of the more difficult issues facing Australia.

The remaining three grants were:

- understand the social consequences affecting our children as a result of the economic downturn (The Academy of the Social Sciences in Australia);
- achieve an environmentally sustainable and socially equitable way of living by 2050 (The Australian Academy Science); and
- improve collaboration and policy research in the humanities (The Australian Academy of the Humanities).

the Science and Technology Leaders Forum 'Innovation Strategy for Green Growth in Asia'.

A possible new grouping of five Asian nations, including Australia, was mooted to progress Green Growth S&T. Korea will host a meeting of the G20 nations in November this year when President Lee is expected to advocate the adoption of Green Growth strategies.

Professor Batterham said global understanding was emerging of the importance of integrated and innovative policies in resource management both within and transcending national borders (that is, energy, water, food, health and environmental security), not only to address the challenges of climate change but also to provide a positive stimulus for new jobs in new industries with a

strong and sustainable economy.

"Such an integrated, multidisciplinary approach is being termed in a number of arenas as 'Green Growth'," he said.

"Initiatives in Green Growth that are being actively pursued by the Republic of Korea have important policy implications in Australia."

The Delegation included ATSE Fellows Dr Peter Cook CBE FTSE, CEO of the CO2CRC; Dr Graeme Pearman AM FTSE, Chair of ATSE's Climate Change Impact Forum; Professor Geoff Stevens FTSE, Department of Chemical and Biomolecular Engineering, University of Melbourne; and Professor Kelly Thambimuthu FTSE, Faculty of Engineering, Architecture and IT, University of Queensland.

A Workshop Report will be prepared by ATSE and NAEK.

Professor Stuart Wenham

FTSE, a world leader in photovoltaic research – a key to Green Growth?



GREEN GROWTH IN AUSTRALIA

Green Growth – with underlying drivers of population, social, agricultural, economic and environmental dynamics – will pose technological challenges to resource security. Critically, this approach to sustainable economic progress must address competition for resources. Historically, energy, environmental and energy issues have been examined separately. However, they are fundamentally interconnected via a complex web of interactions. Finding solutions to resource issues without impeding economic development will require new integrative, interdisciplinary approaches and technologies (for example, smart grids). The project will examine the interconnectivity of major resources, their role in securing Australia's future prosperity and new methods and technologies designed to optimise their use.

MAKING INTERDISCIPLINARY RESEARCH WORK

This multivalent program of research is designed to address two outstanding problems, one a key issue in research management, the other a national challenge. The former is the application of interdisciplinary research to the broad, problem-based research agendas of today and tomorrow. The later issue – addressed as a test case for the methodological work conducted in the first part of the program – is how to use this understanding to find effective ways of approaching the array of challenges confronting Australia in growing our population, sustaining our way of life and our living standards, reducing our burden on the environment, promoting social harmony in a context of diversity, and advancing our nation's role as a leader in the global community.



MMG congratulates the winners of the 2010 ATSE Clunies Ross Awards

MMG is a major resources company producing zinc, copper, gold and silver. We currently operate mines in Australia and Laos in South East Asia while we explore the globe for further opportunities. Our vision is to build the next generation's leading global diversified minerals and metals company.

We are proud to support excellence in science and technology innovation and development.

The resources industry is a major employer of skilled technical people in the fields of engineering, metallurgy, geology, geoscience and environmental science. Early awareness of potential careers in these fields is crucial to the development of our industry and we are pleased to also support the 2010 Extreme Science Experience, giving school students an opportunity to meet scientists and consider tertiary education and careers in science and technology.

www.mmgrouppltd.com



**Respect
Integrity
Action
Results**

www.csiro.au



CSIRO – managing Australian treasures



Did you know that CSIRO manages three major national research facilities: The Australian Animal Health Laboratory, the Australia Telescope, and the research vessel *Southern Surveyor*?

The **Southern Surveyor** is available to marine scientists to explore and study our oceans and is Australia's only dedicated blue-water research vessel.

The **Australia Telescope National Facility** is the largest astronomical institution in Australia. 80% of the telescopes' users come from outside CSIRO.

The **Australian Animal Health Laboratory** has produced new diagnostic tests, vaccines and treatments for both exotic and endemic animal diseases.

CSIRO also manages over 30 other research facilities. These irreplaceable collections include the Australian National Fish Collection, Australian National Insect Collection, Australian National Herbarium, Australian National Wildlife Collection, and the National Tree Seed Collection.

**Chemical plant – typical
of coastal industrial
infrastructure.**

Working for the future of our coasts

PHOTO: CSIRO

Australia has a new \$11 million collaboration aimed at helping translate science into practical applications for adapting to climate change, population growth and other coastal pressures.

Led by Curtin University, the CSIRO Flagship Coastal Collaboration Cluster will tackle the challenge of how to present and communicate scientific results in ways that are both understandable and useful to people who make complex decisions about the future of our coasts.

The partners will use techniques such as Google Earth and custom-built animations to visualise research data and phenomena such as sea-level rise.

CSIRO Wealth from Oceans Flagship Director Dr Tom Hatton says Australia's coasts are facing mounting pressures from urban and industrial development, population growth, recreation, tourism, and climate change.

"Science is often expected to provide key information to help with decisions about coastal management, but the expectations people have of science are often very different from what it can actually deliver," Dr Hatton says. "What we are looking for is a way to make great coastal science accessible to the people who need to understand it. This will require creativity and innovation."

Researchers involved in the Cluster will meet this challenge by collaborating with a wide range of people who make decisions about the future of our coast, including scientists, governments, non-government organisations, Indigenous leaders and the community. They will also investigate what scientific knowledge would be most helpful to these groups and develop and test new methods to both retain scientific accuracy and help groups to use the science in the decisions they make.

**Sustainable aviation fuels offer the
largest single opportunity to reduce
greenhouse gas emissions from the
aviation sector.**

PHOTO: CSIRO



World-first study for cleaner aviation fuel

CSIRO has joined with Australasia's major aviation players in leading a world-first study to help reduce greenhouse gas emissions from air transport by helping to develop a sustainable aviation fuels industry.

