



# FOCUS

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## PRODUCTIVITY, INNOVATION AND PROSPERITY

### THE GREAT AUSTRALIAN CHALLENGE

Contributors discuss the need to link productivity, competitiveness and innovation to the achievement of sustainable economic and social futures for Australia

# Productivity Innovation and Prosperity/The Great Australian Challenge

Linking productivity, competitiveness and innovation to the achievement of sustainable economic and social futures for Australia.

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Photo: iStockphoto



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## 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](mailto:editor@atse.org.au).

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# The Aussie productivity imperative

Any growth policy must delve into the specifics of industries, technologies, processes and functions, examining the opportunities and barriers and adopting policies for each.



By Robert D Atkinson

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The robots are taking our jobs – but we need them.

**T**he robots are stealing our jobs! With unemployment high in many nations this is a growing sentiment. Why else are so many people jobless? Technology must be taking their jobs.

Such worries, even though they have no basis in reality, are perhaps to be expected as nations struggle to create jobs. But with Australian unemployment low by global standards, Australians should be clamouring for more 'robots'.

Accelerating technology and productivity (defined as output of each worker per hour worked) needs to be at the top of the Australian economic agenda. For the major way nations raise living standards is through enabling workers to produce more (not by working longer or harder, but by working smarter using better 'tools').

Unfortunately, Australia's productivity performance has been mediocre. In an Information Technology and Innovation Foundation (ITIF) study, *The Atlantic Century*, Australia ranked just 30<sup>th</sup> of 44 nations in the rate of productivity growth over the past decade. According to the Australian Bureau of Statistics, Australian market sector multifactor productivity actually declined 0.3 per cent per year from 2003 to 2007.

Even if Australia ends its productivity decline, Australian children will still face an unprecedented decline in their real standard of living. For while today about 10 workers support two Australians above the age of 65, by 2050 10 workers will be supporting four retirees. Unless those 10 workers are producing more for every hour they work, they will be 15 per cent poorer than today (since

more of their output will be going to retirees). How does an economy boost productivity? There are five key ways and any national productivity strategy must address all five.

- 1** Workers can get better 'tools' to do the same job more effectively. For example, when truck drivers are equipped with GPS systems and automated dispatch systems they are able to be more efficient. In the future, doctors will be equipped with smart software (such as IBM's 'Watson' system) to help them make more accurate and timely diagnoses of diseases.
- 2** Technology can simply replace the need for labour. Australians see this in their daily lives often without even thinking about it. Twenty-five years ago, service station attendants pumped petrol for us. Today we insert our credit card and pump our own.
- 3** We can reduce the need for a service. Technologies such as telehealth systems are helping elderly persons stay in their home longer before they must move into more expensive assisted living systems. The smart electric grid will reduce the demand for electricity.
- 4** Innovation can develop new products and services that provide us with whole new functionalities. The mobile 4G revolution is today's best example as it lets workers and consumers do things they couldn't do even a decade ago.
- 5** And finally, technology can reduce waste or improve quality. 'Big data' (large scale data sets that are analysed to find patterns) promise to improve the effectiveness of health care.

## To begin the journey

What should Australian policy makers do to help Australia take advantage of these sources of growth? As they say, the longest journey begins with a single step.

In this case the **first step** is to acknowledge the problem (poor productivity performance coupled with an ageing population) and embrace the solution (boosting productivity). The debate in Australia already appears to recognise this and Australians should be proud of this for, in comparison, productivity is barely on the radar screen of American policymakers.

The **second step** is to recognise that without a focused national productivity strategy, the market alone will not get you there, for there are a host of 'market failures' when it comes to driving productivity advance.

One reason is because much of productivity is grounded on innovation 'platforms', such as broadband, a smart electric grid, 4G wireless, GPS, mobile payment systems and others, and these exhibit 'chicken-or-egg' characteristics that lead the private sector to under-invest in the absence of innovation policies. What private company was going to develop GPS or the internet when so many of the benefits accrued to others?

Another is that innovation is rife with 'spillovers' such that absent policies, such as the R&D tax credit, mean innovators have less incentive to invest in innovation since so much of the benefits go to others who can copy and learn from the innovation.

As a result, effective national growth policy can no longer be content to reside at the lofty levels of macroeconomics and simply ensuring that interest rates are set at the "right" level. Rather, any growth policy must delve into the specifics of industries, technologies, processes, and functions; examining the opportunities and barriers in each case and identifying and adopting policies for each.

**Third**, policy makers need to focus on the key drivers of productivity. Economists have been studying this question for more than a generation and the consensus is increasingly clear – innovation drives productivity. Organisations don't get more productivity by adding *more* 'machines', they get better by inventing and using *new* 'machines' in new ways.

Banks didn't boost productivity by building more branches, they did it by adding more ATMs and shifting to online banking. Factories didn't boost productivity by forcing workers to work harder, but by installing more

## Productivity, Innovation and Prosperity

The Academy conducted a keynote seminar *Productivity, Innovation and Prosperity – the Great Australian Challenge* in Melbourne in November. The sponsors were CSIRO, the Victorian Government, Telstra, the Federal Government (DBCDE) and the Victorian Small Technologies Cluster.

Nine speakers addressed the seminar and a number have contributed keynote article for this issue of *Focus*. They were joined by eight panellists from research and industry who provided additional perspectives. Speakers were:

- Dr Robert Atkinson, President, Information Technology and Innovation Foundation, Washington, DC;
- Dr Matthew Butlin, Chair, Victorian Competition and Efficiency Commission;

- Dr Nicholas Gruen, CEO of Lateral Economics;
- Dr Terry Cutler FTSE FAHA, Principal of Cutler & Co, Deputy Chair of CSIRO and chair of the Australian Government's 2008 Review of the National Innovation System;
- Ms Deena Shiff, Group MD, Applications and Ventures Group, Telstra;
- Professor Roy Green, Dean of the Business School, UTS; and
- Ms Patricia Kelly, Deputy Secretary, DIISR.

Panellists were: Ms Leonie Walsh, President, AIRG; Dr Alex Zelinsky FTSE, Group Executive of Information Sciences, CSIRO; Dr Jason Potts, Senior Lecturer, School of Economics, University of Queensland, and Principal Research Fellow, Centre for Creative Industries and Innovation, Queensland University of Technology; Professor Michael Georgeff, Founder and CEO, Precedence Health Care; Mr Nixon Apple, Investment and Economic Advisor, AMWU; Mr Darren Bilsborough, Managing Director, Cminus Consulting, and Director, Green Building Council of Australia; Mr Ross McCann, Chairman, Qenos; and Mr Alexander Gosling, FTSE, Founding Director, Invetech.

## Three key issues emerge in productivity seminar

Three key issues engaged participants at the seminar:

- to demystify the term 'productivity' and recraft a narrative that links productivity, competitiveness and innovation to the achievement of sustainable economic futures for Australia;
- to substantiate what role science and technology have played and can play in productivity growth and industry competitiveness; and
- to identify emerging opportunities and technology platforms that can drive productivity improvement in Australia.

The rich diversity of views and opinion produced consensus about the need for a concerted focus on advancing the quality of the discussion about productivity.

The speakers included two government

computer-controlled machine tools. But as these two examples illustrate not all innovation is equal.

The innovation with the biggest impact is information and communications technology (ICT). From computers to self-service kiosks to mobile commerce, ICT can transform a wide array of industries. Indeed, in the United States, it was the use of ICT by a variety of industries that was responsible for approximately half of the productivity acceleration in the past decade.

Australia has an opportunity to lead the world by crafting a national strategy focused on driving productivity through IT innovation. Australia's national science agency, CSIRO, is already doing leading-edge work to develop an IT-based digital technology strategy. But if these and related efforts are to be successful, they'll need to be fully supported by government and carried out by all agencies of government.

But while technology is important, it's not enough. All too often companies seek government protection from innovative competitors. In the US this 'middlemen protection' is rampant with industries as diverse as car dealers, lawyers, optometrists, wine and beer sellers, pharmacists, and travel agents lobbying to enact laws or regulations to

hobble more nimble digital competitors.

A case in point is auto sales. While a consumer can buy a computer online from Apple, Dell or HP, it's illegal to buy a car directly from Ford, Toyota or GM because car dealers have pushed for state laws preventing this competition. Australian national and state policymakers need to be vigilant in resisting pressures from companies for protection from more innovative competitors.

But it's not just business that fights innovation. Organised labour often does so to save jobs, even though this raises prices for consumers. So-called 'public interest' groups routinely oppose new technology – some privacy groups oppose internet innovation and some environmental groups oppose biotechnology innovation.

And all too often 'thought leaders' fan these flames, claiming falsely that technology kills jobs – another case in point is MIT professors Erik Brynjolfsson and Andrew McAfee's new book, *Race Against the Machine*, in which they claim "the threat of technological unemployment is real". With examples all around us of how technology has improved efficiency (when was the last time you went to a bank teller?) this story sounds ► [MORE ON PAGE 10](#)

ministers – the Victorian Minister for Technology and Assistant Treasurer, Gordon Rich-Phillips, who launched the Victorian Government's new ICT policy plan and initiatives, and Senator Stephen Conroy, the Federal Minister for Broadband, Communications and the Digital Economy, who highlighted the recurrent theme that digital productivity provides a timely focus for an action agenda.

Australia's recent poor productivity performance (in both labour and multifactor productivity) was highlighted and it was noted that – while the drivers for productivity are usually discussed in terms of taxation policy, labour market flexibility, infrastructure delivery and regulation – the need for a continuing focus on structural productivity or technological progress is less often highlighted in public and policy agenda.

The seminar also noted the failure to heed the lessons from past periods of productivity growth.

Discussions highlighted that while organisations such as ATSE focus on innovation, policies for productivity and innovation are generally discussed in discrete forums and policy contexts. Creating a

more informed debate that assists policy development required interdependencies to be reinforced and emphasised and failure to do so would further confuse the public about national priorities. A consistent theme at the symposium was the need for a technology-based innovation strategy for national productivity and competitiveness.

### Successive speakers mentioned the need for Australia to seize emerging opportunities as it enters a period of accelerated ICT-led transformation.

Digital productivity was a thread through the day's discussion, noting that information and communication technology (ICT) is a crucial general-purpose technology that is transforming business models, process and organisations and is a key lever for productivity gains. Successive speakers mentioned the need for Australia to seize the emerging opportunities as it enters a period of accelerated ICT-led transformation, enhanced by the increasing reach and accessibility of high-speed broadband.

Speakers stressed that to maximise these opportunities Australia needed to change the culture of management in industry – noting that for the past few decades it had neglected the need for rounded management education and investment in human capital. Too few top executives had a technical or operational background or perspective, the seminar heard.

Speakers also noted that government needs to promote industry's appetite for market-oriented technology R&D and innovation, and in policy frameworks to focus on areas of high impact. At a state level, Victoria had shown the merits of a multi-layer policy framework around enhancing sectoral strengths and deploying procurement policies that reward innovative firms.

The seminar discussions and presentations provide the elements from which to begin to recraft a narrative around productivity that reminds all Australians that the great challenge is to mobilise productivity and technology innovation as a means of underpinning Australia's future prosperity.

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# Seeing productivity through new eyes

We need some real breakthroughs in our Federal arrangements on which to build reform in health, education and other areas so that increased funding isn't wasted.



By Nicholas Gruen

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Until the 1970s the fundamental metaphor for the economy in thinking about economic policy was the economy as a giant mechanism for making things. The task of economic policy was economic development, seen as building up the firms, the institutions and the know-how to build our economy.

This is the fundamental idea that most people take to economic policy when they think of economic progress. But from the 1970s on a new idea began to take hold – among other things an economy is a giant mechanism for *trading* goods and services and economic policy should pay close attention to the question of the terms on which that trade takes place.

The implications of this framework were that we should not obstruct and otherwise impose taxes on trade between Australia's firms and firms in other countries without good reasons. And most of the time no such good reasons exist – thus we should gradually phase out tariffs.

Moreover trade occurs not just between Australian firms and those offshore but between Australian firms and other Australian firms. Here we liberalised our internal economy with a range of liberalising policies in aviation (ending the two airlines policy), retail (ending the regulation of shopping hours) and introducing competition where possible into all manner of utility services. Nearly a decade of improvised reform in this vein was systematised in the early 1990s as National Competition Policy.

As the son of an economist who grew up thinking of economic reform as something which was a servant of human welfare, it always seemed to me that we could take reform much further, not down the formulaic deregulatory path that it had become by the early 1990s (though most of this formulaic reform had been useful) but into new vistas.

Ironically, the best was already behind us. Growing out

of an unlikely but ultimately successful dynamic tension between the Treasury and the Accord in the 1980s, comprehensive economic reform saw Australia become a 'miracle economy' and the only country in the English-speaking world, with the possible exception of Ireland, where policy leant against the wind of increasing market inequality.

There are lots of things – still barely part of the reform agenda – that could not just make us richer, but directly improve the quality of our lives and even give expression to our more idealistic side. And here's the key: they're not focused on vague yearnings for a better life – more 'community' for instance (how does policy deliver that?) – but rather on that old chestnut of micro-economic reform, addressing market failure.

In his 1953 book *The Philosophy of Science*, Stephen Toulmin comments that "the heart of all major discoveries in the physical sciences is the discovery of novel methods of representation". As I've suggested above, the same can be true of new fronts for economic reform.

I sketch out in this article some ways of viewing the economy or the policy problem. They are not wholly new. Whatever is in social science? But they are certainly ways of seeing things that are underappreciated. Under each heading I set out an issue or a way of seeing the economy or the problems that policy must solve and make some suggestions for policies that look to me like low-hanging fruit.

## Information

Economic theory and common sense tell us that economic systems depend on good information for their efficiency. The sub-discipline of the economics of information has studied the costs of information failure, but remarkably little effort has been put into exploring ways of improving information flows.

Imagine how it could improve school and hospital per-

## Letters to the Editor

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formance if we could get that information and/or if government funders used it to drive improvements. But if we are going to take this seriously, we must do it in ways that are compatible with good incentives for the practitioners.

Thus publishing the death rates of hospitals or the performance of schools from their raw academic scores could easily do as much or more harm than good by wrongly stigmatising some institutions simply because they had a harder job – sicker patients or less motivated and supported students. The focus needs to be on value-added and risk-rated information.

And we need to involve the professionals delivering services in working out ways in which measurement can assist them do their job better, rather than demotivate them by generating misleading indicators.

Firms already survey their workers' job satisfaction, and the better ones have an incentive to publish the results of those surveys to attract increasingly hard-to-recruit labour. Why don't they? Because no standard exists against which to report and so compare results. It might only take a little leadership from Government (or an inspired Opposition?) to get a voluntary standard going.

Although investment advisers are encrusted in regula-

tion and investment products require elaborate disclosure, none of it helps us find advisers whose track records demonstrate their expertise. This might not even require compulsion if a well-advertised voluntary standard was agreed and perhaps supported with some funding by government. Imagine how much more efficiently we might use capital if the mass of regulation actually assisted the market do its job rather than just weighed it down in (frequently nonsensical) compliance burdens.

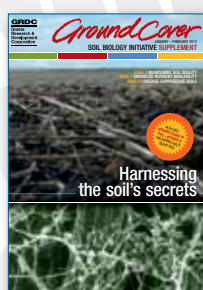
## Risk

Rationalising the number and type of entities that governments own and manage has been sensible – with privatisation and contracting out. But this has shifted risk away from governments, which can often bear it better than the firms or individuals onto which risk has been shifted. Governments can begin redressing the balance by borrowing to build assets for the future – like firms and families do. The board members of BHP Billiton are economic conservatives. That means they're focused on growing their net worth at acceptable risk. They like debt – they just don't want too much of it.

Accordingly, at the same time as we move governments towards borrowing more for investment, we should nev-

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ertheless ensure that this rebalancing happens at the same time as strengthening the institutions of fiscal prudence. Accordingly, we should establish an independent fiscal agency that is required to provide the government with public and independent advice on the appropriateness of its fiscal stance in the same way that the Productivity Commission provides the government of the day with public and independent advice on industry policy.

Robert Shiller disclosed a whole new agenda for governments in his recent book *The New Financial Order*. Governments should explore what informational infrastructure they can establish to assist risk markets to develop further. For instance, new instruments for financing housing investment are emerging, with better statistical information on the movement of house prices. By taking an active interest governments can assist this process of development.

The previous Government's creation of the Future Fund establishes the worthwhile principle that governments should invest in a diversified portfolio of equities managed at arm's length. Such investment should also be done counter-cyclically, with governments seeking to increase holdings of asset classes that are depressed and decrease holdings where asset classes are booming, as the Reserve Bank did in the foreign exchange market in the 1980s.

It generates the double dividend of stabilising the relevant market while generating higher expected returns for governments. But of course all of this should be done, as it is done within the Reserve Bank, at arm's length from government.

And where we've shifted greater risk onto individuals, as for instance with superannuation, we should help

people manage the transition. As in New Zealand, governments should encourage the establishment of 'default' settings for the level of superannuation savings, whereby employees' contributions rise over time to some broadly acceptable level – say 15 per cent – unless they opt out.

And, like Sweden, there should be 'default' investment strategies that people would be free to use if they were too confused, intimidated or suspicious to use investment advisers or salespeople.

### Federalism and regulation

We need some real breakthroughs in our Federal arrangements on which to build reform in health, education and other areas so that increased funding isn't wasted. As well as being prepared to take over areas that are not working, Labor should introduce national regulatory systems to operate alongside state ones for national firms – in areas such as workers' compensation, OHS and other technocratic areas, such as building codes, for instance.

We should acknowledge that in its 20-year history – for all its good intentions – 'regulation review' has been a fizzer, another unsuccessful piece of regulation – this time of regulators. Complex systems like regulatory regimes require much more than 'regulatory impact statements' at the outset. Like markets they require ongoing optimisation down to the minutest detail.

So we need to develop a new regulatory jurisprudence providing those who are regulated with enforceable 'rights to alternative compliance'. And why limit those rights to firms? They should extend to all citizens.

## The legal system

Economists' 'imperialism' towards other disciplines has manifested itself largely in the application of economic methodology to problems that are not purely economic. If few of the results have been sublime, some have been ridiculous.

A more promising kind of imperialism would be the application of simple economic principles to the way various social systems are managed. HECS and managing child support within the tax system are examples of this kind of reform. We should apply it more widely to our system of civil law which, as it stands, is a scandal: available to the rich and those poor enough to access legal aid, but otherwise only to those willing to risk a large part of their life savings.

With absolute respect to the need for judicial independence on interpreting the law, the costs of arbitrating disputes should be commensurate with the magnitude of the damages at risk. This simple micro-economic principle

should be reflected in all legal procedure. Further, both justice and efficiency demand that either litigant to a dispute should be able to pre-emptively elect a low-cost tribunal free from any threat of appeal, except upon their opponent bearing all resulting costs.

## Wikinomic reform

While reform has focused on improving private incentives, something profound has been going on. Technology and globalisation have seen a new burgeoning of new global public goods – and bads!

Just as there's a global interest in fighting new public bads – terrorism and the pandemics that threaten to become global within weeks of initial infections – so the internet has generated new and important classes of public goods.

Open source software, Wikipedia and ABC podcasts are all global public goods – available to all comers at zero marginal cost. There's a whole reform agenda right there! Public goods are core government business.

The ABC has aggressively moved to the global forefront in the new medium of podcasting. Let's do even better. Wouldn't it be exciting to lead the world here – as we did with HECS, and the Child Support Agency, the targeting of social security? Let's make the entire ABC archive available for download from the net – a glowing global advertisement for Australian talent and curiosity.

Then let's buy up some strategic intellectual property. Some copyrights of classic Australian culture, some patents of low value that might nevertheless be barriers to research. Let's experiment with some public seed funding of some strategic open source software. How many schools and universities could use Linux, Firefox and Open Office, rather than the usual Microsoft stuff? Students might get involved in the global effort to continue improving these community programs.

None of this need cost much. Some of it will save money.

But whatever we do we should advertise the fact and invite other countries and philanthropic people and groups to join us. This approach was proposed in one of the recommendations of the Cutler Review in 2008. ◀

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## The Aussie productivity imperative

convincing. But it's a story that's been trotted out before.

In the late 1930s the US Congress debated legislation to require the Secretary of Labor to estimate how many people could be employed if labour-saving devices were eliminated. During the 1961 recession, President John Kennedy created an Office of Automation and Manpower, identifying "the major domestic challenge of the Sixties – to maintain full employment at a time when automation, of course, is replacing men".

These fears were wrong then and they are wrong now. While the decade following 1961 saw the fastest growth in US productivity it also saw the lowest rate of unemployment. As the Organisation for Economic Cooperation and Development states, "technological progress has been accompanied not only by higher output and productivity, but also by higher overall employment".

This doesn't mean that government and companies shouldn't ensure that workers affected by productivity are helped to transition to new jobs. They should. But if the next generation of Australians is to enjoy a better life than their parents, Australia needs to push for more technology and innovation, not less. ◀

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**DR NICHOLAS GRUEN** has advised two Cabinet Ministers, directed the Business Council's New Directions program, sat on the Productivity Commission and is CEO of economic policy consultancy Lateral Economics and Peach Financial. He is Chairman of the Australian Centre for Social Innovation in Adelaide and was a member of the Cutler Review into Australian Innovation and lead author on a range of topics, including Innovation in Government, Information and Market Design and Tax and Innovation. In 2009 Dr Gruen chaired the Federal Government's Government 2.0 Taskforce focusing on the ways governments can embrace Web 2.0 to become more open, innovative, collaborative and productive.

# Productivity, competitiveness and innovation: getting to the essence

The current situation has serious implications because it puts at risk current living standards that are boosted by the terms of trade.



By Matthew Butlin

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This article is based on the presentation by Dr Matthew Butlin at the ATSE seminar *Productivity, Innovation and Prosperity – The Great Australian Challenge*. VCEC provides independent advice to the Victorian Government on business regulation reform and opportunities for improving Victoria's competitive position. It was established 1 July 2004 by Order in Council and is regarded as Victoria's 'Productivity Commission'. The VCEC has been undertaking a public inquiry for the Victorian Government into a State-based reform agenda. This inquiry is focused on improving productivity, competitiveness and participation in the Victorian economy. A draft report was released on 10 November 2011, with the final report to Government due by the end of January 2012.

**P**roductivity is a measure of how much output is produced per unit of input – it is a measure of the efficiency of production. A key long-term economic aim is to have increased real income per head, as an imperfect proxy for increased living standards. The drivers of such increases are population growth, labour participation and productivity and productivity is the dominant driver of living standards in the long term (Figure 1).

There are three measures of productivity:

- 1 labour productivity – the ratio of value added to hours worked;
- 2 multifactor productivity – the ratio of value added to a bundle of inputs (labour and capital); and
- 3 total factor productivity – the ratio of value added to all the inputs.

Both labour and multifactor productivity growth in Victoria seem to be stalling relative to other non-resource states (Figures 2 and 3). This impacts on the living standards of Victorians because – as noted by Commonwealth Treasury Secretary, Martin Parkinson – in the long run, productivity growth is the only sustainable way for future generations to enjoy higher living standards.