Called the Sustainable Aviation Fuels Road Map, the study aims to accelerate the development and commercialisation of a sustainable aviation fuels industry in Australia and New Zealand.

The project has developed in collaboration with the Australasian section of the Sustainable Aviation Fuel Users Group (SAFUG) and the Defence Science and Technology Organisation (DSTO).

Aviation accounts for two per cent of the world's total greenhouse gas emissions. Cleaner jet fuels derived from plant matter (bio-oil) offer the largest single opportunity to reduce emissions while ensuring long-term fuel security for the sector.

The road map will examine the barriers, opportunities and implications of producing bio-derived jet fuels at scale in the Australasian climate and region, including: commercial viability; environmental sustainability; and alternative biomass feedstocks (such as algae and more traditional forest and agricultural products).

Aviation is fundamental to the Australian economy and way of life. The tourism industry alone creates jobs for half a million Australians and contributes billions of dollars to the economy.

The Sustainable Aviation Fuels Road Map gathers an impressive and diverse group of participants from the aviation, science and technology, government and non-government sectors, bringing a wealth of experience and many different perspectives relating to the aviation industry.

The study will draw on the expertise of participants and use sophisticated economic modelling to map out future scenarios. It is intended to provide useful input to decision makers in industry and government on strategic policy and future investment, through the release of a public report in September 2010.

Massive ocean current discovered

A deep ocean current with a volume equivalent to 40 Amazon Rivers has been discovered by Japanese and Australian scientists near the Kerguelen Plateau, in the Indian Ocean sector of the Southern Ocean, 4200 kilometres south-west of Perth.

In a paper published in *Nature Geoscience*, the researchers described the current – more than three kilometres below the ocean's surface – as an important pathway in a global network of ocean currents that influence climate patterns.

"The current carries dense, oxygen-rich water that sinks near Antarctica to the deep ocean basins further north," says co-author Dr Steve Rintoul from the Antarctic Climate and Ecosystems CRC and CSIRO's Wealth from Oceans Flagship.

"The ocean influences climate by storing and transporting heat and carbon dioxide – the more the ocean stores, the slower the rate of climate change. The deep current along the Kerguelen Plateau is part of a global system of ocean currents called the overturning circulation, which determines how much heat and carbon the ocean can soak up."

The joint Japanese–Australian experiment deployed current-meter moorings anchored to the sea floor at depths of up to 4500 metres. Each mooring reached from the sea floor to a depth of 1000m and measured current speed, temperature and salinity for a two-year period.

"The continuous measurements provided by the moorings allow us, for the first time, to determine how much water the deep current carries to the north," Dr Rintoul said.

The current was found to carry more than 12 million cubic metres per second of Antarctic water colder than 0°C.

"Mapping the deep current systems is an important step in understanding the global network of ocean currents that influence climate, now and in the future. Our results show that the deep currents near the Kerguelen Plateau make a large contribution to this global ocean circulation," Dr Rintoul said.

Retrieving ocean monitoring equipment used as part of a moored system to measure ocean currents.



PHOTOS: CSIRO



The 8-star AusZEH demonstration house's unique home-energy-management system.

Australia's first zero-emission home open

Designed to fit the Australian climate – and the lifestyle of a typical middle-income family – Australia's first Zero Emission House (AusZEH) has opened in Melbourne, targeting the 13 per cent of Australia's greenhouse gas emissions (GHG) due to home energy use.

Working with industry partners Delfin Lend Lease and the Henley Property Group, and supported by the AusZEH consortium, CSIRO designed and built the demonstration house 30km north of Melbourne.

The 8-star energy-efficiency rated AusZEH showcases off-the-shelf building and renewable energy-generation technologies, and new future-ready energy-management systems. The AusZEH is designed to produce enough 'zero-emission' electricity from 6kW solar panels to supply all the operating energy needs of the household so that its net total CO₂ or other GHGs is zero.

CSIRO's Energy Transformed Flagship initiated the AusZEH project to demonstrate and evaluate how low-carbon housing can be achieved in Australia to reduce GHG emissions.

Fixing coal mine methane emissions

A new methane burner, developed at the University of Sydney and under consideration by mining companies, has potential to reduce greenhouse gas (GHG) emissions from underground coal mines by almost 90 per cent.

The process of mining coal accounts for about six per cent of methane emissions caused by human activity, says Associate Professor Andrew Harris from the School of Chemical and Biomolecular Engineering. If adopted by industry, the burner would substantially reduce the coal mining industry's GHG output.

"Emissions occur when air is pumped into underground coal mines for ventilation, releasing methane into the atmosphere," Associate Professor Harris says. "This reduces the risk of explosions but significantly increases GHG levels. Methane is about 23 times more potent than CO₂ in terms of its contribution to global warming."

The burner developed by Associate Professor Harris and his colleagues burns methane, converting it into the less harmful CO₂ and water before releasing it into the atmosphere.

Should Australia go nuclear?



ANSTO Chair Dr Ziggy Switkowski FTSE addressed the National Press Club in Canberra recently as part of a debate with Greens Senator Bob Brown titled 'Should Australia go nuclear?' This is an edited version of his opening address.

Australia's energy and climate change strategy is based upon expected contributions from four sources: energy conservation and productivity – we're all going to learn to use less energy; accelerated deployment of renewable energy such as wind and solar power; a gradual substitution by gas of coal; and the presumed success of clean coal technologies and associated carbon capture and storage.

There can be no question as to the merit of each component in this approach. Many countries are pursuing a similar mix, but with the added element of nuclear power, which has near zero emissions, is safe and offers the promise of the lowest cost in a future world of carbon taxes.

Fourteen per cent of global electricity is already produced from nuclear power at 440 reactors in 31 countries. Two-thirds of the world's population gets some of their electricity from nuclear reactors, and most of the other one-third aspire to a similar position.

Countries which have paused in the deployment of nuclear power, countries like Sweden, the United Kingdom, Italy, the US, are reactivating their programs while others such as Germany and Spain have reopened the debate.

The European Union currently gets one-third of its electricity from nuclear power. Compellingly, neighbouring countries most affected by the fallout from the 1986 Chernobyl reactor fire – that traumatic nuclear accident – like Ukraine, Russia and Finland, are increasing their nuclear networks. Others like Poland and Belarus are about to start down this path.

The UK, a victim of climate change leadership, is committed to increase and accelerate its nuclear build program, replacing its current fleet of 19 reactors – as its chief energy advisor forecasts up to 40 per cent of its electricity will be nuclear in the 2030s – double the current levels.

The US cannot meet its climate change goals without more nuclear power, according to President Obama. And of the 50-plus reactors currently under construction, most

are in Asia and 24 are in China.

With the exception of Italy, the world's largest net importer of electricity – nuclear electricity from places like France and Switzerland – no economy of Australia's size or larger is without nuclear power. That's 40 countries within the G20 economies, which include the 19 countries in the EU, which make up 85 per cent of global GDP.

Everyone has a civilian nuclear program or anticipates introducing nuclear power except Australia, which now stands alone among the world's top 28 economies in excluding consideration of nuclear power in a long-term energy and climate change strategy.

Many countries which confront the challenge of adding clean energy and additional capacity have concluded that nuclear power must be in the mix. Why?

1 Nuclear technology is well-established. It's available off the shelf. Today you can pick up a catalogue and pick out the model that you will buy. And it's not dependent upon heroic assumptions of cost or technology breakthroughs in the future.

2 Nuclear electricity is truly base-load. It's optimised for 24/7 operation and it connects into the national electricity grids just the same way as gas or coal-fired power does.

3 The whole of life greenhouse gas emissions – from the point of uranium mining through to the decommissioning of a reactor and the provision for the long term of nuclear spent fuel – are similar to those from solar or wind. It is truly a low-emitting technology.

4 Generating costs are already comparable to coal and gas in much of the world and will be in Australia with a moderate carbon cost – something in the range \$15 to \$40 a tonne of carbon dioxide a year.

Nuclear power has high up-front capital costs, but lower whole-of-life generating costs. It will be our lowest-cost option in the 2020s, but still we have no nuclear strategy for Australia. Our demand for energy is increasing, not

Letters to the Editor

ATSE Focus welcomes letters from readers in response to articles. Please keep letters brief to enhance publication prospects. Longer letters may be run as contributed articles. Please address to editor@atse.org.au

reducing. Outside hydroelectric power, renewables such as wind and solar contribute less than two per cent to our current energy generation.

Carbon capture and storage, which I agree should be a national priority, has yet to be demonstrated as a scalable, cost-effective and safe process. And we cannot rely on adjacent economies for backup, should our energy strategies prove inadequate.

We may be the only developed economy whose electricity generation and emissions reductions strategy is based upon such fragile foundations.

Yet connecting the dots between now and 2050, at least the electricity scene should be clear. The widespread use of coal today makes way for gas as the primary fuel in Australia, as, for example, is the situation in California. After that nuclear power becomes the load-bearing girder for base-load electricity generation, including that that will be required to power an electric vehicle and hydrogen economy by mid-century.

Use of fossil fuels will persist but carbon capture and storage technologies must become ubiquitous. And renewable energy, mainly in the form of wind, solar and geothermal, will make important but, in my view, subordinate contributions.

Government policy at present does not support nuclear power for Australia. In my opinion, and that of other countries around the world, this eliminates a critical element of a successful clean energy strategy.

It's important to acknowledge the reservations voiced by some Australians not yet convinced of the merits of a

domestic nuclear industry. These reservations include the management challenge of long-lived radioactive waste. There is no national repository operation anywhere in the world at the moment, although several are being built.

The costs of nuclear power and project management, especially of the first installations, are likely to be high. There's timeliness – the first reactors in Australia are at least 10 years away, so if your planning horizon is 2020, then nuclear power doesn't enter into your thinking.

People express a concern about the location of reactors. If we went as far as France has gone and produced most of our electricity with nuclear power by 2050, we would need somewhere between 12 and 25 sites for clusters of nuclear reactors plus one national repository, which we would hope to have in operation in the back half of this century, around about 2070.

Other concerns people express are risks of catastrophic accident such as Chernobyl, proliferation, terrorism and access to water – although being able to use seawater makes nuclear better than coal and gas.

But, despite similar concerns, two-thirds of the world's population lives with nuclear power and the proportion is growing. When you travel overseas you almost always land in a country which has some of its energy from nuclear reactors.

Whether you're worried by climate change, whether you're pragmatic in accepting the need to move beyond fossil fuels, whether you recognise the appeal of a balanced energy strategy or are simply supportive of a new growth strategy, nuclear power ticks many of the boxes. ◀

Biofuel crops push 'ignoring' biosecurity impacts

Important biosecurity issues are being ignored in the global push to develop new non-food crops for biofuels and industrial and pharmaceutical uses, according to a report published recently by CSIRO.

The report focuses on the broad biosecurity consequences of 21st century non-food agriculture and makes recommendations for the sustainable development of crop-based biofuels and bioindustries.

It was compiled by representatives of 10 developed countries who attended a summit on 'Biosecurity in the new bioeconomy' in Canberra.

The summit's Convenor, CSIRO

Entomology scientist Dr Andy Sheppard, said the exponential growth in non-food crops could compromise conventional agriculture

if it ignores issues such as the potential invasiveness of new crops, the effects of abandoned plantings of trial crops, new pests and diseases and pest management.



PHOTO: SAMANTHA SETTERFIELD, CDU

A gamba grass invasion in the early dry season in the Northern Territory.

Big improvements needed in renewables

Internationally, the growth of the cleantech sector has been meteoric, but renewable energy technologies needed big improvements in reliability, efficiency, storage capacity, safety and economics.

This was a key message presented at the Sir Mark Oliphant Conference 'Cleantech Science and Solutions – mainstream and at the edge' in Melbourne in May.