The current situation has serious implications because

Figure 1 Labour productivity growth rates (five-year moving average, per cent per annum)



SOURCE: R DIXON AND P LLOYD, FORTHCOMING, *ECONOMIC HISTORY OF AUSTRALIA – CALENDAR*, ECONOMIC SOCIETY OF AUSTRALIA, MELBOURNE

Figure 2 Labour productivity growth rates (five-year moving average, per cent per annum)



it puts at risk current living standards that are boosted by the terms of trade. This makes the job of structural adjustment harder, especially for traditionally manufacturing-based economies like Victoria, and also raises the risk of

Figure 3 Multifactor productivity growth rates (five-year moving average, per cent per annum)

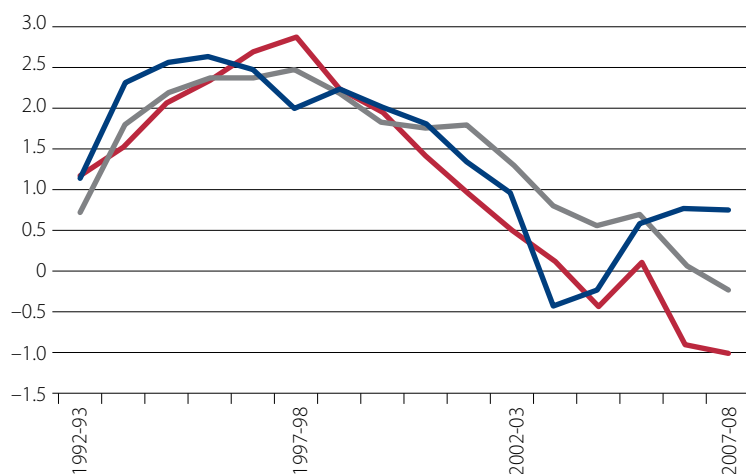
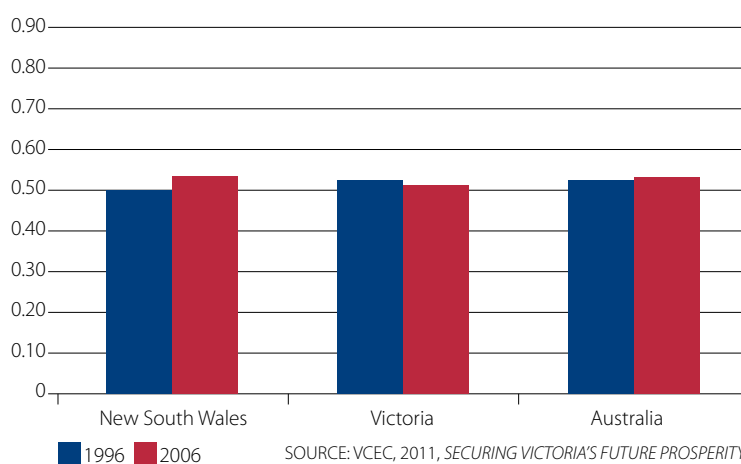


Figure 4 Victoria's competitiveness ranking

	Victoria	ACT	Western Australia	South Australia	New South Wales	Northern Territory	Queensland	Tasmania
Taxation	4	8	6	7	4	1	3	2
Regulation	1	6	3	1	8	5	7	4
Infrastructure	1	4	2	3	7	8	5	6
Education	2	1	3	6	4	7	5	8
Innovation	2	3	4	6	1	7	5	8
Participation	3	1	4	7	5	2	6	8
Wellbeing	2	1	7	3	5	4	6	8
Sum of sectional rankings	15	24	29	33	34	34	37	44
Overall competitiveness ranking	1	2	3	4	5	6	7	8

SOURCE: VCEC, 2011, BENCHMARKING INFORMATION PAPER

Figure 5 Proportion of working age people with adequate reading literacy



SOURCE: VCEC, 2011, SECURING VICTORIA'S FUTURE PROSPERITY: A REFORM AGENDA, DRAFT REPORT

missing the opportunities from industrialisation and urbanisation in Asia.

## Competitiveness

At the sub-national level, competitiveness is determined by a state's ability to attract workers and investment, and to develop and use these resources effectively to maintain high levels of living standards. There are many dimensions to competitiveness and Victoria performs well when compared to other parts of Australia, based on benchmarks on aspects of tax, regulation, infrastructure, education and innovation (Figure 4).

But competitiveness by itself does not guarantee productivity growth and there is scope for improvement in several areas. For example, more needs to be done to enhance our human capital. In Victoria – as with the rest of Australia – the proportion of working age people with adequate reading literacy (roughly equivalent to the standard to complete Year 12 education) is stuck at around 50 per cent (Figure 5).

And while Australia (including Victoria) also ranks well in international comparisons of educational outcomes, it is significantly below the top performing countries such as Canada and Korea in reading literacy (Figure 6).

## What has been happening?

In business, innovation is something that is new or improved done by an enterprise to create significantly added value, either directly for the enterprise or indirectly for its customers (Carnegie, R and Butlin, M, 1993, *Managing the Innovating Enterprise*, Business Council of Australia, Melbourne). It comes in many different forms and sizes, such as continuous incremental improvement, step change or strategic leap. In short, it is a business process that needs to be understood at the level of the enterprise.

Recent Australian research by the Australian Bureau of Statistics and the Productivity Commission examined the relationships between competition and innovation, and innovation productivity. Using Australian data the study found that stronger competition is associated with more innovation and that more innovation is associated with higher levels of firm-reported productivity.

However, global innovation competitiveness indicators (based on business perceptions) suggest that Australia is falling behind other countries. These include areas of government procurement of advanced technology products and in the availability of scientists and engineers. There is also broad recognition that a low rate in Australia of collaboration, especially between businesses and our research institutions, is seen to be a persistent constraint on Australia's innovation performance (Figure 7).

## Reigniting productivity

To reignite productivity growth, increase participation and improve competitiveness, the VCEC's Draft Report into a State-based reform agenda proposed a core agenda focused on issues where change is the most likely to have a large impact, for which the State has high capacity to influence outcomes and for which there is a high degree of confidence in the effectiveness of the transmission mechanism with public policy.

The Commission concluded in its Draft Report that the three priority areas are:

- 1** Human capital and innovation – to lift workforce skills through education and training reforms, and boost the capacity for innovation;
- 2** Melbourne, regions and infrastructure – to strengthen the performance of cities (especially Melbourne) and of Victoria's infrastructure; and
- 3** Regulation and taxation— to reform state taxation, aim for breakthrough reduction in the regulatory burden.

VCEC relied on some key insights in developing reform priorities to lift the rate of innovation in Victoria.

We concluded that, based on the evidence, the capacity of governments to stimulate additional profitable innovation by private agents, including businesses, was limited.

Governments – both Commonwealth and State – have traditionally focused on research (rather than development) and have largely adopted a 'government to business' approach, rather than seeking to encourage business networks. Current efforts are hampered by a weak evidence base to definitively confirm which innovation policies work and which are less effective.

As a result, VCEC's Draft Report recommended that an emerging state-level reform agenda should focus on:

- 1** encouraging innovation linkages, both business-to-business and business-to-research, including addressing barriers within the university system;
- 2** investing in improving leadership/management capability for innovation; and
- 3** driving innovation in public sector service delivery.

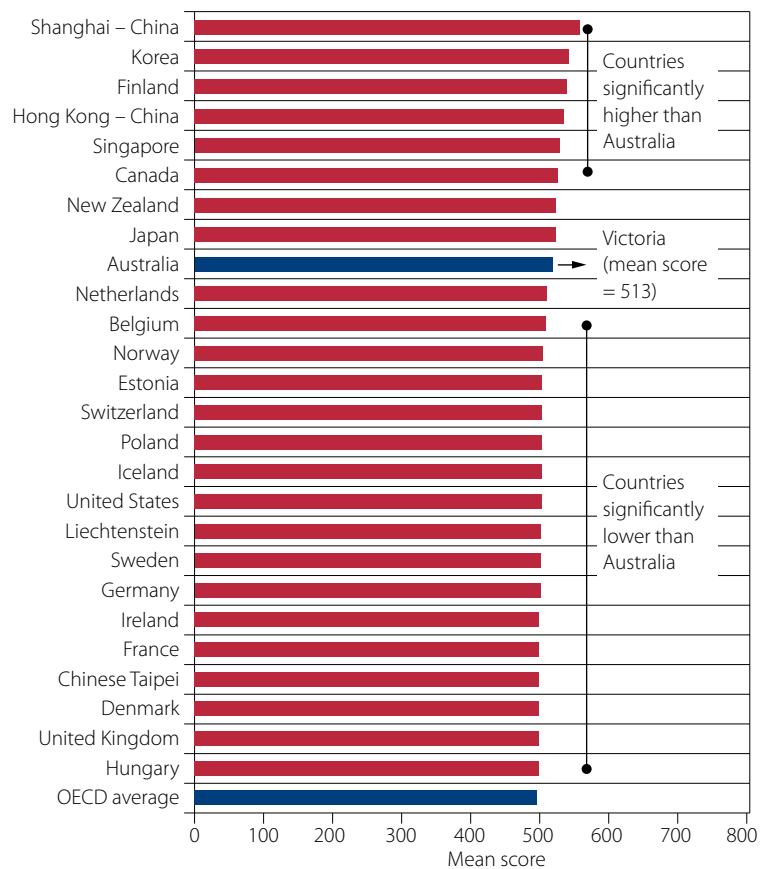
To maximise the impact of these reforms, the Commission considered Victoria's innovation agenda needed to be supported by systemic and rigorous program and policy evaluation.

Productivity is essential to living standards, and it appears that Australia and Victoria's productivity has been slipping.

There are a number of factors that need to be considered to improve productivity. Competitiveness is important to attracting and retaining

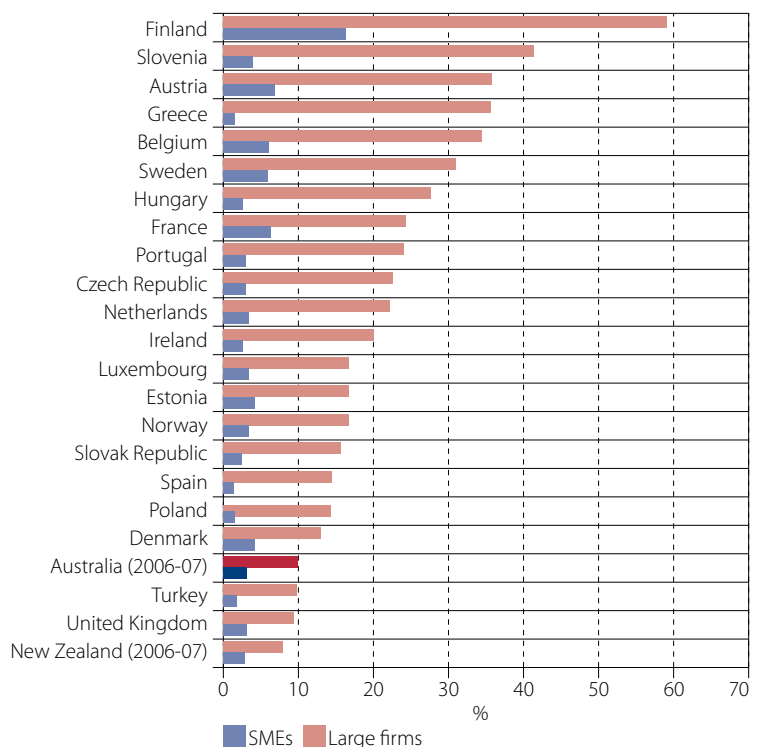
► [MORE ON PAGE 18](#)

Figure 6 PISA mean scores in reading literacy – Victoria and selected OECD countries, 2009



SOURCE: VCEC, 2011, SECURING VICTORIA'S FUTURE PROSPERITY: A REFORM AGENDA, DRAFT REPORT

Figure 7 Firms collaborating on innovation with higher-education institutions by size, 2004-06



SOURCE: OECD, 2009, 'COLLABORATION BY INNOVATING FIRMS', OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD 2009

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The STELR Project is running in more than 280 schools across the country, involving more than 30,000 students. The STELR Project has been enthusiastically received by both teachers and students.

## The STELR Concept

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- presents an exciting curriculum program that aims to reverse the low level of interest among students in science courses and careers
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- is a 6-to-10 week package involving inquiry-based activities
- engages students through investigations into global warming, climate change and renewable energy resources
- operates within the curriculum. It is intended for delivery to all students in the year level

## STELR in action

STELR provides

- a comprehensive set of curriculum materials, including physical science and chemistry units
- teacher resources and student work books
- class sets of laboratory equipment to run hands-on, inquiry-based activities on solar and wind renewable energy resources (one class set caters for up to four classes)
- professional development seminars to be held in major centres in early 2012 (attendance by two teachers is required to ensure the effective use of the resources)
- on-going support throughout the year.

**All Australian schools can now participate in this exciting project so don't miss this chance to take STELR to your students.**

Find out more about STELR by visiting the web site [www.stelr.org.au](http://www.stelr.org.au)

To obtain a price list, contact STELR Project Manager Peter Pentland 03 9864 0906 or [peter.pentland@atse.org.au](mailto:peter.pentland@atse.org.au)



*"Science teaching should be coupled with learning about technology in a 'hands on' manner, which the STELR program currently promotes. It would benefit Australian education for the STELR Project to be made available to more of our schools. This initiative would help ensure that more students chose careers in technological trades, engineering and the applied sciences, benefitting companies desiring a well-trained workforce drawn from local communities. I strongly recommend that you support the STELR Project."*

*— Professor Lyn Beazley AO FSTE, Chief Scientist of Western Australia.*

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# Productivity growth through innovation

Industries and firms will need to become more knowledge-intensive, more nimble and be able to quickly identify and leverage new sources of competitive advantage.



By Patricia Kelly

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It is increasingly clear that innovation has the capacity to drive the productivity growth which is central to improving the future living standards of all Australians.

Innovation can increase productivity through the creation of higher value-added products, more efficient production processes, more effective workplace organisation and opening up new markets.

Innovative entrepreneurs boost productivity by transforming the capabilities of their businesses; collaborating with customers, suppliers and competitors; adapting existing technologies and processes to new uses; and creating solutions to meet customers' needs.

Research is increasingly demonstrating the importance of innovation, with recent work by the Productivity Commission suggesting that initial investments in innovation (including skills development, R&D and design) and their spillover benefits contributed at least 62 per cent of Australia's productivity growth in the long term.

Similarly, OECD research has shown a direct link between R&D, innovation and productivity, leading that organisation to conclude in its recent Innovation Strategy that "all governments must understand the importance of innovation and develop policies to strengthen its outcomes".

The Australian Government is well aware of the importance of innovation and its Powering Ideas policy statement, which was released at the time of the 2009-10 Budget, sets out a 10-year agenda to strengthen the innovation system. As part of this agenda the Government has made major investments in the science base, as well as introducing new programs to strengthen business innovation, better commercialise Australian research efforts and more strongly connect business with research. Spending on science, research and innovation has increased dramatically and is forecast to be around \$9.4 billion in 2011-12, a 43 per cent increase from 2007-08.

The Government is seeking to use the innovation system to drive productivity growth in two ways:

- by transforming existing industries so that they can

cope with competitive pressures and take advantage of new markets; and

- by generating new business opportunities and creating new industries.

In order to withstand increasing competitive pressures, existing industries and firms will need to become more knowledge-intensive, more nimble and be able to quickly identify and leverage new sources of competitive advantage. This will require firms to be not only technologically sophisticated but also to employ best practice management techniques and have access to skilled personnel. These skills and assets will provide the absorptive capacity needed by firms to embrace the new knowledge, technology and innovative practices that are necessary to increase productivity and competitiveness.

It is clear that competitive pressures are especially acute for the manufacturing sector, which is challenged by the resource-driven currency and intense competition from China and other countries in the region.

The Government has put in place a number of initiatives to assist the transformation of existing industries in order to drive productivity growth. For example, the Prime Minister's Taskforce on Manufacturing is currently mapping out a shared vision for the future of Australia's manufacturing sector. The Taskforce will identify a plan for how best to leverage existing efforts, including Government policies and programs, and strengthen innovation performance to capture the opportunities and respond to the challenges the sector is facing.

More generally, under Powering Ideas the Government has introduced a major reform to support business R&D through the R&D tax incentive. The new incentive provides much more attractive rates of assistance to encourage business R&D and, for smaller firms, the support is provided in cash – recognising the cash-starved nature of many SMEs. The initiative is forecast to provide approximately \$1.8 billion through the tax system to support the R&D efforts of firms in this financial year.

Another Government initiative helping firms to improve their productivity and competitiveness is Enterprise Connect, which provides free business reviews to firms and grants to implement the review recommendations. This program has already assisted more than 4500 firms to develop the skills, tools and knowledge needed to maximise their growth potential.

There are a number of examples which show that the Government's efforts to assist the transformation of existing industries are already paying off. Textor Technologies is working with the CSIRO Future Manufacturing Flagship to develop advanced non-woven textiles for use in



PHOTO: ISTOCKPHOTO

the healthcare sector in Australia and overseas markets. Similarly, government, industry and CSIRO have joined together to design a zero-carbon-emissions house with up to 70 per cent energy savings.

The second part of the Government's strategy is to use the innovation system to create new business opportunities and industries.

Australia provides significant support for public sector research. However, we need to get better at leveraging off our research base to build new firms in technology-intensive sectors such as clean energy and the life sciences, which represent industries of the future.

These new firms are a potentially major source of productivity enhancement and wealth creation. This potential is demonstrated by a study of start-ups supported by US venture capitalists since 1970 which found that by 2003 they employed 10 million people, or 9.4 per cent of the private sector workforce, and generated \$1.8 trillion in sales.

The need to capitalise on our research base to drive the development of new industries is a key underlying theme of Powering Ideas. Implementation of this agenda is already well underway with the development of initiatives

such as Commercialisation Australia.

Commercialisation Australia is designed to assist young firms to take ideas and research to the market by providing a range of tailored assistance measures including specialist advice and services as well as financial support for proof of concept and early stage commercialisation activities.

The Cooperative Research Centres program is also playing an important role in bringing together researchers and end users to address major innovation challenges in areas such as health technologies and advanced manufacturing.

We can already see examples of firms who are creating new business opportunities at the technological frontier.

Ceramisphere, a Sydney-based company, is commercialising a nanotechnology platform developed by ANSTO scientists which has the potential to revolutionise drug delivery within the human body, as well as having applications in fields as diverse as paints and food.

Another company developing transformative healthcare technologies is Mesoblast, which is working with CSIRO to develop innovative materials for use in the production of the company's unique proprietary adult mesenchymal precursor cells. The company's lead products have a phenomenal array of applications from diabetes, to eye diseases, to bone marrow cancers, to musculoskeletal conditions. Mesoblast has grown rapidly, with a market capitalisation of \$2.2 billion at September 2011, up from less than \$400 million at the same time in the previous year.

All the above examples demonstrate the association of innovation with the success of firms. The Government is very aware of this link and that is why it has a range of support mechanisms to encourage greater business investment in innovation.

The Government's increased investments in public research, innovation infrastructure and the science base will further improve our capacity as a nation to innovate.

These investments, along with the new technology platforms such as biotechnology, nanotechnology and national broadband network, should lay the foundations for future productivity growth. ◀

**PATRICIA KELLY** has had a career in the Australian Public Service spanning more than 30 years, working in a range of agencies with social and economic policy responsibilities. She is currently Deputy Secretary of the Department of Innovation, Industry Science and Research, responsible for the Innovation, Manufacturing, Research and Science, and Infrastructure Divisions. She also oversees the work of Questacon (the National Science and Technology Centre), the National Measurement Institute and the Australian Astronomical Observatory and chairs the Department's Audit Committee. Ms Kelly was a member of the Panel that undertook the Review of the National Innovation System in 2008.

# Innovation will drive future manufacturing

What has not changed in Australia, despite more than two decades of trade liberalisation, is the predominance of low to medium-tech manufacturing in our industry structure.



By Roy Green

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**"T**he trouble with our times", according to the poet Paul Valery, "is that the future is not what it used to be". This is an apt description of the challenge facing manufacturing in Australia and indeed of the broader dilemma of how our economy can be repositioned with a volatile dollar in a globalising world.

The current squeeze on Australian manufacturing is seen by the Productivity Commission, Reserve Bank and financial market commentators as inevitable 'structural change' by which productive inputs are re-allocated to the resource sector to achieve a higher return. However, this misunderstands the role of manufacturing in the economy as a producer and user of advanced technologies, and the long-term consequences of decline.

Manufacturing is certainly becoming more globalised, more knowledge-intensive and more interdependent with value-adding services such as design, engineering, computing and marketing. But its future remains important for at least two reasons.

**First**, manufacturing drives innovation and technological change – key elements of our productivity performance – and **second** it contributes to our external trade balance.

On the first point, Australian manufacturing allocates \$4.5 billion each year to R&D, or one-quarter of total private sector expenditure. This is directed to adapting existing technologies and developing new ones, increasingly as part of an advanced services economy. And even more is spent on 'non-R&D' innovation, such as new business models, systems integration and high performance work and management practices, with diffusion effects throughout the economy.

Even in the car industry, for every \$90 spent on inputs such as parts and steel, a further \$10 goes to external engi-

neering, scientific and computing expertise. And in some other industries, the production process is becoming integrated within a constellation of activities designed to enhance the customer experience, but which are not counted as manufacturing in the national statistics.

Second, without a manufacturing base, Australia would need to import more consumer and capital goods, exacerbating our chronic inability to run a positive trade balance.

Even with record highs in our currency, terms of trade and commodity export volumes, our export revenues are barely sufficient to pay for rising volumes of imported manufactures. In recent years, according to Treasury, the trade deficit has represented up to a half of our current account deficit, and simultaneously our productivity performance has stagnated. In this context, borrowing to import manufactures together with the repatriation of resource profits expose serious vulnerabilities in our external position.

Before the global financial crisis, conventional wisdom regarded the current account deficit as irrelevant, a view corresponding with the 'efficient markets hypothesis'. Since then, however, economic opinion has switched as financial markets have savaged those countries excessively dependent on foreign borrowings.

The evidence suggests that the developed economies emerging most strongly from the downturn are those with a dynamic, competitive manufacturing sector, such as Germany. Accelerating de-industrialisation results in countries going backwards technologically with a diminished capacity for innovation. Other industries cannot substitute for this loss in capacity.

While in Australia the resources sector has recently increased its R&D spending to match that of manufacturing, the Australian Business Foundation and Lateral

## Contributions are welcome

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Economics have shown that this is directed mostly at tax minimisation rather than technology maximisation. Current changes to the R&D tax concessions are intended to reduce these loopholes.

Domestic high-tech manufacturing and services supplying the resources sector are also small. According to the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), annual sales of consulting and software services and equipment to the local and overseas mining industry amount to just 2.2 per cent of total annual manufacturing sales. The resources boom is not going to save or substitute for a robust manufacturing sector.

### Manufacturing skills

Looking to the future, manufacturing directly employs one in five engineers and many more indirectly as consultants. Without a solid manufacturing base, Australia faces the prospect of losing scientific, engineering and computing expertise that has taken generations to nurture in research and production. These skills, at both university and vocational level, will be critical to new growth industries such as biotechnology and renewable energy.

The skills developed within manufacturing are core infrastructure skills upon which every modern economy depends. Many people initially trained in manufacturing move to other industries. Where will the engineers, technicians, welders, maintenance fitters and machinists come from to install and maintain our telecommunications, power stations, water plants, transport and defence systems? According to the National Centre for Vocational

Education Research, the resources sector does not train for these skills, but rather “buys them in”.

How long will the taxpayer support billions of dollars each year spent by universities and public research agencies into solar energy, aerospace, micro-electronics, advanced materials, nanotechnology or biotechnology when the industries that can use these high-level skills to innovate and make new products have disappeared. The Productivity Commission has already questioned public support for science and engineering when the benefits of the resulting knowledge accrue increasingly to other nations. The transfer of Australian solar panel technology to China, from whom we now source production, is a case in point.

Clearly, the knowledge and skills required to import, install and maintain imported manufactures and technologies are much less than those needed for design and manufacture. Just consider the scientific, engineering and technical inputs for the production of a solar panel, motorcar, jet engine or plasma TV compared with the relatively modest skills required for their installation and maintenance.

Recent experience should be sufficient to dispel the myth that advanced economies can ‘offshore’ their manufacturing base and retain ‘high value’ design and marketing. Asian firms that started as cheap no-name makers of western-designed and branded products have quickly become global design, brand and innovative manufacturing leaders.

Manufacturing is changing the world and is itself changing as the prime source of transformational products and services. Australia’s commodity boom is an opportunity to build this transformational capacity, especially in new and emerging industries, not to let it slip away in the name of a ‘black box’ economic model that fails to recognise the significance of innovation and technological change.

### Public policy challenge

What has not changed in Australia, despite more than two decades of trade liberalisation, is the predominance of low to medium-tech manufacturing in our industry structure, such as steel, non-ferrous processing, motor vehicles, building products, basic chemicals and food processing. These are also the areas most threatened by international competition, especially from emerging economies.

By contrast, we scarcely register in high-tech and medium-high-tech manufacturing, such as pharmaceuticals, scientific instruments, electronics, advanced chemicals, aerospace and electrical equipment, despite some notable successes over the years. These are the fastest-growing areas of world trade, but also the areas where Australia experiences its largest trade deficit.

At the same time, while the resources sector is providing windfall gains for consumers and shareholders, its impact on

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#### Productivity, competitiveness and innovation: getting to the essence

business, but improving competitiveness alone will not be sufficient to improve productivity. Innovation supports productivity but is difficult to influence.

A range of policy reforms will be required to ensure adequate productivity growth is achieved – in human capital, in cities and infrastructure, and in tax and regulation. ▶

**DR MATTHEW BUTLIN** has been the Chair of the Victorian Competition and Efficiency Commission since October 2008. He is also the current President of the Victorian Branch of the Economic Society and is a member of the Council of Leadership Victoria. He was previously a Commissioner at the Productivity Commission, the Research Director at the Business Council of Australia, and a senior executive at CRA Ltd and Newcrest Mining. Earlier parts of his career included executive roles with the Commonwealth Government. Dr Butlin holds a Bachelor of Economics from the Australian National University and a PhD in economics from the Massachusetts Institute of Technology.

manufacturing competitiveness has been far from benign. As well as the effect of exchange rate appreciation, there are limited opportunities in downstream processing and supply chain access for local manufacturers, who also face increased wage costs and skill shortages due to mining recruitment.