More than 350 delegates at the ATSE-sponsored conference heard from leaders in the cleantech field from across the world on how economically viable clean technologies will drive the world towards sustainability through increased efficiency, reduced waste and the adoption of renewable energy.

Following the conference opening by The Hon Richard Marles MP, Parliamentary Secretary for Innovation and Industry, Professor Eric Isaacs, Director of the US Department of Energy's Argonne National Laboratory, and Professor Robin Batterham AO FREng FAA FTSE, President of ATSE, presented keynote addresses.

"We have many promising renewable energy technologies, but there isn't one of them today that can generate significant amounts of energy that we can actually use on

a large scale," said Professor Isaacs, who heads one of the largest research and development facilities in the world.

"They all need big improvements in some combination of reliability, efficiency, storage capacity, safety and economics. We need strong programs to solve the basic science problems, and industry needs to be deeply involved to be sure there's a manufacturing path.

"Energy storage is a good example of the opportunity. In the US alone, if we could convert all our cars and light trucks from gasoline and diesel to electricity, we could save 7.2 million barrels of oil a day. That would cut national oil consumption about one-third and reduce the well-to-wheels carbon footprint of our light-duty fleet by nearly 25 per cent."

Professor Isaacs said the ties between basic research and industry had weakened in the past two decades.



Eric Isaacs

"The innovation ecology – the partnership between academia, national laboratories and industry – needs reinvigorating.

"Much of the system's core is still in place, but we need better incentives for industrial researchers to work closely with university and national laboratory scientists and engineers, preferably in the early stages of research. The goal is to speed the transition from basic research to marketable product."

"A reliable energy supply is critical to long-term economic health and national security; without it, we won't long have either. This is true for every nation. But our existing sustainable energy technologies are in their infancy. They all need dramatic performance improvements. Our challenge is to understand and control materials and chemical processes at the basic molecular and nanoscale levels."

"We are at the dawn of a new era that will combine breakthroughs in understanding materials and chemical processes with new capabilities in computer modelling. We are moving toward an era in which we can design new materials and chemistries for specific needs. We will be able to predict the behaviour of materials that have not yet been made, and then make them with atom-by-atom chemical precision," he said.

Professor Batterham addressed long-term futures for clean and new energy sources that must be considered after coal production has peaked.

Dr Sheppard said there are no accepted international regulatory approaches to evaluating these crops for the risks of bioinvasions, off-target pest impacts and degradation of natural ecosystems and associated ecosystem services.

"The report stresses the role of science in developing and regulating sustainable crop-based biofuels so its recommendations are relevant to a wide international audience including farmers, industry, researchers and policy makers," he said.

It also highlighted the need for a global vision for future agricultural development around biofuels and international standards and certification for the industry to avoid repeating the environmental harm previous agricultural 'revolutions' had caused.

"While it is clear that biofuel-based rural industries can be beneficial, new non-food crops must meet the triple bottom line – people, planet, profit – criteria," Dr Sheppard said.

Introduced to tropical Australia as a pasture plant, Gamba grass has gone feral, growing to four metres, and turned open forest savannah land to monospecific grassland – an example of a plant introduced without appropriate risk assessment which illustrates why new non-food crops must be assessed properly.

Biosecurity in the new bioeconomy is available at www.csiro.au/resources/2009-Biosecurity-Symposium-Booklet.html

Economics, politics, trade, war and *The Coming Famine*

By John Radcliffe

john.radcliffe@csiro.au

Prolific science author and ATSE Fellow Julian Cribb in his book *The Coming Famine* re-explores the ground previously covered by Malthus and the Club of Rome. He recognises the gains in agricultural science that achieved the Green Revolution and 'headed off at the pass' the 1970s doomsday scenario. He records that the International Food Policy Research Institute has shown that world food prices declined 75 per cent in real terms between 1975 and 2005.

However, he identifies the changes that have been occurring in recent years that may lead to a food crisis in the mid-21st century.

Population is continuing to increase, although the world is having fewer babies and raising them better. Food demand per person is also increasing. Water availability, especially groundwater, is becoming seriously limiting. Land is being swallowed up by urban expansion, nutrients are becoming scarce – we are likely to be facing the point of 'peak phosphorus' consumption before we reach 'peak population'.

Energy costs are rising and ocean resources are becoming much depleted, while climate change impacts are expected. The forces of economics, but more especially populist politics, are continuing to affect world trade. He raises the valid question of whether war drives famine or famine leads to war, noting the much greater worldwide movement of refugees now occurring.

A large proportion of the human population is now divorced from the natural environment. In developed nations, consumers have adopted behaviours that embody high levels of food and nutrient waste. Production systems also encompass much waste, for example, through excessive fertiliser applications and the discarding of

fisheries by-catch.

Farming and food marketing are increasingly driven by ideologies, with an unfortunate rift between adherents to 'organic', or small-scale, low-input farming and large-scale, high-input farming. It is observed that to return the world to small-scale, low-input farming would be a prescription for mass starvation.

The author argues that the world cannot afford to turn its back on any new technology that may help to address the fundamental drivers of the coming famine – shortages of water, land and nutrients, emerging diseases, soil problems and erratic climate. He notes that the story of GM is an object lesson in how not to introduce a powerful new technology without consulting the people most affected – the consumers.

He shows that in 'rich countries', agricultural research represents 1.8 cents in the dollar of total research expenditure and research gains have been "flat-lining" in recent years.

Perhaps with some vested interest, he argues that current policies result in scientists getting most of the R&D money and leave communicators with practically nothing to disseminate new knowledge. He estimates that to achieve global food security, the worldwide annual investment should be increased from \$36 billion to \$145 billion for research and communication, noting that it would represent one-tenth of the current annual global weapons budget.

It is argued that food security is often confused with food self-sufficiency. Removal of commodity subsidies in developed countries would allow small-holders in developing countries to market much more output and increase those countries' standards of living.

However, Julian Cribb does come up with a few inconsistencies and some startling assertions.