These are the dimensions of Australia's public policy dilemma. While it is easy to say that a commodities boom is the kind of problem other countries wish they had, it is nevertheless a real problem for our non-mining trade-exposed industries. They require a policy framework that enables them to restructure and reinvent themselves, both to enhance their competitiveness during the boom and to ensure that Australia has a balanced and diversified economy when the boom comes to an end, as it most surely will.

The alternative is continuing manufacturing decline. As we have seen, some would argue on the basis of a static equilibrium model of the economy that this is not a problem at all but simply 'structural change' which results in a re-allocation of labour and capital, leaving us all better off. This conventional model is static because it excludes innovation, and equilibrium because it assumes all resources are fully employed.

The main deficiency of the conventional model is that it confines itself to asking how a fixed quantity of resources can be efficiently allocated. Consequently, it sees industry assistance policy as literally a zero-sum game, with some firms benefiting at the expense of other producers and consumers, with no net economic gain.

However, influenced by the work of Joseph Schumpeter, economists and policy-makers are modelling capitalism as a 'dynamic system', driven by technology and innovation, where change is the only constant. It is increasingly recognised that because innovation is risky and expensive, and information is costly to acquire and use, government has a role in reducing risk and encouraging the uptake and diffusion of new technologies and skills.

Senator Kim Carr, the former Minister for Innovation, Industry, Science and Research, commendably brought innovation to the forefront of industry policy. This included support not only for R&D and entrepreneurial start-ups in high-tech manufacturing but also the development of innovation capability in low and medium-tech firms through programs such as Enterprise Connect, and most recently the Industrial Transformation Research Program to encourage collaboration with research and educational institutions.

It is important to acknowledge that industry policy is not simply about replacing low and medium-tech manufacturing with high-tech, which is as unrealistic as it would be counterproductive. Already considerable innovation takes place in these firms, but rather than investing in their own R&D, their focus is on technology absorption, systems integration and business model adaptation.



Getting a grip on innovation to drive manufacturing.

PHOTO: ISTOCKPHOTO

## Vision of manufacturing

A shared vision of future manufacturing should have three main elements.

- 1** First, it should intensify the engagement of industry with research and educational institutions, given the importance of public research in Australia's innovation system.
- 2** Second, it should further enhance the 'absorptive capacity' of manufacturing firms, along with more effective local procurement, so they are better placed to participate in global markets and supply chains.
- 3** Finally, there should be a renewed emphasis on management and workplace innovation as the key to long-term growth and competitiveness.

Our recent study of management practice and productivity showed that the area where Australian managers lag world best practice by the largest margin is "instilling a talent mindset". This finding has now been confirmed and further elaborated by an important new study on the leadership, culture and management practices of high-performing workplaces by the Society for Knowledge Economics.

If future jobs are about talent and creativity, they will require a workplace of the future. ◀

**PROFESSOR ROY GREEN** is Dean of the Business School, University of Technology, Sydney. He is also Chair of the CSIRO Manufacturing Sector Advisory Council and has now been appointed to the Prime Minister's Manufacturing Taskforce. He is a graduate of the University of Adelaide with a PhD in economics from the University of Cambridge, and has worked with universities, business and government in Australia and overseas, including the OECD's National Innovation System Programme, the EU's FP7 and Ireland's Programme for Research in Third Level Institutions (PRTLII). He is grateful to Dr Phil Toner for his contribution to this article.

# US report backs innovation as the key driver

Innovation is the key driver of competitiveness, wage and job growth, and long-term economic growth, according to a new report prepared by the US Department of Commerce and the National Economic Council. Titled *The Competitiveness and Innovative Capacity of the United States*, the January report notes three key pillars that helped “unleash the tremendous innovative potential of the private sector” in the US in the 20th century and suggests they can improve future competitiveness.

It highlights Federal support for basic research, education and infrastructure as the three pillars

“Federally supported research laid the groundwork for the integrated circuit and the subsequent computer industry; the Internet; and advances in chemicals, agriculture and medical science,” it says. “Millions of workers can trace their industries and companies back to technological breakthroughs funded by the government.

“The US educational system in the 20th century produced increasing numbers of high school and college graduates, more so than anywhere else in the world. These highly skilled workers, in turn, boosted innovation.

“The transformation of infrastructure in the 20th century was nothing short of amazing: the country became electrified, clean water became widely available, air transport became ubiquitous and the interstate highway system was planned and constructed. All of these developments helped businesses compete by opening up markets and keeping costs low.”

Common to all three pillars – research, education and infrastructure – is that they are areas where government

has made, and should continue to make, significant investments, the report says. The need for the Federal government to play an important role in research, particularly basic research, derives from the fact that there is a divergence between the private and social returns of research activities, which leads to less innovative activity in the private sector than is best for the nation.

“To improve the trajectory of American innovation, thoughtful, decisive and targeted actions are needed. These actions include sustaining the levels of funding for basic research by the Federal government, extending a tax credit for private-sector R&D to give companies appropriate and well-designed incentives to boost innovation above the baseline level that would have been reached absent these incentives, and improving the methods by which basic research is transferred from the lab into commercial products.

It notes that factors such as poor preparation in maths and science and the high cost of tertiary tuition and expenses are restricting the flow of American science, technology, engineering and mathematics (STEM) graduates from US universities – and also notes Administration initiatives are addressing these challenges by making college more affordable, spurring classroom innovation at all levels, expanding the size and quality of the STEM teacher ranks, and encouraging and facilitating students’ and workers’ continued STEM education.

The US is lagging behind in certain key aspects of a 21st century infrastructure (such as broadband internet access) and facing capacity constraints for other aspects (wireless

## New major international prize for engineering

A new £1 million (A\$1.48 million) global award for engineering, to be administered by the Royal Academy of Engineering, has been established to celebrate outstanding advances in engineering that have created significant benefit to humanity.

The Queen Elizabeth Prize for Engineering will recognise and celebrate the best, and also serve to illuminate the sheer excitement of modern engineering. The search for the prize will provide an unparalleled opportunity to demonstrate how engineers and engineering are making a real difference across the world.

The Queen Elizabeth Prize will be international and aims to attain the stature of the Nobel Prizes. It will be awarded biennially, the first award being announced in December 2012 and presented in early 2013.

The prize will be awarded to an individual or team of up to three people, of any nationality, directly responsible for advancing the application of engineering knowledge. The judges will seek to recognise achievements “which have contributed to the solution of global challenges of our time”. The prize results from a growing realisation that engineering

promotes the sharing of ideas and information, empowering the desire for freedom, security and a better quality of life and underpins almost every detail of daily life while helping tackle the biggest global challenges facing the world.

The Queen Elizabeth Prize for Engineering joins a small but select group of international prizes that have similar aims – the Millennium Technology Prize, with a value of €800,000 (A\$992,310) to the winner, run by the Technology Academy, Finland, and the Charles Stark Draper Prize, with a value of \$500,000 (A\$483,850), run by the US National Academy of Engineering.

# Demand-side policies are key

communications) given the high demand for these services, the report says. Ensuring that the US has the infrastructure it needs to be competitive in the 21st century will require both additional support by the government and an appropriate policy framework to enable the private sector to build on the government's support.

It highlights the importance of manufacturing.

"A crucial component of the United States' future competitive strength is a flourishing manufacturing sector. Manufacturing creates high-paying jobs, provides the bulk of US exports, and spurs innovation. While manufacturing continues to play a vital role in the US economy and provides jobs for millions of Americans, it also has faced significant challenges, especially over the last decade.

"Manufacturing's share of GDP and the number of workers in manufacturing has fallen, while the trade balance in manufactured goods has worsened. In the manufacturing sector, the Federal government has historically played an important role in providing a level playing field and must do so with renewed vigour to ensure that manufacturing continues to thrive in the United States.

"The current and future health of the manufacturing sector is strongly linked to the investments we make in research, education, and infrastructure. Increasing the competitiveness and the capacity to innovate goes beyond improving research, education, infrastructure and manufacturing.

"Many other policies that ensure the private sector has the best possible environment in which to innovate contribute to competitiveness, including incentives to form regional clusters, promotion of exports and access to foreign markets, the level and structure of corporate taxes, and an effective intellectual property regime (domestically and abroad)." ◀

The Academy has suggested to the Victorian Government that it should not establish an innovation and entrepreneurship research institute, suggesting more benefits would flow from supporting demand-side policies.

In a recent submission responding to the Government's draft report *Securing Victoria's Future Prosperity: A Reform Agenda*, ATSE said it supported greater emphasis on demand (market-pull) innovation policies as proposed in the draft's chapter on innovation.

Its reservation about a new entity, ATSE said, was because of the extensive global literature on innovation and the availability of information from organisations such as the US Information Technology and Innovation Foundation (ITIF) and the National Endowment for Science Technology and the Arts (NESTA) in the UK.

"If additional funds were available or to be diverted from other activities, ATSE feels that they would be better deployed in support of demand-side policies rather than in the creation of another institute to study the processes and practice of innovation," the submission said.

It noted increasing recognition in Australia of the weak linkages between research organisations and business, particularly SMEs, which needed to be addressed through suitable policy initiatives. For researchers this included the assessment of research

impact as well as excellence, based on traditional measures such as citations, and for industry incentives to develop new products and services via linkages with research organisations and other collaborators.

ATSE referenced its workshops in 2011 in Sydney (*Strengthening Links Between Industry and Public Sector Research Organisations*) and Brisbane (*Increasing the innovation dividend from emerging technologies*).

## ATSE SUGGESTED THREE INITIATIVES FOR CONSIDERATION:

- change the incentives in the universities by introducing a third stream (as in the UK) to reward outreach and collaboration;
- expand the Small Technologies Industry Uptake program to pay for SMEs to prototype and market test innovations; and
- introduce a scheme to provide targeted support for networks, venture funds or other initiatives set up to bridge the funding 'valley of death' between university research outcomes and industry's needs for more mature commercial-ready technology.

**ATSE said it strongly supported the overall directions of the draft report and the opportunities it represented for State Government leadership to complement national policy initiatives for innovation.**

## Technology can boost seniors' health

Australian Governments urgently need to consider how technology can be harnessed to reduce costs and improve the quality of life for senior Australians, ATSE has told a Government inquiry. Responding to the release of the second report of the Advisory Panel on the Economic Potential of Senior Australians, *Realising the economic potential of senior Australians: enabling opportunity*, the Academy took the opportunity recently to present the key findings of its 2010 Report *Smart Technology for Healthy Longevity* and the associated document *Ageing-in-Place: Living Well with Enabling Technologies*.

The report noted that technology offers cost-effective solutions to provide medical

support and treatment at home and to relieve the pressure on service providers. Such innovations enabled ageing-in-place, whereby senior Australians can remain in their homes, safely, securely and for longer. The report noted that, for example, an 'ageing-in-place' policy could reduce government expenditure by more than \$500 million a year if 10 per cent of the current group of older Australians were enabled to remain in the community and by approximately \$85 million per annum if only 10 per cent of falls could be prevented.



# AVOIDING THE 'VALLEYS OF DEATH' FOR CLEAN ENERGY DEVELOPMENT

Strategic investment decisions are necessary to avoid the 'twin valleys of death' confronting developers of clean energy technologies, the Academy has told the Clean Energy Finance Corporation (CEFC).

In a submission in December to the CEFC's Expert Review Panel, which will advise the Australian Government on the design of the \$10 billion CEFC, ATSE said Cleantech Ventures, a small venture capital firm, has noted that investment in new technologies for clean energy faced the "twin valleys of death" problem.

## 'VALLEY OF DEATH' 1

The first was the funding gap in moving from government-funded bench-scale embryonic scientific studies into pilot-scale development. Energy technology was capital-intensive so, to move to pilot scale, several tens of millions of dollars were often required and technology proponents using private-sector funding needed to rely on venture capital equity to provide this, the submission noted.

Venture capitalists provided equity funding for this level of development, but required high projected rates of return (typically more than 25 per cent a year) over a relatively short timescale of perhaps five years

to provide funding. Only a small proportion of projects (typically less than five per cent) managed to achieve venture capital funding to overcome this first "valley of death".

## 'VALLEY OF DEATH' 2

The second occurred prior to 'first-of-a-kind' demonstration projects, where several hundreds of millions of dollars may be required. If the venture-capital-funded pilot studies had been successful and risk had been reduced, the venture capitalist would receive its return by selling its equity interest to a willing buyer – via an IPO or a private equity firm, with debt being provided by a commercial bank.

Generally, the risk at this stage would need to be low enough to justify the investment returns on the large financial sums involved. Unfortunately, ATSE said, the perceived risk at this stage was often too high for the technology to cross this second 'valley of death'.

The submission noted that clean energy technologies were currently expensive relative to the alternative, even with a carbon price, and they were at many stages of development. Wind technologies had virtually crossed the second 'valley of death', but other

technologies, such as geothermal and some solar thermal technologies, had not.

Most new clean energy technologies required subsidies and a carbon price to be financially viable and at this stage both the value of the Renewable Energy Certificates (RECs) and the carbon price were too low to ensure financial viability, it said.

Further, the technology and financial risks were still too high for private investors to provide funds (either equity or debt) at the appropriate returns commensurate with the risk.

The Academy repeated its public view that a portfolio of new clean energy targets would be required to ensure that Australia reached its clean energy targets. It said the CEFC would need to undertake strategic investment decisions to overcome the 'twin valleys of death' and that there were opportunities for CEFC to partner with private investors to achieve this.

The Academy recommended that the CEFC adopted a strategy of reducing the financial risks for financial institution investors, with one option being the provision of debt funding at a relatively low rate of return in partnership with a private investor who provided equity.

## New environments challenge research training

Tomorrow's research graduates need to be trained to accommodate new environments and to be comfortable with teamwork and interdisciplinary research, according to the Academy.

Public sector researchers were increasingly being asked to demonstrate and foster the impact of their research, ATSE said in responding to the DIISR Consultation Paper on Defining Quality for Research Training in Australia.

In the private sector, companies were now focused on distributed research models – or 'open innovation' – where inter-company cooperation and the involvement of public

sector researchers was encouraged, ATSE added in its comments on the training of research students at Australia's universities, especially in the fields of engineering, applied science and the technologies.

These aspects should be an important consideration in assessing the quality of research training in the technological areas, the Academy argued in its submission. It noted ATSE's support for the broad measures outlined in the paper that will see an improvement in the postgraduate experience but cautioned against a 'one-size-fits-all' approach because of the different nature of research and its

supervision in different disciplines.

For applied disciplines it recommended a furlough in industry, use of industry co-supervisors, more flexible approaches to intellectual property ownership and inclusion of a highly focused coursework component.

While ATSE supported the Excellence in Research Australia (ERA) approach as an institutional quality indicator, it said in its submission that in applied fields of research the measurement of the uptake of outcomes of the research by industry is important and a partial determiner of the likelihood of a satisfying research student experience.



Wind technologies – over the second ‘valley of death’.

PHOTO: iSTOCKPHOTO

## Key issues in climate change adaptation

Climate change adaptation is a key issue that cuts across most facets of Australian life and ATSE has carried out a number of studies in recent years that have identified barriers to effective adaptation.

Education, training and communication will be key features needed to develop the national capabilities to plan and manage adaptation to climate change – given the inherent uncertainties associated with estimation of future climate on a local level and the inherent community attitudes.

Consistency of regulation and planning will be needed to ensure that our infrastructure is resilient enough to efficiently manage uncertainties in both social and environmental factors.

These are key points made in a recent Academy submission to the Productivity Commission responding to its Issues Paper, *Barriers to Effective Climate Change Adaptation*.

ATSE also makes the point that, as Australia is highly urbanised, there should be a focus on increasing the resilience and efficiency of our urban areas.

ATSE said technological innovation was a key driver for implementation of the systems required for effective climate change adaptation and necessary the technological framework would have to incorporate a risk management approach to ensure balance between robustness and optimisation of systems.

Long-term planning, particularly investment planning and resourcing, would be key for successful adaptation to climate change.

Sustained and consistent measurement of environmental and socio-economic indicators would be needed so that progress could be monitored and long-term trends distinguished from natural variability.

The data would need to be quality controlled, securely archived and readily accessible and measured within a national (or international) framework.

The CEFC could provide expert advice to technology proponents about how to develop the key elements of a robust business plan for technology development and also facilitate independent evaluation of technologies.

The Academy noted the opportunity for the CEFC to support energy efficiency projects,

■ *The Government announced the CEFC in 2011 as part of the Clean Energy Future package to encourage private investment and help overcome capital market barriers to commercialising clean energy technologies. The Government said the CEFC would provide a new source of finance to renewable energy, energy efficiency and low-emissions technologies and would also invest in firms utilising these technologies as well as manufacturing businesses that focused on producing inputs to these technologies.*

particularly those that were transferable to other companies, thus leveraging CEFC funding.

The Academy submission recommended further coordination between funding agencies for existing clean energy government initiatives.

Noting the significant changes taking place nationally and internationally in the conduct and application of public and private sector research, ATSE said there were questions internationally about the benefits of public sector research, with countries keen to avoid the ‘Swedish paradox’ – the name given large investment in university and public sector research which fails to deliver a proportionate increase in the productivity of the country.

ATSE noted the very different nature of customary research training in the technological disciplines compared with the arts and the humanities.

In the former the accent was frequently on the researcher in training joining a research

team under the leadership of an accomplished researcher. Published output from the group was frequently multi-authored and the challenge in assessing the PhD candidate was one of assessing his/her contribution to the team effort.

By contrast, the humanities candidate often focused on a research problem and expected the supervisor to provide guidance on approach, but not to be a co-author of any published output. The dynamics of supervision in the two cases can be markedly different and there was a significant challenge in attempting to develop uniform guidelines for supervision in these two very different situations, the Academy said.

# 100 NEW SCHOOLS JOIN STELR

One hundred additional schools have joined the STELR Project for 2012, taking the total number of schools using the STELR materials, philosophy and equipment to 285. This means that more than 30,000 students from all states and territories will benefit from STELR in 2012.

Previously, schools undertaking STELR were able to do so without cost, thanks to a funding grant from the Federal Government and support from State education departments and corporate sponsors. This new crop of schools has invested significant funds to join the scheme – a testament to the high regard in which STELR is held by the education community.

When joining STELR, schools purchase at least one class set of equipment at \$3780 and undertake to send two teachers to professional development sessions held in major centres



Teachers from Unley High School, Netherby, South Australia, investigate wind turbines.

around the country. Schools are also required to cover the costs associated with professional training and the purchase of student workbooks and teacher support materials.

The 100 new STELR schools have received a subsidy of \$3000 to help cover their costs through sponsorship from the University of South Australia, the University of Queensland,

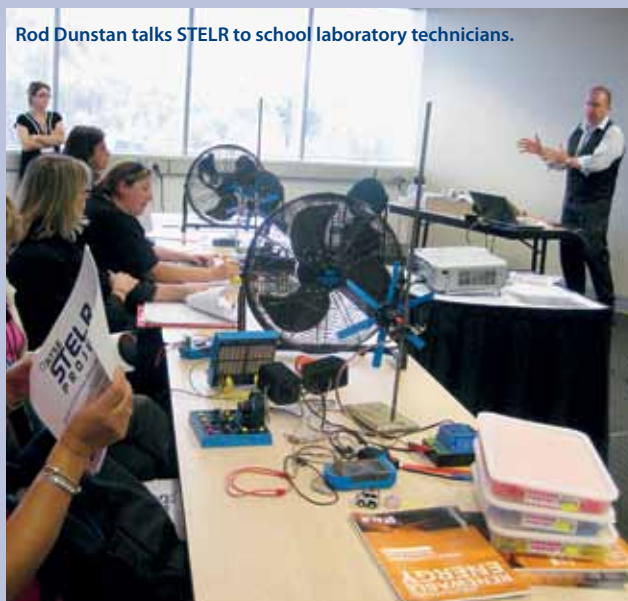
Charles Darwin University, Orica and the Australian Power Institute. Funding has also been provided by the education departments of South Australia and the ACT.

## Professional training

Professional development training is vital to the success of the STELR project as many

The Science Technology Education Leveraging Relevance (STELR) Project is ATSE's flagship education initiative. Its main aim is to encourage more secondary school students to study maths and science subjects at years 11 and 12. It does this by using a context relevant to student concerns. The main theme of the STELR program for Year 9 or Year 10 students is renewable energy. This taps into the high level of concern students have about global warming and climate change. ATSE provides schools with curriculum materials written to support the new Australian Science Curriculum, class sets of equipment to support the hands-on, inquiry-based activities and professional development for the teachers.

Rod Dunstan talks STELR to school laboratory technicians.



## ATSE takes STELR to laboratory technicians

STELR Project Officer Rod Dunstan delivered two workshops to 47 laboratory technicians at the 2011 LabCon Conference held in Melbourne in November, with support from Louise McFarlane, Head of Science at Box Hill Senior Secondary School – a STELR school – and the school's Laboratory Technician, Iris Avery. The participants were from schools that are not involved in STELR and had come to learn about the program and how it would fit with their school's science curriculum.

The workshops were very 'hands-on', with the technicians working in small groups and using all the STELR equipment. Having Louise and Iris give the teacher and laboratory technician perspectives on STELR added to the participants' ability to assess the strengths of the program, which gave them the ability to give a clear recommendation as to whether their school's science department should purchase the STELR program.

The feedback was very positive and ATSE already has some orders placed from participating schools.

secondary teachers do not have extensive science backgrounds, especially in the physical sciences.

Professional development training sessions cover a wide range of topics including:

- implementation of the STELR core program using the teacher and student books;
- managing multiple classes with the equipment;
- support for teachers;
- the STELR website;
- careers activities for students;
- assessment in the STELR project;
- inquiry-based learning;
- teaching energy concepts; and
- STELR hands-on activities, where teachers work through the core activities with the same equipment as provided to schools.

The first batch of the current professional development sessions for schools took place in December. The first session was held at the Mawson Lakes campus of the University of SA, which 38 teachers and laboratory technicians from 19 schools attended.

Northern Territory sessions were held in Darwin and Alice Springs, servicing 30 staff from 10 schools – with strong support from Dr Greg Smith from Charles Darwin University's Education Faculty, who organised the venues and presented the education theory components.

The ACT session was held at Stromlo High School on 19 December. Professional development sessions for teachers from schools in other states will occur in February and March.

Evaluation of the professional development sessions has been extremely positive with comments such as:

- "This was a valuable time for staff and enhanced confidence in the subject matter."
- "Excellent."
- "Useful to have a go at the experiments to know first hand the ease/difficulties with the materials and the questions possibly being generated."

There is no deadline for schools signing up to STELR. Schools interested in participating should contact ATSE's STELR Program Manager Peter Pentland ([peter.pentland@atse.org.au](mailto:peter.pentland@atse.org.au) or 03 9864 0906).

## ATSE CALLS FOR BIGGER NATIONAL COMMITMENT TO AGRICULTURE

Australian agriculture suffers from a shortage of investment capital to use research outputs and declining investment in agricultural research, and education is limiting Australia's ability to export agricultural outputs to a world facing food shortages.

This was a key message from ATSE in a recent submission to the Senate Education, Employment and Workplace Relations Committee inquiry into Higher Education and Skills Training to Support Future demand in Agriculture and Agribusiness in Australia.

The ATSE submission noted that agriculture and agribusiness in Australia was in a period of rapid transition, with new technologies playing an increasingly important role.

Factors impacting on the current supply of skills in agriculture and agribusiness included education and training. But other factors had reduced Australia's competitiveness. These included demographics (the ageing profile of landholders), investment finance (most owner-operators are small and cash-poor and unable to afford investment in new technologies), a lack of producer understanding of markets and labour rates (especially in food processing).

Agriculture and agribusiness were crucial

to meeting the growing international challenge of food security, but Australia's agriculture and agribusiness sectors needed inputs from disciplines as diverse as botany, zoology, geography, econometrics, mining, water science, mechanical engineering, chemical engineering, food technology, forestry, fibre science, DNA profiling, reproductive technologies, fermentation science, veterinary science, plant pathology, entomology, molecular biology and nanotechnology.

ATSE argued that it was no longer possible to encompass all these disciplines in a single university faculty or department, so it was important to recognise that several university faculties and departments provided graduates to the agriculture and agribusiness sector.

Australia needed a national commitment to sound rurally based agricultural education.