He notes that as the world's grain bowls dry out and cereal farming becomes more unreliable in these regions, a return to pastoralism is the best way to prevent marginal land becoming a weed-infested wasteland – overlooking that pastoral lands are likely to have even higher climate variability than arable cropping lands.

He hypothesises a much-increased consumption of vegetables (which will employ more labour in their production than cereals), while showing in table 13 that the energy yield per hectare is generally lower than that for cereals. He suggests people will need to be more conservative in their consumption of meat – a sound proposal but at odds with the increasing enthusiasm for meat consumption in countries as their standards of living rise.

He runs a little close to repeating the IPCC errors in regard to the Himalayan snow melt with his observations



on the Himalayan “water tower”. More startling is his assertion that the typical early 21st century cookbook – with its gorgeous illustrations, elegiac combinations of the failing fruits of the Earth with those that cost us the climate, water, soil and our safety to produce – is, unambiguously, a recipe for disaster on a planetary scale.

His widespread use of the short, simple sentence imparts a sense of breathless urgency to the topic. The text is extensively referenced from recent conferences, reports and press articles, although access dates are not given for the numerous web references.

Despite the many issues facing world food production capacity, Julian Cribb remains optimistic for the future, given all the opportunities to at least maintain current output in the face of scarcity by reducing waste, recycling resources, developing alternative methods such as biocultures and algae farming and reinvigorating the research enterprise for both high intensity and small holder agriculture.

This is a significant, well-researched book that closely examines the many variables contributing to the future of world stability through food production. It is recommended to the thoughtful reader. ◀

The Coming Famine – The Global Food Crisis and What We Can do to Avoid It, CSIRO Publishing, (264pp, \$29.95) www.publish.csiro.au/nid/21/pid/6447.htm

DR JOHN RADCLIFFE AM FTSE, an agricultural scientist, authored the Academy's 2004 review *Water Recycling in Australia*. Previously he was Deputy Chief Executive of CSIRO, and before that Director-General of Agriculture in South Australia and a Murray–Darling Basin Commissioner. From 2005–08 he served as a Commissioner of the National Water Commission with specific responsibilities for urban water and groundwater.

Agriculture ‘must adapt’ to climate change

Australian agriculture needs to adapt now to climate change, according to a new CSIRO book *Adapting Agriculture to Climate Change: Preparing Australian Agriculture, Fisheries and Forestry for the Future*.

“Our science highlights a clear urgency to act to prepare Australian agriculture for future impacts and opportunities under climate change,” said the book’s co-editor, CSIRO Chief Research Scientist Dr Mark Howden.

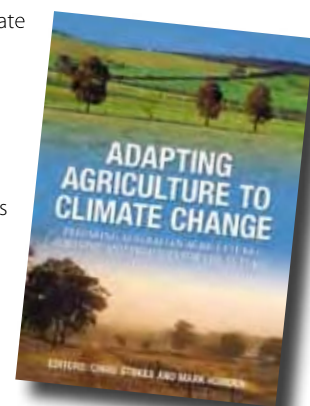
“Australia is highly sensitive to climate change and we know enough to start preparing adaptation strategies now. Well-informed and forewarned by science, we have the opportunity to implement practices to minimise the risks and enable primary industries to survive and prosper.

“With effective adaptation, it is possible that agriculture will not be substantially worse off under the quite challenging climate change scenarios for Australia, but we need to start planning and acting now,” Dr Howden said.

The book includes potential options for significant industries to survive and prosper in the face of climate variability and change. Industries include: grains, cotton, rice, sugarcane, wine grapes, horticulture, forestry, broadacre grazing, intensive livestock industries, marine fisheries, aquaculture and water resources.

Examples of adaptation options include: new breeds of crops better suited to higher carbon dioxide concentrations in the air, higher temperatures and reduced water resources; changing fishing practices to match changing species distributions and populations; and choosing more suitable sites and species for forestry plantations.

Stokes C. & Howden M. (Eds.) 2010, *Adapting Agriculture to Climate Change: Preparing Australian Agriculture, Forestry and Fisheries for the Future*, CSIRO Publishing (296pp, \$59.95), www.publish.csiro.au/nid/20/pid/6170.htm



QUT to research on-farm carbon storage

World-leading climate change scientist and Nobel Prize winner Dr Richard Conant will join forces with Queensland University of Technology (QUT) to research farmland carbon storage.

Dr Conant, who shared the 2007 Nobel Peace Prize with other IPCC (International Panel on Climate Change) scientists, will join QUT's Institute of Sustainable Resources (ISR) and will relocate to Brisbane for a three-year fellowship jointly funded by the Queensland Government and QUT.

Dr Conant currently works with one of

the world's leading ecological think tanks, the Natural Resource Ecology Laboratory at Colorado State University, in the US.

Dr Conant will be researching how improved grazing management could enable greenhouse gas carbon dioxide emissions to be stored in soil – a technique seen as a crucial part of the solution to global warming.

ISR director Professor Peter Grace said the carbon storage process, called biosequestration, had the potential to reduce 10 to 15 per cent of the world's annual carbon dioxide emissions by locking carbon into the soil.

“Dr Conant is an international leader in the field of soil carbon sequestration after more than a decade of work on farmland carbon storage,” Professor Grace said.

Professor Grace said Dr Conant's research would contribute to much-needed information on practical mitigation strategies for increasing soil carbon and reducing nitrous oxide and methane emissions. He said Dr Conant was recognised internationally for his work in developing strategies for reducing greenhouse gas emissions from agro-ecosystems.

Fellows share in Super Science

Six ATSE Fellows were among those awarded the 100 Super Science Fellowships funded by the Australian Government to begin in 2010 and 2011.

Attracting and retaining the best and brightest early-career researchers from within Australia and around the world is at the heart of the Australian Government's decision to fund 100 Super Science Fellowships, with 50 starting in each year.

More than \$27.2 million will be spent on the Fellowships over four years to help keep Australia at the forefront of global research and ensure it remains internationally competitive.