ATSE also noted that:

- there had been a reduction in Australian research outputs in agriculture;
- international professional work by Australian agricultural researchers has declined; and
- other countries, most notably China, far exceeded Australia's commitment to agricultural research.

**Time to boost  
commitment to  
agriculture.**



# The Murray–Darling Basin dilemma

The Murray River.



By John Radcliffe

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**T**he future management of Australia's Murray–Darling Basin and its water resources is causing angst among a wide range of concerned groups – irrigators, environmentalists, State and Federal lawmakers, water resource managers and the general community. That isn't anything new.

However, the Millennium drought (2000–09) and the deteriorating condition of the Murray River, the need to dredge its mouth for eight years, and to address what was clearly an over-use of scarce water resources resulted in the passage of the *Water Act 2007*, the creation of the independent Murray–Darling Basin Authority (MDBA) with a Board of five members, and an obligation to develop a Basin Plan that would be accepted by the Basin states Ministerial Council.

The objects of the Act included:

- to enable the Commonwealth, in conjunction with the Basin States, to manage the Basin water resources in the national interest;
- to give effect to relevant international agreements;
- to promote the use and management of the Basin water resources in a way that optimises economic, social and environmental outcomes; and to
  - (i) ensure the return to environmentally sustainable levels of extraction for water resources that are overallocated or overused;
  - (ii) protect, restore and provide for the ecological values and ecosystem services of the Murray–Darling Basin (taking into account, in particular, the impact that the taking of water has on the watercourses, lakes, wetlands, groundwater and water-dependent ecosystems that are part of the Basin water resources and on associated biodiversity); and subject to (i) and (ii) to,

(iii) maximise the net economic returns to the Australian community from the use and management of the Basin water resources.

In consequence, a *Guide to the proposed Basin Plan* was developed by the MDBA “to present proposals to the community for discussion”. It described the consequences of

## Murray irrigation: 125 years of history

Irrigation commenced in formal schemes at Renmark and Mildura in 1887. Management of water resources was retained by the states at Federation in 1901 (Constitution, clause 100). A Royal Commission following the 1902 Corowa Conference on lack of agreement on use of Murray Waters advised that the Murray and its tributaries must be looked at as one and the need was seen for a single management body representative of, and independent of States and Federal authorities.

In 1915, after the severe 1914–15 drought and after 13 years of negotiation, the Commonwealth, NSW, Victoria and South Australia developed the Murray Waters Agreement, leading to the creation of the River Murray Commission. Plans were agreed to construct a major storage on Upper Murray, Lake Victoria, 26 weirs and locks between Echuca and Blanchetown (only locks 1–11, 15–26 were built), other weirs and locks on Murrumbidgee or Darling, coordinate the States constructing the storages and locks, and regulate the river. This was to ensure reliable and economical river transport (almost immediately rendered redundant by advances in railways and motor transport) and to share the water.

Construction of the Hume dam commenced in 1919 and was completed in 1936, with the dam further enlarged in 1954–61. After the SA Government had taken out a writ against the Commonwealth and upstream states over the potential

reducing the then average consumptive use in the basin of 15,400 gigalitres per year (13,700GL/year of surface water and 1700GL/yr of groundwater) by 3000, 3500 or 4000GL/year as the basis of seeking to bring water consumption within “environmentally sustainable levels”. It acknowledged the limited Basin social data to which it had access.

A series of meetings were held around the country. Irrigators felt threatened. Although water entitlements had originally been obtained as a “free good”, they now had significant capital value and irrigators had made considerable investments over the years to use their water. It was widely assumed their water entitlements would be compulsorily reduced, although the Guide suggested water only be purchased from willing sellers and water savings be achieved through irrigation infrastructure efficiency projects.

Few seemed to have had time to read the Guide. Many thought it was ‘The Plan’. Opportunistic photographers encouraged angry irrigators to burn copies of the Guide – a process unlikely to have enhanced its understanding. Thirty-three communication meetings were held across the Basin, most being quite orderly. But the communication process became politicised and did not seem to be well defended.

### “Nobody asked me”

A subsequently commissioned review, *Community impacts of the Guide to the proposed Murray–Darling Basin Plan*,

insecurity of SA’s water entitlement through diversion of waters into the Snowy scheme, an unseemly set of wrangles over a proposal to build a dam on the Victorian–SA border at Chowilla followed, during which three SA Governments came and went. A railway was built to the dam site, then removed, unused.

Subsequently, the 4000 gigalitre Dartmouth Dam was built between 1972 and 1979 on the Mitta Mitta River. During 1985–88, the management of the Murray–Darling Basin again changed, with the formation of the Murray–Darling Basin Ministerial Council and the Murray–Darling Basin Commission. Policies changed from those of water resources to those encompassing water, land and the environment. A Natural Resources Management Strategy and a Salinity and Drainage Strategy recognised the needs of the Environment. Queensland and the ACT later joined the Council and Commission.

A ‘cap’ limiting the taking of water from the Murray River to 1993–94 levels was followed by a 50 per cent increase in the use of Basin groundwater resources by 2007. The 1994 COAG Water Reform Agenda and the 2004 Intergovernmental Agreement on the National Water Initiative confirmed the principles of water resource planning, management and trading, with mechanisms developed to trade Murray River permanent water entitlements or temporary water allocations within and between states.

based on interviews with 700 people from January to April 2011, covered 48 social catchments, 80 local government areas and 119 towns and regional centres. It found that the most vulnerable communities were those with a small population, high dependency on agriculture and a high irrigation spend per capita. Social impacts could include loss of population and change in population mix, change in community identity, increased demand for social services and psycho-social impacts. Local communities said: “Nobody asked me”; “It will have devastating impacts – you are not listening”; and wanted to be part of the planning process.

Following the resignation of the Chairman and one other MDBA member, a new Chair and member were appointed. The incoming Chairman visited widely around the Basin while the Authority proceeded to develop a draft Plan, which was released on 28 November 2011. The formal *Proposed Basin Plan for consultation* has the appearance of a draft Bill for Parliament – a daunting format not easily assimilated. However, it is accompanied by a *Plain English Summary of the proposed Basin Plan* including explanatory notes – a well-presented document.

It suggests an initial reduction in the “sustainable level of take” to 10,873GL/year, a reduction of 2750GL/year of consumptive use. Specific reductions are suggested in individual catchments, with additional non-specific reductions sought to maintain base river flow. A review of progress and implementation mechanisms by 2015 is suggested, with achieving implementation of the plan by 2019.

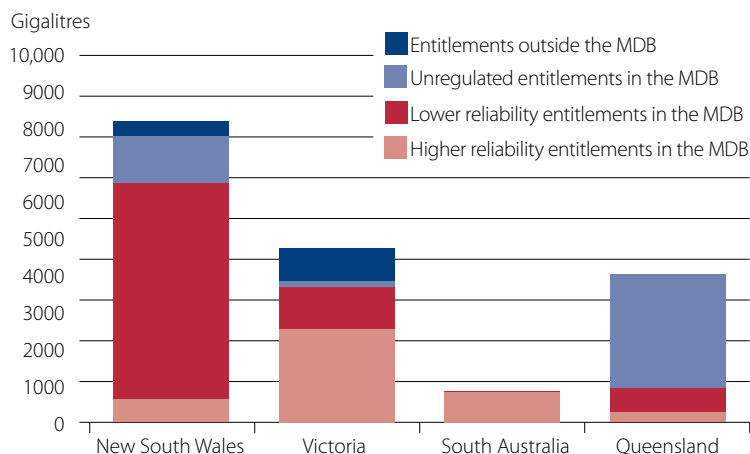
The science has been subjected to some criticism in an independent review by CSIRO. A series of meetings has been initiated across the Basin. Again, many irrigators are insecure and unhappy, being unclear what their future holds, while many others with a strong orientation to environmental sustainability are plugging for a reduction of 4000GL/year.

The MDBA has established a website to receive feedback on the *Proposed Basin Plan*. A perusal of responses in early 2012 showed there were at that time 298 responses, 128 of which consisted of a draft response generated from the website of community group Environment Victoria. A further 17 had text components suggested by a Greens member of the Australian Senate.

One might conclude that, thus far, few respondents have read the proposal or its plain English summary. Several advocated the Bradfield Scheme, while others suggested piping water from the Ord in Western Australia. Some worried about food security, while others entwined the Murray–Darling Basin groundwater issues with debates on coal seam gas located in distant areas. None have yet addressed economic issues.

It can be noted, though, that many of those presenting their own independent viewpoints appear to have faith in the need to recognise the science that must underpin the plan.

Figure 1 Surface water entitlements in the Murray–Darling Basin by reliability class



SOURCE: NWC AUSTRALIAN WATER MARKETS REPORT 2009–10

Some assert that the plan is a “political fix”. The major industry groups have yet to provide their responses and probably will not do so until just before the deadline of 16 April 2012.

### What are the issues?

There will be changes in rural communities, whether something or nothing is done. As some correspondents point out, a dying river cannot be the basis of a sound regional economy, although many take heart in the extent of recovery (‘the resilience’) of the river since the end of the drought. But that cannot be assumed.

Rural adjustment will continue to occur as properties get larger and labour efficiency and water use efficiency im-

prove. Farmers adapt – they have to. Production efficiencies will increase, in part driven by the declining terms of trade.

Australia has seen a long progression of small towns gradually reducing in size as regional centres increase in size. That process will inevitably continue.

What proportion of investment in achieving the Plan should go to improving water infrastructure?

South Australia converted its open channel systems to pipes in the 1990s with Federal, State and grower funds, but there is an additional cost in having to pump the water, a cost likely to increase as replacement electrical infrastructure and new carbon costs are introduced.

The \$2 billion Northern Victoria Irrigation Renewal Project (NVIRP) will rationalise channel infrastructure, improve delivery efficiency, line remaining channels with plastic to minimise seepage (although this precludes recruitment back to groundwater) and establish greatly improved automated monitoring.

However, the Productivity Commission, in its report *Market Mechanisms for Recovering Water in the Murray–Darling Basin*, observed that subsidising infrastructure is rarely cost-effective in obtaining water for the environment, nor is it likely to be the best way of sustaining irrigation communities. There are trade-offs to be faced in making any of these decisions.

With the world’s population increasing, there is scope for Australia to play an increasing role in contributing to world food security and it is developing a National Food Plan to do just that. The Murray–Darling Basin generates

## Groundwater a “buried treasure” but remains a



Craig Simmons

Groundwater will be a major determinant of Australia’s future as the climate warms and our population swells, a leading scientist has cautioned.

“Groundwater makes up 97 per cent of the fresh water on the planet. It currently supplies around 20 per cent of humanity’s drinking water and 30 per cent of our total water use,” says Professor Craig

Simmons, Director of the National Centre for Groundwater Research and Training (NCGRT), based at Flinders University.

“However, it will be far more important in future, as surface supplies become ever more stressed due to competing pressures from evaporation, population growth, and the demands of industry, agriculture and the native landscape. That’s why it is vital that Australians better understand and manage our groundwater resources today.”

In a future where rainfall cannot be relied on, groundwater represents Australia’s national water security for the future, Professor Simmons says. “Where our national security is concerned, we should spare no effort to assure it.”

Australia is a dry continent without glaciers, permanent snowfields or large and abundant

permanent lakes, where evaporation generally exceeds rainfall across much of our arid and semi-arid continent. Groundwater is a critical resource for large parts of the country, he says.

“But because it is underground, we pay it insufficient attention – often treating it as a free resource, to be tapped at will. If that continues, we risk another tragedy of the commons,” he says. “Such attitudes must change if we are to have sufficient water for the 31 to 42 million Australians which current estimates suggest could inhabit this continent in 50 years’ time.”

“Groundwater needs to feature much more prominently in our national and local water debates, planning and reform. The critical nexus between water, population, climate and energy must be a major driver for

39 per cent of Australia's agricultural production by value. Forty per cent of this is accounted for by irrigation (15 per cent of the national agricultural output), but represents only seven per cent of the gross regional economy of the Basin.

The Basin's economy is growing at two per cent a year. The future of the irrigation industries will depend on water use efficiency, the technologies used for its application and the markets available for what is being produced. But none of the debate has given much thought to the fact that irrigators have different reliabilities of water (see Figure 1) that have different values in productivity and economic terms.

NSW has the largest total water entitlement but a low proportion of high security water compared with a much greater proportion of "general security" water whose owners have their allocations reduced earlier during droughts. Those with "general security" water will grow annual crops (cotton, rice). They may not plant during times of low allocations and may more profitably sell their remaining water to growers of perennial fruit and nut tree crops, which earn a higher return per unit of applied irrigation water.

Victoria has a greater proportion of high security water, whereas all irrigation water in SA has a similar level of security (the growers all bear the pain of reduced allocations together).

World prices will also influence crops planted. If water is short or cotton prices are low, dryland wheat may be planted instead. This gives growers more flexibility among their options. There is often widespread criticism of the use of water for cotton and rice yet they have their place

among the cropping options and their growers are technically efficient by world standards.

Those with the managerial skills will adopt innovations to improve productivity. Investment in research and development, new crops and better training opportunities can be among the best mechanisms for helping producers adapt to changed circumstances. Those near retiring age may be pleased to sell their water to other irrigators or to the Commonwealth and separately sell their land, which may be used for other enterprises. Decisions will depend on the short-term and long-term objectives of individual landholders.

In a democracy, it will depend on all the stakeholders working together to achieve an acceptable outcome and achieve the passage of any necessary legislation for progressing the management of the Murray–Darling Basin. In the final analysis, Australia needs continual adaptation and improvement in its approach to its management.

The MDBA is to develop a monitoring and research program. The Federal Government has already completed the purchase 1179GL of Basin water entitlements for the Commonwealth Environmental Water Holder. Further improvements can be made over time.

Australia must move beyond what has potential to continue as a confrontation. Doing nothing is not an option. ◀

**DR JOHN RADCLIFFE FTSE, an Honorary Research Fellow in CSIRO, is Chair of the Academy's Water Forum. He is a former National Water Commissioner, and earlier was Deputy Chief Executive of CSIRO, Director-General of Agriculture in South Australia and a South Australian Murray–Darling Basin Commissioner.**

## "poor cousin"

national water reform as we move into the 21st century.

"Groundwater is, literally, buried treasure, and it is time Australians saw it that way. It is far and away our biggest water reserve.

"Over the long term it is potentially more valuable even than gold, oil, wheat or coal. And mining and agriculture rely heavily on it. Yet it receives a mere fraction of the attention devoted to these resources."

Professor Simmons says groundwater is:

- vital for many urban and rural users across Australia;
- widely misunderstood – as, for example, when surface and groundwater is 'double counted', leading to overestimation of the water resource;
- versatile – it can be recharged, stored and

PHOTO: NCGRT



The iconic Australian windmill demonstrates our reliance on groundwater.

- desalinated for public consumption;
- critical – in that it sustains most of Australia's native landscapes, agriculture and other large industries, as well as cities such as Perth and Newcastle, and is an essential part of any strategy for 'water proofing' the country;

- vulnerable – to salinity, industrial pollution, over-extraction, nutrients, pesticides, potential impacts of mining and coal seam gas, climate change, and ignorance of its extent, recharge rates and age.

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# Chief Scientist is enthusiastic

After more than two years as NSW's first Chief Scientist and Engineer, Mary O'Kane is enthusiastic about the research and science strengths and opportunities of the State.

"It's been enormous fun and a great honour advising the NSW Government at this time," she says. "Several of our indigenous high technology companies are byproducts of large high-impact research centres in our universities and CSIRO."

Dr O'Kane is also principal of a Sydney-based consulting company Mary O'Kane & Associates Pty Ltd, which specialises in major reviews for governments, universities and the private sector, challenging work that can have a big impact. Some of the company's well-known reviews are the Review of the Bureau of Meteorology in 2007 and the Review of the CRC Program in 2008.

She also serves on boards. For the Commonwealth Government she chairs the Australian Centre for Renewable Energy, a key component of the \$5 billion Clean Energy Initiative announced in May 2010. In the



Mary O'Kane

international development field she chairs the board of the Development Gateway, a Washington-based not-for-profit organisation that specialises in provision of open source software to aid transparency and governance in the world's very poorest counties. And she still has a major involvement with research bodies including being Chair of the CRC for Spatial Information.

Dr O'Kane had a classic research and academic career, building Australia's earliest speech recognition group in the 1980s and having all the fun of working in an interdisciplinary field at a time when the field was most competitive, with groups competing from around the world and comparing results on a daily basis.

Her career highlights include being the first female Dean of Engineering; her appointment to the Australian Research Council in 1993, aged 38; her appointment as Vice-Chancellor of the University of Adelaide in 1996; and – shortly afterwards – her appointment to the boards of CSIRO and FH Faulding & Co Ltd.

"I've been lucky – particularly lucky to have parents who let me do engineering experiments in the backyard – and lucky to have a wonderful first-degree education in maths and physics from the University of Queensland."

## ◀ FROM PAGE 29

### Groundwater a "buried treasure" but remains a "poor cousin"

Groundwater issues lie at the heart of the current national debates over the Murray–Darling Basin and coal seam gas, Professor Simmons says. "Neither of these major issues can be satisfactorily resolved without a full understanding of groundwater and its impact on other resources, communities and industries," he adds.

Despite this, he says, groundwater remains the 'poor cousin' in the national water debate – often overlooked, insufficiently measured and monitored, frequently misunderstood or taken for granted, and increasingly over-exploited.

"It faces intensifying pressures – from population growth (especially along the coast), from climate change, from mining and coal seam gas production, from agriculture and from the need to restore and safeguard the Australian landscape, our rivers, lakes and wetlands, which all depend on groundwater."

A recent CSIRO study indicated that

groundwater was heavily overallocated in seven of the Murray–Darling Basin's 20 irrigation areas. Across Australia generally, groundwater supplies are in fair to good condition.

"But all groundwater resources are threatened by droughts and climate change, which can dramatically reduce the rate at which our aquifers recharge. When rainfall declines, most of the available moisture is taken by evaporation and surface vegetation and has little chance to get into groundwater. Thus, a small decline in rainfall can lead to a very large reduction in aquifer recharge.

"Yet the first thing people do, when a drought comes, is start extracting more groundwater."

Like the continent itself, Australian groundwater is often very old – some of it recharged ages ago in ancient wetter climates, Professor Simmons says.

"We have to husband these resources with great care so they are available if and when we really need them – not extract them as if there

was no tomorrow. Also, with the breaking of the 10-year drought, apathy towards water has again set in, in some quarters.

"We have seen many droughts in this country throughout recorded history. We are a land of drought and flooding rains. We must accept that droughts will be a part of our future. At the same time, we have an increasing population as well as growing demands on water from agriculture, industry and mining.

"We need to start thinking now about how we will meet Australia's water requirements in future droughts – and with, potentially, double our present population."

"The key to effective groundwater management is knowledge: knowing with precision how large is the resource, how long it takes to recharge, how it connects to surface waters, and how quickly it is being depleted by competing social, economic and environmental demands on it.

"This is at the heart of effective policy."

# MICHELLE SIMMONS TOP NSW SCIENTIST



Professor Michelle Simmons

PHOTO: UNSW

A University of New South Wales Professor of Physics and mother of three young children has been named the 2011 NSW Scientist of the Year for pioneering the development of quantum computers.

Scientia Professor Michelle Simmons, who leads the ARC Centre of Excellence for Quantum Computation and Communication

Technology, is pioneering the

development of the world's first quantum computer.

Professor Simmons, who moved to Sydney from Cambridge 10 years ago, was one of 12 scientists, engineers and teachers who were honoured in the 2011 NSW Science and Engineering Awards. She wins \$55,000 for her achievement.

"Professor Simmons' work represents a major technological challenge and opens the door to developing a silicon-based quantum computer, a powerful new form of computing that promises to transform industries dependent upon information processing," Deputy Premier and Minister for Trade and Investment Andrew Stoner said.

Professor Simmons said she was honoured to receive the Award. "I'm pleased that this award will bring recognition to the work of the whole team, many of whom have been working on this project for years," Professor Simmons said.

"Quantum computing is not easy science – it takes many different skill sets. Here at UNSW we can manipulate individual atoms to create the world's smallest electronic devices. We are international leaders in this field. There is no one else doing what we are doing and I am proud to lead this research effort," she said.

"I think it's important for women to know they can have a family and a career. It's not easy, but it is possible and it's incredibly rewarding," she said.

The ARC Centre for Quantum Computation and Communication Technology is an international research effort, funded by the Australian Research Council, the NSW Government, the US Army Research Office and the Semiconductor Research Corporation, and whose partners include the Australian Department of Defence, IBM and Toshiba.

The NSW Scientist of the Year Awards were established in 2008 to recognise and reward the state's leading researchers for cutting-edge work that generates economic, health, environmental or technological benefits for NSW. In 2011, the awards were renamed the NSW Science and Engineering Awards 2011.

Nine awards of \$5000 each were made to individuals in the following categories:

- Climate Change and Environment;
- Mathematics, Earth Sciences, Chemistry, Physics and Astronomy;
- Biomedical Sciences and Engineering;
- Plant and Animal Research;
- Engineering and Information and Communications Technology;
- Emerging Research;
- Invention;
- Innovation in Public Sector Sciences and Engineering; and
- Innovation in Science and Mathematics Education.

## Margaret Sheil heads to Melbourne as Provost

The CEO of the Australian Research Council, Professor Margaret Sheil FTSE, will be the next Provost of the University of Melbourne. Professor Sheil, whose appointment follows an international search and selection process, will begin as Provost in late April 2012. She succeeds Professor John Dewar who became Vice-Chancellor of La Trobe University in January.

Professor Sheil has advanced the cause of research nationally and internationally through her work at the ARC, where she was responsible for the Excellence in Research for Australia (ERA) initiative.

Professor Glyn Davis, Vice-Chancellor of the University of Melbourne, in announcing the appointment said Professor Sheil's experience, combined with her extensive record of academic leadership, would be an enormous asset to the university.

Professor Sheil is a member of several national and international research bodies including the Cooperative Research Centres Committee, the Prime Minister's Science, Engineering and Innovation Council, the National Research Infrastructure Council and the Board of the Australia-India Council, and is a member of the ATSE Clunies Ross Awards Committee.

From 2002 to 2007 she was Deputy Vice-Chancellor (Research) at the University of Wollongong (UOW), following 12 years there as a senior academic and then Dean of Science. Before joining UOW, Professor Sheil held positions as a Research Fellow at ANU and the University of Utah.



Professor Sheil with Professor Robin Batterham after she launched ATSE's Health Technology report in 2010.

# CSIRO rates the air conditioner

CSIRO engineers have designed and commissioned a new air conditioner test facility to evaluate the electrical, cooling and heating performance of conventional and solar-powered systems.



PHOTO: CSIRO

**CSIRO's new National HVAC Performance Test Facility in Newcastle.**

The National Heating Ventilation and Air Conditioning (HVAC) Performance Test Facility, at the CSIRO Energy Centre in Newcastle, simulates the climate conditions of a winter in Hobart to a tropical summer in Darwin.

CSIRO Energy Transformed Flagship's solar cooling research leader, Dr Stephen White, says the facility will greatly enhance Australia's capability to perform ratings and Minimum Energy Performance (MEPS) testing of new and existing products on the Australian market.

"For the large number of HVAC systems available in the Australian market, only a few test facilities exist to validate manufacturers' claims regarding the thermal and electrical performance of their product," Dr White says.

This facility expands Australia's capacity to undertake spot-checks on products already on the market and validate new products, giving accurate information that can eventually be used for product labelling.

"It offers industry new resources to develop innovative products, test new product assembly combinations or undertake specific tests on novel and conventional air conditioning systems," Dr White says.

"Consumers are also winners because they will be able to have accurate information they can rely on to assist in making better purchase choices."

Nearly 75 per cent of Australian households have air conditioners – and heating, cooling and ventilation accounts for up to 40 per cent of business energy bills. Air conditioning also contributes significantly to peak load pressure on the electricity network and is driving the demand for upgrades to the existing electricity infrastructure.

## BIOFUELS DEMO PLANT TARGETS PETROL, DIESEL AND JET FUEL

A new biofuels commercial demonstration facility at Somersby, near Gosford in NSW, may offer the potential to reduce greenhouse gas emissions as it demonstrates the production of bio-crude oil that has the potential to be refined into petrol, diesel and jet fuel that emits less carbon dioxide than traditional fossil fuels.

The Licella plant's catalytic hydro thermal reactor works by

converting woody materials and other biomass into liquid bio-crude oil.

Licella, a wholly owned subsidiary of Ignite Energy Resources Ltd (IER), has been supported through a \$2.3 million grant from the Australian Government's Second Generation Biofuels Research and Development (Gen 2) Program. Licella and IER have entered into agreements with joint venture partners TRU Energy and Norske Skog and a memorandum of understanding with Virgin Australia.