THE 2010 PROPOSALS ARE:

- University of Wollongong, Professor Gordon Wallace FTSE – \$556,800 to research three-dimensional polymer structures for bionic applications;
- Monash University, Professor Amanda Lynch FTSE – \$556,800 to research the dynamics of subtropical anticyclones and the connection to drought, heatwaves and bushfires in southern Australia; and
- University of Adelaide, Professor Tanya Monro FTSE – \$835,200 to research disruptive approaches to biological sensing.

THE 2011 PROPOSALS ARE:

- University of Melbourne, Professor Geoff Stevens FTSE – \$835,200 to research nanoengineered polymeric materials for environmental and biological applications;
- University of Adelaide, Professor Monro – \$835,200 to research transformational diagnostics;
- University of Western Australia, Professor Lorenzo Faraone FTSE and Professor Chennupati Jagadish FTSE – \$835,200 to research a fundamental study of electronic transport in advanced semiconductor nanostructures; and
- ANU, Professor Jagadish – \$835,200 to research nanofabrication of metamaterials for next-generation optical devices.

"Our aim is to support exceptional domestic and international researchers to establish and maintain careers in Australia, the Minister for Innovation, Industry, Science and Research, Senator Kim Carr said, announcing the Fellowships.

The research programs involving Super Science Fellows will:

- help provide a better understanding of future changes to groundwater resources;
- revolutionise the field of nanophotonics for a variety of novel applications including defence and renewable energy; and
- enhance the prospects of Australian scientific and technical involvement in next-generation astronomical facilities such as the Square Kilometre Array.



Tanya Monro



Chennupati Jagadish

The scheme is administered by the Australian Research Council and is part of the Australian Government's \$1.1 billion Super Science Initiative, aimed at helping to build a stronger higher education and innovation system for the 21st century.

MASSIVE image facility opens soon

Monash University is partnering with some of the country's leading technology providers and research institutions to establish an advanced image processing facility that will enable scientists to create, view and analyse high-resolution scientific images and 3D-models previously too large to visualise.

The Multi-modal Australian Sciences Imaging and Visualisation Environment, to be known as MASSIVE, is the first facility of its kind in Australia and will open in August 2010. It will be funded by the Australian Government through the National Computational Infrastructure (NCI), the Victorian Government's Department of Innovation, Industry and Regional Development (DIIRD) and the project partners, which include Monash, NCI (hosted by ANU), CSIRO, the Australian Synchrotron and the Victorian Partnership for Advanced Computing.

It will host high-performance computers and graphic technologies to quickly reconstruct and display data-dense 2D, 3D and 3D-plus images from the new-generation instruments in the Clayton precinct and beyond. The MASSIVE facility will provide specialist expertise in visualisation, helping researchers to graphically reconstruct experimental data and utilise visualisation tools, including libraries, to analyse and support their inquiries.

Monash University Senior Deputy Vice-Chancellor and Deputy Vice-Chancellor (Research) Professor Edwina Cornish FTSE said MASSIVE would provide cutting-edge capabilities and supporting expertise for the diverse array of research and education activities carried out at Monash, within the Clayton precinct and across Australia.

Monash University e-Research Centre Director Professor Paul Bonnington said the facility would offer researchers from a range of fields – including biomedicine, astronomy, engineering, geoscience and climate studies – unparalleled capacities to construct and view visualisations of the objects of their investigations.

Megatrends and megashocks

A new report from CSIRO – *Our Future World* – identifies five global megatrends and eight megashocks that are changing the world.

"Megatrends are collections of interlinked trends that will change the way people live and the science and technology products that they demand," report co-author CSIRO's Dr James Moody said.

"Megashocks are hard-to-predict risks defined by sudden and significant events, like the Asian tsunami and the GFC.

"As well as informing science activities within CSIRO, we hope that this report will help inform Australian industry, government and community decisions. Our aim is to take a fresh approach to understanding the future by using new data, methods, technology and ideas."

The megatrends presented in the report are based on analyses of more than 100 trends contributed by leading scientists and business development staff across CSIRO.

The report identifies Megatrend 1 as 'more from less'. In a world of increasing demand for depleting natural resources, coming decades will see a focus on resource use efficiency and a major global effort on extracting more from less.

Megatrend 2 is 'a personal touch'. Growth of the services sector, now representing more than 70 per cent of the Australian economy, is being followed by a second wave of innovation aimed at tailoring and targeting services en masse, to individual customers.

Megatrend 3 is 'divergent demographics', recognising the growing contrast between ageing OECD populations experiencing lifestyle and diet-related health problems, and high fertility rates and problems of not enough food for millions in poor countries.

Megatrend 4 notes that more and more of the world's people are 'on the move', changing jobs, moving house and travelling more often and commuting further to work.

Megatrend 5 is dubbed 'i World', predicting that everything in the natural world will have a digital counterpart.

Report co-author Dr Stefan Hajkowitz said that the megashocks of our future world would have profound and far reaching implications for people's lives and were based on 36 global risks identified by the World Economic Forum in 2009.



Eight risks particularly important from an Australian science and technology perspective were identified relevant to Australian science:

- asset price collapse;
- slowing Chinese economy;
- oil and gas price spikes;
- extreme climate change related weather;
- pandemic;
- biodiversity loss;
- terrorism; and
- nanotechnology risks.

Our Future World: An analysis of global trends, shocks and scenarios is at www.csiro.au/resources/Our-Future-World

Nanopatch uses 100 times less vaccine

New research, led by Professor Mark Kendall, from the Australian Institute of Bioengineering and Nanotechnology at UQ, demonstrates that a vaccine delivered by a Nanopatch™ induces a similarly protective immune response as a vaccine delivered by needle and syringe – but uses 100 times less vaccine.

This discovery, in animal trials, has implications for many vaccination programs in both industrialised and developing nations, which must overcome issues with vaccine shortages and distribution.

Professor Kendall said the Nanopatch™ was much smaller than a postage stamp and consisted of several thousand densely packed projections invisible to the human eye. Being both painless and needle-free, the nanopatch offered hope for those with needle phobia, as well as improving the vaccination experience for young children.

"The Nanopatch targeted specific antigen-presenting cells found in a narrow layer just beneath the skin surface and as a result we used less than one hundredth of the dose used by a needle while stimulating a comparable immune response," Professor Kendall said.

"Our result is 10 times better than the best results achieved by other delivery methods and does not require the use of other immune stimulants, called adjuvants, or multiple vaccinations.

"Because the Nanopatch requires neither a trained practitioner to administer it nor refrigeration, it has enormous potential cheaply deliver vaccines in developing nations," he said.

"By using far less vaccine we believe that the Nanopatch will enable the vaccination of many more people," Professor Kendall said.

"When compared to a needle and syringe a nanopatch is cheap to produce and it is easy to imagine a situation in which a government might provide vaccinations for a pandemic such as swine flu to be collected from a chemist or sent in the mail.

"This is an exciting discovery and our next step is to prove the effectiveness of Nanopatches in human clinical trials," he said.

Government commits funds to boost engineering workforce

The Australian Government will provide \$350,000 for two new research projects to boost the nation's engineering workforce.

The Minister for Education and Employment, Julia Gillard, said the projects would be conducted by Australian National Engineering Taskforce (ANET) – in which ATSE is a partner – to assist both the education sector and industry to combat engineering shortages.

The first project will study demand and supply of engineering skills while the second will research pathways for engineering education in the vocational education and training and university sectors.

Ms Gillard said the Government recognised that skills shortages in the engineering sector could be a brake on innovation and lead to project delays and cost blowouts. These research projects will help strengthen Australia's current and future engineering workforce.

She said the taskforce would build on recent increases in engineering university applications to help protect the industry from future skills shortages. Another focus of the study would be the participation of women and students from low SES backgrounds, both of which were currently under-represented in the industry. The taskforce would also look at ways to improve retention rates to provide more stability for employers within the sector.

The two projects would:

- analyse supply and demand by key industries;
- detail issues hindering the industry and suggest changes for improved workforce development;
- identify and promote existing solutions that are working well, and
- identify policies for workforce development through education, professional development, HR management and migration.

A report on the findings is expected by the end of 2010.

ANET is a partnership between the Association of Professional Engineers, Scientists and Managers Australia (APESMA), Engineers Australia, Consult Australia (formerly the Association of Consulting Engineers Australia), the Australian Council of Engineering Deans (ACED) and ATSE. More information about ANET research projects is available at www.anet.org.au.

School laboratory technicians forum

Minister for Education Julia Gillard has announced a national forum for school science laboratory technicians in Sydney in July, supporting the delivery of quality science education in schools.

The Australian Government will provide \$20,000 for the forum, following its \$2 million commitment towards the roll out of ATSE's Science and Technology Education Leveraging Relevance (STELR) program to 180 secondary schools across Australia this year.

School science laboratory technicians play an important role in facilitating hands-on science activities for students and in ensuring safe school laboratory practices.

The Australian Science Teaching Association (ASTA) will invite up to 30 participants to the forum, including representatives from Science Education Technicians Australia (SETA) and the Catholic and Independent education sectors.

The forum will discuss issues and challenges in training and supporting school science and technology technicians, including developing a training framework and guidelines.

Curtin and ANSTO link on nuclear waste storage

Curtin University of Technology has signed a four-year, \$1.2 million agreement with the Australian Nuclear Science and Technology Organisation (ANSTO) to conduct research into the storage of nuclear waste.

The project brings together materials modelling researchers from Curtin's Nanochemistry Research Institute (NRI) with ANSTO experts to undertake fundamental research into the design and implementation of nuclear waste forms.

Curtin's Deputy Vice-Chancellor, Research and Development, Professor Linda Kristjanson said the university was pleased to be working with ANSTO on such an important research area.

Professor Kristjanson said Curtin already had research capacity in the area with Associate Professor Nigel Marks, who had an Australian Research Council (ARC) grant to work on nuclear materials, and ARC Professorial Fellow, Professor Julian Gale.

ANSTO's Institute of Materials Engineering Head, Professor Lyndon Edwards, said the collaboration would build national capacity in materials modelling that would be important for Australian science and industry and produce outcomes that further improve our understanding of nuclear waste.

"There has been a significant increase in global interest in nuclear power in recent years and more nuclear power plants are being planned around the world today than at any time in the past 30 years," he said.

"New higher efficiency, intrinsically safer Generation IV reactor systems are also being developed which will require new nuclear waste solutions.

"By working with Curtin, ANSTO is ensuring that Australian science remains at the forefront of how to design, manufacture and store nuclear waste in a safe, economic and timely manner."

Artist's impression of CSIRO
solar Brayton Cycle field.

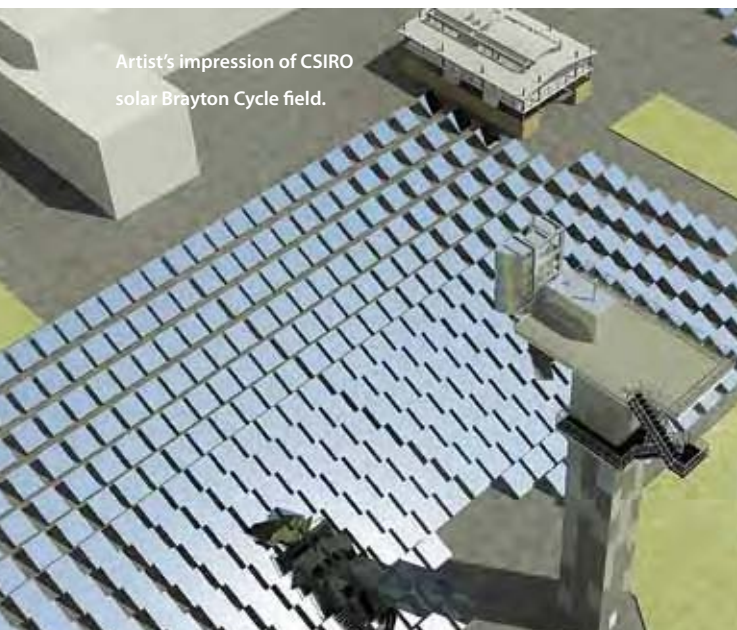


IMAGE: CSIRO

CSIRO building largest solar power tower

CSIRO is building the largest solar-power tower of its type in the world at the National Solar Energy Centre in Newcastle.