The TRU Energy agreement is to locate a commercial demonstration plant at Yallourn Power Station, in the Latrobe Valley, scheduled for mid 2012. Trials of the technology will assess its potential to add significant value to Victoria's brown coal resource by producing quality liquid fuels and solid coal products, while also testing its capacity to significantly reduce greenhouse gas emissions from burning brown coal.

Licella and Norske Skog Australasia will form a new joint venture company called Licella Fibre Fuels, which will hold the exclusive global license to Licella's catalytic hydro thermal reactor technology to transform multiple biomass feedstocks, including forestry residues, agricultural waste and energy crops into bio-crude oil.

Licella also announced a memorandum of understanding (MoU) with Virgin Australia to support the commercialisation of a process to convert biomass into sustainable aviation fuel. Under the MoU, Virgin Australia and Licella will explore the potential of the Licella technology to produce aviation fuel, with the aim of supporting its certification and reaching a commercial off-take agreement.

• *ATSE 2011 Fellow Professor Thomas Maschmeyer FAA FTSE, Professor of Chemistry at the University of Sydney, is a technology consultant to IER.*

## QUEST FOR TRUCK BIODIESEL

A \$1.5 million industry-linked project will see University of Adelaide researchers establish a small-scale biodiesel production facility in partnership with a South Australian company, which will use the renewable fuel to power its large fleet of trucks and machinery.

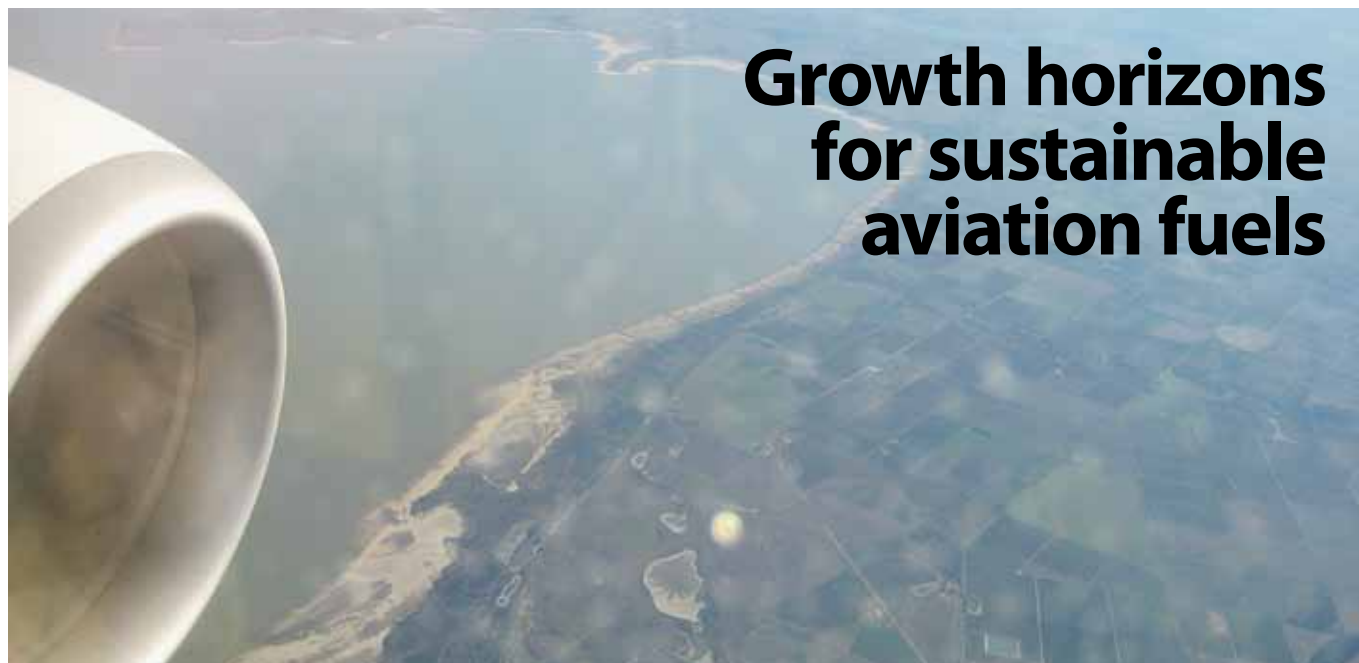
The university's FOODplus Research Centre has teamed with Peats Soil and Garden Supplies, a major manufacturer and distributor of organic farm and garden products, such as potting mixes, soils and mulches.

The project – supported by a \$622,997 Linkage Grant from the Australian Research Council (ARC) – is aimed at developing new methods of producing biodiesel from various organic and food wastes.

As part of the project, FOODplus researchers will set up biodiesel production equipment at one of Peats' operational sites at Brinkley, south of Murray Bridge, near the Murray River.



**Renewables sought to power Peats Soil and Garden Supplies trucks.**



# Growth horizons for sustainable aviation fuels

Sustainable fuel blending into airline operations.



By Susan Pond

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Australia should develop a sustainable aviation fuels industry to underpin Australian aviation and add to the diversity, strength and security of the national economy. Commercial aviation is indispensable to Australia. The industry has facilitated domestic economic growth and international trade, investment and tourism. The number of passenger movements through Australian airports reached 54.5 million in 2011 and is expected to grow by at least four per cent a year over the next 20 years.

The industry is growing in a complex business environment with many bustling intersections, including the complete reliance of jet engines on liquid fuel and the imperative to reduce greenhouse gas emissions. Globally, aviation accounts for two to three per cent of CO<sub>2</sub> emissions, derived predominantly from burning jet fuel (Jet A or Jet A-1 kerosene).

In 2009, The International Air Transport Association adopted a set of targets: carbon-neutral growth beyond 2020; an average annual improvement in fuel efficiency of 1.5 per cent a year to 2020; and reduction in CO<sub>2</sub> emissions by 50 per cent by 2050.

The emissions reductions will need to be achieved in large part by the use of Sustainable Aviation Fuels (SAF).

SAF are derived from waste streams or renewable biomass, have a low carbon emission life cycle relative to fossil fuels, meet accepted sustainability criteria, 'drop in' to existing fuel supplies and are compatible with old and new aircraft. The volumetric and gravimetric energy densities and other properties of SAF (lubrication, flash point etc) are identical in effect to the petroleum fuels on which current aircraft design and performance depend.

Production of SAF is already technically feasible. In July 2011, ASTM International\* approved revisions to D7566, the safety specification for Aviation Turbine Fuel Containing Synthesised Hydrocarbons. The revisions allow use of a 50:50 blend of petroleum jet fuel with synthetic components manufactured from hydro-processed esters and fatty acids (HEFA) produced from renewable sources including oilseed crops and microalgae.

Several other processes to produce SAF, including pyrolysis and alcohol to jet, are progressing through ASTM qualification. Multiple pathways will be required to ensure the SAF supply required to meet IATA's targets.

On 7 November 2011, a commercial United Airlines flight from Houston to Chicago with 189 passengers was powered by a blend of algal oil and petroleum jet fuel. Many other airlines have flown demonstration flights of

\* ASTM International, known until 2001 as the American Society for Testing and Materials (ASTM), is an international standards organisation that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

biofuels. Qantas and Virgin Australia have announced plans for feasibility studies of SAF from various sources.

Airlines will adopt SAF when they achieve cost parity with jet fuel. Cost parity will add significant additional motivations to use SAF and drive industry demand. These include the potential to exert greater control on fuel costs (40 to 50 per cent of direct operating costs of an airline) and security of supply. These motivations are leading the US Department of Defense to purchase SAF at prices above cost parity. Cost curves will fall rapidly as SAF plants come on line and supply chains mature.

The year 2011 provided important signals from the private and public sectors in Australia that the inherent attributes of the aviation industry – vital service, unified vision, concentrated fuel purchasing and distribution, dependence on liquid fuels, stringent fuel qualification specifications and technically adept customers – create the opportunity to take a leadership position in alternative fuels.

The industry-led Sustainable Aviation Fuel Users Group released its report *Flight Path to Sustainable Aviation*. It concluded that Australia had sufficient biomass to support a SAF industry that would bring significant economic, social and environmental benefits. The Australian Department of Resources, Energy and Tourism (DRET) signed a Memorandum of Understanding (MoU) with the US Department of Transport to work collaboratively on SAF. The US-based private-public coalition, the Commercial Aviation Alternative Fuels Initiative (CAAFI), is a major partner with Australian counterparts in the implementation of the work plan.

DRET released the Summary Report Advanced Biofu-

els Study: Strategic Directions for Australia. It highlights Australia's comparative advantages for establishment of a SAF industry, including world-class expertise in agricultural science and large-scale agricultural production, the innovative Australian companies with demonstration or early commercial projects, and the potential economic benefits, including job creation and new economic activity in rural and regional areas.

The report emphasised the challenges, particularly: the complexities associated with simultaneous and collaborative development of the entire supply chain from feedstock to fuel and co-products; lack of local refining capacity; and developing coherent and consistent policy and regulation.

Australia can develop large-scale transformative industries and should meet these challenges. We will only fail to develop a significant SAF industry if we procrastinate or limit our vision, aspirations and growth horizons. ◀

**DR SUSAN POND AM FTSE** is Adjunct Professor in the Dow Sustainability Program at the United States Study Centre at the University of Sydney. Her area of interest is the development of the advanced transportation biofuels industry, including the critical success factors required for commercially viable production at scale. Dr Pond is a Board Member of ANSTO and Commercialisation Australia and Vice-President of ATSE. Previous appointments include senior executive positions with Johnson & Johnson, as Director of Pharmaceutical Research for six years and Managing Director for the next six years of its Sydney-based biotechnology company, Johnson & Johnson Research Pty Ltd (JJR). Dr Pond was Director and then Chairman of AusBiotech Ltd from 2004–08.

## SCIENCE BEHIND CARBON STORAGE “VERIFIED”

The CO2CRC Otway Project at Nirranda South in south-west Victoria, has provided verification of the underlying science of geological carbon dioxide storage, according to the CO2CRC.

The journal paper ‘Safe storage and effective monitoring of CO<sub>2</sub> in depleted gas fields’, published in the *Proceedings of the National Academy of Sciences of the USA*, provides an overview of the science behind the project, led by the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC).

“The Otway Project has confirmed that storage in depleted gas fields can be safe and effective, and that these structures could store globally significant amounts of CO<sub>2</sub>,” said Dr Charles Jenkins from CSIRO, lead author of the

paper and monitoring program manager.

“Since April 2008, CO2CRC researchers have used a natural source of CO<sub>2</sub> at the site to inject, store and monitor over 65,000 tonnes of CO<sub>2</sub>-rich gas, two kilometres underground in a depleted natural gas reservoir.

“The work has been a major scientific and logistical exercise covering risk assessment, monitoring and verification, reservoir modelling, regulation and community relations and has produced a huge amount of scientific and practical information on CO<sub>2</sub> storage and monitoring.

“The research included the world’s first measurement of storage efficiency for CO<sub>2</sub> storage, lending weight to the conclusion that depleted gas fields have enough storage capacity to make a significant contribution to

reducing global CO<sub>2</sub> emissions.

“Monitoring of the stored CO<sub>2</sub> has been a major part of the project, allowing researchers to fine-tune a wide range of monitoring and verification procedures, including air, water, soil and sophisticated subsurface monitoring and sampling techniques. These showed that large-scale geological storage can be monitored to ensure safety, to confirm the stored CO<sub>2</sub> does not escape gradually back to the atmosphere and to underpin CO<sub>2</sub> trading mechanisms.

The paper’s authors include CO2CRC partners from CSIRO, Geoscience Australia, Lawrence Berkeley National Laboratory (USA), Simon Fraser University (Canada), Curtin University, the University of Adelaide and Schlumberger Carbon Services.

# University commercialisation needs realistic and achievable goals



By Larry Lopez and Russell Barnett

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Over the past several years, we have spent considerable time pondering the challenge of creating successful and sustainable commercialisation offices within Australian universities. We have taken close looks at operations across Australia and in New Zealand, Israel and the United States. We have drawn upon our experiences and research to develop strong views regarding the role of university commercialisation initiatives and the critical factors in their success.

University commercialisation offices exist generally to identify, protect, manage and, ultimately, transfer university-generated and owned intellectual property (IP) and technology to commercial enterprises.

Often, expectations of generating commercial returns are unrealistic and result in unproductive behavior. In the current environment, the best strategies are built around realistic and achievable outcomes that are relevant to the size and nature of the institution's underlying research activities and are aligned with the participating institution's overall strategy. Many models are based on unrealistic outcomes, and, based on their goals, are doomed to fail.

One of the most common and counterproductive missteps is when commercialisation offices try to play the venture capital game by creating spin-outs.

Venture capital is a serious business with a very small number of successful participants. To imagine a university commercialisation office could outperform experienced venture capitalists may seem absurd, but we have seen this belief reflected in office behaviours and KPI's time and time again.

In this regard, there has been a trend among university commercialisation offices towards creating start-up or spin-out companies by transferring university IP to specially formed entities that have a beneficial, and often direct ownership, relationship with the university. In fairness, this has partially been as a necessity driven by structural requirements related to qualifying for Australian Government-sponsored funding schemes, but also driven by a perception that creating companies would be a wealth creator for the contributing university.

The absence of accessible sources of proof-of-concept funding has arisen as an additional perceived need driving universities to create spin-outs. As creating, funding and developing start-up companies is not a core competency of most universities, the creation of spin-out companies has not, to date, delivered the results many participants anticipated. This problem is exacerbated in smaller universities that have relatively low research budgets, as there is a clear relationship between the size of the annual research budget and the volume and quality deal flow.

The most common spin-out model in Australia appears to be one that revolves around the university investing cash and granting the spin-out company a royalty-free licence in exchange for equity in the venture. From the perspective of building a financially self-sustaining commercialisation function at a university, this model seems flawed. In order to flatten the J-curve (longitudinal profile of cash-flow), a model that involves an annual licensing fee in lieu of reduced or nil equity in the venture would seem a more sensible commercial approach to spin-out transactions.

To the extent universities invest directly in spin-outs, it should be done as a co-investment alongside professional investors, such as venture capitalists, with the experience and motivation necessary to validate the high risk associated with early stage investment. When Vice-Chancellors decline to invest in a specific project, but the commercialisation office continues to financially support a spin-out company, the alarm bell should sound loudly, and considerable analysis based on commercial criteria should be applied to justify continued project support.

VCs don't always get it right, but most university commercialisation offices do not have the resources or experi-

ence to build successful companies. The inability to garner meaningful support from appropriate investment professionals is generally a solid indicator of the long-term viability of a project or spin-out.

An additional challenge to creating university spin-outs is the scarce supply of experienced start-up managers in Australia. The ability to recruit appropriate management teams is a major factor in the successful development of start-up companies. When making investment decisions, most professional investors place significant weight on the quality and experience of management.

Finally, disengaging or shutting down spin-out companies with low probabilities of success is very difficult under any circumstances, and is particularly difficult for universities. There are unique emotional and operational issues that make it very hard for universities to close down spin-outs. Most university spin-outs are closed down due to failure, not because of rational decision-making prior to failure.

Another common mistake is building commercialisation programs around expectations of profitability. This expectation is difficult to achieve in the short to medium term, and often results in unnecessary disappointment and premature changes in strategic direction.

University commercialisation functions that produce meaningful commercial returns are very rare and are usu-

ally the result of a very small number of, often singular, commercialisation transactions. Most university commercialisation offices either fail, or just manage, to consistently generate adequate licensing, optioning or assignment income to cover the annual operating costs of their activities. Furthermore, achieving the level of activity required to produce sufficient income usually takes five to 10 years of consistent operation.

In light of this, most commercialisation functions should be viewed as cost centres that primarily exist to protect university owned intellectual property and to facilitate and optimise interaction between the university and industry with a long-term goal of becoming a financially self-sustaining business unit within the university.

It is also important that universities understand and tabulate the derivative benefits accrued by the university in the form of net new incremental research income directly resulting from specific technology transfer activities, when analysing cost/benefits.

While the term 'commercialisation office' may be a misnomer, technology transfer is an important function at most successful universities. A technology transfer office must be a competent manager of university-generated intellectual property. It must actively capture and protect the IP generated by the institution's research activities. At the same time,

## Nanopatch man wins Innovation Challenge

A plan to deliver vaccines to millions of the world's poor through biomedical patches the size of postage stamps was named the overall winner of *The Australian* Innovation Challenge awards in Brisbane recently.

The University of Queensland's Professor Mark Kendall was overall winner in the Professional Category and also won the Manufacturing and High-tech Category. He and winners across six other categories shared in \$70,000 prize money to assist their work.

Professor Kendall's nanopatches contain thousands of tiny projections and require only about one-hundredth the dose needed for a syringe.

"When the nanopatch is applied to the skin, the projections breach our tough outer skin layer to reach our immune 'sweet spot' layers of skin abundantly rich in immune cells," he said.

It is about to undergo clinical trials, and Professor Kendall – a biomedical engineer –

hopes to be market-ready within five to 10 years.

The idea grew from shocking statistics on deaths from preventable infectious diseases – such as influenza – in developing countries and put Professor Kendall on the path to the invention of a patch to replace needles and syringes in vaccination.

The device could revolutionise immunisation globally but its greatest impact is expected to be in poor countries.

The Australian newspaper, in association with Shell and with DIISR, conducted the inaugural \$70,000 *The Australian* Innovation Challenge, which recognised some of the nation's best ideas.

Three Fellows were named as finalists: Professor Tanya Monro FTSE, of the University of Adelaide, in the Health Category; Dr David Topping FTSE, of the CSIRO Division of Food and Nutritional Sciences, in the Agriculture and Food Category; and Professor Liangchi Zhang FTSE, of the University of NSW, in the

Minerals and Energy Category.

**Professor Monro**, Alexandre Francois of the University of Adelaide and colleagues invented the Vespr (versatile enhanced surface plasmon resonance) sensor, which will enable patients to get rapid diagnoses of diseases such as cancer, HIV and influenza from their GPs.

The Vespr combines biotechnology and photonics – the booming field based on photons, or 'packets' of light. In trials, the patented device detected an inactivated flu virus within five minutes, says Professor Monro, Director of the University of Adelaide's Institute for Photonics and Advanced Sensing. "Vespr is potentially capable of screening for multiple pathogens in small sample volumes quickly and with high specificity," she says.

When CSIRO scientists bred a new variety of barley that promised to protect against colorectal cancer, their work had just begun. Despite the cultivar's potential health benefits, the team still had to convince manufacturers

technology transfer functions must cultivate and maintain relationships with relevant industry partners and sources of capital to ensure optimisation of the research outcomes.

The technology transfer function must work with university researchers in a proactive and mutually beneficial relationship. It is important that researchers perceive the office as providing an accessible and value-added service that creates ongoing benefits to their research projects. The benefits must not be limited to financial success, as this often is of minimal appeal to researchers, and most likely not achievable.

Furthermore, because of the early stage nature of the opportunities a commercialisation function is managing, developing the revenue base that is required to achieve adequate economies of scale is a medium to long-term objective – up to 10 years or more.

Arguably the most effective Australian university commercialisation operations, as measured by quantum and progress of transactions, are Uniquist (University of Queensland, University of Wollongong, James Cook University, University of Technology, Sydney, University of Tasmania and Mater Medical Research Institute), New South Innovations (University of NSW), Melbourne Ventures (University of Melbourne) and Monash University Commercialisation Office.

These draw 'deal-flow' from universities with broad and deep technical faculties with total research budgets of be-

tween \$240 million and \$408 million. They are also among the highest-ranked Australian universities according to various university ranking systems. Similarly, Uniservices at the University of Auckland has a strong track record in commercialisation, and sources its deal-flow from an annual research budget of approximately NZ\$200 million.

One of the biggest challenges to building successful technology transfer organisations is structuring meaningful key performance indicators (KPIs) to measure and incent behaviour that is consistent with the goals. Typical KPIs for university commercialisation offices should be structured to:

- ensure all commercially relevant university-generated intellectual property is identified, captured, protected, analysed and, when appropriate, commercialised effectively and in the university's best interests;
- ensure that expenditure on opportunities is commensurate with an appropriately rigorous and ongoing analysis of the opportunity;
- ensure that the best pathway for commercialisation for the opportunity is accessible and achievable; and
- ensure that projects are shut down in a timely manner based on viability as defined by cost/benefit analysis.

Technology transfer is an important activity for all universities engaged in research and, when appropriate, it is in everyone's best interest to optimise com- ▶ [MORE ON PAGE 38](#)



Professor Mark Kendall and his wife Faith at the Innovation Challenge awards ceremony in Brisbane.

to include the grain in food where wheat, rice and oats are the grains most commonly used.

Team member **Dr Topping** says – after 10 years' research – BARLEYmax™ is now in eight breakfast cereals on sale in Australia and CSIRO hopes to export it. Dr Topping says the variety contains a fibre component called resistant starch. "It resists digestion in the small intestine and gets into the large bowel where it is fermented by bacteria," he says.

The fermentation breakdown products are essential to bowel health, and are believed to lower the risk of colorectal cancer, which is one of the most common forms of cancer in Australia, he says.

When mechanical engineer **Professor Zhang** watched his new rock-cutting tips get through 500 metres of sandstone without getting blunt, even he was amazed.

Professor Zhang and his team drew on their knowledge of rock mechanics and materials engineering to design tips with a shape dramatically different from that of tips now fitted to excavation equipment, such as

longwall shearers used in coalmining.

The new tips are tougher than existing gear and promise to deliver big savings to the mining industry. Made of an advanced composite material, the tips can penetrate the hardest rock – even granite – more efficiently than conventional ones, Professor Zhang says.

He says they will extend tool life and save time. They create less dust and will slash power consumption because they reduce the cutting force that has to be applied to the rock.

The Innovation judging panel was chaired by Dr Terry Cutler FTSE FAHA and included a number of ATSE Fellows – Professor Robin Batterham AO FREng FAA FTSE, ATSE President; Dr Geoff Garrett AO FTSE, Queensland Chief Scientist; Professor Mary O'Kane FTSE, NSW Chief Scientist and Engineer; Dr Jim Peacock AC FRS FAA FTSE, former Australian Chief Scientist; and Professor Veena Sahajwalla FTSE, of the University of NSW.

# The GMT: putting Melbourne's history under the telescope

By George Littlewood

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**F**ew major scientific instruments could have had such a remarkable history as the Great Melbourne Telescope of 1869 and few could have had their story as well told as Richard Gillespie has accomplished in his recently published book on the telescope.

And the story is not yet over. A project to restore the tele-

scope and make it available for public use is well underway.

The GMT, a giant of science, had a mirror 1.2 metres in diameter and a lattice tube that soared more than 10 metres above ground level when pointed at the zenith. It was the largest telescope in the southern hemisphere for decades and the largest fully steerable telescope in the world for more than 20 years.

But these statistics, impressive as they are, give only a glimpse of the telescope's fascinating history. Gillespie engagingly captures the story from the time that 'Marvellous Melbourne' – made wealthy by the discovery of gold in 1851 and keen to display its cultural, commercial and scientific credentials – set out to secure the GMT for Melbourne. Even better, he brings the story alive by telling it through the adventures and misadventures of those who promoted and operated it.

The idea of a major telescope being located in the southern hemisphere (the Cape of Good Hope was initially considered) had its genesis in the 1840s, with the Royal Society and the British Association being the major supporters. But the path towards realisation of this goal was complex, protracted and occasionally combative.

The Victorian Government of the time voted the then

The goal of the Great Melbourne Telescope (GMT) project is to restore the telescope to working order so that it may be used for educational and public viewing. In August 2008, the Astronomical Society of Victoria, Museum Victoria and the Royal Botanic Gardens Melbourne signed a memorandum of understanding to pursue the feasibility of restoring the GMT and reinstating it in its original building at the former Melbourne Observatory site, adjacent to the Botanic Gardens. A report for the Royal Botanic Gardens by conservation architects Lovell Chen shows that the building is structurally sound and that there are no major impediments to restoring the building. The major tasks will be to reinstate the telescope piers, remove some later additions, enable the roll-off roof to once more operate and to reinstate the photographic stage. The project is overseen by a Project Coordination Committee, representing the three organisations, which is pursuing the re-installation of the GMT, development of the National Herbarium, Victoria, and associated ideas to engage visitors in the history and future of science.

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## University commercialisation needs realistic and achievable goals

mercial outcomes. But an imbalance has occurred resulting in many universities overweighting commercialisation activities in the technology-transfer process. This is usually a result of unrealistic expectations in terms of profitability.

University-created and managed spin-out companies should be rare exceptions, as they rarely succeed and are tremendous users of valuable resources. The best chance for success will be based on strategies that are tightly interwoven and aligned with the subject university's overall strategy.

It is better to deal with reality than to create a strategy that, although appealing, is unlikely to deliver upon expected outcomes. ◀

*The paper on which this article is based can be obtained by contacting Larry Lopez (larry@ventureconsultants.com.au).*

**RUSSELL BARNETT** and **LARRY LOPEZ** are partners at Australian Venture Consultants (AVC), a Perth-based strategic consulting firm focused on creating successful commercial outcomes for knowledge-based organisations and projects. The firm has a diverse range of clients including: Fortune 100, SME and start-up companies; investment managers; universities and other research organisations; and government policy-makers. Mr Barnett has more than 18 years' experience in complex strategic and operational management across a range of industries in the Asia-Pacific region. He has an MBA and is an adjunct Associate Professor in innovation at the UWA Business School and a member of the Senate of Murdoch University. Mr Lopez has 27 years' experience in management and strategic planning, working in and with companies and institutions in government, financial services, biotechnology, desalination, mining and renewable energy. Before joining AVC, he held executive positions in California's Silicon Valley, and has worked with companies across Europe and in Israel, the US, Canada and Australia.

impressive sum of £5000 to build the telescope. The GMT's local champions made sure that the order was in the mail (more accurately, on the sailing ship) before the funding decision could be revoked, as a newly installed government initially contemplated. Funding of major scientific projects was no easier then than now!

The commission was awarded to a Dublin engineer, Thomas Grubb. The GMT's first speculum mirror (a mixture of copper and tin) was cast in mid-1866. The telescope, weighing more than eight tonnes, was an engineering masterpiece. Many of its innovative features set the pattern for major telescopes for many decades.

The GMT arrived in Melbourne in 1869 and was installed in its purpose built 'house' at the Melbourne Observatory, adjacent to the Royal Botanic Gardens. The GMT House, with a innovate roll off roof, stands to this day.

Richard Gillespie, a science historian who heads the History and Technology Department at Museum Victoria, in his amusing and entertaining book charts the telescope's life – from initial success in gathering priceless new data on southern hemisphere astronomical objects to its decline by the end of the 19th century and then its remarkable revival when it was transferred to the Mt Stromlo Observatory in 1945.

On two occasions the telescope, with new optics, was upgraded and made major contributions to our knowledge of the universe. Alas, this phase of the GMT's life came to an end with the 2003 Canberra firestorm that engulfed Stromlo and damaged the telescope beyond repair for professional use.

But even that did not end the GMT's story. Thanks to Museum Victoria gathering together over the years more than 90 per cent of its original components and the dedicated restoration work of a team of volunteers from the Astronomical Society of Victoria, the GMT, Phoenix-like, is poised to rise from the ashes, to be returned to its Botanic Gardens 'house' and be made available for public use.

Gillespie's scholarly and delightful book is a fitting testament to the GMT's extraordinary story and a powerful inspiration for ensuring its return to its former glory. ◀

**GEORGE LITTLEWOOD** is secretary of the Great Melbourne Telescope Project Coordination Committee and one of Australia's leaders in corporate and strategic communication, having served in a variety of senior management and communications roles in a long career with the Rio Tinto Group in Australia and overseas.



*The Great Melbourne Telescope, by Dr Richard Gillespie (192pp, paperback, colour and black & white illustrations, 2011) is published by Museum Victoria and available for \$29.95.*

## Fewer but fiercer cyclones predicted

CSIRO climate scientist Deborah Abbs says there could be a 50 per cent reduction in the number of storms in the second half of this century compared to the period from 1971 to 2000.

But the climate model developed by Dr Abbs' team indicates a distinct shift towards more destructive storms.

"Despite a decrease in the number of tropical cyclones, there is a greater risk that a tropical cyclone that forms will be more severe in future," Dr Abbs told the annual meeting of scientists and policy makers of the Indian Ocean Climate Initiative (IOCI), which is a strategic research partnership between the Western Australian Government, CSIRO and the Bureau of Meteorology. IOCI's aim is to build the science-policy partnerships to examine the climate influences that are important for WA.

"Even a small increase in cyclone intensity is concerning because of the threat to life, property, industry and agriculture," Dr Abbs said.

A significant proportion of the WA coastline, as well as offshore industry, is vulnerable to tropical cyclones, and this area is likely to change.

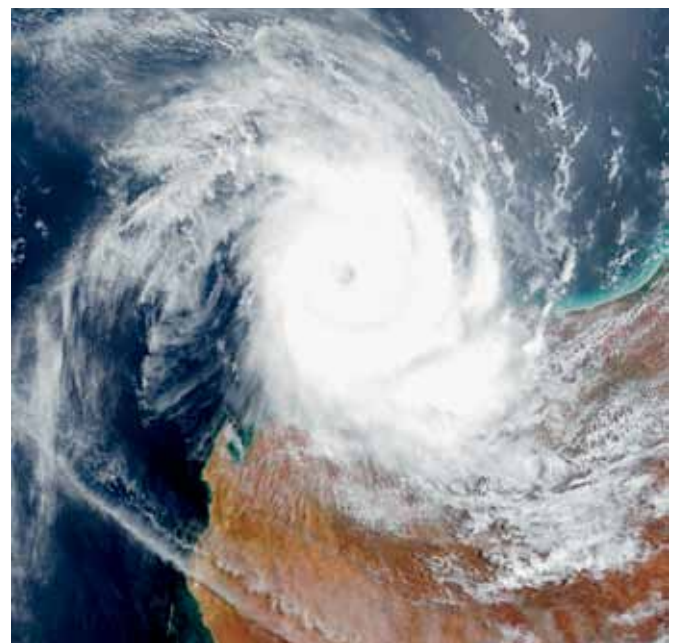
Dr Abbs' research shows 100-kilometre southward movement in both the formation and decay regions of tropical cyclones in WA by later this century, so areas not currently affected may face the risk of tropical cyclones in the future.

The incidence and behaviour of tropical cyclones is complex. Wind speed alone does not fully explain a cyclone's potential to cause damage, particularly via wave or storm surge, so the researchers used an additional measure (called integrated kinetic energy) that accounts for both wind speed and the overall area covered by a cyclone's strong winds.

Importantly, Dr Abbs' research shows this measure also indicates a distinct shift toward more destructive cyclones.

**Fewer tropical cyclones may form off WA, but they are likely to more intense, such as the Category 4 Tropical Cyclone Monty, shown 165km north-west of Karratha in 2004.**

IMAGE: NASA





David White (left) and Mark Randolph.

## UWA oceans engineers honoured

Winthrop Professor Mark Randolph FRS FREng FAA FTSE, Professor of Civil Engineering at the Centre for Offshore Foundations (COFS) of the University of Western Australia (UWA), was named as a finalist in the WA Scientist of the Year awards. The Award was won by Professor Richard Hobbs, Professor of Restoration Ecology at UWA.

Professor Randolph, a Fellow since 1993, is a distinguished geotechnical engineer whose research has concentrated on problems of particular relevance to WA, but which also have application internationally. The challenge in bringing new offshore oil and gas projects to fruition is considerable, and it has been essential to establish local expertise in the area of offshore geotechnical engineering.

He has been instrumental in developing and translating geotechnical engineering expertise to the industry and has built a substantial research group in WA. The research infrastructure generated under his leadership includes Australia's only geotechnical centrifuge facility and a world-class soil-characterising laboratory established in 1997, both of which are in increasingly high demand by industry for specialist testing.

Professor Randolph also has a direct link with industry through his role as Founding Director of specialist consultants Advanced Geomechanics, which has become the primary offshore geotechnical consultancy for all projects off the coast of Australia.

His colleague, Professor David White of the UWA Oceans Institute, was named WA Early Career Scientist of the Year.

Professor White, who is based at COFS, is a geotechnical engineer working on research involving offshore structures such as pipelines and oil and gas structures. He left a lectureship at Cambridge University to become the youngest professor at UWA in 2007 at the age of 31 and currently holds an ARC Future Fellowship.

"The seabed around Australia presents unique engineering challenges to the oil and gas industry and

when I moved to Australia five years ago I was attracted by the opportunity to conduct research that would be adopted by industry," he said.

The head of the COFS, Winthrop Professor Mark Cassidy FTSE, paid tribute to both engineers.

"David and Mark are outstanding researchers who have achieved international reputations for their work and leadership in areas of offshore engineering such as pipeline stability analysis," said Professor Cassidy, who is also Deputy Director of the Oceans Institute.

"Their work, along with that of their COFS colleagues, has been adopted in the long pipelines being built offshore, and further strengthens UWA's reputation as an international research centre for the oil and gas industry.

It's the second major award in a week for Professor White, earlier named as WA's Young Tall Poppy Scientist of the Year for his excellence in research and commitment to community engagement.

## ANSTO & MACQUARIE GO UNDERGROUND

A new agreement between Macquarie University and the Australian Nuclear Science and Technology Organisation (ANSTO) will help us better understand everything from where earthquakes might occur to where gold is deposited.

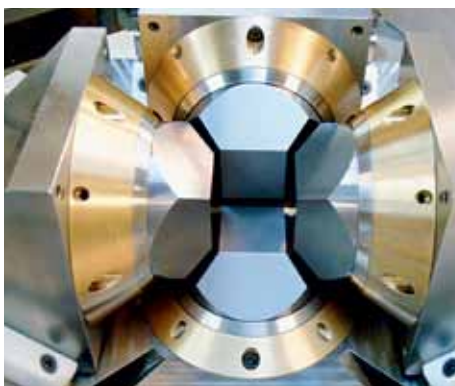
The partnership provides joint funding for a senior-level research appointment in Macquarie University's Department of Earth and Planetary Sciences. This arrangement is the first of its kind between the university and ANSTO.

The successful appointee will help lead work to replicate environments 400 kilometres beneath the Earth's surface – specifically a layer called the upper mantle, which is the source of most magma or molten rock beneath the surface. The new researcher will use both the Melbourne-based Australian Synchrotron and the Sydney-based OPAL research reactor. To this point, high-pressure research has been conducted primarily in the US and Japan.

The study of the physical and chemical processes at these depths will provide a better understanding of the Earth, including how mineral

deposits are formed. And by providing a fuller working model of the processes that occur in the Earth's interior, scientists hope to better understand how to predict and anticipate geologic events such as earthquakes and volcanic eruptions.

Along with the appointment is building of the first multi-anvil experimental facility on the Australian Synchrotron – delivering the first high-pressure synchrotron facility for geoscience research. Each anvil is effectively a hydraulic ram.



This multi-anvil apparatus will be used to conduct real-time experiments, which recreate the conditions found deep in the Earth.

# CSIRO opens world's most bio-secure lab

CSIRO has opened the world's most advanced bio-secure laboratory at its Australian Animal Health Laboratory (AAHL) in Geelong.

The AAHL Collaborative Biosecurity Research Facility (ACBRF) allows researchers from across Australia and overseas to work together on projects of national importance, using the highest levels of biological containment.

The Centre was built with the aid of \$8.5 million in Federal funding, through the National Collaborative Research Infrastructure Strategy.

The ACBRF is located within AAHL's high containment facility and incorporates a linked Australian Microscopy and Microanalysis Research Facility. This facility enables fundamental research with infectious disease agents that require the highest levels of biocontainment.

AAHL has developed a significant international reputation as one of the world's finest animal bioscience research laboratories and is the most sophisticated laboratory in the world for the safe handling and containment of infectious micro-organisms.

The additional high containment laboratory facility at AAHL will provide the necessary bio-secure and bio-safe infrastructure required to undertake vital research to effectively tackle increasing biosecurity threats – in Australia and around the world.

PHOTO: CSIRO



**The ACBRF provides advanced technology and infrastructure for scientists undertaking research that requires a laboratory environment with high biosecurity.**

## HAPTICS TECHNOLOGY IN NEW SIMULATOR

It might look like a state-of-the-art theme park ride, but future jet fighter pilots are more likely to experience the thrills with Deakin University's latest innovation.

Deakin's Universal Motion Simulator (UMS) will take trainee pilots and drivers through their paces in a safer, cheaper and more realistic training environment than currently available elsewhere in the world.

"This next-generation simulator uses its oversized robot arm to spin

users at high speeds in any direction," explained Professor Saeid Nahavandi, the Director of Deakin's Centre for Intelligent Systems Research (CISR).

"No other simulator can provide the full experience of flying a military jet with all the gut-wrenching G-forces while only seven metres off the ground," he said.

"While suited for training pilots, the UMS is also the perfect platform for simulating land-based vehicles including tanks and other armoured vehicles, trucks, race cars and motorbikes. Its training capabilities are endless.

"What sets the UMS apart from standard simulators is the integration of haptics technology, which provides a sense of touch and feel to virtual or remote objects, and its ability move at high speed and in any direction.

"Combined with a high-resolution 3D display mounted inside a headset, the user is totally immersed in the set training environment and has a 'real' experience, both visually and physically."

Deakin has received \$1.8 million in ARC/CRC grants towards the establishment of the facility that houses the UMS, including a \$285,000 ARC Linkage-Infrastructure and Equipment Facilities Program grant in 2008. ARC Linkage funding of \$210,000 was recently announced for a flight simulation project starting at the CISR in 2012 and an additional \$3.9 million has been received from the Commonwealth to undertake security-related projects.

- *The UMS is essentially a giant industrial robot arm with a reach of seven metres, a seat attached to the end of it and the capability to exert up to 6 Gs of force – ideal for flight simulation. Haptics adds a sense of touch and feel to virtual or remote objects. The technology generates forces and vibrations that simulate a realistic sense of touch and feel to the user through devices such as a joystick or steering wheel. The headset has a high-resolution 3D display and can also monitor the pilot's physical and mental responses – brain, heart pulse and blood pressure – using an EEG (electroencephalogram) and ECG (electrocardiogram).*





(From left) Captain Murray Doyle, the Governor-General Quentin Bryce and Dr Stephen Nicol.

## Antarctic medals

Leading Antarctic marine biologist Dr Stephen Nicol and a Master of Australia's Antarctic research and resupply vessel, Captain Murray Doyle, shared the 2011 Australian Antarctic Medal for service in the Antarctic.

Dr Nicol is the world's foremost Antarctic krill scientist, with more

than 33 years' experience studying the biology, conservation and management of krill and their role in the Southern Ocean food chain. He has spent long periods in the Southern Ocean, leading and participating in nine marine science voyages between 1987 and 2006 and his scientific research has appeared in more than 100 peer-reviewed publications, including *Nature*.

Captain Doyle has been Master of the RSV *Aurora Australis* for 16 years, supporting the scientific and logistical operations of Australia in the Antarctic and sub-Antarctic regions.

During his time as Master, Captain Doyle has developed an exceptional level of experience and skill to safely guide the vessel, crew and expeditioners through the unpredictable tempestuous Southern Ocean and challenging ice conditions of the Antarctic.

The Governor-General, Quentin Bryce, presented the medals on board the *Aurora*

*Australis* in Hobart in December before the ship headed south on voyage two of the Antarctic season, with 53 expeditioners on board bound for Casey station – 100 years to the day after the departure of Sir Douglas Mawson's Australasian Antarctic Expedition from Hobart.

## ENGINEER TO MARVELLOUS MELBOURNE

Dr Robert La Nauze FTSE, former Chair of AMIRA International and now Chair of the Ian Wark Research Institute's Advisory Board, has taken family history to a real level of impact.

He has been busy piecing together the life story of an all-but-forgotten Australian engineering hero, William Thwaites. This interest arose when a box of his wife's family papers arrived containing letters and reports to Thwaites that included personal letters from Alfred Deakin and James Mansergh, an English consultant brought to Melbourne in 1889 to provide advice on the drainage of Melbourne.

Robert's book, *Engineer to Marvellous Melbourne*, published in late 2011 by Australian Scholarly Publishing, traces the Thwaites family from Yorkshire, through the deprivations of London to their arrival in the fledgling town of

Melbourne in 1842.

William Thwaites, born in 1853, was the third graduate in engineering from the University of Melbourne (the Engineering School celebrated 150 years of teaching in 2011). He served on the emerging Victorian and South Australian railways



Rob La Nauze



William and Elizabeth Thwaites in 1885.



Construction of the outfall sewer aqueduct over Kororoit Creek, Melbourne, 1885.

# Deakin takes a CADET approach to engineering

Deakin University is taking a novel approach to attacking Australia's shortage of engineers by making engineering significantly more attractive to students, particularly young women. It is seeking funding from the Australian Government's Education Investment Fund (EIF) to



How Deakin's CADET might look.

before joining the water branch of the Public Works Department in 1881. Here he had an immediate and dramatic impact through the discovery of additional sources of water, boosting Melbourne's drought-prone water supply.

Thwaites then made significant improvements to rural and urban areas through major swamp-drainage schemes, some of which are now pleasant areas of suburban Melbourne.

In 1889 he presented a detailed scheme for sewerage Melbourne to a Royal Commission and, on the establishment of the Melbourne and Metropolitan Board of Works, became its engineer-in-chief.

Using the family letters, Robert has shown the extent to which Thwaites provided detailed assistance to Mansergh and how Thwaites, as chief engineer, had discovered a critical flaw in Mansergh's design. Privately Thwaites then instituted his own design, accepting the political expediency at the time of calling his changes 'modifications' to Mansergh's scheme.

Regrettably, after 15 years of tireless and meticulous effort, Thwaites died as this monumental colonial civil engineering project neared completion and his roles as its architect and builder have been largely forgotten.

***Engineer to Marvellous Melbourne: The Life and Times of William Thwaites* (paperback, \$39.95) can be purchased online at [www.scholarly.info/book/9781921875267](http://www.scholarly.info/book/9781921875267)**

partially fund its proposed Centre for Advanced Design in Engineering Training (CADET) at its Waurin Ponds campus, near Geelong.

The objective is to build aspiration for engineering training in rural and regional parts of Victoria, particularly among young women, by showcasing the importance of design, prototyping and modelling in modern engineering.

CADET is a collaborative venture between Deakin and Gordon Institute of TAFE, with local schools Belmont High School and Matthew Flinders Girls Secondary College as core partners. Deakin and its partners have lodged an application for \$21 million through the current Regional Priorities Round of the EIF. The total cost would be about \$50 million.

The CADET initiative is driven by the shortage of engineering professionals in Australia, the comparatively low entry and graduation rates in tertiary engineering courses and the unprecedented demand for engineering professions driven, in part, by the mining and infrastructure sectors. It takes account of anecdotal indications that a major barrier to wider interest and uptake in the engineering professions in Australia (particularly among young women) is one of 'image' – with engineering in Australia still perceived as a dirty 'shop-floor', factory-embedded activity, little changed over the past 60 years.

It also notes that women engineers currently represent less than seven per cent of the engineering workforce in Australia – one of the lowest participation rates of women across all professions in Australia – and that ensuring more women join and remain in the profession is vital from a social equity viewpoint while providing a means to increase excellence and address the shortage of engineering skills.

A core objective of CADET will be advocating "the 21st century reality of engineering", providing an "under-one-roof" emphasis on the design, rapid prototyping and modelling aspects, which has been shown to make engineering significantly more attractive to students, especially young women.

From a regional perspective it proposes to: facilitate the articulation pathway across and between the VET and HE sectors; increase the physical capacity to service student demand in the region; and reinvigorate and revitalise the face of engineering as an essential component of a skilled regional economy.

The partners expect the CADET initiative will raise the public perception of engineering, including within secondary schools, by increasing the visibility of the innovative and creative nature of engineering and the range of engineering occupations that contribute to Australia's prosperity, security, health and environment.

- *The Education Investment Fund (EIF) was announced in the 2008-09 Budget. The Government says the role of the EIF is to build a modern, productive, internationally competitive Australian economy by supporting world-leading, strategically focused infrastructure investments that will transform Australian tertiary education and research.*



**Premier Anna Bligh (left), Peter Gray and Karen King get some media attention at the site inspection.**

## AIBN in \$65m biologics production venture

DSM Biologics (The Netherlands), the University of Queensland's Australian Institute for Bioengineering and Nanotechnology (AIBN) and the Queensland Government will collaborate to develop next-generation smart medicines, called biologics, at a \$65 million scale-up facility under construction at the Princess Alexandra Hospital in Brisbane.

Biologics are medicines based on natural proteins made using DNA technology, offering exciting new treatment options for a wide range of diseases including cancer and auto-immune disorders. Biologics may be used for a variety of medical conditions for which there are no other treatments – and offer the only known potential treatment for Hendra virus infection.

The collaboration makes it possible for both development and potential large-scale commercial production of the experimental Hendra virus antibody, among other therapeutics, in Queensland.

DSM Biologics will operate the scale-up facility, owned by the Queensland Government entity Biopharmaceuticals Australia Pty Ltd, under construction next to the Translational Research Institute (TRI). The facility will produce clinical and commercial grade biologics for global markets.

Queensland Premier Anna Bligh, DSM Biologics President Karen King and AIBN Director Professor Peter Gray FTSE inspected progress at the new scale-up facility recently.

Ms Bligh said an MoU between DSM Biologics and AIBN completed a vital link in the chain between biopharmaceutical research and manufacturing.

Ms King said the announcement represented a significant strengthening and deepening of DSM Biologic's links and involvement with Brisbane researchers.

"The expertise at AIBN is very complementary to DSM's skills. AIBN has world-class experience in mammalian cell line development," Ms King said.

Professor Gray, an ATSE Vice President, said the collaboration with DSM would ensure that Australian bioresearchers were able to rapidly progress from laboratory work to late-stage research in a clinical setting using high-purity material developed in Brisbane.

Queensland Premier Anna Bligh said Mr Kendall was leading the research team responsible for developing the biggest breakthrough in vaccine delivery since the invention of the syringe in 1853.

## FIRST 3D HUMAN TISSUES BIOPRINTER

In a major medical breakthrough, an Australian company has developed the world's first commercial 3D bioprinter, helping organisations working on tissue construction and organ replacement.

Start-up company Organovo and Melbourne-based Invetech were awarded the Engineering Innovation Award, which is sponsored by AusIndustry.

Congratulating Organovo and Invetech, former Innovation Minister Senator Kim Carr said that their success showed the power of innovation and its ability to have a real impact on human life.

"Invetech and Organovo are a great example of what innovation can do," Senator Carr said. "For decades the goal of tissue engineers has been to advance beyond simple cell cultures to creating three-dimensional organs. This partnership took just nine months to solve these engineering challenges and design, develop, manufacture and ship the world's first commercial 3D bioprinter."

The partnership solved engineering challenges that had confounded the biomedical industry for decades to design, develop, manufacture and ship the world's first commercial 3D bioprinter. The printer includes robotically controlled precision print heads and a computer-controlled, laser-based calibration system.



**An Organovo engineer printing blood vessel structures on the 3D bioprinter.**



**ALS Environmental's National Technical Manager, Marc Centner, and Operations Manager – Australia, Geoff Anderson, with the CARE Award.**

## Contaminant testing technology wins award

Contaminant testing in water can now be performed in a much safer, more efficient and environmentally friendly way, thanks to an award-winning innovation in the laboratory, which has won the inaugural CARE Award for sustainable environmental technologies.

Pollutants such as total petroleum hydrocarbons (TPH), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and phenols and other semi-volatile compounds in water can now be tested using significantly lower sample volumes as a result of evolutionary method development by ALS Environmental. The new methodology also decreases waste, greenhouse emissions and improves manual handling considerations across the industry.

ALS was awarded the inaugural CARE Award for sustainable environmental technologies by CRC CARE's Managing Director, Professor Ravi Naidu, for introducing this new technology.

"This is an exceptional piece of technology that is going to make the task of contaminant identification and cleanup a whole lot easier," Professor Naidu says.

"Testing for these contaminants previously required one litre of sample, which has its disadvantages," says Mr Kieren Burns, of ALS. "These large samples often contained a high concentration of sediments, which can impact the quality of the results – often resulting in the reporting of slight false positives".

Over the past six years, ALS has progressively refined the technology and its methodology, to accommodate lower sample volumes without compromising quality and detection levels. "With a lower sample

volume, the total amount of solvent required can be cut by up to 90 per cent. Glassware usage and waste can be reduced by 70 per cent."

"This innovation most significantly impacts ground waters, and associated field sampling. Instead of pumping and moving 10 litres of liquid from 10 locations, field staff can now sample 10 wells and carry only one litre. Not having to sample such large volumes also means that the fieldwork can be performed more efficiently, reducing consultant time and costs."

## CLEAN-UP TOOL FOR CONTAMINANTS

Australia has taken a key step towards improving measures of human health risk with the release of new guidelines targeting one of our commonest sources of industrial contamination.