The site will consist of around 450 mirrors (heliostats) that will direct solar heat onto a 30-metre-high tower to produce super-heated compressed air for a Brayton Cycle turbine.

The field of mirrors will cover an area of 4000 square metres and when built will be capable of operating at temperatures above 900°C.

The field will be fully operational by March 2011 and is being built adjacent to an existing solar tower field that creates SolarGas – using water and natural gas – at the National Solar Energy Centre site.

“The new technology will pave the way for solar power of the future – solar power that only requires the sun and air to create electricity,” says the Director of CSIRO’s Energy Transformed Flagship, Dr Alex Wonhas.

“The field will be used to refine the technology in order to make it a cheaper, more efficient energy source that is suitable for many desert locations in Australia, and the world.

“Most solar thermal power stations require water to operate a steam turbine to produce electricity. Our Brayton Cycle technology does not need water. This technology is therefore ideally suited to many parts of Australia that only receive minimal rainfall,” Dr Wonhas said.

CSIRO received \$5 million in funding from the Australian Solar Institute (ASI) – an Australian Government initiative – to build the field and conduct research over two years.

Solar power at Alice Springs Airport

Work has started on a \$2.3 million solar power station – the largest technology of its type in Australia – at Alice Springs Airport.

Once completed, high-tech solar panels at the site are expected to cover an area larger than the average soccer or rugby pitch and generate about 600 megawatt hours (MWh) of solar energy a year – enough to power 70 homes.

Half the funding will come from the Federal Government’s \$94 million Solar Cities program.

The power station will be the first application of Solfocus concentrator photovoltaic technology in Australia.

Queensland to make medicines

Queensland will launch Australia’s first major contract manufacturing facility for biologic drugs and therapeutics – under the direction of the inventor of Gardasil, Professor Ian Frazer FAA FTSE.

The facility is being built in partnership with Queensland Government-owned BioPharmaceuticals Australia, and will be located with the Translational Research Institute on the Princess Alexandra Hospital campus in Brisbane.

The TRI, headed by Professor Frazer, is set to open in 2012, with the BioPharmaceuticals Australia facility on track to begin manufacturing by 2013.

International drug manufacturer DSM Biologics will operate the facility, with the Queensland Government providing \$7 million in seed funding for the facility under its 10-year Biotechnology Strategic Plan and the Commonwealth investing \$10 million as part of its ongoing push to win high-tech, high-value jobs and industries for Australia.

The remaining \$45 million required to build the \$62 million facility will come from the Translational Research Institute funding pool, which includes \$140 million from the Commonwealth and \$100 million from the Queensland Government, along with generous contributions from philanthropic and institutional partners.

The facility will allow local companies to make the relatively small quantities of biopharmaceuticals needed for early-stage clinical trials. Biopharmaceuticals are produced in live cells from plants and animals, especially mammals, which most resemble humans. Drugs of this kind are being developed for conditions such as rheumatoid arthritis, hepatitis and cancer.

Federal Innovation Minister Senator Kim Carr and Queensland Premier Anna Bligh announced the contract in Chicago at the world’s biggest biotechnology conference.

Professor Frazer won an ATSE Clunies Ross Award and the Howard Florey Medal in 2007 and has since won the Balzan Prize.

2010

ATSE CLUNIES ROSS AWARDS

Rewarding leadership in technology

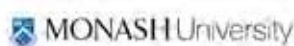
2010 **ATSE** Clunies Ross Awards winners

The **ATSE** Clunies Ross Foundation wishes to congratulate the 2010 **ATSE** Clunies Ross Award winners:

Professor Tim St Pierre, Mr Andrew Jessett, Dr John Parker FTSE, Dr John O'Sullivan, Mr Graham Daniels, Dr Terence Percival, Mr Diethelm Ostry, Mr John Deane, Dr David Skellern FTSE, Dr Neil Weste FTSE, Dr John Boldeman FTSE

The 2010 **ATSE** Clunies Ross Awards were made possible through the generous support of the following sponsors:

PLATINUM



GOLD



SILVER



BRONZE



The **2011 ATSE CLUNIES ROSS AWARDS** are now open **Nominations close 26 July 2010**

For more information about the nomination process or to download a nomination form visit www.atse.org.au/clunies-ross-award





RESEARCH INNOVATIONS: FROM CONCEPT TO REALITY

The University of Queensland continues to build its reputation as one of the top research universities in nationally-funded competitive schemes.

UQ leads industry collaboration and research funding for Australian universities, with its researchers constantly pushing the boundaries to achieve world-acclaimed breakthroughs.

The University's research commercialisation entities, UniQuest, IMBcom, JKTech and

i.lab, are recognised leaders and exemplars of best practice. All four companies identify, nurture and protect intellectual property, develop international networks, negotiate and execute licences, and bring investors to develop start-up enterprises.

UniQuest, Australia's largest university commercialisation company, is responsible for translating many UQ innovations from concept to commercial reality including those found in the world's first cervical cancer vaccine (Gardasil), the Triple P - Positive Parenting Program, and many of the world's high resolution Magnetic Resonance Imaging systems.

UQ consistently ranks among the world's top universities* and attracts over 4000 people annually from around the world to pursue research higher degrees (RHD).

Through Australia's most convenient RHD entry scheme, you may apply for admission and scholarship with just one form, any day of the year. To apply, visit uq.edu.au/grad-school and discover Australia's world-class research for yourself.

**UQ has been named in the top 50 universities in the world for the fifth year running in the UK's 2009 Times Higher Education-QS World University Rankings.*