A new guidance document on the health screening levels (HSLs) for petroleum hydrocarbons in soil, soil vapour and groundwater has been released by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE).

It is expected to provide the basis for guidance in the updated national framework for the assessment of site contamination.

"Petroleum products are our commonest source of contaminants and are found in many of the nation's 160,000 contaminated sites," CRC CARE Managing Director Professor Ravi Naidu said.

"What Australia has needed for a long time is a reliable way of knowing whether they constitute a health risk or not in different situations, to inform the decision about what level of clean-up is necessary. These new HSLs provide a screening tool to determine if a health risk exists."

The HSLs help explain the possible level of health risk posed to the community and workers that may be exposed to petroleum hydrocarbon contaminants from a contaminated site, said CRC CARE's Demonstration Program Coordinator, Dr Prashant Srivastava.

"Every former petrol service station, motor workshop, rail yard, fuel dump, gasworks or factory over the past 100 years is potentially a hydrocarbon-contaminated site. Most of these are now in the heart of our big cities where people live, work and play. There are so many of them that we need to be able to make good decisions about which ones are in need of remediation," Dr Srivastava adds.

"The HSLs help us to decide the level of risk posed by different types of contamination in different situations, so clean-up can be prioritised."

"Petroleum products are our commonest source of contaminants and are found in many of the nation's 160,000 contaminated sites. What Australia has needed for a long time is a reliable way of knowing whether they constitute a health risk ... These new health screening levels (HSLs) provide a screening tool to determine if a health risk exists."

– CRC CARE Managing Director Professor Ravi Naidu

# Researching wheat for the future

With climatic conditions across Australia's wheatbelts changing – with rising atmospheric carbon dioxide concentration and temperatures and reducing rainfall – a significant challenge confronts wheat-breeding programs as they race to bring on new adapted wheat varieties.

Leading the way in assessing the challenge and finding a way to combat it, CSIRO Plant Industry and the University of Western Australia's Institute of Agriculture are working together in WA to inform wheat breeders about how climate change and variability will affect the genetic traits they select for.

A research collaboration – between UWA Institute of Agriculture Director, Winthrop Professor Kadambot Siddique AM FTSE, Dr Helen Bramley (UWA) and Adjunct Associate Professor Jairo Palta (CSIRO and

UWA) – is evaluating the impact of the interaction between elevated CO<sub>2</sub>, high temperature and terminal drought on high-yielding traits of wheat. Another component will identify wheat genotypes with efficient root-to-shoot signalling patterns associated with response to water stress, using pots to manipulate moisture in the rhizosphere.

Professor Siddique said recently evaluating how wheat crops responded to changing climatic conditions

**With one-fifth of the world's food dependent on the 200 million hectares of wheat grown worldwide, any yield declines due to climatic factors could be disastrous. Although wheat's global yield rose 20 per cent from 1987 to 1997, a one per cent decline from 1997 to 2007 flagged that wheat production would struggle to sustain the escalating global population, which is likely to rise from seven billion to nine billion by 2050.**

would help quantify the impact of climate change and identify possible improvements.

"While studies into the impact of future climate change have so far focused on the effects of increasing average temperatures or carbon dioxide levels independently, climate change models predict that in southern Australia the increase in CO<sub>2</sub> concentration, temperature and incidence of terminal drought will occur simultaneously.

"It is crucial that we quantify how wheat genotypes respond to these factors, backed up with accurate data, so that we can ensure a sustainable future for wheat production through improved varieties, efficient decision-support systems and innovative agronomic packages.

"Our research will generate new information relevant to wheat physiology and breeding strategies to help develop future water-efficient wheat varieties and the results will allow wheat breeders to select traits to best respond to the changing climate," Professor Siddique said.

## USING TECHNOLOGY TO IMPROVE YOUNG LIVES

A new Cooperative Research Centre – the Young and Well CRC – will research ways to use the internet, social media and other applications to help young Australians grow up safe, healthy and resilient.

Launching the Young and Well CRC in Melbourne, former Innovation Minister Senator Kim Carr emphasised the importance of science and technology in transforming society. "This centre will explore the role of technology in young people's lives to develop ways of using technology to improve their mental health and wellbeing," Senator Carr said.

"One in four young Australians will experience mental health difficulties, disrupting relationships, education and work. With over 95 per cent of young Australians using the internet daily, the web is the ideal tool to support young people to improve their cybersafety, mental health and wellbeing."

The Young and Well CRC will receive more than \$27 million of Australian Government funding to link young people with researchers, practitioners and innovators from more than 70 partner organisations in the not-for-profit, academic, government and corporate sectors. By using technologies that are part of their daily lives, the CRC's research aims to reduce the depression, anxiety, substance use and social isolation that can lead to youth suicide, suicide attempts and self-harm.

Young people will themselves play a key role in the work of the centre. The Youth Brains Trust, a group of 19 young people from all walks of life and all around Australia, has been formed to provide strategic direction to the CRC, alongside seasoned mental health professionals.



(From left) Professor Kadambot Siddique, Adjunct Associate Professor Jairo Palta of CSIRO, Mr Sam Henty of CSIRO, Ms Renu Saradadevi of UWA, Mr Eduardo Dias de Oliveira of UWA, UWA retiring Vice-Chancellor Professor Alan Robson and Dr Helen Bramley (front) of UWA.

PHOTO: FARM WEEKLY

## Tanya Monroe wins Pawsey Medal

Professor Tanya Monroe FTSE has won the prestigious Pawsey Medal – named in honour of the late Dr J L Pawsey – which recognises outstanding research in physics by scientists under the age of 40.

As Director of the Institute for Photonics & Advanced Sensing (IPAS) and the Centre of Expertise in Photonics (CoEP) at the University of Adelaide, Professor Monroe leads a team of academics, researchers, technicians and professional staff. She has made contributions of international significance to emerging areas of optical physics, most notably in the development of novel photonic, sensing and measurement technologies.

The Pawsey Medal, awarded by the Australian Academy of Science, recognises a number of key achievements by Professor Monroe and her team including creating: optical fibre cores that act as nanowires for sensing devices; the world's first surface-functionalised optical fibre 'dip sensor'; a new form of surface sensor that enables rapid virus detection; a new form of optical fibre that allows the fibre itself to be an active sensing material; and porous fibres for transmission of TeraHertz radiation (T-rays). As well as setting the record for the world's smallest nonlinear fibre, nearly 6000 times smaller than conventional telecommunications fibres, and encapsulating diamond nanoparticles in glass to create a hybrid material.

"Winning the Pawsey Medal is a great honour and it reflects the enormous breadth and depth of the work being conducted at IPAS, from the discovery and demonstration of new devices, pushing the boundaries of known optical fibre theory and design, and our research into materials and fabrication," Professor Monroe said.

"Ultimately, our work aims to change



Tanya Monroe

the way science is done within traditional discipline areas, to stimulate the creation of new industries and to inspire a new generation of scientists to be engaged in solving real-world problems."

Professor Monroe was named the 2011 Scopus Young Researcher of the Year Award for Physical Sciences and is South Australia's Australian of the Year 2011.

## Another win for Stuart Wenham

Professor Stuart Wenham FTSE, Director of the Photovoltaics Centre of Excellence at the University of NSW, won the 2011 NSW Scientist of the year award in the Climate

Change and Environment category.

Professor Wenham's pioneering work is at the forefront of solar technology and has contributed to solar cell technology, development and commercialisation. His work with Professor Martin Green FAA FTSE on solar technology won them the 1999 Australia Prize and Professor Wenham also won an ATSE Clunies Ross Award in 2008.

Awards of \$5000 were made to the winners of each of the nine categories in the 2011 NSW Science and Engineering Awards, including Professor Wenham.

UNSW Scientia Professor Michelle Simmons, who leads the ARC Centre of Excellence for Quantum Computation and Communication Technology, won the Mathematics, Earth Sciences, Chemistry, Physics and Astronomy category and was named 2011 NSW Scientist of the Year (see page 31).

A number of ATSE Fellows attended the awards at Government House, Sydney.



Stuart Wenham



ATSE Fellows at the awards (from left) Dr John Keniry, Dr Richard Sheldrake, Professor Aibing Yu, Professor Martin Green, Dr Mary O'Kane, Professor Mike Dureau, Professor Susan Pond, Professor Hugh Durrant-Whyte, Mr Peter North and Dr John Boldeman.

# Megan Clark 2011 Oration poses three questions

Dr Megan Clark FTSE, CEO of CSIRO, delivered the 2011 ATSE Oration at the AGM Dinner on 26 November. The Oration – or “chat” as Dr Clark positioned it – was an exciting and challenging exposition of her views of where science is going, the work of CSIRO and the opportunities and excitement that await us in the world of astronomy.

She noted that science itself was being questioned, that nations must make difficult decisions on the trade-offs between energy, water, climate change, food security and land use and that technology and innovation would underpin growth – and that the Academies had important roles in sharing the consensus views of their members with the community and increasing roles in science diplomacy and education globally.

Dr Clark tackled three questions in her oration:

- 1** How will science respond to future megatrends in a world where science itself is questioned?
- 2** What new opportunities are emerging for Australia that will be driven by science and innovation?
- 3** What will Australia have to do differently to remain globally relevant in R&D?

In relation to megatrends Dr Clark said the challenges of securing our food, water and energy needs in a world of finite resources were connected and could not be dealt with in isolation.

“We have always been taught to break down problems so we can see things simply, but understanding how things are connected requires us to model and comprehend complex systems. For example, we urgently need, as a nation, a picture of the interplay of our carbon, water and land use.



Megan Clark makes a point during her 2011 ATSE Oration.

“The insights of this new future will be fuelled by the power of our networks and computers. Our science future will be data-intensive and collaborative and globally connected.”

On new opportunities, Dr Clark said there would be market opportunities in green technologies that decreased energy, reduced environmental impact and increased efficiency; and in service industries where opportunities would be unlocked by the power of networks such as smart grids, water and environmental services.

“Australia has no free ride here and we will have to be smart, with globally competitive intellectual property, focused and ruthless in our prioritisation,” she said. “Why? Because these market opportunities will be open to one of the greatest shifts in innovation we have seen in our history in manufacturing and services.”

On remaining globally relevant, Dr Clark noted that global investment in R&D was

growing faster than global GDP.

In 2008 the US (35.4 per cent), Japan (13.2 per cent), China (9.1 per cent) and Germany (6.4 per cent) accounted for 60 per cent of global Gross Domestic Expenditure on R&D – with Australia only spending 1.3 per cent.

“If we are to have the science quality that will give us relevance we must build on our strengths and commit to national precincts of global standing and critical mass of more than 10,000 researchers and students, combined annual investment of over \$1 billion by all players in the precinct and appropriate computing infrastructure and collaboration.

“We will need this level of commitment if our innovation is to be visible from Shanghai, Frankfurt, London or New York,” she added.

## Oration dinner recognises new Fellows

ATSE’s annual Oration Dinner in Melbourne in November was the occasion

for the President, Professor Robin Batterham AO FREng FAA FTSE, to present certificates to most of the 32 new Fellows who were admitted to the Academy in 2011.

The dinner followed the AGM and the New Fellows Seminar held earlier in the day.

The 150 Fellows and guests attending the dinner relished the opportunity to renew

acquaintances and the evening was rated highly successful.

Megan Clark’s  
full 2011 Oration is  
available on the ATSE  
website at [www.atse.org.au/  
news/featured-articles/323-  
megan-clarks-2011-  
atse-oration](http://www.atse.org.au/news/featured-articles/323-megan-clarks-2011-atse-oration)



Robin Batterham presents Murray Ellen with his Fellowship certificate.

# Graham Clark wins CSL Florey Medal



Professor Graeme Clark

Professor Graeme Clark AC FRS FAA FTSE, one of Australia's greatest scientists and the pioneer of the bionic ear, has been awarded the \$50,000 2011 CSL Florey Medal, Australia's premier award for biomedical research.

The Florey Medal is an Australian award for biomedical research named in honour of Australian Nobel laureate Howard Florey, who discovered penicillin. The medal is awarded biennially by the Australian Institute of Policy and Science and is sponsored by CSL Ltd.

Accepting his prize from Professor Rick McLean, Chair of the Australian Institute of Policy and Science at the Australian Medical Research Institute's annual dinner at Parliament House, Canberra, Professor Clark spoke of his passion for returning to the laboratory and exploring the potential of technology to bridge the gap between electronics and the brain – bringing hi-fi quality and music, not just sound, to bionic ear recipients.

He announced that he was joining NICTA, Australia's national ICT Research Centre of Excellence, to help bridge the gap between electronics and the brain. In the position of Distinguished Researcher, Professor Clark (76) will lead a new project aimed at developing technologies capable of providing new types of hearing implants that can improve various aspects of auditory perception for hearing loss patients.

The 2009 medal was won by Professor John Hopwood for research and clinical application in lysosomal disorders, for which he also won an ATSE Clunies Ross Award

in 2009. In 2006 it was won by Professor Ian Frazer FRS FAA FTSE, also an ATSE Clunies Ross Award winner, for development of the cervical cancer vaccine Gardasil.

The Medal was first awarded in 1998, the centenary of Florey's birth, when it was won by Professors Barry Marshall and Robin Warren for their work on *Helicobacter pylori* and its role in gastritis and peptic ulcer disease.

## Changes on the Academy Board

The Academy President took the opportunity at the AGM to acknowledge the service of three retiring Directors, each of whom has served the Academy with great distinction over a long period of time.

Vice Presidents Peter Laver and John Grace both retired from the Board on 31 December at the completion of their terms as Directors. Both have served on the Board since its inception (and previously on the Executive Committee and Council) and have played extremely valuable roles in the transition to ATSE's new governance arrangements over the past three years.

Mr Laver has taken the Director's role in the Academy's Projects work, supporting the Executive Director – Technical, Dr Vaughan Beck FTSE, and playing a valuable role in identifying and delivering many of our most interesting policy impacts in recent years.

Mr Grace has chaired the Audit, Remuneration and Investment Committee of the Board with distinction and the Academy's strong financial position is in no small way a reflection of his diligence and skills.

Mr Peter North also retired as a Director in December, also at the completion of his term. His contribution in the area of governance, where he has been able to draw on extensive public board experience, will also be missed.

Dr Calum Drummond and Dr John Wright, who were elected by the Fellowship in a ballot, joined the Board as Directors from 1 January 2012. Directors Professor Peter Gray and Professor Susan Pond were elected by the Assembly as Vice Presidents, from 1 January.

## Three Fellows awarded Honorary Doctorates

Three Fellows were recently awarded Honorary Doctorates by Australian Universities.

Academy President Professor Robin Batterham AO FREng FAA FTSE received his Doctor of Engineering honoris causa from The University of Queensland. Described as a long-term friend of UQ, he has been a frequent visitor, delivering a number of invited presentations, including as the guest of honour during annual Research Week events. He also continues to work closely with the Julius Kruttschnitt Mineral Research Centre in the Sustainable Research Institute in a technical advisory capacity.

Mr Martin Albrecht AC FTSE, the former Managing Director and Chairman of Thies and former Chairman of Geodynamics, was admitted to the degree of Doctor of University by Griffith University, in recognition of his distinguished services to the community and the university.

Diabetes expert Professor Paul Zimmet AO FTSE, Honorary President of the International Diabetes Federation (IDF), was awarded an Honorary Doctor of Laws by Monash University, presented by Monash Chancellor Dr Alan Finkel AM FTSE, in the presence of Monash Vice Chancellor Professor Ed Byrne AO.



(From left) Ed Byrne, Paul Zimmet and Alan Finkel at the ceremony.



## Sir Zelman Cowen: an acclaimed Australian

Honorary Fellow the Right Honorable Sir Zelman Cowen AK GCMG GCVO KStJ FTSE, who died in Melbourne on 8 December 2011, aged 92, was acclaimed across Australia for his achievements.

A Rhodes Scholar and former Vice-Chancellor of the universities of New England and Queensland, Sir Zelman was elected an Honorary Fellow in 1979. He served as Governor General 1977–82 before taking an appointment as Provost of Oriel College, Oxford, until 1990.

His funeral in Melbourne was attended by three former Prime Ministers, the Governor-General, the Prime Minister and Leader of the Opposition and a wide array of prominent Australians.

He was dux of Scotch College, Melbourne, and at the University of Melbourne he studied Arts and Law, being named the Supreme Court Prizeman in 1941.

In 1940 he was awarded a Rhodes Scholarship. His studies were interrupted by war service from 1941–45 in naval intelligence. He was based in Darwin during the Japanese attack of 1942. He was later a sub-lieutenant on General Macarthur's staff in Brisbane.

After the war, he studied at Oxford, revelling in "the blazing richness of life, in intellectual and cultural terms", and thriving academically in the system of "close relationship between teacher and student".

In 1947 he was the Vinerian Scholar in Law, and from 1947–51 he was lecturer in law and a fellow of Oriel College. In 1951 he returned to Melbourne as a very young Professor of Public Law.

From 1967–70, Sir Zelman was Vice-Chancellor at the University of New England, and from 1970–77 Vice-Chancellor of the University of Queensland. In 1969 he became

an academic member of the Board of the Hebrew University and in 1977 he was chairman of the Australian Vice-Chancellors Committee and also a Law Reform Commissioner of the Commonwealth of Australia.

In 1977 he was appointed Governor-General and during his tenure he travelled and spoke extensively. In 1982, when his term was completed, he returned to Oriel College as Provost, a position he held until 1990. He was also Pro-Vice-Chancellor of Oxford University 1988–90. From 1983–88 he was chairman of the British Press Council.

Sir Zelman's contributions to the law and to Australian society have been recognised by several honours. In 1976 he was awarded a knighthood of the Venerable Order of St John of Jerusalem, and in 1977 he was honoured with a knighthood of the Order of Australia and with a knighthood of the Grand Order of Saints Michael and George. In 1981 he was made a Privy Counsellor.

His publications and speeches attest to the number and breadth of his interests. He was much in demand as a speaker and wrote on international law, the law of evidence, freedom of the press and rights of the individual.

He was a loyal and active member of the Jewish community all his life and wrote a biography of the first Jewish Governor-General, Sir Isaac Isaacs.

## Two Fellows on GRDC Board

Dr Jeremy Burdon and Professor Rob Lewis have been appointed directors of the Grains Research and Development Corporation (GRDC).

Dr Burdon FTSE has an international reputation in evolutionary biology, particularly the application of molecular technologies to crop production.

Sir Zelman Cowen (centre) with former Prime Minister Bob Hawke (left) and ATSE SA Division Chair and former Chancellor David Klingberg at the University of South Australia.

Leading the Plant Industry Division of CSIRO for the past eight years, Dr Burdon has responsibility for the development of its scientific capability; the strategic direction of the science; and its financial health and staff training. The division has a strong reputation for the execution and delivery of high-quality research to several industries, including the grains industry.

Professor Lewis is a former SA Division Chair and was CEO/Executive Director of the South Australian Research and Development Institute (SARDI) for 18 years, a position from which he retired in June 2010.

SARDI is the principal institution for public sector research in life sciences for the SA government. Professor Lewis's leadership was noted for his depth of experience in research, research management, public and private sector policy and governance, IP management and commercialisation.

The GRDC is responsible for planning, investing and overseeing research and development and delivering improvements in production, sustainability and profitability across the Australian grains industry. It operates as a research investment body in partnership with growers and government.

Announcing the appointment of directors, the Minister for Agriculture, Fisheries and Forestry, Senator Joe Ludwig, said: "Their range of skills, industry experience and scientific and strategic management will benefit Australia's grains industry and help drive the international competitiveness and profitability of the industry in the long term."



Rob Lewis

Jeremy Burdon

# UWA farewells Alan Robson as Vice-Chancellor

When he walked out of the Vice-Chancellery for the last time as Vice-Chancellor of The University of Western Australia, recently retired Professor Alan Robson AM FTSE knew



**Alan Robson**

he would miss many things – but what he admits he won't miss are the exceptionally long hours he's invested in his leadership of this university over two decades, first as Deputy, then as Vice-Chancellor.

"It's been a very demanding job and yes, I do work long hours because the job is completely open-ended and there's always something more you can do," he said before retirement.

"I've been very fortunate because I have a wonderfully supportive wife and family who made it possible for me to be so committed."

Those who have worked closely with him acknowledge the steely determination and drive that lie behind a genial leader. Professor Robson has quietly steered UWA into tertiary education's increasingly global arena, setting an ambitious course for its recognition among the world's great universities, which will in 2013 mark the centenary of the enrolment of students at WA's longest established university.

Professor Robson's leadership and the strategic targets he set have been endorsed by business, industry and government leaders alike. Closer links with a research-intensive university committed to training the next generation of innovators and leaders is now widely acknowledged as mutually beneficial – not only by industry giants fuelling the state's phenomenal growth but also by schools and students excited by the widening employment prospects.

International travel is on his radar, including a visit to the windswept Shetland Islands off

Scotland, home to his great-grandfather who ran away to sea when he was 15.

When he enrolled in Agricultural Science at the University of Melbourne, Alan Robson was the first member of his family to go to university. Scholarships funded by local farmers saw him through university and he arrived at UWA as a PhD student, newly married and just 21. UWA and Western Australia made a good first impression and in 1974 he returned as a lecturer in plant nutrition.

The young soil scientist rose swiftly through the ranks and within a decade had been appointed to the vacant chair in soil science. A year later he was Dean of the Faculty – but not for long. At the time UWA was applying to host the Cooperative Research Centre for Legumes in Mediterranean Agriculture (CLIMA), which was established with \$2 million funding and with Alan Robson as its Foundation Director.

CLIMA quickly established itself as a research leader acknowledged internationally, and Professor Robson's leadership caught the eye of Vice-Chancellor Fay Gale who persuaded him to be her Deputy. He agreed, provided he could spend a year getting CLIMA established.

During his term of office, he has seen many researchers and students honoured at the highest international level: Professors Barry Marshall and Robin Warren won Nobel Prizes, while students regularly secure Rhodes, Fulbright and Sir John Monash scholarships.

Professor Robson has advanced the initiatives put in place by Professor Gale, UWA's first female Vice-Chancellor. Increasing the number of women at senior levels and supporting a family-friendly workplace have ensured that UWA has been the Federal Government's Employer of Choice for Women for an exceptional nine consecutive years.

Professor Robson acknowledges that, while happy to retire from the challenging roles he has held since 1993, he's not ready to leave the campus he loves and that he joined as an agricultural scientist in 1974.

"I can't imagine not having an interest

to turn my mind to – and my home just isn't large enough for all the books I've accumulated," he muses. "My plan is to return to a research role in the Institute of Agriculture – agriculture being sufficiently far away from the Vice-Chancellery that the new Vice-Chancellor won't feel I'm looking over his shoulder!"

Professor Robson has joined the Board of the General Sir John Monash Foundation, has been appointed founding Chair of the Federal Government's Higher Education Standards Panel and will head the inaugural Academic Board of University College London's Adelaide campus.

– story courtesy Uniview, UWA's graduate magazine.

• Professor Alan Robson was recently named Australia's leading CEO for the advancement of women. The award was presented by the Australian Government's Equal Opportunity for Women in the Workplace Agency, and follows UWA's award for national employer of choice of women in 2011.

## Peter Lilly joins BHP Billiton

Dr Peter Lilly FTSE, Executive Director of Minerals and Energy Strategy at Curtin University's Institute of Minerals and Energy and former head of the CSIRO Minerals Down Under Flagship, joined BHP Billiton in January as Senior Manager Research and Development within Group Resource

and Business Optimisation.

In this role he will provide a focal point for technology, research and development across the company. He takes up the role from Dr Brian Smith FTSE who, after a



**Peter Lilly**

long and distinguished career, is retiring from BHP Billiton in March 2012.

Dr Lilly is Chair of the WA Division, a former President of the Australian Institute of Mining and Metallurgy and headed the WA School of Mines from 1999 to 2006.

## Malcolm Chaikin: leader and philanthropist

The death of Professor Malcolm Chaikin AO OBE FTSE in Sydney in January, aged 88, brought to an end a long and remarkable career in textiles science, university leadership and philanthropic support. He had been a Fellow since 1977 and served as a Councillor.

Born in China in 1923 to Ukrainian



Malcolm Chaikin

parents, Professor Chaikin was a leading authority on textiles, former Pro-Vice-Chancellor of the University of NSW, former Chairman of the National Institute of Dramatic Art and

well known for his support of science education and achievement through the

Malcolm Chaikin Foundation at the University of New South Wales, which has been a strong supporter of the ATSE Clunies Ross Awards.

After completing his schooling in Shanghai in 1945, and serving with the US Air Force in China, he obtained a BSc in Textile Industries from the University of Leeds in 1950 and a PhD in 1953. He joined the CSIRO Division of Textile Physics in 1953 before joining the University of NSW – then in its infancy – in 1955, when (at 31) he was as the youngest professor in Australia as the Foundation Chair of Textile Technology.

He soon became known as Australia's foremost authority on textiles and was among the first to recognise the benefits to higher education of increased commercialisation and knowledge-transfer activities, and

the protection and application of intellectual property.

As well as enjoying an international reputation as an eminent scientist, Professor Chaikin played a vital role – first as a Dean (then Australia's youngest) and later as UNSW's first Pro-Vice-Chancellor for External Affairs – in securing the spectacular growth of the university from the newly established institution he joined to the world-renowned university it is today.

He had a great love of the arts and was for many years the Chairman of Australia's National Institute of Dramatic Art (NIDA).

In 2009 – 62 years after he entered the University of Leeds – he was honoured with a Doctor of Science (*honoris causa*) from his alma mater. He received many awards and prizes from universities and organisations during his career, held some 30 patents and was named a Carnegie Fellow (1966) and a Ben-Gurion Fellow (1986).

## Huntly Higgins was a leader in papermaking

Dr Huntly Higgins FTSE, who died in Melbourne in December 2011, aged 94, achieved national and international prominence in the science of papermaking during his long career with CSIRO.

He became Chief of its Division of Chemical Technology and, after his retirement in 1982, served as an Honorary Research Fellow in CSIRO and a Senior Associate with the University of Melbourne.

Dr Higgins, who joined the Academy in 1976, began his career with CSIRO in 1945 and served in the Division of Forest Products until 1973, when he became Assistant Chief of the Division of Chemical Technology.

In a tribute, CSIRO and staff of the former CSIRO Division of Chemical Technology said they were saddened by the death of an "outstanding" Chief.

"He was a world authority on the science of papermaking. His work ranged from providing an understanding of cellulose/ based fibre bonding to improving the quality

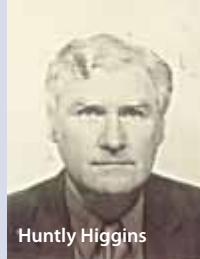
of a range of forest products.

"As an Honorary Fellow in the CSIRO Division of Forest Products, Huntly continued his interest in the fundamentals of paper physics for many years. Huntly will long be remembered as a leader, friend and mentor of his staff."

Dr Higgins was a Fellow of the Institute of Physics, the Australian Institute of Physics, the Royal Australian Chemical Institute and the Institute of Wood Science.

He was born in Perth and educated at the University of Western Australia (UWA), where he won a Hackett Scholarship in 1939. He commenced his career as a geologist, working in WA and New Guinea between 1938 and 1941, including a spell as a lecturer at the WA School of Mines in 1940.

He served as a Meteorological Officer with the RAAF 1941-45, attaining the rank of Flight Lieutenant. Former ATSE President Professor John Zillman AO FAA FTSE recalls that



Huntly Higgins

Dr Higgins attended the anniversary reunion of the RAAF Meteorological Service at the Bureau of Meteorology in August 1995, 50 years after the end of World War II.

### A tribute to Huntly Higgins

By Warren Hewertsen FTSE

Huntly majored in physics and geology at the University of WA in 1937. After surveying the Finisterre Ranges in New Guinea for a WA oil company, he returned to UWA and took honours in geology. He worked in Kalgoorlie as Assistant Geologist, where he also took charge (part-time) of the Geology Department in the WA School of Mines.

World War II saw him change the course of his career irreversibly. He obtained a commission to train as a meteorologist. "Digging gold out of the ground to rebury it in Fort Worth" seemed less worthy than applying his knowledge of physics to support the RAAF. His forté for studying the physics of complex systems became evident very quickly. He developed a model for predicting katabatic (night-time coastal mountain-induced offshore) winds. Another forecasting

Professor Chaikin fitted more into his 'retirement' than many do in their working lives. He continued to maintain a daunting portfolio of professional commitments: acting as a Visiting Professor; using his extensive contacts to facilitate international educational partnerships, supporting academic initiatives to address Australia's water shortage; serving as Vice-President of the Australian Academy of Forensic Sciences; and involving himself closely in a wide range of charitable activities.

Much of this latter activity was directed through his own Malcolm Chaikin Foundation, set up in 1988 to benefit high-achieving Australian students of science or engineering.

He maintained strong links with the Academy and was a strong supporter of the ATSE Clunies Ross Awards through sponsorship by the Malcolm Chaikin Foundation.

tool involved storm fronts in the tropics which, apparently, became invaluable in determining when it was advisable for planes to take off and land. At the end of the war, he accepted the offer of a job as paper physicist in the (then) CSIR Division of Forest Products.

The exigencies of war were such that when he reported for duty, he was informed that the plywood group was lacking competent staff.

Again, he quickly adapted to a new challenge. His fundamental work on the glass transition temperature of lignin in various timbers resulted in a good understanding of what had been a somewhat empirical approach. In addition, he departed into the realms of chemical and colloidal properties of casein – the predominant reconstituted wood adhesive of the day. Huntly's collaboration with others led to the development of a rheometer that became key to the study of both plywood and paper rheology. This was a forerunner to the universal Instron tester.

Work in paper physics began for Huntly in 1951; he was to become a leading authority in this area. He took his penchant for tackling complex issues by undertaking

## Fellows take AAS Council roles

Professor Chennupati Jagadish FAA FTSE, nanotechnology and photonics expert from the Australian National University, currently a member of Australian Academy of Science Council, will become the its Secretary for Physical Sciences.

Professor Michael Raupach FAA FTSE, CSIRO climate specialist, will become a Council member for physical sciences.



**Chennupati Jagadish**

Cervical cancer vaccine specialist Professor Ian Frazer FRS FAA FTSE, from the University of Queensland, will become a Council member representing biological sciences. The new Councillors will assume their roles at the Academy's AGM on 4 May 2012.

Cervical cancer vaccine specialist Professor Ian Frazer FRS FAA FTSE, from the University of Queensland, will become a Council member representing biological sciences. The new Councillors will assume their roles at the Academy's AGM on 4 May 2012.



**Alex Zelinsky**

## Alex Zelinsky is the new Chief Defence Scientist

Dr Alexander Zelinsky FTSE has been appointed Chief Defence Scientist and head of the Defence Science and Technology Organisation (DSTO).

Dr Zelinsky has worked with private and public sector organisations at the senior executive level and was the Group Executive, Information Sciences Group, in CSIRO before his new appointment, effective early 2012.

The Minister for Defence Science and Personnel, Warren Snowdon, said Dr Zelinsky was an internationally recognised scientist who has made substantive technical contributions in addition to providing leadership to the high technology community.

"Since joining CSIRO in 2004, Dr Zelinsky's focus was on building the research capabilities of his Group to address Australian national challenges, particularly in the energy, health, agriculture, mining and environment sectors," Mr Snowdon said.

"In his previous role as a Professor at the Australian National University, Dr Zelinsky was known for his pioneering work in developing novel technologies for human/machine interaction, which has been recognised as a key breakthrough technology by academia, industry and the wider community."

Dr Ian Sare FTSE has been acting Chief Defence Scientist since the retirement of Professor Robert Clark, announced in August 2011.

"Dr Sare has done a wonderful job steering the DSTO team over the past several months, and I trust the coming period will prove to be just as productive under Dr Zelinsky's leadership," Mr Snowdon said.

## Strong links to new CRCs

ATSE has strong links to four of the six new Cooperative Research Centres announced recently.

Dr Matthew Cuthbertson FTSE heads the Automotive Australia 2020 CRC, which received \$26 million in funding and will undertake research programs and build human capital in areas of vehicle electrification, gaseous fuels and production of greener vehicles and components. Guided by the outcomes of the Automotive Australia Technology 2020 Roadmap, the new CRC will tackle the complex issues that are currently impeding the uptake of low-carbon vehicles worldwide, with innovation specifically in the areas of vehicle electrification, gaseous fuels and clean manufacturing.

Dr Ian Dagley FTSE heads the CRC for Polymers (to receive \$14.5 million in funding), which will contribute to establishing Australia as a leading provider and exporter of products that meet emerging global needs in the areas of health therapies, water and food security and low-cost solar energy by developing enabling and sustainable advanced polymer technology. The products developed are anticipated to improve productivity, grow the manufacturing sector, create high-skill, high-value manufacturing jobs and reduce CO<sub>2</sub> emissions.

Polymer scientists Professors Ezio Rizzardo and David Solomon, who were jointly awarded the 2011 Prime Minister's Prize for Science, in their acceptance speeches both recipients thanked the CRC for Polymers, which has provided them with funding support.



(From left) Professors David Solomon and Ezio Rizzardo with Prime Minister Julia Gillard and Senator Kim Carr.

Professor Rizzardo was the Inaugural/ Interim Director of the CRC for Polymer Blends from 1992–94 and has been a Research Program Leader in continuing entity at the CRC for Polymers since 1994. His research in the CRC has resulted in many licensed technologies, most recently polymer technology for reducing the biofouling of membranes.

Professor Solomon joined the CRC in 2005 and is leading its research based at the University of Melbourne on applying polymer science to reduce evaporation from water storages.

Six new CRCs will be funded to \$148 million under the 14th selection round, announced by the Minister for Innovation, Industry, Science and Research, Senator Kim Carr.

ATSE has links to two others: the CRC for Low Carbon Living, headed by Professor Deo Prasad from the University of NSW, and the CRC for Water Sensitive Cities, headed by Professor Tony Wong of Monash University.

Both Professor Prasad and Professor Wong were invited to join an ATSE delegation to Korea in April last year to attend a Green Growth Workshop organised by ATSE and the National Academy of Engineering of Korea (NAEK).

### Geoff Stevens now a Laureate Professor

Professor Geoff Stevens FTSE, from the Department of Chemical and Biomolecular Engineering, is the University of Melbourne's newest Laureate Professor.

Professor Stevens now becomes the third Laureate Professor within the Melbourne School of Engineering, alongside Professor Rob Evans FAA FTSE, from the Department of Electrical and Electronic Engineering, and Professor Rod Tucker OAM FAA FTSE, Director of the Institute for a Broadband-Enabled Society.

Professor Stevens, a Fellow since 2003,

completed his PhD at the University of Melbourne in 1981 and his research interests are in the areas of separation processes, particularly solvent extraction, interfacial phenomena and emulsion stability. His research is primarily in the hydrometallurgical field but also covers aspects of food, pharmaceutical processing and environmental or wastewater processing.

Professor Stevens leads an internationally recognised separations group in the Department of Chemical and Biomolecular Engineering. He is the Director of the Particulate Fluids Processing Special Research Centre and a Project Leader in the CRC for Greenhouse Gas Remediation (CO<sub>2</sub>CRC). He is also Secretary General of the International Solvent Extraction Committee.

### Clive Bell chairs soil science committee

Emeritus Professor Clive Bell FTSE will chair a Queensland Strategic Cropping Land soil science committee, announced by the Queensland Government.

Professor Bell was nominated by the Australian Society of Soil Science. He is a well-respected soil scientist and academic with a PhD in Soil Chemistry and is internationally recognised as an expert on post-mining land rehabilitation.

He is a former Executive Director of the Australian Centre for Soil Minerals Extension and Research, and former Head of the Department of Agriculture and Director of the Centre for Mined Land Rehabilitation at the University of Queensland.

He is also a Fellow of the Australasian Institute of Mining and Metallurgy and the Australian Institute of Agricultural Science and Technology. Professor Bell has been

actively involved in mine rehabilitation for more than 35 years, the author or co-author of more than 200 publications and is currently Emeritus Professor, University of Queensland.



Matthew Cuthbertson Ian Dagley



Clive Bell

## Peter Høj joins CSIRO Board

Professor Peter Høj FTSE, Vice-Chancellor of the University of South Australia, has been appointed a part-time member of the CSIRO Board.

Professor Høj commenced his current role in 2007 and prior to this was Chief Executive Officer of the Australian Research Council (2004–07) and Managing Director

of the Australian Wine Research Institute, based in Adelaide (1997–2004).

Professor Høj was educated at the University of Copenhagen, majoring in biochemistry and chemistry. He has a Master of Science in biochemistry and genetics and a PhD in photosynthesis.

He holds an Honorary Doctorate from the University of Copenhagen.

After arriving in Australia in 1987, Professor Høj also worked as a lecturer and senior lecturer in biochemistry at La Trobe University, and as Professor of Viticultural Science and Oenology at the University of Adelaide.

In 1992 he was awarded the Boehringer–Mannheim Medal by the Australian Society for Biochemistry and Molecular Biology, and in 2003 he received a Centenary Medal for his service to Australian society through wine research and science.

Professor Høj is a board member and Deputy Chair of Universities Australia, a board member of Business SA and a member of the National Research Infrastructure

Committee, the Higher Education Research Reference Group and the Australian Qualifications Framework Council.

He joins Dr Terry Cutler FTSE FASSA (Deputy Chair), Dr Megan Clark FTSE, CEO of CSIRO, and Professor Tom Spurling AM FTSE on the CSIRO Board.



**Peter Høj**

Welcoming the news, UniSA Chancellor and Chair of the CSIRO Minerals Sector Advisory Council, Dr Ian Gould AM FTSE, said he believed Professor Høj would make a significant contribution to Australian science through his work on the Board.

## Bernard Bowen enters WA Science Hall of Fame

Dr Bernard Bowen AM FTSE is the 2011 Western Australian Science Hall of Fame Inductee – an award that recognises meritorious contribution to the science community over an extended period of time.

His award was announced as part of the annual WA Science Awards presentations.

In a long and distinguished career, Dr Bowen – a Fellow since 1978 – has made a significant contribution to fisheries research, marine resource management, environmental protection and radio astronomy in WA.

Dr Bowen held the position of Director of the Department of Fisheries for 23 years and

has chaired many committees in the science field at a state, national and international level. He has played a significant role in the development of four research institutes: the WA Fisheries and Marine Research Laboratories; the WA Wildlife Research Centre; the WA Marine Science Institution;

and the International Centre for Radio Astronomy Research.

Dr Bowen currently holds several chairmanships, including on the Board of the International Centre for Radio Astronomy



**Bernard Bowen**

Research in WA; the Woodside Marine Expert Advisory Panel for Woodside Energy Ltd; the Albany Port Authority Dredging Reference Group; and the WA Marine Science Institution.

The late Professor John De Laeter AO FTSE was the 2008 inductee.

## Lyn Beazley has been “sponging”

A newly discovered sea sponge with a unique morphology has been named *Manihinea lynbeazleyae* after Western Australia's Chief Scientist Professor Lyn Beazley AO FTSE.

WA Museum curator of marine invertebrates Dr Jane Fromont identified the sea sponge, found in Perth Canyon off Rottnest Island. Dr Fromont says the sponge was named after Professor Beazley for her dedication to WA science and taxonomy, her support for Dr Fromont's work and because the sea sponge was found “close to (Professor Beazley's) patch”.

*Manihinea lynbeazleyae* is one of only two

known species belonging to the *Manihinea* genus. The first was discovered in the East African Indian Ocean in 1993, which established the genus because it did not fit the morphological characteristics of any other known genus.

Dr Fromont says when she discovered *Manihinea lynbeazleyae* she could immediately see it had the same characteristics. “But our species differs as it has an ‘erect branching sponge,’” she says. “The organisation of the skeletal structure is what makes it unique.”



***Manihinea lynbeazleyae* showing preserved colour and live colour.**

PHOTO:  
J. FROMONT

## ATSE Forum elections underway

The Academy has begun the process of formalising the leadership of its key Forums, following the approval of a new Guidelines for ATSE Forums document at the ATSE Board meeting in December.

The Academy gratefully acknowledges the strong contributions and leadership of the establishment Forum Chairs and members of the leadership groups that have guided the operations of the Forums to date and looks forward to their continued involvement and support. The term of office of current Forum Chairs and Deputy Chairs, who can nominate for further two-year terms, will continue until the close of nominations or elections as appropriate.

Nominations for positions of Forum Chair (one position) and Deputy Chairs (two positions) closed on 2 February for terms concluding 1 January 2014. Elections for Forum Chairs – if required – are scheduled 7 to 21 February. Forum Chairs will be announced on 28 February. Elections for Deputy Chair (if required) will open on 1 March and close on 15 March. Deputy Forum Chairs will be announced on 20 March.

Following the appointment of Forum Chairs and Deputy Chairs, Forum Committees will be established, in accordance with the Guidelines for ATSE Forums, and are anticipated to be in place by early April.

• *ATSE focuses its project and technical endeavours through its four Forums – Energy, Water, Education, and Health and Technology – with support from the Climate Change Advisory Group. A Built Environment Working Group has also been established.*

### Paul Zimmet heads IDF

Australian diabetes expert Professor Paul Zimmet AO FTSE was elected Honorary President of the International Diabetes Federation (IDF) at the recent World Diabetes Congress in Dubai. The appointment was made “in recognition of service to the International Diabetes Federation and the diabetes cause with distinction and sustained commitment”.

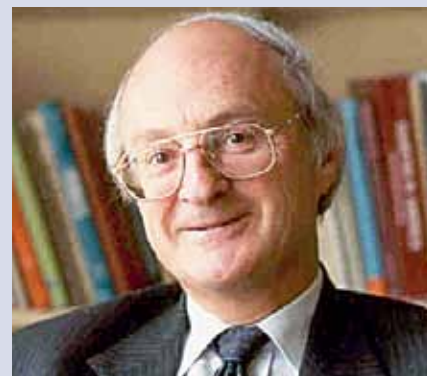
Professor Zimmet is also chair of the program for the next World Diabetes Congress in Melbourne in 2013, which is expected to attract more than 12,500 researchers, medical practitioners and policy experts, and inject more than \$32 million into the economy.

“It was a shock and a surprise as this is an honour that was totally unexpected,” Professor Zimmet said. “It results from the wonderful contribution of my team, first at the International Diabetes Institute and now Baker IDI, in demonstrating the magnitude of diabetes as

a growing global epidemic, and creating the awareness that has resulted in recognition at the UN and WHO of the epidemic”.

Professor Zimmet was the Founding Director of the International Diabetes Institute, which merged with the Baker Heart Research Institute in 2008 to create the largest diabetes and cardiovascular research facility in the Southern Hemisphere, the Baker IDI Heart and Diabetes Institute. He is Director, International Research and Director Emeritus of Baker IDI Heart and Diabetes Institute. He is also co-Chair of the IDF’s Taskforce on Epidemiology and Prevention.

Professor Zimmet has devoted his life to the research, education and care of people with diabetes, with his research and advocacy attracting international recognition in raising awareness of diabetes as an international public health epidemic.



Paul Zimmet

## Fellows

### Margaret Hartley

ATSE CEO Dr Margaret Hartley FTSE has been presented with an ASCEPT Achievement Award by the Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists for her “outstanding contributions and achievements in pharmacology and toxicology over a long period of time”.

### Ramesh Mashelkar

Dr Ramesh Mashelkar, Foreign Fellow, President of the Global Research Alliance and former Director General of the Indian Council of Scientific and Industrial Research,

has been named a foreign honorary member of the American Academy of Arts and Sciences. Dr Mashelkar is a past president of the Indian National Science Academy, a member of the Scientific Advisory Council to the Prime Minister and acknowledged as a key mover in shaping India’s science and technology policies.

### Rob La Nauze

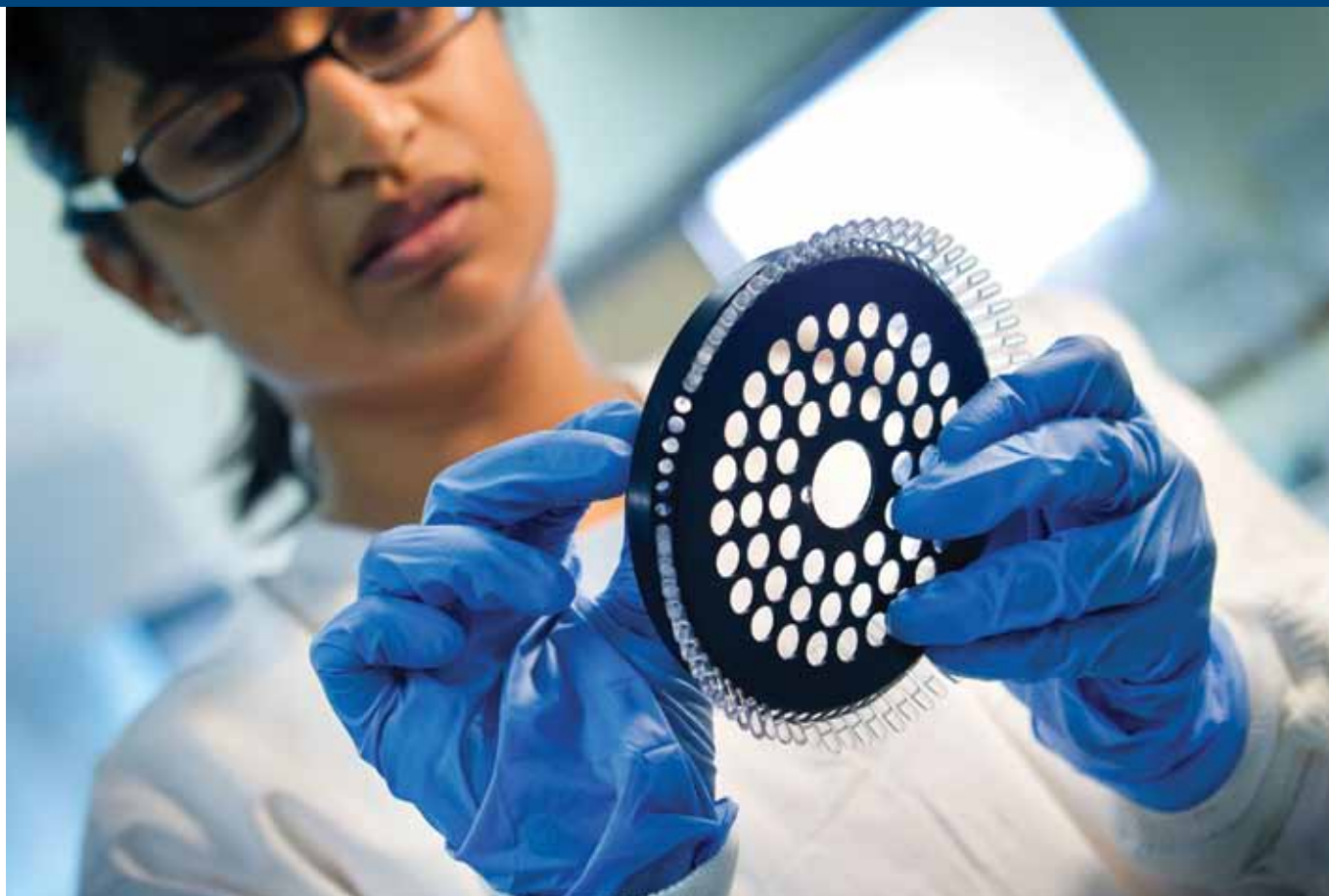
Dr Robert La Nauze FTSE has been appointed by the University of South Australia to Chair the Ian Wark Research Institute’s Advisory Board. After a career with CSIRO and Western Mining, Dr La Nauze stepped down as Chair of AMIRA International in 2008 and from his Advisory Board positions with CSIRO in 2010.

He replaces the Wark long-serving inaugural Chair, Dr Max Richards AM FTSE.

### Thomas Maschmayer/ Susan Pond

Two Fellows have named in the Top 100 People in Bioenergy for 2011-12 by the readers and editors of *Biofuels Digest* (claimed as the world’s most widely read biofuels daily). ATSE Vice President Professor Susan Pond, Director, Dow US Studies Centre, University of Sydney, was named at 100 and new Fellow Professor Thomas Maschmayer, co-founder of Ignite Energy and ARC professorial Future Fellow and Professor of Chemistry, University of Sydney, was at 94. Ms Heather Brodie, CEO, Biofuels Association of Australia, was also listed.

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The UQ Solar Array underpins a number of cutting-edge research projects, in diverse fields including physics, engineering, economics and sustainability and provides research opportunities unparalleled in Australia.

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Enhanced by its strong industry partnerships, including research agreements with a number of world-leading companies in renewable energy, the project forms one element of the UQ Energy Initiative which was established to integrate existing strengths across the spectrum of energy research.

The Federal Government's 2010 Excellence in Research for Australia (ERA) survey confirmed The University of Queensland as one of the nation's top two universities, measured on a combination of research quality and breadth. ERA reported that research at UQ is above world standard in more broad fields than at any other Australian university: this reflects UQ's leading global role in many areas of discovery. UQ's outstanding critical mass offers researchers significant interdisciplinary capability.

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